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Introduction

In the U.S. health care system, public and private payers purchase healthcare services from providers subject to regulations imposed by federal, state and local governments as well as private regulatory organizations.

Public purchasers are governments at the federal, state and local levels. At the federal level (Under the federal government), the Department of Health and Human Services (HHS) plays the most significant administrative role in the U.S. health care system. HHS is made up of agencies that manage the public Medicare and Medicaid programs through the Centers for Medicare & Medicaid Services (CMS) and the Children's Health Insurance Program (CHIP) (Rice et al., 2013). Medicare is a federal program funded by Social Security payments. It provides health insurance coverage primarily to people aged 65 and older, some disabled people under age 65, and to people with end-stage renal disease and amyotrophic lateral sclerosis. The Medicaid program is jointly funded by the federal government and states and is available to individuals of all ages and families with low income and means, who cannot afford adequate medical care. Each state sets its own eligibility rules and services covered by Medicaid. Eligibility depends on several factors, including age, pregnancy status, disability, income, and resources, as well as whether individuals are U.S. citizens or legal immigrants (Dieleman et al., 2020).

Although the proportion of public and private spending on health care is roughly comparable, only a minority (30%) of the United States population is covered by the public financing system – mainly Medicare and Medicaid- while most Americans (54%) obtain their coverage through private health

insurance, with most privately insured through an employer, while one in six Americans is uninsured (Rice et al., 2013). 1

Even though the United States spends significantly more on health care than any other nation (both globally and per person), it meets a select number of quality and outcome metrics from an international viewpoint, while failing to perform as well on a large number of other measures (Rice et al., 2013). In fact, between 1996 and 2016, the total cost of healthcare rose from an estimated $1.4 trillion to an estimated $3.1 trillion, leading to mixed results on a few key quality indicators: it performs highly in terms of five-year cancer survival, middling on in-hospital case-specific mortality, and poorly in terms of hospital admissions for chronic conditions and diabetic amputations (Squires, 2011). We reckon that the widening economic inequality in the USA has been accompanied by increasing disparities in health outcomes, such that the life expectancy of the wealthiest Americans in 2017 exceeds that of the poorest by 10–15 years (Dickman et al., 2017). This inequality is particularly evident when looking at mental health problems since if they are living in poverty, having to manage with higher health care costs, decreased productivity, and poor general health (Vick et al., 2012; Anakwenze and Zuberi, 2013). According to the National Survey of Drug Use and Health (NSDUH), in 2015 an estimated 9.8 million adults aged 18 or older in the U.S. had a serious mental illness (SMI), including 2.5 million adults living below the poverty line. Nevertheless, it was estimated that only about one-third of Americans with mental health problems has received treatment for their problems (Cunningham, 2009).

This increase in health care spending has been accompanied by an increase in health inequality: the life expectancy of the wealthiest Americans in 2017 is 10-15 years higher than that of the poorest Americans, according to our estimation of the relationship between widening economic inequality in the USA and growing health disparities (Dickman et al., 2017). This inequality is, indeed, particularly manifest when observing mental health issues since the challenges that adults with mental illness face are made more difficult if they are living in poverty, having to deal with higher health care costs, decreased productivity, and poor general health (Vick et al., 2012; Anakwenze and Zuberi, 2013). A serious mental illness (SMI) affected 9.8 million adults in the United States who were 18 years of age or older in 2015, including 2.5 million who were living below the poverty line, according to the National Survey on Drug Use and Health (NSDUH). Nevertheless, it was estimated that only about one-third of Americans with mental health issues have received treatment. (Cunningham, 2009).

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[1] Public sources constitute 48% of health-care expenditures in the United States, private third-party payer sources 40%, with the remaining 12% being paid by individuals out of pocket (Rice et al., 2013)

In a survey of primary care physicians conducted in 2004–2005, 67% reported that they were unable to obtain high-quality outpatient mental health services for their patients, while 34% reported that they couldn't get referrals to specialists (Cunningham, 2009). The lack of adequate patient health insurance coverage and health plan barriers are largely caused by insurance-related issues (Cunningham, 2009). These insurance issues made it difficult to attain specialty referrals, outpatient services, and non-emergency hospital admissions. As a result, the stigma associated with mental illness contributes to the low level of mental health care utilization. The stigma associated with mental illness has existed for centuries. Despite improvements in eliminating it, traces still exist. Nevertheless, failure to provide psychosocial care and inadequate care can lead to injury and death. In one study, 58% of errors in a state psychiatric hospital resulted in patient harm (Grasso et al., 2003). It is estimated that the use of restraints and seclusion in inpatient psychiatric facilities causes 150 deaths each year in the United States (SAMHSA, 2004). Untreated mental illness can lead to incidents as severe as suicide (IOM, 2006).

The Patient Protection and Affordable Care Act, also known as the ACA, was signed into law in 2010. It reflects a thorough effort to improve the American healthcare system. The ACA has a number of provisions that have an impact on employers, providers, consumers, and private and public insurance coverage. Its most important provision -which, like many other provisions, does not take effect until Jan. 1, 2014- is the expansion of private and public insurance coverage. The major goals of the ACA were to expand health insurance coverage to all Americans, enhance the general standard of healthcare services (Di Novi and Migheli, 2017), lessen the financial burden of medical treatment on less-wealthy Americans, and facilitate access to mental health services. In general, the ACA has mandated substantial subsidies (on a sliding scale) for the purchase of health insurance for people and families with incomes below 400% of the federal poverty line for private insurance coverage; It has required that businesses with 50 or more employees provide health insurance coverage and expanded Medicaid coverage to include people and families with incomes at or below 133% of the federal poverty threshold. The expansion of insurance coverage for mental health and the number of people who will be insured has aided in the promotion of mental health parity. Discrimination against people with pre-existing conditions, such as mental health issues, will be prohibited under insurance regulations. (Rice et al., 2013).

Even though the Affordable Care Act has made significant strides toward addressing persistent issues with the US health care system related to access, affordability, and quality of care, the USA continues to be a country where the correlation between income inequality and health status and health care

inequality is strong (Dickman et al., 2017) [2] . 38% of people in families making less than $22,500 per year between 2011 and 2013 reported experiencing poor or fair health. Even while both categories had insurance, only 12% of households earning more than $47,700 annually reported having poor to medium health (Hero et al., 2017). In 2018, individuals with low incomes are more than three times as likely to struggle with the activities of daily living, than the affluent. They become too unwell from a chronic sickness to eat, bathe, or clothe themselves. Compared to children from wealthy homes, theirs have a higher likelihood to be fat and have elevated blood lead levels (Chokshi, 2018).

Along with the previously mentioned challenges, the USA has recently experienced a number of climatic catastrophes that have negatively impacted Americans' health and quality of life. Climate change projections all agree that the burden of medical conditions and the state of people's mental health and wellbeing will rise as a result of the changes in the climate.

Given the foregoing, we examine in chapter 1 how extreme events related to climate change could depreciate the health stock inherited as a starting point, leading to mental health illnesses.
The health production approach is one of the many methodologies that has shown how changes in the environment affect the rate at which a person's stock of health depreciates, eventually causing irreparable harm to a person's physical and mental well-being (Cropper, 1981). Heatwaves, droughts, floods, and storms _more frequent and intense under a changing climate_ will have an impact on health both directly, through environmental risks and changes in the patterns and dynamics of a subset of infectious diseases, as well as indirectly through changes in food sources, disruptions in food production techniques, and decreased economic productivity (McMichael et al., 1996; Watts et al., 2015). Nevertheless, extreme weather events can directly affect emotional wellbeing by causing stress and anxiety, major depressive disorder (MDD), post-traumatic stress disorder (PTSD), and complicated grief, and can directly affect the emotional well-being by causing stress and exhaustion, which are experienced as intrinsically unpleasant (Frederick and Loewenstein, 1999; Kovats and Hajat, 2008). We discovered that 22 studies pertaining to five extreme weather events (global warming, bushfires, floods, and droughts) were accepted and incorporated in our review, after meeting the inclusion criteria. Since excessive global warming impacts a big number of individuals differently depending on where they live and offers varied health concerns, the majority of research find a connection between it and mental illness. Different populations are also impacted by climate change, and these populations are more vulnerable due to their geographic location and lack of access

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[2] Since the Affordable Care Act became law, the uninsured rate has declined by 43%, from 16.0% in 2010 to 9.1% in 2015, primarily because of the law's reforms.

to resources, information, and protective measures. Although some of the associations are tenuous, the majority of the included studies have demonstrated that extreme weather events like droughts, bushfires, and floods are likely to have an impact on people's mental health.

In chapter 2, we investigate how the Affordable Care Act's significant changes to the American healthcare system may have affected the self-perceived mental health of adults aged 19 to 64, their access to preventive healthcare (such as blood pressure and cholesterol checks), and their general health behaviours (such as smoking habits and health issues related to obesity). We do this to test for the ex-ante moral hazard effect hypothesis, which still lacks in empirical evidence and makes the demand for health irregular.

We tested the ex-ante moral hazard hypothesis with specific reference to preventive care and health behaviours since incentive difficulties in insurance markets are well-established in economic theory. The ex-post moral hazard, which is related to the overuse of medical services after a person falls ill and possess health insurance, is a major topic of the research on health economics (Arrow, 1963; Pauly, 1968; Zweifel and Manning, 2000; Maia et al., 2019). Less consideration is given to the ex-ante moral hazard, which develops when changes in insurance coverage, particularly changes in preventative actions that influence the insurer's future costs, may have an impact on people's present healthy behaviours. Ex-ante moral hazard occurs when there are no incentives for people to seek preventative care before an ailment develops.

Furthermore, possessing health insurance coverage might lead to underinvestment in preventative care on the part of individuals. Since the ACA has provided the largest expansions of mental health and substance use disorder coverage that have ever occurred, we used outcomes to evaluate the impact on people's perceptions of their mental health. We likewise utilized health - related behaviours to test the ex-ante moral hazard effect hypothesis and access to preventive healthcare services to assess the impact on people's use of these services.

We use five different measures: the self-perceived indicator of mental health status, smoking attitude and obesity risk, blood cholesterol and blood pressure checks, to estimate people's levels of mental health, their use of preventive healthcare, and their health behaviours to test the ex-ante moral hazard following the implementation of the ACA. We have assessed our model using a Propensity Score Matching approach to estimate differences in observable features of individuals enrolled in health insurance plans, as contrasted to those who remained uninsured, taking into account the potential selection bias. Finally, we utilize longitudinal data from the 2014–2018 Medical Expenditure Panel

Survey–Household Component (MEPS–HC), gathered by the Agency for Healthcare Research Quality (AHRQ).

Our results demonstrate the moral hazard theory applicability, particularly to dangerous behaviours like smoking. We have also examined several indirect effects of insurance that might influence the individual decision to receive preventive treatment, such as the income effect or risk-averse attitude, and that could offset the impact of ex-ante moral hazard. Our research has identified an increase in self-perceived poor mental health in relation to all policies, with the exception of the Employer Mandate, when looking at the effects of the ACA on self-perceived conditions of personal mental health. Although our data do not allow us to identify the causative process, there are several potential explanations that future research might consider.

Consistent with prior literature on the rise in adult inpatient psychiatric admissions in the United States of America after the enactment of the ACA, it is nevertheless plausible that easier access to mental health treatments has raised public awareness of individual mental illnesses. A socioeconomic gradient is frequently linked to health disparities between and within nations, with lower socioeconomic groups having greater rates of unhealthy lifestyle choices including smoking, inadequate diet, and physical inactivity, while higher socioeconomic groups experience better health. (Yip et al., 2002; Veugelers and Yip, 2003; Huber, 2008; Griffith et al., 2017; Di Novi et al., 2020).

Inability to afford expensive healthcare services and financial obstacles to treatment widen pre-existing income-based gaps, preventing indigent individuals from accessing care. The income-related disparities in accessing care are far wider in the USA than in any other wealthy country (Waldron, 2007; Chatty et al., 2016; Dickman et al., 2017). In fact, the Patient Protection and Affordable Care Act (ACA) mandated insurance companies to provide full coverage of preventive treatments, awarded either an A or B rating by the US Preventive Services Task Force, in an effort to boost the use of preventive healthcare (UPSTF).

These benefits are intended to be covered without deductibles, co-payments, or maximums. This provision is expected to significantly enhance access to cancer screening, eliminating health inequities between individuals from different socioeconomic backgrounds. Determining whether the Patient Protection and Affordable Care Act (ACA) legislation has had an impact on socioeconomic disparities in access to cancer screening tests such as breast examinations, pap smears, colonoscopies, and PSA testing among private insurance holders is the focus of chapter 3.In fact, in the last chapter, we discuss the decline in health inequalities among private insurance consumers who had access to a

list of ACA-established essential health benefits starting on October 1, 2013, with coverage commencing on January 1.

We compute the horizontal inequity in access to cancer screenings through CI in the first section of our empirical analysis, and then we break down the CI into the contributions of demographic and socioeconomic determinants in the second section. Our dependent variable in the probit model for the concentration index takes value 1 if the responder routinely undergoes screening tests (such as a pap test, breast exam, colonoscopy, or PSA exam), and value of 0 otherwise.

We make use of the Medical Expenditure Panel Survey's individual-level data, which covers the years 2012 to 2016 and includes information on medical care spending, demographics, family income, and a variety of health status variables.

We discover that the gaps associated to income have not been significantly affected by the removal of cost sharing for preventative screenings. Our findings compel policymakers to take into account other complimentary policy approaches to increase screening rates.

Chapter 1

The Indirect Consequences of Climate Change and Extreme Environmental Events on Mental Health: A Literature Review

1.1. Introduction

Over the past century, natural disasters have increased in frequency, severity, and geographic distribution (Field, 2012; Stocker et al., 2013; Leaning and Guha-Sapir, 2013; Melillo et al., 2014; Loftis, 2015; Haddow et al., 2017, Brown et al., 2017). In fact, according to the report from the World Meteorological Organization, over the past 50 years the number of disasters has increased by a factor of five, driven by climate change in which weather and water hazards accounted for 30% of all disasters, 45% of all reported deaths (more than 91% of these deaths occurred in developing

countries) and 74% of all reported economics losses. In particular, floods and storms were the most frequent events according to the human cost of disasters 2000-2019, seeing floods grew from 1,389 to 3,254 and storms from 1,457 to 2,034. In general, in the world the climate-related disasters went up from 3,656 in 1980-1999 to 6,6681 in 2000-2019, establishing an increase of 83%. [3]

Some natural phenomena, such as solar radiation and autonomous planetary activity (e.g. volcanic eruptions), result from the cycles of nature, while some others, such as extreme heat, climate change-related water disasters (sea-level floods, hurricanes, and coastal storms), droughts, wildfires, winter storms, extreme snowfall, and severe CAPE (convective potential energy) thunderstorms (supercells, derechos, and tornadoes), are caused by conditions on the planet that are partly due to anthropogenic activities. Indeed, human activity raises the risk of some types of extreme weather, especially those linked to heat, since the use of fossil fuels, deforestation and pollution has intensified global warming (Cianconi et al., 2020). These changes to the Earth's biophysical systems have already caused potentially irreversible damage to the environment, producing a strong repercussion on human societies, namely infrastructures damages, economic loss, life loss, and enduring impacts on people's physical and mental health (Whitmee et al., 2015; Cruz et al., 2020).

Numerous consequences of climate change on mental health are associated with extreme weather: different kinds of psychological and psychopathological distress, compared to normal seasonal weather changes, have been observed throughout tornados, floods, and droughts, inducing depression, anxiety and mood disorders, post-traumatic stress, sleep disruption, suicide, congenital defects, impair neurodevelopment; they have even triggered endogenous mental disorders and aroused psychosomatic and neurological disorders (Haines et al., 2006; McMichael et al., 2006; Clayton et al., 2015; Bell et al., 2018; Hoegh-Guldberg et al., 2018; Palinkas and Wong, 2020).

According to the previous literature, there is no univocal definition of an extreme event: people and communities judge events such as "extreme" by comparing them with personal experiences that are unprecedented or divergent from usual phenomena and may be felt as "extreme" (Trenberth, 2012).

For the purposes of this paper, we will consider those weather and climate-related events that rarely occur at a given location or have a significant socio-economic impact, along with those linked to anthropogenic climate changes (Bell et al., 2018). This paper focuses on the irreversible impact on the environment of some extreme events that have struck some countries in the last century and had detrimental effects on the physical and mental health of individuals who both directly and indirectly experienced these events (Whitmee et al., 2015; Cruz et al., 2020). In the following, we present a systematic review to quantify the prevalence of common mental health problems in populations

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[3] UN report, 13 October 2020.

exposed to extreme weather events. We applied qualitative analysis (narrative synthesis) to gain insights about people's experiences and perceptions of extreme weather events to better understand how exposure to these events affects mental health.

The links between environmental conditions and mental illness have long been recognised and have recently received additional attention in light of climate change (McMichael et al., 2006; Berry et al., 2010). Mullins and White found an increasing, quasi-linear relationship between high temperatures and mental health problems, with the former exacerbating the burden of the latter. Indeed, nearly 45,000 people in the United States and 800,000 worldwide die by suicide each year (National Institute of Mental Health, 2018; World Health Organisation, 2018), while in 2017, 18.1% of American adults reported struggling with a diagnosable mental, behavioural, or emotional disorder (Mental Health America,2018).

The health risks of climate change will continue to be unevenly distributed, with vulnerable populations and regions affected differently. Some population groups (e.g., the elderly, people with chronic conditions, people with mobility challenges, the poor and the isolated, black and indigenous populations and other people of colour, certain occupational groups, women, and girls) will be disproportionately affected by impacts due to heightened physiological sensitivities, greater exposures, or reduced ability to take protective measures (Ebi et al., 2019). This work can help inform governments and the environmental policy agenda to bring about integrated solutions to prevent and reduce mental health problems associated with extreme weather events. The burden of climate-sensitive health impacts requires explicit government action and investment in social and health protection measures aimed at reducing inequalities, as well as investment in climate mitigation and adaptation (Ebi and Hess, 2020)

1.2. Search strategy

We have conducted a systematic search for studies measuring mental health consequences of extreme events on adults, by using the major databases commonly employed in reviews, such as PubMed, Embase, Scopus, PsychINFO, Medline, Cochrane Library, and PTSDpubs (previously PILOT) (Levi et al., 2018; Aboubakri et al., 2018; Wondmagegn et al., 2019). We have searched to identify peer-reviewed scientific journals from a wide range of disciplines. Search term protocols were "extreme events", OR "natural disasters" OR "climate changes" OR "hurricane" OR "droughts" OR "heat waves" OR "tornadoes" OR "disaster events" OR "surface air temperature" OR "rise temperature" OR "floods" OR "flooding" OR "increased waters" OR "wildfires" OR "vector borne disease" OR

"deglaciation" OR "deforestation" OR "river disappearance" OR "increased of desert" or "extinction" OR "solastalgia" OR "ecoanxiety" OR "ecomigration" OR "resilience" OR "adaptation" AND "mental health" OR "mental health consequences" "PTSD" OR "posttraumatic stress" OR "post-traumatic stress" OR "traumatic neurosis" OR psychological distress" OR "depression" OR "anxiety" OR "substance use" OR "substance" OR "psychosis" OR "anxiety" OR "psychiatric disorder" OR "psychosis" OR "schizophrenia" OR "suicide" OR "mood disorder". The Boolean connector (Wee and Banister, 2016) "OR" was used to combine terms within each keyword and "AND" to connect each keyword to do the final literature search. Moreover, we scanned all references listed by candidate papers and searched relevant grey literature using Google Scholar.

1.2.1. Inclusion and exclusion criteria

The search was limited to studies in English. Studies use:

• Adult participants aged 18 and older who were directly or indirectly exposed to a natural disaster, including those who lived in the disaster-affected area, those who lived in the disaster-affected area at the time of the disaster, those who arrived in the disaster-affected area shortly after the disaster, those who had family and friends living in the disaster-affected area during the disaster, and those who were exposed to the extreme event through the media;[4]

• Quantitative or mixed methods, including pre/post designs, interventions, tools validation, and comparisons.

The literature search was conducted in four steps. First, duplicates were removed. Second, the relevance of titles was reviewed. Third, abstracts were reviewed. Finally, selected articles were retrieved in their entirety for full-text review and evaluation. Examples of literature excluded at this stage include assessment of mental health consequences of natural disasters not due to anthropogenic activities. The exclusion criteria pertain to:

- Articles on urbanization, air and water pollution, chemical pollution, and ionizing radiation were excluded because they are not directly related to the focus of our study (even if they demonstrate a direct impact on the mental health of individuals).

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[4] By "directly exposed" we mean those individuals who live or were in the affected areas during the event or got there in the following days and were exposed to material and human consequences; by "indirectly exposed" we mean individuals who have been exposed to the consequences of the extreme event through the media or through the experiences of family members or acquaintances.

- Articles dealing exclusively with the transmission of infectious diseases or physical medical pathologies were excluded.

Data extracted from the above articles include the first author's last name, year of publication, country, study period, type of data and sources, study design, study population, health outcome measures, and main outcomes (Li et al., 2015).

[Table 1 about here]

Prisma Flow-chart of the selection criteria adopted
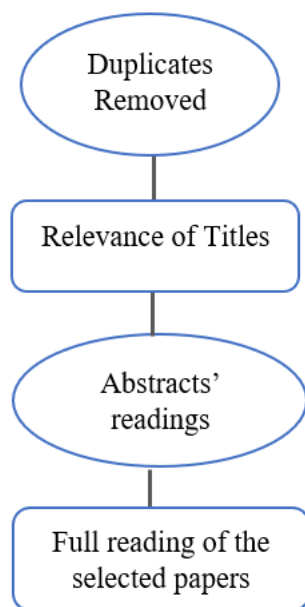
1.3. Results

The focus of this review is on the impact of extreme events attributable to anthropogenic activities on the mental health of individuals. The results section proceeds as follows. In Section 3.1, we present the current evidence on each natural disaster and the associated mental health issues. Section 4 discusses the findings.

A total of 22 articles were included in the final review (summarized in Table 1). Some of these studies were conducted in high-income countries: ten from the USA (Kessler et al., 2006; Galea et al., 2007; Noelke et al., 2016; Lin et al., 2016; Lieberman_Cribbin et al., 2017; Basu et al., 2017; Ruskin et al., 2018; Taioli et al., 2018; Obradovich et al., 2018; Mullins and White, 2019), three from Australia (Sartore et al., 2008; Reifels et al., 2015; Ellis and Albrecht, 2017), and two from Canada (Willox et al., 2013; Hetherington et al. 2017). Two papers were from China, a middle-income country (Dai et al., 2017; Chan et al., 2018). The remaining articles were from middle- and low-income countries that

are much more vulnerable to extreme events and have relatively low resilience capacity: one from Taiwan (Chen et al., 2018), one from South Korea (Lee et al., 2018), one from Iran (Keshavarz et al., 2013), one from India (Bandla et al., 2019), and one from northern Vietnam (Trang et al., 2015). All of the aforementioned studies used different surveillance data to estimate the mental health consequences of extreme events. The time span of the studies ranged from 1 month to 10 years. Data used include hospitalizations, ED visits, self-reported mental health status, and weather records. Beyond this, there are no notable differences in health outcome measures, although there are some differences in the characteristics of the study population and the types of extreme events analyzed.

1.3.1 Climate Change and Mental health

The literature on climate change and mental health is growing rapidly, highlighting the harmful effects that can occur after or even before an extreme event (Berry et al., 2010; Bourque and Willox, 2014; American Planning Association, 2017). Extreme events could lead to mental health conditions that range from minimal stress and distress symptoms to clinical disorders (i.e., from anxiety and sleep disturbances to depression, post-traumatic stress, and suicidal thoughts), because they involve life disruption, such as loss of life, economic resources, social support, and social networks or extensive relocation (US global change, 2016). In general, acute impacts refer to all the extreme events (e.g. floods, hurricanes, wildfires, etc.) that immediately expose undefended and helpless people to mental injuries, whereas subacute impacts involve intense emotions experienced by people who indirectly witness the effects of climate change, anxiety related to uncertainty about surviving of humans and other species and, finally, fellings of being blocked, disorientation, and passivity (Cianconi et al., 2020). Moreover, the increase in intensity and frequency of these disasters during the last decades has led survivors to have less time for developing resilience and capacity to deal with the economic, familiar, emotional, and personal losses, strengthening the onset and persistence of mental health issues (US global change, 2016).

The disruption of those places that are emotionally and psychologically related to identity, belonging, security, self-esteem, self-efficacy and solace, generates other consequences for survivors, such as reduced daily life activities and loss of their "sense of place" (Proshansky et al., 1983; Frumkin, 2003; Albrecht, 2005; Eyles and Williams, 2008; Antonsich, 2010; Ellis and Albrecht, 2017). 'Solastalgia' forms part of a broader 'psychoterratic typology' of positive and negative earth-related emotions. 'Solastalgia' is the specific term used to describe the distress produced by environmental change impacting on people, while they are directly connected to their home environment and is typically

considered the opposite of 'topophilia', a positive emotional experience related to the health and the vitality of a place as expressed in feelings of joy, familiarity, and being 'at home' (Tuan, 1974; Albrecht, 2005; Albrecht et al., 2007; Albrecht, 2012).

News regarding climate change exacerbates mental health risks, making people uncertain and stressed, even depressed, and with a sense of powerlessness. Long-term outcomes come in the form of large-scale social and community effects, outbreaking into forms of violence, struggle over limited resources, displacement and forced migration, post-disaster adjustment, and chronic environmental stress (Hsiang et al., 2013; Acharibasam and Anuga, 2018; Abel et al., 2019; Cianconi et al., 2020).

[Figure 1 about here]

1.3.2 Global Warming and Mental Health

Health risks caused by the increase in the global temperature have significantly risen in recent years. Research in psychology and economics of mental health has suggested that heat exposure reduces emotional wellbeing (Keller et al., 2005), increases interpersonal aggression (Anderson and Anderson, 1998; Anderson and Bushman, 2002), diminishes life satisfaction (Connolly, 2013; Denissen et al., 2008; Lucas and Lawless, 2013; Schwarz and Clore, 1983) and increases hospital admissions for mental and behavioural disorders (Hansen et al., 2008).

Eleven of the articles included in our review studied the stress directly caused by the increase in intensity and frequency of the heat days that range outside the normal temperature for a specific season (extreme hot temperatures, heat waves, increased ambient temperature, and droughts) according to various definitions of exposure.[5] Four studies deal with the health effects of warming temperature in the USA.

One paper explores the effect of heat on the emotional well-being of Americans and their ability to lower adverse effects through Climate-driven migration and heating and cooling technologies as well, like air conditioners (Deschênes and Moretti, 2009; Albouy et al., 2013; Barreca et al., 2016). Noelke et al. (2016) have performed a multivariate analysis using all measures, explicitly referencing the emotional well-being of 1.9 million Americans included in the Gallup G1K dataset over the period

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[5] Exposure is defined as realized contact between a human and an indoor or outdoor environment that pose a risk of physical illness, mental illness or both simultaneously.

from 2008 to 2013 and linking these survey responses to temperature data. They find that temperatures from -7 to 21 °C do not affect the emotional well-being of Americans, whereas exposure to one day averaging 21–27 °C reduces well-being by 1.6% and temperatures above 32 °C on a day reduce it by 4.4%. Similarly, the authors observe that moderately hot and very hot days have a sizable negative effect on the well-being of Americans aged >46 years old. Due to the educational-level specific effect, less educated individuals are more sensitive to temperature variations, experiencing larger decreases (increases) in well-being at high (low) temperatures, whereas individuals with a bachelor's degree experience levels of well-being 7% higher, compared to those perceived by individuals with a high school degree. Direct exposure to heat temperature leads to sleep disturbance and exhaustion that in turn cause aggressivity and a decrease in well-being. The authors conclude by highlighting a limited heat adaptation.

In one study, the effect of changes in temperature in California on self-assessed mental health status is examined. Mullins and White (2018) have carried out a panel fixed effects regression model with feasible control for local seasonality throughout Emergency Department (ED) visits and suicide data collected during many years, roughly from 1960 to 2016, to discover that higher temperature increases of 0.06% self-reported days of poor mental health, whereas one additional day >27°C leads to a 0.30% increase of ED visit rate and a 0.24% increase in the monthly suicide rate. Sleep disruption is found to be the link between higher temperature and worse mental health outcomes. Basu et al. (2017) have employed ED visits for mental health disorders data taken from the California Office of Statewide Health Planning and Development for the period 2005-2013, to evaluate the association between ambient temperature and the ED visit rate in California, focusing on violence and self-harm as effects of hotter weather. Performing a 2 stage-time series method with Poisson regression, they have found that the increase of 5.6°C in the mean apparent temperature during the warm season is associated with an increase of 4.8% in the risk of access to emergency health care for mental health disorders, 5.8%, self-injury/suicide and 7.9% intentional injury/homicide. Finally, interactions between multi-year warming and self-reported mental health difficulties for American residents from 2002 to 2012 are approached by Obradovich et al. (2018) through a pooled cross-sectional linear probability model. The study reveals that shifting from monthly temperatures between 25 °C and 30 °C to >30 °C increases the probability of mental health difficulties by 0.5% points, whereas 1°C of 5-year warming is associated with a 2%-point increase in the prevalence of mental health disorders. One study investigates the effects of increased seasonal temperatures in Northern Canada. Willox et al. (2012) conducted an explanatory case study among the Inuit communities: community members, and local and regional health professionals were observed to analyse their emotional responses to

climate changes and the subsequent disruption occurred to social, economic, and environmental determinants. From January 2010 to October 2010, a total of 67 individuals were interviewed: 40 females and 27 males aged from 9 to 80 with a variety of backgrounds. In association with increased seasonal temperatures, the individuals have reported suffering from family stress, drug and alcohol use disorder, and mental health stressors, that, amplifying previous traumas, lead to suicidal ideation. The study also reveals that the effects are firstly experienced by individuals with pre-existing mental health issues, marginalized populations, communities that rely more closely on the local ecosystem, and some areas most susceptible to climate change.

Four of the studies included in our literature review investigate the effects of heat on the Asian continent. Chen et al. (2018) conducted a time-series study in Taiwan, a region with a tropical climate. Employing Health records from the Taiwan Nationwide Longitudinal Health Insurance database for the period 2003-2013 and performing a penalized spline regression, the authors discovered that the risk for Major Depressive Disorder (MDD) incidence is lower among residents in regions with an average temperature of 23 °C, whereas in regions recording an average temperature higher than 23 °C, each 1°C increase raises the risk of major depression by 7%.

For the age-specific effects, males aged more than 65 years old were the most vulnerable to heat-related major depression, whereas young women resulted more vulnerable than men to developing Depressive Disorders due to heat temperature (Chen et al., 2018). Lee et al. (2018) studied the diagnoses of mental disease-related disorders in Emergency Admissions (EA) of residents in Korea in the period of 2003 to 2013 through both a multivariate meta-regression and a distributed Lag Non-linear Model. They found that in Southern Korea, during heat temperature, the EA increased by 14.6% for mental health diseases and 31.6% for anxiety. The elderly are found to be especially affected by heat temperatures. Similarly, in Northern Vietnam, the hospital admissions for mental health disorders, specific mental-health disorders, and organic mental disorders, including symptomatic illnesses (dementia, delirium, and behavioural disorder) have increased every 1,3 or 7 consecutive days of heatwaves, in particular for men, rural communities and the elderly (Trang et al., 2015). In Hong Kong, hospital admissions for transient mental disorders and episodic mood disorders are correlated with 20°C, in particular for women and adults aged 15-59 years old (Chan et al., 2018). Health effects caused by droughts are investigated in two studies, one carried out in Australia and one in Iran. Keshavarz et al. (2013) conducted face-to-face interviews in two selected villages in Fars Province (Iran) to investigate the emotional and psychological consequences of droughts, such as a sense of hopelessness, failure, and loneliness, at the farm family level. The data collected highlight that the increase in intensity and frequency of droughts has caused a reduction of the resilience ability

in particular in vulnerable families, leading them to major suffering. Depression and hopelessness are disproportionately experienced by women, children, and older people.

Sartore et al. (2008) deal with the long-term effect of the prolonged droughts on the rural communities in Australia. Using focus groups to collect information about well-being and emotional condition, loss, and distress associated with the chronic drought for two Farming communities (males, females farmers, business people, health workers, support workers, and school principals), the authors found that many distresses drought-related effect reduce the communities' ability to respond to needs caused by extreme weather conditions, raising the communities' psychological and economic disadvantages. To summarize, a statistically significant impact on mental health issues in extreme heat events is reported in most studies, despite the variations in study locations, study designs, qualities and definition of exposure. Increased risks of hospital admissions due to mental health disorders are also found to be associated with heat waves. Only two studies have addressed the effects of droughts with consistent analysis of the mental health status at a rural-community level.

1.3.3. Floods

Four studies reported the impacts of floods employing different data sources (interviews or national surveys) and the same mental health outcomes. Two of them use interviews (telephone or face-to-face) to collect data and investigate positive associations between floods and Post-Traumatic Stress Disorder (PTSD), anxiety, depression, and substance use disorder. In one study, one month after the event, Bandha et al. (2019) interviewed 223 residents in Chennai and Cuddalore (India): the interviewees were directly exposed to floods. Performing a chi-square test, the authors have found that psychiatric morbidity was 45.29% among survivors: out of the total of individuals interviewed, 101 suffer from depression, 60 from PTSD, 48 from anxiety, and 11 from substance use disorder. The other study is a cross-sectional analysis conducted by Dai et al. (2017) who interviewed 325 survivors of the 1998 Dongting Lake Flood, China, 15 years after the event. They have found a prevalence of PTSD at 9.5% and anxiety at 9.2%. For the gender-specific effects, the most vulnerable resulted to be the female, with at least three flooding-related stressors and exposed to low social support and emotional instability.

A longitudinal prospective cohort analysis explores the short-term mental health impact of the 2013 Calgary (Australia) flood event on women. Hetherington et al. (2017) performed a multivariate logistic regression using the All Our Families (AOF) 36-month questionnaire, which some participants completed up to 18 months preceding the flood. The authors have found that before the

flood, respondents reported elevated anxiety, associated with 2.49 (95% CI: 1.17, 5.26) increased odds of experiencing high levels of post-traumatic stress, regardless of whether respondents lived in a flood-risk community or not. Women, who experienced property damage, or who provided help to others, are more likely to perceive an increased sense of community cohesion (adjusted odds ratio (AOR): 1.67; 95% CI: 1.09, 2.54 and AOR: 1.68; 95% CI: 1.13, 2.52, respectively).

Although previous studies have reported similar high-quality results, a significant study from the USA, which approaches flooding as a key component of the Hurricane Sandy effect, showed that the type of exposure measures used has a strong influence on the significant association between flooding and mental health (Lieberman_Cribbin et al., 2017). In this study, Lieberman_Cribbin et al. (2017) conduct multivariable logistic regression to examine the association between New York City and Long Island residents' flood exposure and anxiety, depression, and post-traumatic stress disorder (PTSD) using two types of surveys: self-reported data and Federal Emergency Management (FEMA) Modeling Task Force Hurricane Sandy Impact Analysis data, both from 2013 to 2016. The final sample is 1231 individuals. The study shows a significant discrepancy between self-reported and FEMA flood hazard data. Self-reported dichotomous flooding is positively associated with anxiety (OR adj: 1.5 [95% CI: 1.1±1.9]), depression (OR adj: 1.7 [1.3±2.2]), and PTSD (OR adj: 2.5 [1.8±3.4]), whereas self-reported continuous flooding is associated with depression (OR adj: 1.1 [1.01±1.12]) and PTSD (OR adj: 1.2 [1.1±1.2]). Models with dichotomous FEMA flooding (OR adj: 2.1 [1.5±2.8]) or continuous FEMA flooding (OR adj: 1.1 [1.1±1.2]) are significantly associated with PTSD only.

These studies suggest that flooding could potentially lead to deterioration in mental health.

1.3.4. Hurricanes

All six studies were conducted in the United States. Three of these six studies of hurricane effects on mental health focus specifically on Hurricane Sandy (Lin et al., 2016; Ruskin et al., 2018; Taioli et al., 2018). Consistent results are shown by Ruskin et al. (2018), who analyse the extent to which damage to health infrastructure and disruption of public health services due to the hurricanes, particularly lack of access to health structures in New York City and Long Island, increased the likelihood of developing symptoms of PTSD, anxiety, depression, and perceived stress (Bourque et al., 2006). A multivariate logistic regression is conducted accounting for self-reported medical access and mental health symptomatology roughly from 2013 to 2016. Results show that male gender, low socioeconomic status, and preexisting condition are associated with increased odds of losing access

to medical care during a hurricane. Another study examines the psychological consequences of living in a shelter after a hurricane. Taioli et al. (2018) conducted in-person interviews with residents of New York City and Long Island (Hurricane Sandy) and Houston (Hurricane Harvey) who were sheltered after the event. The relative risks for developing stress, depression, anxiety, and PTSD are increased by the lack of coherent management within these structures, which left individuals in a state of persistent uncertainty (they could be moved at any time to another shelter without any previous communication) and without any mental health support.

An ecological study was conducted at the county level (8 counties in southern New York State) to describe the impact of the power outage caused by Hurricane Sandy on anxiety, adjustment disorders, psychosis, mood disorders, substance abuse, and suicide (Lin et al.; 2016). Lin et al. (2016) run a Poisson regression model linking data changes in environmental factors -particularly power outages- to emergency department (ED) visits for mental health problems. Results show a statistically significant increase in the use of anxiolytics/hypnotics among male retirees (15.88%) and non-retirees (12.2%).

The last two studies deal with Hurricane Katrina. Thirty days after Hurricane Katrina, Galea et al. (2007) conduct a community survey of 1043 pre-hurricane English-speaking residents in New Orleans, Alabama, Mississippi, and Louisiana to examine hurricane-related stressors, anxiety-mood disorders, and PTSD. The authors find that among residents of the New Orleans metropolitan area before the hurricane, the 30-day prevalence of anxiety and mood disorders was 49.1% (estimated prevalence of PTSD: 30.3%), compared with 26.4% (12.5% PTSD) in the rest of the sample. The extent of stressor exposure is also more strongly related to outcomes in the New Orleans metropolitan area subsample than in the rest of the sample. The stressors most strongly associated with these outcomes are physical illness/injury and physical adversity in the New Orleans metropolitan area subsample and property loss in the rest of the sample. In the same affected areas, Kessler et al (2006) used pooled logistic regression and a Taylor series linearization model to examine the frequency of episodes of major depressive disorder (MDD), panic disorder, generalized anxiety disorder, PTSD, agoraphobia, social phobia, and specific phobia, as well as suicidal thoughts, plans, and attempts among adults aged ≥18 years. Respondents were more likely to have a severe mental illness after the hurricane (11.3%) than before (6.1%) (mild to moderate mental illness after the hurricane 19.9%, before 9.7%; any mental illness 31.2% after the hurricane, before 15.7%). Differences in suicide patterns were not significant. Many people suffered from PTSD, stress, depression, and anxiety related to the hurricane events. Severity of exposure, physical injury, loss of property, and previous mental health problems have been shown to be stable predictors of the development of distress. One

strategy for coping in the immediate aftermath of a hurricane is to successfully evacuate vulnerable areas by reducing casualties (Cianconi et al., 2020).

1.4. Discussion

This systematic review contributes to the knowledge of the relationships between several extreme weather events (global warming, bushfires, floods, droughts) and mental health outcomes (heat stress, depression, anxiety, PTSD, and others) in different areas of the world. After a systematic literature search of seven databases, we included 22 eligible studies in this review with a variety of study designs, study populations, exposure and outcome assessments, and qualities. For the included extreme temperature studies, potential confounders such as humidity, wind speed, day of the week, and time course were generally well controlled. The effects of extreme heat events were examined in most studies, and most of them reported negative effects on overall mental health status, regardless of climate region. In most studies, mental health, human well-being, and heat temperature seem to be particularly related. Heat stress directly caused by heat waves has been associated with mood disorders, anxiety, and related outcomes (Padhy et al., 2015). In addition, people with mental illness were three times more likely to die during a heat wave than those without mental illness (APA, 2017). Some evidence suggests a difference in vulnerability between the sexes, with women being most at risk (Dai et al., 2017). Negative consequences of heat waves are also related to social factors: The elderly and those with low socioeconomic status have been shown to be more vulnerable to disaster-related anxiety and mood disorders. In addition, a positive correlation has been found between heat stressors (e.g., sleep disturbances) and feelings of hostility and aggressive thoughts and possibly actions (Basu et al., 2017). Nevertheless, all authors concluded by emphasizing the importance of investing in preventive measures against heat, planning targeted public health surveillance, and providing countermeasures for vulnerable individuals to protect human health. A combination of high temperatures and low rainfall increases the frequency of droughts in the world (Demetillo et al., 2019). Temperature variability correlates with agricultural losses, a decline in economic growth, long-term economic disadvantage, and even political instability and conflict (Bathiany et al., 2018). Sartore et al. (2008) and Keshavarz et al. (2013) portray farmers' vulnerability to environmental mental health risks from drought as the regulation and adjustment of their emotions is disrupted by depression, demoralization, fatalism, and passive surrender to fate.

Floods are one of the most common types of major disasters, resulting in 53,000 deaths over the past decade (Nahar et al., 2014). The focus of many articles is on PTSD occurring immediately after

flooding, when vulnerable people are more at risk and susceptible (Nahar et al., 2014). However, it is noted that the disruption of infrastructures caused by the floods is one of the most dangerous impacts, as it could potentially exacerbate mental health issues and cause problems for standard care systems, including mental health care that could support and mitigate the psychological impact on victims.

In addition, families who do not live near the affected area also exhibit high levels of post-traumatic stress as they still bear the burden of disrupting community cohesion (Hetherington et al., 2017). The interactions between mental health status and community and family social cohesion in the immediate aftermath of disasters appear to be critical to reducing suffering and promoting effective recovery (Stanke et al., 2012). People affected by flooding may demonstrate remarkable resilience, but still need organizations to support them to recognize and cope with the emergency while providing assistance to avoid potential additional mental health problems or disorders resulting from the situation. Community resilience also has a preventative effect by preparing the population for future events while helping them cope with the current situation (Hetherington et al., 2017). Hurricanes have increased in intensity, frequency, and duration in recent decades. In our study, data on hurricanes and mental health problems came from Hurricanes Katrina in Florida and Louisiana in 2005 and Sandy in 2012 (Kessler et al., 2006; Galea et al., 2007; Neria and Shultz, 2012). Severity of exposure and previous mental health problems have been shown to be stable predictors of the development of distress (Bourque et al., 2006). Damage to health care infrastructure and disruption of public health services due to hurricanes lead to increases in PTSD, stress, depression, anxiety (Ruskin et al., 2018), and suicide (Kessler et al., 2006). However, the prevalence of PTSD, which has been studied in more detail, is consistently associated with several factors, including age, sex (women), low educational attainment, low socioeconomic status, pre-hurricane unemployment or disability, and relationship status (single), (WHO, 2014). Shelter placement often disrupts normal psychological processes, particularly familiarity, attachment, and identity, by leading to disconnection from social support networks and a decrease in perceived social support in the months following the hurricane, which in turn has been shown to be associated with an increase in symptoms of general psychological distress. Moving from one emergency shelter to another is traumatic and compounded by the limited availability of health services (Taioli et al., 2018).

Finally, our review highlights that the consequences of climate-related disasters are dissimilar for low- and high-income countries since the gravity of loss and damage could also depend on the vulnerability and adaptive capacities of societies and to the target-oriented adaptive strategies to the various impacts of climate -related hazards. Indeed, for the latter are crucial policies that try to prevent

these consequences whereas for the former is fundamental rebuilding and helping individuals to deal with material and personal losses after the event and facing shortly to the disruption of structures, such as hospitals, and roads needed to achieve the affected areas. Both characteristics belong to medium- or high-income countries that are able to invest a large amount of money in policies to recover and support areas affected by or that could be shortly affected by some climate-related disaster.

1.5. Conclusions

This systematic review adds to the growing body of evidence that some extreme weather events affect human health. We included studies on the effects of climate change and extreme weather events on mental health, noting that climate is only one of several factors that influence the occurrence of these conditions. One of the strengths of this systematic review is the comprehensive manner in which we examined the associations between extreme weather events around the world and their impact on mental health, which provides insights into the diversity and severity of climate impacts at the regional level. The systematic approach and the three databases used to identify relevant studies increased the sensitivity of the literature search and reduced the risk of overlooking relevant articles. The moderate-to-high quality of the included studies indicates that the studies were carefully conducted, potential confounders were identified and controlled for, and the results are generalizable across settings. In addition, the missing themes and research gaps found in the included studies should be able to guide future research overall.

Nonetheless, there are several limitations to our review that should be considered. First, the included studies had heterogeneous study designs, study populations, methods, and quality, making it difficult to draw definitive conclusions. Second, some relevant studies may inadvertently have been neglected, although we tried to include all eligible studies.

Future studies should consider social and political aspects in addition to meteorological impacts. It is expected that more studies on region-specific effects of extreme weather events on mental health will be conducted to make the results comparable worldwide.

Finally, we reckon the requirement of a new model for proactive management that will focus on building a resilient society in the countries as policy options. Useful principles for urban resilience include homeostasis, omnivory, high flux, flatness, buffering, redundancy, foresight and preparedness/planning, compartmentalisation, and flexible planning/design. A resilience approach makes the system less prone to disturbances, enables quick and flexible responses, and is better

capable of dealing with surprises than traditional predictive approaches. Local actors frame resilience as a flexible approach to adaptation that would be more suitable and tailored to local situations than rigid top–down regulations. In addition to a change in policy, it would require a more pro-active mentality among the population that needs to be educated about climate changes and lifestyle adaptations that are responsible and respectful of nature.

Figure 1- American Psychological Association Task Force on the Interface, list of the direct and indirect impacts of climate change and variability on mental health and wellbeing

Possible Direct Pathways	Potential Implications for Mental Health & Well-Being	Possible Indirect Pathways
Acute or extreme weather events and storms (cyclones, tornados, hurricanes)	Elevated rates of mood disorders and depression	Physical health (communicable and non-communicable diseases, allergens, nutritional disruption)
Sub-acute weather events (drought, heat waves)	Elevated rates of acute anxiety disorders and chronic stress	
	Increased incidences of violence and conflict	Disruption to social and economic support networks (loss of livelihoods, decreased social connections, disruptions to communities)
Resulting natural disasters from acute and sub-acute events (mudslides, wildfires, flooding)	Increased rates of suicide ideation and traumatic deaths	
	Sense of loss of identity, purpose, capabilities, and place	Landscape degradation and loss of ecosystem biodiversity (experienced indirectly, through mediated experiences or affecting activities, livelihoods, and lifestyle through affecting another pathway)
Landscape degradation and loss of ecosystem biodiversity (experienced directly, disrupting activities, livelihoods, and lifestyle)	Increased rates of drug and alcohol usage	
	Strong emotional reactions: sadness, distress, fear, anger, worry, helplessness	

Chapter 2

The Affordable Care Act effects on Americans' Mental Health, Health Behaviours and Preventive Healthcare Access: Evidence from MEPS

2.1. Introduction

The Patient Protection and Affordable Care Act (also known as the Affordable Care Act - ACA) was approved in March 2010 and came into effect in January 2014. Through a combination of mandates, subsidies, Medicaid expansions, and health insurance exchanges, the ACA has reformed the US health care system, making the healthcare services far more affordable, particularly for a share of the US population that, before the reform, could not afford them. The ACA implementation has allowed the US health care system to insure a large number of Americans, especially low-income individuals and immigrants (Blumenthal et al., 2020): even though the ACA has led to an increase in the healthcare services access, its effect on individual health and health behaviours requires being further investigated.

The literature on the effects of the ACA's implementation on individuals has mixed results. Amongst them, Barbaresco et al. (2015) found mixed evidence regarding the impact of dependent coverage expansion (DCE) on risky health behaviours: They observed an increase in the probability

of risky drinking as well as an improvement in weight-related behaviours, though the DCE did not have a significant impact on preventive care among young adults. Furthermore, Courtemanche et al. (2018) showed that the ACA has increased the prevalence of preventive care use (i.e., well-patient check-ups, pap and HIV tests, and mammograms), though there were no statistically significant effects in terms of body mass index (BMI) and smoking behaviours. Finally, Antwin et al. (2015), investigating the Dependent Coverage Provision effect, found evidence that adults aged 19 to 25, compared to those aged 27 to 29, increased their inpatient visits by 3.5 percent, while mental illness visits increased by 9.0 percent.

Our contribution aims at elucidating the impact of four policies included in the ACA reform on individual health-related matters. In particular this paper investigates the impact of Medicaid expansion, Dependent Coverage (also in accordance with the above-mentioned literature), Premium Tax Credit and Employer Mandate (for a more detailed description of these policies, see Section 2) on the individuals' self-perceived mental health status, on the preventive care (specifically, blood pressure check and blood cholesterol check) and on health behaviours (specifically smoking habits obesity).

Using existing health insurance models, this paper examines whether the extension of health insurance coverage due to the implementation of the ACA resulted in individuals who were uninsured prior to the reform engaging in risky health behaviours. Since the effective ex-post cost of illness declines with insurance coverage, people have fewer incentives to protect themselves from disease risks and might be more likely to engage in unhealthy activities, such as smoking, unhealthy eating, and sedentary behaviours. As shown in the medical literature, these dysfunctional behaviours are likely to cause serious long-term health problems, with obesity being the highest risk (Bonnet et al., 2005; Pinto and Trunzo, 2005; Wu et al., 2006; Loewenstein et al., 2007; Jones and Lollar, 2008; Ding et al., 2015). If the ACA's expansion of health insurance coverage was accompanied by increased risky health behaviours and unhealthy lifestyle changes, then the net benefit of this large-scale reform on Americans' health would be significantly reduced.

Furthermore, we have investigated the impact of the reform on the perceived mental health of individuals since the ACA has provided the largest expansions of mental health and substance use disorder coverage, requiring all plans to offer affordable mental health and substance use disorder service without any discriminatory financial requirements and quantitative and not quantitative limits[6] (Frank & McGuire, 2000).

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[6] In 2019, the incidence of mental illnesses in U.S.A among U.S. adults was of 20.6% for mental illness in 2019 (51.5 million people) and of 5.2% for serious mental illness in 2019 (13.1 million people). Mental Alliance on Mental Illness

To test the impact of the ACA on onset-insured mental health, physical and health behaviours, we used longitudinal data drawn from the 2014–2018 Medical Expenditure Panel Survey—Household Component (MEPS-HC; Yoon and Bernell, 2013; Breslau et al., 2017; Gai and Jones, 2020). MEPS is an ongoing survey sponsored by the Agency for Healthcare Research and Quality (AHRQ), which provides a nationally representative sample of US civilian non-institutionalised individuals. MEPS is self-reported and contains detailed information on demographics, including age, sex, marital status, education levels, income, work status, and geographic location. It also collects information on the respondents' health statuses, health charges and payments, access to care, health conditions, health behaviours, and health insurance coverage.

Propensity-score matching (PSM) was employed to determine the differences in the observable characteristics between individuals enrolled in health insurance plans and those who were uninsured and their complex relationship between health insurance and preventives activities and the direct or indirect effects that exogenous insurance has. Our results support the ex-ante moral hazard hypothesis: The provision of health insurance due to the ACA reform discouraged individuals from pursuing healthier lifestyles until to behave in a riskier way, for example increasing the risk of being obese or do not checking the cholesterol levels in the blood, even if it was demonstrated that having access to healthcare services decreased smoking among Americans: Medicaid expansion decreased smoking by 4%; the DCE decreased smoking by 17%; and the premium tax credit decreased smoking by 11%. Finally, contrary to what was expected, we identified a general improvement in the poor self-perceived mental health through all the policies.

The remainder of the paper is structured as follows. Section 2 describes the Institutional Background and the ACA reform. Section 3 reviews the previous literature. Section 4 describes the data and the empirical model, while the results are presented and discussed in Section 5. Concluding remarks are made in Section 6. The sensitivity analysis is available in the Appendix.

2.2. Institutional Background

The US healthcare system is characterised by both private and public health insurance coverage, as is the case in many other countries in the world. However, the US is unique in that private health insurance companies are dominant as they cover the largest portion of the American population

(Assaf et al., 2017). Indeed, according to the most recent data from the US Census Bureau (2019), approximately 68% of the US population is covered by private health insurance. In 2018, employer-based health insurance was the largest source of health coverage for the non-elderly, covering around 55.1% of this population (US Census Bureau, 2018).

Medicaid and Medicare are both governmental health insurance plans, financed by the US state and federal governments, but they differ in the candidates who are considered eligible for insurance coverage and in what they cover. Medicare is a federal programme funded through social security payments that mostly provides health coverage to people aged 65 and older, to some disabled people under 65, and to people with end-stage renal disease and amyotrophic lateral sclerosis. Medicaid is jointly funded by US federal and state authorities and is available to individuals of all ages and low-income families that cannot afford proper medical care. Each state sets its own rules about eligibility, which depends on several factors, including age, pregnancy status, disability, income, and resources, in addition to whether individuals are US citizens or legal immigrants. Due to the ACA, Medicaid has recently been expanded to all non-elderly citizens and eligible legal residents whose family income does not exceed 133% of the federal poverty line (FPL). In July 2016, 30 states and Washington, D.C. expanded Medicaid, and 20 states did not. State discretion on key aspects of coverage expansion limited the extent to which regional differences narrowed and tempered national gains, resulting in disparities in coverage and access across states. Each state determines its own criteria for what types of healthcare coverage are included in state-funded services and who can benefit from them. Moreover, each state decides if these services will be supplemental services that fill the gaps in other public insurance plans or whether they are essential services for uninsured people. For example, some state-funded services offer financial support services to people with serious mental illnesses in the form of income or housing assistance.

Americans can either buy individual health plans offered by private health insurance companies directly or gain coverage through employer-based mechanisms, which is dependent on the number of employees in the company, such as whether they are small or large companies.

2.2.1. The Healthcare Coverage and The Ten Essential Benefits

The ACA was signed into law by President Obama in March 2010, thus introducing important changes in the US healthcare system with the intent to improve the overall quality of the healthcare services provided (Di Novi and Migheli, 2017). To achieve this goal, all plans were mandated to

guarantee the 'ten essential health benefits', which are the services offered by a typical insurance plan, including general medical treatment such as inpatient hospitalisations and pharmacotherapy, and behavioural healthcare, which relates to mental illness in the form of partial hospitalisation, mobile crisis services, and assertive community treatment. Moreover, the ACA amended the Mental Health Parity and Addiction Equity Act (MHPAEA) introduced in 2008 by the US Government, in order to ensure that mental health and substance use disorder treatments are delivered in a comparable manner to the medical and chirurgical benefits by health plans, without any discriminatory financial requirements and quantitative and not quantitative limits.

2.2.2. The Policies

The ACA provided substantial federal funding to states so as to allow for the expansion of the Medicaid public programme in the form of non-elderly adults with a family income below 133% of the FPL being considered eligible. After the Supreme Court's 2013 decision on states having the option to adopt the Medicaid expansion or not, 25 states and Washington D.C. expanded their Medicaid programmes (Beronio et al, 2014). Kominski et al. (2016) asserted that, immediately after the ACA's implementation in 2014, the probability of obtaining healthcare coverage increased by 68% for childless adults and by approximately 40% for all adults in the states that adopted the expansion compared to the period before the ACA's implementation.

The ACA also introduced the premium tax credit, which offers tax credits to people with an income between 100% and 400% of the FPL and who do not have affordable employer-sponsored coverage but have private insurance coverage through the state and federal health insurance marketplaces that were established in each state (Beronio et al., 2014). Indeed, through these marketplaces, individuals can choose their degrees of coverage: from the plans with the lowest premiums and higher out-of-pocket costs to the plans with the highest premiums and lower out-of-pocket costs. In addition to premium subsidies, the ACA also established cost-sharing subsidies through which individuals with an income lower than 250% of the FPL receive a subsidy on their cost-sharing expenses, thereby benefitting from a higher actuarial plan coverage that is equal to that of a more comprehensive plan, such as a 'Gold' or 'Platinum' plan (Zhang et al., 2014).

The DCE allows dependents to extend their coverage under their parents' health insurance to 26 years of age instead of the previous cut-off ages of 19 for non-students and 23 for students. A 'dependent' is anyone who is claimed as a spouse, domestic partner, or a child younger than 26 on an

individual's income tax return. These children can be biological, legally adopted, or stepchildren. Thus, the DCE acknowledged the group that had the largest proportion of those without health insurance: young adults. Antwi et al. (2014) stated that before the ACA was enacted, around 40% of individuals aged 21–23 were uninsured, and they were the group with a higher prevalence of mental health needs compared to the rest of the US population. Moreover, the DCE mandates that insurance companies allow dependents to take advantage of all the services provided by the ACA without any supplemental premium needing to be paid and regardless of their economic and social statuses (e.g., student or worker, married or single, financially independent or financially dependent on their parents). This allows parents' insurance plans to be characterised as small, large, group, individual, or Medicaid plans. Although the adoption of the DCE was not mandated by law, 37 states enacted this policy and set limitations for it, such as the majority of companies requiring applicants to verify their status as a student when applying for the DCE. Due to the implementation of the DCE under the ACA reform, a large number of young adults gained comprehensive healthcare coverage under their parents' plans, allowing them to access all the services they needed. Therefore, among younger adults, there has been a significant decrease in the likelihood of their delaying or not obtaining care (Sommers et al., 2013).

The Employer mandate mandates the employers whose employee labour force is higher than 50 full-time employees and/or full-time equivalents (FTEs) to ensure them an affordable health insurance and a minimum value coverage. "Affordable" means that the employee contributions for employee-only coverage do not exceed a certain percentage of an employee's household income, while "minimum value" is a plan that pays at least 60% of the cost of covered services. If employers do not offer an adequate coverage to their employees or any coverage at all, they will receive an economic sanction. This mandate aims at sharing the responsibility for health plan coverage between employer and employees. The relevance of this mandate is due to the large number of Employer-sponsored health insurance in the American Healthcare System.

Through these changes in health insurance coverage, the ACA has led to a significant increase in the number of people who qualify for eligibility: Prior to the implementation of the ACA, most individuals who purchased individual (nongroup) coverage were not eligible for any financial assistance from the government, and due to the Medicaid expansion (in those states that adopted this policy), the new tax credit ensured that most Americans with incomes below 400% of the FPL who were uninsured had access to financial assistance for their health insurance.

2.3. Literature Review

From 2014, many studies have been conducted on the potential effects of the ACA. Different aspects have been highlighted, such as Adams et al. (2015) using national surveys from 2011 and 2012 on previous preventive measures to demonstrate that individuals' demographic or socioeconomic conditions can influence their use of preventive care. In fact, in the years immediately following the implementation of this policy, a consistently different effect was found across racial and ethnic dimensions: Hispanic young adults and lower-income groups were less likely to access preventive care than those who were not covered before the ACA's implementation.

Barbaresco et al. (2015) focused on the DCE, which was implemented on September 23rd, 2010. This provision allowed dependents to remain on their parents' private health insurance plans from the start of the first plan year until they turn 26 years old (a plan year is generally the twelve-month period beginning when the health plan comes into effect). Employing data from the Behavioural Risk Factor Surveillance System Survey (BRFSS), these authors used a difference-in-differences approach on 23–25-year-olds, who were categorised as the treatment group, and 27–29-year-olds, who comprised the control group. Their findings demonstrated that this provision increased their access to health insurance, primary care doctors, and reports on their self-assessed mental health and also led to a reduction in obesity. However, this policy also resulted in an increase in high-risk drinking and did not lead to any significant increases in the use of preventive care.

Winkelman and Chang (2017) investigated the effects of Medicaid Expansion on the mental health in a sample of adults of age 18 to 64, whose family income was below 133% of the federal poverty line, using data from 2011 to 2015 of BRFSS and comparing those citizens who lived in States that brought the Expansion and those who lived in States that did not. They found that Medicaid Expansion is associated with the reduction in poor health days (-1.2 days) or in days limited for poor health, but only among the population suffering from chronic conditions. Medicaid Expansion has also brought a reduction in depression diagnoses (-3-4%) among adults with chronic conditions. Simon et al. (2017) investigated how the expansion of Medicaid has affected the use of preventive care (e.g., dental visits, immunisations, mammograms, cancer screenings), risky health behaviours (e.g., smoking, heavy drinking, lack of exercise, obesity), and self-assessed health among low-income individuals aged between 19 and 65 years of age. Using a difference-in-differences model with data that were collected between 2010 and 2015 in the BRFSS, the outcomes of the states that did expand Medicaid and those that did not were compared. These findings underscored the impact of increased insurance coverage on the use of certain preventive care programmes and in individuals' self-assessed

health in the states that expanded Medicaid. However, no evidence for increased ex-ante moral hazard attitudes was found.

Courtemanche et al. (2018), who used a difference-in-difference-in-differences model with data from the 2011–2016 BRFSS found that the ACA increased the use of some types of preventive care in non-elderly adults between 19 and 64 years of age: They underwent well-patient check-ups, pap and HIV tests, and mammograms. However, no evidence was found for a statistically significant effect on individuals' getting flu shots, their BMI, drinks per month, smoking, or exercising. Therefore, gains in preventive care are concentrated among those in the lower half of the income distribution, while the ex-ante moral hazard can be seen among the upper half.

To the best of our knowledge, the effect of the ACA on the moral hazard attitude has scarcely been investigated. Indeed, only Mendoza (2016) conducted a literature review to investigate the relevance of the moral hazard to the ACA. This qualitative study analysed the moral hazard theory, its evolution, its alternative theory, and in which ways it affected healthcare production and consumption under the ACA, from which it was concluded that the moral hazard could be treated as an opportunity to generate welfare and equity depending on the ACA provisions, insured population, covered illnesses, treatments, services, and outcomes that are taken into account.

Since the ACA's primary goal is to improve American citizens' general health outcomes, an important aspect to consider is the impact of ACA on individuals' obesity and smoking habits, which are both multifaceted conditions that have psychological and social factors. Healthcare providers should attempt to modify individuals' behaviours to reduce the prevalence of these behaviours. Obesity is a chronic metabolic condition that leads to both short- and long-term health problems, and it has a direct impact on annual medical costs and an indirect effect in the form of productivity loss. This condition requires a multilevel approach (Bowen et al., 2018). , Despite the expected effects of the ACA reform, Courtemanche et al. (2018) revealed that there were no statistically significant results for changes in BMI in the three years after the ACA's implementation. The authors hypothesised that the reduction in medical costs due to the coverage provided could lead to less healthy lifestyles through the ex-ante moral hazard since financial risk-sharing in healthcare is proven to incentivise unhealthier attitudes.

Smoking is a preventable behaviour that leads to disease, disability, and death (The Centre for Disease Control and Prevention, 2019). Due to this, the ACA allows insurers to impose a surcharge of up to 50% on tobacco users' premiums for plans purchased on the marketplace. Friedman et al. (2016) analysed data from the 2011–2016 BRFSS, which investigated US adults between 25 and 65 years of age who had incomes above 100% and below 400% of the FPL (i.e., those excluded from

Medicaid and Medicare coverage). This analysis revealed that one year after the ACA's implementation, smokers who faced surcharges had significantly reduced coverage (11.6% compared to 4.6% of smokers who did not face surcharges) and that smokers who faced lower surcharges had quit smoking in significant numbers. These results conflict with the goals pursued by the reform.

2.4. Empirical Strategy

2.4.1. Sourcing the Data

This study used the longitudinal data from the 2014–2018 MEPS-HC that were collected by the AHRQ, which is a federal government organisation that has collected MEPS data since 1996. MEPS is an ongoing national survey of representative samples of the US civilian noninstitutionalised population, and the Household Component collects data from households and individuals in selected communities across the US, which is a sample drawn from the nationally representative subsample of households that participated in the prior year's National Health Interview Survey conducted by the National Centre for Health Statistics. MEPS is self-reported and contains detailed information on the financing and consumption of medical care as well as demographic information (i.e., age, sex, marital status, income, work status, and geographic location). In addition, MEPS contains information on the respondents' health statuses and conditions, health costs and payments, access to care, and health insurance coverage.

Data from 2014 were analysed as this is the year in which the policy interventions that were analysed came into full effect. A subsample of 58,138 individuals and their healthcare experiences over a span of two consecutive years (2014–2015, 2015–2016, 2016–2017, or 2017–2018; cohorts were added every two years to maintain a representative sample) were analysed, resulting in 84,644 observations. The subsample included individuals of working age (18–65) who had health insurance through their parents' coverage, individual markets, their employers, or organisations such as unions, professional associations or other groups, or Medicaid. We took advantage of the extension introduced by the ACA, thereby allowing us to test the effect of onset-insured status on health and health behaviours. Those who were covered under Medicare were excluded from the sample (i.e., individuals aged ≥65) since this federal health program for older Americans was not interested by the reform, and veterans covered by Champus or ChampVa insurance were also omitted from the dataset since their demand and access to medical services significantly differed from the rest of the sample.

2.4.2. Estimation Strategy

This research aims to investigate the effects that some specific interventions (described in Section 2) introduced by the ACA might have had on the American population using a national survey. Notably, we have focused on the perceived mental health of American citizens, on preventive care (blood pressure and cholesterol checks), on smoking attitude and on obesity risk.

From a methodological point of view, in observational data treatment, assignment is not random. This leads to greater odds for individuals not to have the same distribution of observed and unobserved characteristics in the treatment and comparison groups, making it more difficult to find comparable observations for estimating the counterfactual. Propensity scores is a useful tool for estimating the effect of a treatment on an outcome using observational data and when selection bias due to non-random treatment assignment is likely. Indeed, the PS matching technique allows to produce two balanced groups, one made up of the insured and one made up of the uninsured ("statistical twins"): the score substitutes a collection of confounding variables with a single covariate that is a function of all the variables, making it easier to both isolate the effect of the treatment and to use the control group as proxies for the counterfactual.

In our case, people with health insurance coverage may differ substantially from the uninsured: for instance, the insured may have better health or socio-economic conditions and be eligible (and thus obtain) for a more affordable insurance plan. This potential endogeneity problem can be corrected by matching each insured (the 'exposed/treated') with an uninsured individual (the 'control/untreated') on each characteristic known to be associated with the likelihood of insurance coverage and health, preventive care and health behaviour outcomes (Caliendo and Kopeinig, 2008).

The validity of Propensity Score Matching is based on the Conditional Independence Assumption (CIA) which requires the independency for any treatment outcome from any given value of a vector of observable characteristics (Ichino et al., 2008). In our study, we cannot include all the factors that could influence the outcomes, but we have a rich set of variables that directly impact on the outcomes under the assumption of exogeneity. We evoke the common support modeling option which restricts the set of data points over which the test of the balancing property is sought to those belonging to the intersection of the supports of the PS of treated and controls.

Applying this method, mental health, preventive care and health behaviours of matched individuals are compared to estimate the average effect of being insured rather than not. Specifically, we are interested in the average effect of the treatment on the treated (ATT), that is the difference between

the mental health, preventive care and health behaviours outcomes for those who are insured and those who are not.

We tested the robustness of our results by performing the matching with different algorithms: Radius (with caliper size 0.0001, except for The Employer Mandate it was 0.0015) and Kernel Matching (with caliper size 0.0001, except for The Employer Mandate it was 0.0015).

2.4.3. Outcome Variables

As stated before, in this report, we have taken into account five dependent variables: mental health status, smoking attitude and obesity risk, blood cholesterol, and blood pressure checks. The status of individuals' mental health is measured through a self-reported indicator.

The following standard self-assessed mental health status question was asked: 'Would you say that, in general, your mental health is: excellent, very good, good, fair, poor?'. Self-assessed mental health was therefore measured on a five-point scale from 'excellent' (score 5) to 'poor' (score 1) (O'Donnell et al., 2008). We have dichotomized the multiple-category responses to construct a binary indicator with value one if individuals report that their mental health is fair or poor and zero otherwise (excellent, very good or good) in line with the most widely used methods of scaling self-assessed mental health available in the literature (see, for instance, Browne and Doerpinghauset, 1993; Shibuya et al. 2002; Schneider and Schneider, 2006; Unden and Elofosson, 2006; Piko and Kereszteset, 2007; Contoyannis and Jones, 2004; Balia and Jones, 2008; Di Novi, 2010; Di Novi, 2013). This practice helps to avoid the imposition of some scale, even though it results in a loss of some information (Wagstaff and Van Doorslaer, 1994).

To test the *ex-ante* moral hazard phenomena, we have included in our analysis several measures of preventive care and health behaviours. Indeed, the previous literature reveals that having health insurance might have a distortive effect on lifestyle choices (Anderson and Stanciole, 2008). The ex-ante moral hazard, in particular, refers to the incentive of individuals to increase their risky behaviours usually affecting the future costs of illness whose economic responsibility will be shared with the insurance companies (Maia et al., 2019). Therefore, health insurance coverage may cause a reduction in prevention activities (including a healthier lifestyle), since individuals could be less concerned about their future health status and its costs (Ehrlich and Becker, 1972): according to Stanciole (2008), health insurance coverage provides incentives to smoke more and to reduce physical exercise, together with the likelihood of suffering from being overweight or obese.

The smoking habits of the individuals are measured through a self-reported binary indicator. We created a dummy variable that takes value 1 if the respondent is a current smoker, 0 otherwise.

We use the Body Mass Index (BMI) to compute an indicator of the individuals' risk of suffering from obesity. BMI is a useful measure of body size that combines weight with height (weight in kg/height in m). The National Heart, Lung, and Blood Institute (NHLBI) in United States defines BMI as an advantageous measure for overweight and obesity. If the BMI is higher than 25, the individual is at risk of overweight; when the BMI is higher than 30, the individual is at risk of obesity. We constructed a binary variable as an indicator of the risk of being overweight that takes value 1 if BMI≥ 25 , and 0 otherwise.

Moreover, we employed two measures of preventive care: blood cholesterol and blood pressure checks; high blood pressure and high cholesterol are strictly connected to the probability of suffering from cardiovascular diseases such as atherosclerosis, heart attack, stroke and hypertension; and the early identification of one of these two chronic illness symptoms could minimize the probability of developing a full-blown illness and its secondary complications.

The following self-reported status about the control of pressure or cholesterol were asked "Did you check blood cholesterol in this year" and "Did you check blood pressure this year?". We constructed two binary variables that take on the value 1 if the self-reported answer is affirmative, or the value 0 otherwise.

2.4.4. The Logit Model for the Propensity Score

A logit model was developed and used to determine the scores: The dependent variable was a binary variable in which 1 denoted the interviewees who were insured and 0 represented the uninsured participants. We constructed the treatment variable using the respondents' self-reported answers to the following question: 'What is your current health insurance coverage condition: private, public, or uninsured?'. We used the biennial information to extract the onset insured and create a dummy variable in which 1 denoted the respondents who were uninsured in the first year but gained coverage in the second year and 0 represented those who were uninsured the entire time. We also eliminated those who were insured and remained insured in the second wave of the interviews from the sample. Moreover, since each of the four policies under investigation refers to a specific class of individuals, we created four different samples in order to identify through which policy individuals obtained health coverage, thereby isolating the causal effect between a specific policy and its outcome. Indeed, for the sample impacted by the Medicaid expansion, we selected individuals who belonged to the

groups defined in the survey as poor (100% of the FPL) and near poor (100%–124% of the FPL). For the DCE, all individuals older than 26 years old were excluded from the sample, thereby avoiding any overlap with the DCE. For the sample impacted by the premium tax credit, we selected those who were considered low-income (125%–199% of the FPL) and middle-income (200%–399% of the FPL). Lastly, for the sample impacted by the Employer Mandate, we selected only employees who work in big companies (namely, with a number of employees ≥50).

The independent variables were grouped into the following categories: demographics (i.e., age, age squared, area of residence), family conditions (i.e., number of family members, number of family members squared, marital status), socioeconomic conditions (i.e., educational levels, income, employment or self-employment status), health conditions (i.e., in need of care, in need of a specialist, poor health status and poor mental health status at time t-1, activity limitations), and insurance attitude. Age is a continuous variable that was employed to identify the beneficiary of these policies: For the regression analysis related to the DCE, we used this variable to define those who were eligible for this specific policy, but we used the continuous variable in the premium tax credit and Medicaid expansion samples as there are no age requirements in these policies. Marital status was categorised into married, never married, divorced, widowed, and separated. We created a binary indicator for each marital status. The International Standard Classification of Education (ISCED) was used to classify the education variable. ISCED is classified into seven levels: 0 (pre-primary schooling); 1 (primary education); 2 (lower secondary); 3 (upper secondary); 4 (post high school); 5 (university); 6 (postgraduate). In the analysis, the ISCED levels were categorised into three groups: 0, 1; 2, 3; and 5, 6. Three levels of education were considered: (1) no education or primary school education (low education); (2) lower high school education (secondary education) or high school education (medium education); and (3) university degree or postgraduate qualification.

Regarding income factors, family income was denoted as a percentage of the FPL. Five aspects were included among the control variables: poor income, which is an income less than 100% of the FPL; near poor income, indicating an income of between 100% and 124% of the FPL; low income, referring to an income between 125% and 199% of the FPL; middle income, denoting an income between 200% and 399% of the FPL; and high income, signifying an income that is equal to or more than 400% of the FPL. Among the control variables, we included the family size to ensure that family members' disposable income was taken into account.

The quality of care and health status differs between ethnic groups in the US as there is a significant association between health disparities due to race, poor health status, and mental illnesses (Miranda

et al., 2008).[7] Therefore, we controlled for individuals' ethnic characteristics as follows: White (reference category), Black, Hispanic, and Other Races (e.g., Asian, Indian). We also constructed a variable concerning respondents' areas of residence, which were categorised into the Northeast, South, West and Midwest, with a binary indicator for each. While it would have been useful to analyse the impact of the reform by comparing states that have implemented these policies to those that have not, the MEPS does not specify in which state respondents live as it only provides the regions listed above. Therefore, these cardinal points were used to determine if geographic variation had an influence on health indicators, disparities in coverage, and access (Radley et al., 2016).

The literature has demonstrated that individuals who are engaged in paid work have more opportunities to build self-esteem, social support, and life satisfaction, especially for women when comparing workers and homemakers (Sorensen and Verbruggeet, 1987; Annandole and Hunt, 2000; Artazcoz et al., 2004). Accordingly, among the control variables, we included employment status as a dummy variable, with 1 representing the employed and 0 denoting the unemployed. Moreover, we controlled for employment status because most non-elderly US citizens obtain health insurance through their employers, organisations such as unions and professional associations, or other groups to which they belong. Moreover, people who do not have access to group insurance (e.g., self-employed individuals or people who are not offered health insurance plans through their work) may choose to purchase individual health insurance from an insurance company, which usually has higher premiums. Thus, employment may have an influence on the probability of being insured (Rubin and Thomas, 1996; Brookhart et al., 2006). Herein, the premium tax credit is applied to both employed and self-employed individuals. Poor health status was also included among the regressors since individuals' poor health status is strongly correlated with the outcomes analysed.

The moral hazard was measured in terms of the likelihood of being at risk or participants considering health insurance to be worthless. Individuals that belong to lower socioeconomic groups smoke from an early age and are at a high risk of dying from smoking-related diseases (Kunst et al., 2004). Additionally, obesity could be associated with a moral hazard behaviour since having insurance and bearing a small portion of the total costs of the consequences could lead to an individual taking more risks. Stanciole (2007) highlighted that having insurance encourages heavy smoking, sedentarism, and obesity.

[Table 1 about here]

2.5. Results

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[7] Losing Ground: How the Loss of Adequate Health Insurance Is Burdening Working Families.

Table 2 shows the pre-matching summary statistics. Minor differences exist between the insured and the uninsured: Insured individuals presented a slightly lower risk of obesity, smoked less, and accessed preventive healthcare services in the form of blood pressure and cholesterol checks more frequently. Apparently, the insured present a higher risk of suffering of poor mental health. This finding aligns with the literature in that uninsured patients were more likely to adopt the most common risk behaviours, such as eating fried foods, not eating the recommended quantities of vegetables and fruits per day, drinking caloric beverages, not exercising regularly, smoking, and not seeking medical care when needed. Conversely, insured patients, particularly those with private insurance, were more likely to be risk averse and to consequently have a healthier lifestyle (i.e., they exercised more and smoked less) and to invest more in preventive treatments (Courbage and De Coulon, 2004; Smalley et al., 2012; Hemenway, 1990, 1992).

The results of the logit model for the PSM and the balancing test are displayed in Table 3. The results of the covariate balancing test demonstrate that both the type of matching chosen, and the narrowness of the caliper mitigated the differences in observable characteristics between the insured and the uninsured: The absolute median bias was reduced by approximately 88.44%–93.75%. Cochran (1968) and Rosenbaum and Rubin (1984) stated that bias reduction can be expected in balancing units of approximately 90%, which confirms the validity of our results. Moreover, the pseudo R-squared measures of our model were always close to zero, suggesting that the covariates had no explanatory power in the matched samples and that the randomisation was well-implemented (Lee, 2013). These results play a central role in estimating treatment effects, thereby providing useful information on whether plausible counterfactuals have been created.

Table 4 shows the average effect of obtaining healthcare insurance on preventive care (i.e., blood pressure and cholesterol checks) health behaviours (i.e., smoking habits and obesity) and self-assessed mental health.

[Table 2 about here]

[Table 3 about here]

[Table 4 about here]

At first glance, the results show a significant average increase in the BMI-related outcome for Medicaid expansion (+10.1%) and for the DCE (+9.8%), suggesting the presence of an ex-ante moral hazard. No statistically significant impact on BMI was found for the premium tax credit and for the Employer Mandate. Moreover, the results showed a correlation between smoking habits among poor people and Medicaid expansion, which aligns with the finding that those living below the poverty line and with lower educational levels are more likely to have higher cigarette consumption rates than the general population and a pronounced reluctance to stop smoking (Brown-Johnson et al., 2014; Vijayaraghavan et al., 2013; Vijayaraghavan et al., 2018). Additionally, there was little preventive care among young adults and those who were privately insured, whereas preventative care was more significant in all the policies (+17.9% for Medicaid expansion; +20.1% for the DCE; and +20.5% for the premium tax credit; +22.2% for the Employer Mandate).

Therefore, these results confirm our hypothesis that newly insured individuals are less incentivised to adopt a healthy lifestyle because they are likely to feel less burdened with their future care. Additional indirect effects of being insured are possible: The exogenous provision of health insurance to individuals who previously purchased their coverage could lead to an income effect, which is the phenomenon in which the money previously spent on insurance can now be spent on risky behaviours (Lindhal, 2005; Snyder and Evans, 2006; Barbaresco et al., 2015; Apouey and Clark, 2015), such as buying more junk food or more cigarettes. These mechanisms could offset the direct effect of insurance on primary prevention.[8]

There was a significant reduction in smoking habits for the DCE (–4.4%) and the premium tax credit (–4.8%), confirming that young adults are more likely to quit smoking than older individuals in the latter and highlighting the positive effect of the surcharge on tobacco users' premiums in the former. Indeed, to account for excess tobacco users' healthcare costs and encourage cessation, the ACA specifically includes an allowable 1.5-to-1 ratio for tobacco use, implying that health insurers can charge tobacco users up to 50% compared to non-tobacco users (Freidman et al., 2016). However, Medicaid expansion did not result in a reduction in smoking rates due to the influences of addiction, which is characterised by an inelastic demand as consumption persists even if the costs of cigarettes increase, and the income effect. Finally, the employees who received the health benefits through the Employer Mandate underscore a relevant reduction in smoking habits of 8.2%. We reckon that this could be due to the employers' strategy of offering a variety of inducements to their employees, including cash incentives, discounts on health insurance premiums and lower deductibles with the

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[8] Centers for Disease Control and Prevention, CDC

intent to improve their health, increase morale, reduce health care costs, decrease absenteeism, or enhance productivity. In particular, the employers focused on smoking cessation' plans since smokers are less productive than no smokers, besides to present higher costs of health therapies, arriving to impose to tobacco-using employees surcharges of up to 50% of the cost of coverage, a level comparable to the tobacco use premium adjustments allowable under the ACA in the individual and small-group markets (Kaiser Family Foundation and Health Research and Educational Trust 2012; Madison et al., 2013; Madison et al., 2014). No employee was required to do anything, but if an employee was ready to take greater responsibility for his or her health, employers were more than willing to subsidize that effort (Mathiason et al., 2007; Madison et al., 2013).

The results related to cardiovascular preventive care reveal the ACA's overall positive impact. For example, blood pressure checks increased (Medicaid expansion: +17.9%; DCE: +20.1%; the premium tax credit: +20.5%; The Employer Mandate: +22.2%). We postulate that these metrics improved due to individuals being able to check their blood pressure at home using a digital blood pressure monitor as well as increased knowledge of the consequences of carelessness due to the doctor-patient relationship that is facilitated by greater access to care. Notably, cholesterol tests had a positively significant correlation only for Medicaid expansion (+1.6%).

Our analysis of the impact of the enhancements in access to affordable mental health services, on the individual perceived mental health, showed that the reform did not lead to the expected results: there has not been any significant results for young adults and employees whereas American adults have significantly increased their perceived poor or fair mental health status (respectively + 2.3% the Premium Tax and + 3.2% the Medicaid Extension). The previous literature has frequently illustrated the negative interaction between poverty (the slot of income interested by Medicaid insurance) and mental illnesses. We can assume that previous exclusionary policies have favoured mental disorders in individuals who lived in unstable socio-economic conditions, gathering during the years, many individuals who needed care, but were unable to access to mental health care. The possibility to use many provisions, including Accountable Care Organizations, health homes and other structures, that provide incentives for integrating primary care and behavioural health services often required by individuals with severe and persistent mental health conditions, has probably led to an increase in the awareness about poor personal feelings and mental health conditions. The Premium Tax Credit show, as well, significant results, +2.3%. Likewise, we have noted the exception for both the Dependent Coverage Expansion and the Employer Mandate that are showing a not statistically significant result.

Moreover, during the period taken into exam, all over the USA there have been different major events related to climate changes which have caused different kinds of psychological and psychopathological distress, compared to the normal seasonal weather changes, such as tornados, floods, and droughts (Cianconi et al., 2020). Indeed, the American citizens who have directly or indirectly experienced such calamities could incur congenital defects, neurodevelopment impairment and endogenous mental disorders. The high intensity and frequency of these events throughout the American States are likely to have increased the number of individuals experiencing a poor or fair mental health status, thus leading to flipping the expected results of the Reform.

Even if we cannot determine the causal mechanism for these results with our data, there are several potential explanations that future research might consider.

We have also used the perceived health status as an indicator of coherence for the perceived mental health.

2.5.1. Robustness and Sensitivity Check

Propensity scores are a useful tool for health services researchers seeking to account for observed differences between treated and comparison groups as it allows them to isolate the effects of a treatment (Stuart, 2010). However, propensity scores cannot adjust for unobserved differences between groups. We carefully considered which variables to include in the propensity score, and we thoroughly checked for balance before and after matching or weighting. In a bid to reduce bias, the regression model included covariates that correlated to the outcome but not to the treatment (Brookhart et al., 2006; Austin, 2009). Moreover, we controlled for potential confounders by treating them as explanatory variables (e.g., risk attitude, insurance preferences, and blood cholesterol checks), which both acted as a good proxy that could predict the outcomes of being insured or not and were predictive of ex-ante moral hazard attitudes. Indeed, individuals who purchased health insurance (as the premium tax credit reform required) were more risk averse (Finkelstein and McGarry, 2008; Stanciole, 2008). Our final robustness check addressed the potential concern of the reverse causality for the time-variant variables (e.g., socioeconomic conditions and health conditions), which could have been influenced by the treatment itself. Therefore, to avoid any problems of reverse causality, we employed lagged indicators measured as time t-1.

The sample comprised data from 2014 to 2015. In January 2014, all Americans had access to affordable health insurance options as this is when the ACA's major provisions came into effect: Discrimination due to pre-existing conditions or gender was prohibited, the annual limits on insurance coverage were eliminated, access to care was made more affordable, the health insurance marketplace was established, middle- and low-income families obtained tax credits that paid for a significant portion of their coverage, and Medicaid was expanded to include a larger number low-income Americans. Therefore, we constructed our sample using the MEPS design structure, thereby allowing for estimates over two consecutive calendar years and an examination of person-level changes in the insured status for selected variables over a two-year period.

Moreover, radius and kernel matching were employed to test the validity and robustness of our results. The two algorithms provided similar patterns for the coefficients as well as statically significant results for the uninsured and insured groups. Due to the small sample included in the support, we chose a tight caliper to greatly reduce bias and to improve the PSM, generating closer similarity in *matched* units (counterfactual outcomes) even though a large number of subjects could not be matched.

2.6. Conclusion

This study investigated the effects of the four main policies of Medicaid expansion, the DCE, the premium tax credit and the employer mandate included in the ACA reform on preventive care and individuals' health behaviours. Our findings support the ex-ante moral hazard hypothesis, revealing that, by lowering out-of-pocket costs for future healthcare, the insurance coverage provided by the ACA reform has reduced preventive activities and has encouraged more unhealthy behaviours, such as eating more and consuming less healthy items. Indeed, there was a significant correlation between the risk of obesity and Medicaid expansion (+10.1%) and the DCE (+9.8%), whereas the correlation between reduction in smoking and Medicaid expansion was insignificant, suggesting the null effects of the reform on this aspect.

We hypothesise that the ex-ante moral hazard effect is supported by the income effect: The ACA has brought about changes in individuals' income by providing free health coverage through Medicaid expansion and the DCE, thereby freeing up some of the individuals' money. A survey on national health and nutrition by the National Center for Health Statistics found that Americans tend to consume

junk food (from 2013 to 2016, 36.6% of American adults had consumed fast food). Thus, the additional money might have been spent on poor quality food since this is generally more affordable, delicious, quick, and easy than high-priced healthy food.[9]

Moreover, the smoke-free policy, accounted for in the premium tax credit reform by imposing tobacco surcharges of up to 50% on smokers' premiums, achieved a significant result (–4.8%), whereas poor individuals gaining healthcare coverage did not result in a significant effect on their quitting smoking. We contend that poor individuals ignore information (which may have improved due to the health insurance provided) about a given prevention strategy due to their addiction and the income effect, which has resulted in more money being available to buy more cigarettes and subsequently leading to an inelasticity of smoking demand and statistically insignificant results. Nevertheless, in contrast with Friedman et al.'s (2015) findings, we found that surcharges on smokers' premiums have decreased the consumption of cigarettes in a large number of privately insured individuals who have quit smoking to claim the benefits provided by the health insurance marketplace. Also, the smoke-free policy applied by employers for improving the health of their work force achieved a significant result (-8.2 points in smoking habits): for employers smoking adds significantly to organizational health care expenditures and lost productivity (smoking breaks, illness-associated absenteeism and presenteeism). So, the interest to offer financial incentives for healthy behaviours increased in the employers' intents until to tie health plan–based rewards or penalties to standards involving tobacco use with programs' health-contingent incentives that could give a reward equal to $1000 to nonsmokers or, alternatively, impose a $1000 surcharge on smokers (for example) (Mathiason et al., 2007; Madison et al., 2014; Madison et al., 2013).

The effect of insurance on secondary preventive healthcare was positive, with significant results for checking blood pressure (+17.9% for Medicaid expansion; +20.1% for the DCE; +20.5% for the premium tax credit; and + 22.2% for the employer mandate), whereas there was only a slightly significant result for cholesterol checks and only among poor individuals in the Medicaid expansion sample (+1.6%). However, a moral hazard factor could be causing these effects since uninsured individuals who expect to be covered in future reduce their investment in healthy behaviours before they are even insured (the anticipatory ex-ante moral hazard) and increase their use of the health services included in their policies once insured (the ex-post moral hazard). Nevertheless, the ACA

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[9] 'The Effects of Poverty on Healthy Eating Choices', 2009-2010, University of Cleveland

reform has permitted more extensive access to health services and has increased contact with health professionals who might improve individuals' health knowledge and decrease their propensity to engage in risky behaviours (Kenkel, 1991).

This paper contributes to the limited evidence on the ex-ante moral hazard. We used the ACA as the largest health policy experiment undertaken in America in the last few decades to test the ex-ante moral hazard among US citizens. Aware of the protean real-world challenges of the ACA, we employed PSM, a quasi-experimental method, to reduce confounding biases inherent in observational studies. Moreover, in contrast to the main studies in this field, we ran the ex-ante moral hazard analysis on four of the main policies enacted by the ACA: Medicaid expansion, the DCE, the premium tax credit, and the employer mandate. As each of these policies has impacted a specific segment of American society, this study can be considered a framework into which existing limited contributions can be integrated and that can be used to guide future studies.

There are several limitations to our study, which provide avenues for future research. While we investigated the early effects of the ACA reform, two years is not enough time to see real changes in individuals' habits, especially if we consider the time needed to achieve significant results of treatment pathways in health behaviours. For example, obesity and smoking are addictions, which are often associated with individuals' mental health and socioeconomic conditions. Moreover, the literature review indicates that the ex-ante moral hazard has limited consequences on the health insurance marketplace. Thus, we share Zweifel's and Manning's (2000) view that the effect of insurance coverage on the use of preventive care and health behaviours could be more indeterminate since there still are utility losses, such as pain and suffering, that reduce individuals' choices in terms of risky behaviours (i.e., risk-averse attitudes) even though the monetary aspect is covered by insurance. Therefore, future investigations could evaluate the long-term effect of the ACA reform on individuals' health behaviours.

Moreover, this study did not fully analyse the effects of coverage expansion. The primary intent of the ACA reform was to protect individuals from financial risks. Therefore, more attention should be paid to the compensation provided in terms of benefits and costs in future analyses of the ACA's effects, thereby examining the intention to reduce the economic burden of healthcare. Likewise, more attention should be paid to the patterns of the services provided with the aim of reducing smoking or obesity: A rearrangement of the policies geared towards these goals is necessary due to the continuous growth in their related healthcare costs and losses in individuals' quality of life and productivity.

Risky habits have harmful effects on individuals' health statuses and increase the probability of disease or premature death, imposing external costs on society.

Individuals do not seek healthcare for many reasons, such as the cost of the services, negative perceptions of healthcare professionals, individuals believing they can handle their health situation themselves, and ineffective treatments (Schomerus and Angermeyer, 2008; Gulliver et al., 2010; Weil, 2015). Thus, policymakers should stimulate a sense of community in terms of people choosing healthy lifestyles, and they must counteract the stigma that exists around physical and mental health conditions by communicating more effectively about any difficulties, such as depression or obesity. However, insurance plans acting as third-party payers could continue to limit benefits by developing a narrow network.

We have estimated the effect of the ACA on the perceived mental health of individuals. Before ACA was enacted, individuals who suffered from mental or substance use disorders, serious or persistent, were uninsured because of expensive services excluded from the typical insurance plans or cost barriers (Frank and McGuire, 2000). The reform has also required that all plans guarantee the ten Essential Health Benefits, pursuing the issues drawn out in 2008 by Mental Health Parity and Addiction Equity Act (abbreviated as MHPAEA), providing mental health and substance use disorder treatments without any discriminatory financial requirements and quantitative and not quantitative limits. In the different policies examined, we have identified one main noteworthy result regarding self-perceived mental health: an increase in the poor self-perceived mental health of individuals enjoying public and private policies that cover mental health and substance use disorder services (the Medicaid expansion +3.2%; the premium tax credit +2.3%), in compliance with the reform (i.e. health insurance plans for individuals and small employers), as opposed to the absence of a significant change on self-perceived mental health of American young adults and employees not enjoying the wide coverage of those services provided by the reform (i.e. the Dependent Coverage Expansion and the employer mandate). Even if we cannot determine the causal mechanism of these results on the basis of our data, there are several potential explanations that future research might take into consideration. It is assumable that the ACA had to deal with national healthcare providers and insurers until resulting in negative effect on the ability of the reform to enhance the delivery of mental healthcare services. For example, in order to keep the costs down, with the new health insurance plans agreed, some insurers have reduced premiums by selecting the "low cost" providers who limited the mental health services offered. Furthermore, although the possibilities offered by the reform, 55% of the counties, largely located in rural areas, have no mental health services (Thomas et al., 2009; Ellis et al., 2009) and only a small number of practicing psychiatrists (only 50% compared to 89% for all

physicians) have accepted third-party coverage. These conditions provided some other limitations on the expansion of mental health services, leading the upper-income families to residing in upscale suburban and urban areas, namely the only areas with a reasonable chance to have access to psychiatric care, including talk therapy. Moreover, during the years that we have examined, some natural disasters have occurred on American soil. We reckon that environmental factors may well cause important damage to the mental health of those individuals who have directly or indirectly witnessed such events. Some of the main consequences are anxiety, schizophrenia, mood disorder, depression, suicide, aggressive behaviours, despair over the loss of the usual landscape, and other phenomena related to climate change and extreme weather (Cianconi et al., 2020). The high intensity and frequency of these events may have led to an increased number of American citizens in need of care after experiencing poor, or fair perceived mental health.

TABLES

Table 1 Variable description

VARIABLE'S NAME	VARIABLE'S DEFINITION
MALE	1 if male, 0 otherwise
AGE	From 18 to 65
WHITE	1 if white, 0 otherwise
BLACK	1 if black, 0 otherwise
HISPANIC	1 if hispanic, 0 otherwise
ANOTHER RACE	1 if another race, 0 otherwise
INSURED	1 if moves from uninsured to insured, 0 if remains uninsured
POOR INCOME	1 if less than 100% of FPL, 0 otherwise
NEAR POOR INCOME	1 if between 100%-124% of FPL, 0 otherwise
LOW INCOME	1 if between 125%-199% of FPL, 0 otherwise
MIDDLE INCOME	1 if between 200%-399% of FPL, 0 otherwise
HIGH INCOME	1 if equal or more than 400% of FPL, 0 otherwise
LOW EDUCATION	1 if no educational certificates or primary school certificate or lower secondary education, 0 otherwise
MEDIUM EDUCATION	1 if upper secondary education or high school graduation, 0 otherwise
HIGH EDUCATION	1 if university degree or postgraduate, 0 otherwise
NORTHEAST	1 if lives in the Northeast region, 0 otherwise
MIDWEST	1 if lives in the Midwest region, 0 otherwise
WEST	1 if lives in the West region, 0 otherwise
SOUTH	1 if lives in the South region, 0 otherwise

POOR HEALTH STATUS		1 if perceived health status is poor, 0 otherwise				
POOR MENTAL HEALTH STATUS		1 if perceived mental health status is poor, 0 otherwise				
RISK ATTITUDE		1 if is likely to take risk, 0 otherwise				
INSURANCE PREFERENCES		1 if agrees with "Health insurance is not worth the money it costs", 0 otherwise				
MARRIED		1 if married, 0 otherwise				
WIDOWED		1 if widowed, 0 otherwise				
DIVORCED		1 if divorced, 0 otherwise				
SEPARATED		1 if separated, 0 otherwise				
NEVER MARRIED		1 if Never Married, 0 otherwise				
EMPLOYED		1 if employed, 0 otherwise				
UNEMPLOYED		1 if unemployed, 0 otherwise				
SELF-EMPLOYED		1 if self-employed, 0 otherwise				

Table 2 Pre-matching descriptive statistics of variables employed in the logit model

	FULL SAMPLE		INSURED		UNINSURED		P-VALUE DIF.
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	
DEPENDENT VARIABLE							
MENTAL HEALTH	0.08	0.27	0.08	0.28	0.07	0.25	-0.01***
SMOKER	0.14	0.35	0.13	0.35	0.17	0.37	-0.03***
OBESITY RISK	0.65	0.47	0.65	0.47	0.67	0.46	-0.01***
CHECKED BLOOD PRESSURE	0.70	0.45	0.74	0.42	0.45	0.49	0.28***
CHECKED BLOOD CHOLESTEROL	0.01	0.13	0.02	0.15	0.00	0.08	0.01***
INDEPENDENT VARIABLE							
MALE	0.46	0.49	0.45	0.49	0.53	0.49	-0.08***
AGE	41.31	13.57	41.70	13.77	38.2	12.16	3.49***
WHITE	0.42	0.49	0.46	0.49	0.20	0.40	0.25***
BLACK	0.18	0.38	0.19	0.39	0.16	0.37	0.01***
HISPANIC	0.29	0.45	0.23	0.42	0.57	0.49	-0.32***
OTHER RACES	0.10	0.30	0.10	0.31	0.05	0.22	0.05***
POOR INCOME	0.17	0.37	0.15	0.36	0.29	0.45	-0.13***
NEAR POOR INCOME	0.05	0.22	0.04	0.21	0.09	0.29	-0.04***
LOW INCOME	0.15	0.36	0.14	0.34	0.23	0.42	-0.09***
MIDDLE INCOME	0.29	0.45	0.30	0.45	0.27	0.44	0.02***
HIGH INCOME	0.31	0.46	0.35	0.47	0.09	0.29	0.25***
LOW EDUCATION	0.14	0.35	0.15	0.35	0.29	0.45	-0.17***
MEDIUM EDUCATION	0.45	0.49	0.58	0.49	0.50	0.50	-0.05***
HIGH EDUCATION	0.37	0.48	0.26	0.44	0.18	0.38	0.22***

NORTHEAST	0.15	0.36	0.17	0.37	0.09	0.28	0.07***
MIDWEST	0.19	0.39	0.20	0.40	0.13	0.33	0.07***
WEST	0.27	0.44	0.27	0.44	0.21	0.41	0.06***
SOUTH	0.37	0.48	0.34	0.47	0.55	0.49	-0.20***
POOR HEALTH STATUS	0.13	0.33	0.14	0.34	0.14	0.33	-0.00
RISK ATTITUDE	0.18	0.38	0.17	0.38	0.24	0.43	-0.07***
INSURANCE PREFERENCES	0.23	0.42	0.22	0.41	0.32	0.46	-0.09***
MARRIED	0.48	0.49	0.49	0.50	0.39	0.48	0.10***
WIDOWED	0.01	0.13	0.02	0.14	0.01	0.12	0.004***
DIVORCED	0.11	0.31	0.11	0.31	0.10	0.30	0.01***
SEPARATED	0.03	0.17	0.02	0.16	0.05	0.21	-0.02***
NEVER MARRIED	0.34	0.47	0.33	0.47	0.43	0.46	-0.10***
EMPLOYED	0.70	0.45	0.71	0.45	0.67	0.46	0.03***
UNEMPLOYED	0.29	0.45	0.28	0.45	0.31	0.47	-0.03***
SELF-EMPLOYED	0.06	0.25	0.06	0.24	0.11	0.32	-0.05***
NUMBER OF OBSERVATIONS	69,494		60,010		9,484		

Table 3 Results of covariate balancing test

Kernel Matching

	No. of treated	No. of controls	No. of treated off support	Logit pseudo R^2 before matching	Logit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Policy Dependent Coverage Extension	1,440	1,754	9,370	0.131	0.003	0.000	0.526	20.5	1.8	91,21%
Policy Medicaid Extension	1,708	3,172	10,936	0.147	0.003	0.000	0.500	19.9	2.3	88,44%
Policy Premium Tax Credits	3,404	3,996	24,046	0.126	0.003	0.000	0.014	18.1	1.6	91,16%
Employer Mandate	2,636	770	15,064	0.176	0.005	0.000	0.001	24.7	2.3	90,68%

Radius Matching

	No. of treated	No. of controls	No. of treated off support	Logit pseudo R^2 before matching	Logit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Policy Dependent Coverage Extension	2,354	1,440	8,770	0.129	0.002	0.000	0.581	20.8	1.3	93,75%

Policy Medicaid Extension	1,708	3,172	10,936	0.147	0.003	0.000	0.459	19.9	2.7	86,43%
Policy Premium Tax Credits	3,404	3,996	24,046	0.126	0.003	0.000	0.008	18.1	1.4	92,26%
Employer Mandate	2,636	770	15,064	0.176	0.005	0.000	0.001	24.7	1.9	92,30%

Table 4 Average treatment effect on the treated (ATT)

	Radius Matching	*Kernel Matching*
Policy Dependent Coverage Extension		
Mental Health	0.003	0.003
Smoker	-0.044***	-0.043***
Risk to Obesity	0.098***	0.098***
Checked blood cholesterol	-0.001	-0.001
Checked blood pressure	0.201***	0.183***
Policy Medicaid Extension		
Mental Health	0.032*	0.033*
Smoker	-0.000	0.000
Risk to Obesity	0.101***	0.100***
Checked blood cholesterol	0.016***	0.016***
Checked blood pressure	0.179***	0.182***
Policy Premium Tax Credits		
Mental Health	0.023***	0.023***
Smoker	-0.048***	-0.046***
Risk to Obesity	0.022	0.021
Checked blood cholesterol	0.000	0.000
Checked blood pressure	0.205***	0.205***
Employer Mandate		
Mental Health	-0.016	-0.015
Smoker	-0.082***	-0.082 ***
Risk to Obesity	0.035	0.035
Checked blood cholesterol	0.003	0.003
Checked blood pressure	0.222***	0.220***

The ATT figures were obtained using Radius and Kernel matching techniques (with calliper 0.0001), expect for Employer Mandate (both the techniques had a calliper of 0.0015 size). A restriction was applied to the common support by excluding observations whose propensity scores were either above the maximum or below the minimum propensity scores of the combined controls. ***, **, *: respectively indicate a significance level of 1, 5, and 10 %

Chapter 3

Inequalities in Accessing Cancer Screening Test: the influence of the ACA Reform

3.1. Introduction

A socioeconomic gradient is often associated to inequalities in health across and within many countries, whereby unhealthy lifestyle habits, such as smoking, lack of adequate nutrition and physical inactivity are more widespread in lower socioeconomic groups, while individuals with a higher education and income experience better health (Yip et al., 2002; Veugelers and Yip, 2003; Huber, 2008; Griffith et al., 2017; Di Novi et al., 2020). Financial barriers to healthcare and the inability to afford expensive healthcare services increase pre-existing income-based disparities, preventing indigent individuals from accessing care.

The income-related disparities in accessing care are far wider in the USA than in any other wealthy country (Waldron, 2007; Chatty et al., 2016; Dickman et al., 2017). Indeed, before 2010, 39% of Americans with below-average income reported not having consulted a doctor about medical issues due to the costs of medical access, compared to 7% of low-income Canadians and 1% of British ones (Davis and Ballreich, 2014). However, disparities in healthcare access are largely due to the high rates of the uninsured or to inadequate health insurance plans among destitute Americans. Taking into account the above-mentioned, we can state that the Patient Protection and Affordable Care Act (ACA), once signed into law in 2010 and fully implemented in 2014, established as its main objectives the improvement of population health status and the extension of health insurance coverage and benefits offered by health insurance plans.

The most relevant passages of the reform were: reducing the number of uninsured Americans through the expansion of Medicaid eligibility to individuals with an income up to 133% of the federal poverty level (previously up to 100 %), and mandating coverage of the Ten Essential Health Benefits and preventive services, identified by the U.S. Preventive Services Task Force. The Ten Essential Health Benefits should be guaranteed by both public (such as Medicaid and Medicare) and private health insurance plans (such as Health Insurance Marketplace) through standardized insurance packages (Baicker et al, 2013; Sommers et al, 2016; Miller and Wherry, 2017; Choi et al., 2017).[10] The intent of the reform was to reduce the financial barriers for health care usage. Specifically, since the willingness to make use of preventive health services, such as regular medical check-ups and participation in population screening programmes, is more widespread among higher socioeconomic groups than among poorer people, in spite of the greater burden of disease and need for health services of the latters, the policy mandates that health insurance plans provide benefits without cost sharing for all services recommended with a rating of A or B by the United States Preventive Services Task

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[10] These Ten Essential Benefits include: ambulatory patient services; emergency services; hospitalization; maternity and new-born care; mental health and substance use disorder services, including behavioural health treatment; prescription drugs; rehab and rehabilitative services and devices; laboratory services; preventive and wellness services and chronic disease management; and paediatric services, including oral and vision care.

Force (USPSTF) (Veugelers and Yip, 2002; Zhang and Polite, 2014).[11] Among these services, many clinical treatments were included, as well as preventive services for cancer. The policy of cost-sharing elimination is partially motivated by the economic theory predicting that easing the cost burden of a screening test for patients should lead greater numbers of those to get tested. Evidence from experimental and observational studies demonstrates that preventive care is price-sensitive, supporting the above-mentioned theory (Baicker et al., 2013; Lohr et al., 1986; Meeker et al., 2011; Solanki and Schauffler, 1999; Karter et al., 2003). Indeed, through the Premium Tax Credit the reform tried to increase the insurance coverage rate among those families with incomes between 100 and 400 % of the federal poverty level. Premium Tax Credit is a refundable tax credit designed to purchase health insurance through both state and federal Marketplaces for individuals and also employers with less than 50 full-time employees. Four types of insurance coverage are provided on the Marketplaces: Bronze, Silver, Gold, and Platinum. Although these four plans cover the Ten Essential Health benefits and certain preventive care measures, they differ as to the offer of different premiums and the share of costs covered (Zhang and Polite, 2014). In addition to premium subsidies, the ACA established cost-sharing subsidies: namely, two types of cost reduction measures; these subsides are applicable only to individuals who purchase silver plan coverages and with an income of less than 250% of FPL. Moreover, the ACA reform also mandates the employers, whose employees force is higher than 50 full-time employees and/or full-time equivalents (FTEs), to ensure them an affordable health insurance and a minimum value coverage (the employer mandate). The ACA established as well that insurers should not impose annual or lifetime coverage caps on the Ten Essential Health Benefits. The aforementioned measures were substantially expected to increase the access to health care services, reducing deductibles, co-payments, coinsurance and total out-of-pocket expenses, in particular for those health services included in the Ten Essential Health Benefit. Contrary to expectations, in 2015 the premiums rose dramatically, making the products available on Health Insurance Marketplace unattractive to consumers who do not qualify for federal assistance. Accordingly, most private plans reduced premium costs by restricting the choice of providers for patients in order to narrow the networks of doctors and hospitals, which often exclude academic and cancer referral centres. Enrolees who seek out-of-network care (either by choice or due to medical necessities) generally must pay the entire bill out of pocket.[12]

The previous literature observed mixed effects after the implementation of the ACA reform. The benefits in access to health care are higher for public insurance holders than for holders of a

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[11] The USPSTF recommends health services if there is high certainty that the net benefit is substantial or moderate (A and B), whereas it recommends selectively offering, or it directly discourages the use of services if the benefit is small, or the harms outweigh the benefits (C, D and E)

[12] The Henry J. Kaiser Family Foundation, 2015. Preventive Services Covered by Private Health Plans Under the Affordable Care Act. The Henry J. Kaiser Family Foundation.

private one: Okoro et al. (2017), using the 2014 Behavioural Risk Factor Surveillance System Survey (BRFSS) data, found that income disparities in breast and cervical cancer screenings, for adults aged from 18-64, decreased in the Medicaid expansion states, while increasing in those states that did not make use of that; Griffith et al. (2017), using data of nonelderly adults (people aged from 18–64) who responded to the 2011–15 BRFSS, found that, in the period from 2011 to 2015, people in lower socioeconomic strata enhanced health care access in states that expanded eligibility for Medicaid than in states that did not, significantly narrowing the socioeconomic disparities in health care access. Moreover, Hamman and Kapinos, (2015), using data from the 2015 BRFSS, found that annual colonoscopy rates increased significantly among Medicare insurance male holders aged 66-75, confirming as well that the incremental reduction in expected out-of-pocket expenses for colonoscopies led to significant increases in screening rates among men, predominantly among socioeconomically disadvantaged individuals. As for the private side, Mehta et al. (2015) have analysed data on small business beneficiaries, aged 50- 64, of Humana insurance for years 2008 and 2012, noticing that nothing significantly changed in cost-sharing rates for beneficiaries of small-business non-grandfathered plans who were required to eliminate cost sharing (intervention), whereas the utilization of colonoscopy and mammography slightly changed. Alharbi et al. (2019) ran counterfactual analysis to try to understand if the ACA's cost-sharing provisions impacted mammograms and Pap tests rates. Using MEPS data from 2009 and 2016, they found that the introduction of free preventive services did not affect the overall use of these cancer screenings (mammography cohort included women aged 40 and older and the pap test cohort included women aged 21–65). In addition, Steelanda et al. (2019), using Massachusetts All-Payer Claims Database in the period from 2009 to 2012, observed no significant effects on utilization for cervical cancer or colon cancer screening, but a slight immediate increase in breast cancer screening utilization rate in the month after the policy change, with no change in trend after the ACA plan.

This is the first study employing Medical Expenditure Panel Survey (MEPS) as source of data to describe the income-related inequalities in preventive cancer screenings usage exclusively for holders of private insurances. Indeed, we focus on the trend of the income-related inequality index in access to preventive cancer screenings among private insurance holders before and after the ACA reform. We analyse the period from 2012 to 2016, employing data drawn from the MEPS. The survey contains person-level data on medical care expenditures, demographic characteristics, household income, and a wide array of health status measures. We have measured socio-economic inequalities in access to screening tests by means of the Wagstaff and van Doorslaer (2000) Concentration Index (CI), with the adjustment proposed by Erreygers (2009). We have decomposed Erreygers index into

the contributions of socio-economic status, demographic factors and need factors (see also Van Doorslaer Koolman and Jones, 2004), which helps to identify the drivers of the inequality.

This paper does not aim to enter the debate concerning the ACA accomplishments from a theoretical viewpoint, even though the mentioned framework may be useful to interpret the empirical results. Therefore, the ACA will be read as an interesting case study, in order to reveal how the policies that try to shape the socio-economic determinants could reduce the health inequalities gap. Consequently, adding evidence may be useful to guide policies at national and international level. The main element of novelty of this paper compared to the previous literature, instead, is the detailed description of the effects on income-related inequality implemented by the four screening tests (i.e., breast exam, pap smear, colonoscopy, PSA exam) for the most common and deadly cancer in the USA, with an in-depth analysis of socio-economic determinants of health inequalities gap.

3.2. Income-related inequality in health care access in USA

All over the world, the access to health care among individuals is strongly associated to several socioeconomic factors, including income, education, employment, sex, race, and wealth (Pappas et al., 1993; Ward et al., 2004; Mensah et al., 2005; Baicker et al., 2013; Griffith et al., 2017).

In the USA, the disparities in health between the wealthy and the poor are wide (Chetty et al., 2016; Gaffney and McCormick, 2017). The association between income and life expectancy is strong and the health care access is influenced by insurance coverage, out-of-pocket costs, travel costs, opportunity costs associated with care-seeking (i.e., the time spent by patients traveling to, waiting for, and receiving medical care), perceptions of the benefits of care and competing personal and family needs (Chen and Escarce, 2004; Chetty et al., 2016). In addition, unhealthy lifestyles tend to be concentrated disproportionately among disadvantaged socioeconomic groups, since they are liable to live in areas where physician and medical facilities are scarce and over-extended, and medical care providers may treat high-income and low-income patients differently, owing to differences in payment rates or other factors (Kikano et al., 1996). Indeed, any fixed amount of cost sharing represents a greater relative burden for people with low incomes while the well-off is more able to purchase supplemental insurance or upgrade coverage so as to reduce their cost sharing (Manning et al., 1987; Chen and Escarce, 2004). Based on these and other related considerations, it is unsurprising that high-income Americans benefit from health care access to a higher extent than the low-income ones.

Several studies have shown that the socioeconomic disparities in health care access for every age group are largest in the USA. Dickman et al. (2017) highlighted as poor Americans have worse access to care than wealthy Americans, partly because uninsured, despite coverage expansions since 2010, due to the ACA. Moreover, they found that for holders of private insurance, rising premiums and cost sharing undermined wage gains and drive many households into debt and even bankruptcy. A rife disparity in life expectancy between the wealthy and the poor Americans is observed by Gaffney et al. (2017), who highlighted that, with regards to race-based health inequalities _consequence of centuries of repression and exclusion_ middle-aged white Americans, predominantly the less literate, experienced a higher mortality rate. The ACA reform struck socioeconomic disparities, as Griffith et al. (2017) and Kino and Kawachi (2018) observed, especially through the Medicaid extension, which the authors related to a substantial (but incomplete) narrowing of income-related inequality gap in access, particularly among Americans in low-income households, individuals without a college degree and unemployed.

Various socioeconomic inequalities may contribute to a difference in the uptake of preventive health services. Even though these services are recognized as the most cost-effective ones, providing help finding out and addressing health issues, before symptoms appear. For instance, undergoing timely screening tests for certain types of cancer may mean diagnosis and treatment at an early stage, thereby reducing patients' disease economic risk, especially for the poor. In 1993 the World Health Organization identified the equal access to prevention as a public health priority in the "Health for All" Agenda, suggesting the duty to lead more visits for preventive screenings to ensure well-being for all at all ages.

We provide a summary measure of the degree of income-related inequality in preventive health care access, trying to assess changes in inequality over time or differences across subgroups of the population.

3.3. Data and Methodology

3.3.1 Data

In an effort to increase the use of preventive healthcare, The Patient Protection and Affordable Care Act (ACA) required insurance plans to offer full coverage of preventive services, assigned either

an A or B status by the US Preventive Services Task Force (UPSTF).[13] These services are to be covered without deductibles, co-pays or maximums. Under this provision, access to cancer screening is projected to substantially improve, reducing health disparities between people who belong to different socio-economic conditions. We describe the reduction of health disparities among private policy holders who had access to a set of defined essential health benefits, established by the ACA, starting Oct. 1, 2013, with coverage beginning Jan. 1. Indeed, the ACA insurance exchange policy determined that among the specified essential benefits in health care packages offered through the Health Insurance Marketplace to individuals and Small Business Health Options Program (SHOP) for employers with fewer than 50 full-time employees, there were included many clinical treatments, as well as preventive services, for cancer without deductibles, co-pays, or maximums or out of pocket costs (Zhang and Polite, 2014).

Since the object of our research is the privately insured population, we are to analyse the trend in the use of breast, cervical, colorectal and prostate cancer screenings between 2012 and 2016. Specifically, in 2014 the ACA health insurance exchange policy provision took effect; in this respect, it is important to analyse the two years before and after the enactment of the abovementioned provision. We employ the data of individual medical care expenditures and reimbursement, demographic characteristics, marital status, educational level, household income, employment status, health status measures and access to health care obtained from the Medical Expenditure Panel Survey (MEPS), a U.S. civilian noninstitutionalized population survey. The sampling frame is drawn from respondents to the National Health Interview Survey (NHIS), conducted by the National Centre for Health Statistics. The data are collected through an overlapping panel design, namely by selecting each year a new panel of sample households and collecting data for each panel for two calendar years. The ongoing longitudinal studies of MEPS allow us to analyse the determinants and the different alterations occurring in health care provision with respect to social and demographic factors, such as employment or income.

After correcting for the missing values, the sample include 23485 observations in 2012 (out of 57191), 22318 in 2013 (out of 54258), 21070 in 2014 (out of 53246), 21487 in 2015 (out of 51884) and 21492 in 2016 (out of 50978).

Individual weights have been applied in all computations to make the results representative of the American population[14].

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[13] The US Preventive Services Task Force (UPSTF) is an independent panel of experts in primary care and prevention.

[14]As common when using individual survey data, we use survey stratification weights provided by MEPS in all our models. Survey stratification weights are defined during survey sampling by the provider of the data and are essential to make the analysis representative of the entire population.

3.3.2 Health Access Inequality Index

In the first part of our empirical analysis, we compute the horizontal inequity in accessing cancer screenings, employing CI and, in the second part, we decompose the CI into the contributions of demographic and socioeconomic factors.

Formally, inequalities in health care are detected by means of CI (Wagstaff et al. 1991; Wagstaff and van Doorslaer 2000). The CI can be written as:

$$CI = \frac{2}{n\mu} \sum_{i=1}^{n} h_i R_i - 1 \tag{1}$$

Where h_i is an indicator of the access to cancer screening by individual i, μ is its mean, R_i is the rank of individual i according to her household income distribution and n is the sample size.

A more convenient formula for the computation of CI defines it in terms of covariance between the indicator of the use of cancer screening by individual and household income rank divided by the average of cancer screening frequency:

$$CI = \frac{2}{\mu} cov(h_i, R_i) \tag{2}$$

In both formulas, the CI depends only on the relationship between the indicator of rank of cancer screening usage and household income, and not only on the latter. The formulas (1) and (2) are both multiplied by 2 to ensure that the CI ranges between -1 and +1. When the horizontal inequity index takes value -1, it means that a high frequency of preventive health care, as cancer screenings in this case, is concentrated among the less-well off (i.e. pro-poor inequity), while if it takes value +1, it means that the better-off make greater use of cancer screenings (i.e. pro-rich inequity); 0 is the value that the horizontal inequity index assumed when the use of preventive cancer care is equally distributed across the entire population. Since variables that measure access to screening tests are dummy variables, we use a correct version of the concentration index to measure the inequality in the use of preventive cancer care (Erreygers, 2009) which satisfies the mirror condition – the invariance of the inequality index to the coding of the healthcare variable as 0 or 1.[15]

$$E(h) = \frac{4\mu}{(b_n - a_n)} CI(h) \tag{3}$$

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[15] In our case, this means that the inequality index does not change if inequalities in preventive healthcare access are measured with respect to use (i.e., preventive healthcare access = 1) or no use (i.e., preventive healthcare access = 0) of preventive care.

where b_n, a_n represent the maximum and minimum value of dependent variable (for us respectively 1 and 0), μ is the average of cancer screening's frequency in the sample and CI(h) is the concentration index specified in (2).

Wagstaff et al. (2003) have demonstrated that it is possible to compute the CI also through the OLS properties, decomposing the CI into two parts, the first showed as the deterministic part while the second as the residual one. Indeed, for any linear additive regression model of health (y)

$$EI(h)$$

$$= 4\left[\beta_r \bar{x}_r CI_r + \sum_k \beta_k \bar{x}_k CI_k + GCI(\varepsilon)\right] \qquad (4)$$

where $\bar{x}_r$ is the mean of the household income used to rank the population (x_r) and $\bar{x}_k$ are the means of the regressors included in the regression model for the computation of the concentration index (x_k), while CI_r, CI_k are the concentration index and $GCI(\varepsilon)$ is the generalized concentration index for the residual term (ε).

Equation (4) reveals as the decomposition of the inequality index allows to compute the health care access for cancer preventive care inequality as a weighted sum of the inequalities expressed in the deterministic part, with regressors coefficients evaluated at the means as weights (i.e., semi-elasticities), plus the residual component that reflects the income-related inequality in health that is not explained by a systematic variation in the regressors by income. Thus, it is possible to identify the driving factors that lead to inequality in health care access for cancer preventive care inequality. However, the decomposition index showed in the equation (4) is based on linear modelling of inequality while our outcome variable is binary. For this reason, we decompose the inequality index through a linear approximation based on partial effects estimated through a probit model (see among others van Doorslaer et al., 2004; O'Donnell et al., 2008).

In the probit model for the concentration index, our dependent variable takes value 1 if the respondent gets screening tests regularly (i.e., pap-test or breast exam or colonoscopy or PSA exam), 0 otherwise. On the Medical Expenditure Panel Survey, each respondent indicates whether he/she has executed the cancer screenings tests within the past 1, 2, 3, 4, 5, or more, years or never. Since several information is promptly available for proper cancer prevention, we refer to both the Centre for Disease Control and Prevention (CDC)- U.S. Department of Health & Human Services, and the American Cancer Society to evaluate if the last period in which the respondent has undergone screening tests is within a regular interval or not. Following their recommendations, a regular cancer prevention requires that women undergo cervical cancer screenings every 2 or 3 years and breast cancer

screenings every 2 or 3 years[16]; men prior to age 40 should get PSA exam every 2 years while both men and women should get colonoscopy exam every 5 years (the pertinence of time depends also on the age of the individual and on their family history of cancer). Finally, we construct every dependent variable assuming value 1 if the individual has had the pap smear in the last 3 years, 0 otherwise; 1 if the individual has had the breast exam in the last 3 years, 0 otherwise; 1 if the individual has had the PSA exam in the last 2 years, 0 otherwise; 1 if the individual has had the colonoscopy exam in the last 5 years, 0 otherwise.

Moreover, we control for a set of explanatory variables, that, according to the previous literature, are correlated to health care utilization, such as gender, age, macro-region of residence, race, marital status, educational level, household income, employment status, health status and an indicator of completeness of the health insurance coverage.

Age is modelled as a continuous variable. The macro region of individuals' residence is specified as Northeast, South or Midwest and West as refence category. We have, as well, included a binary variable that takes value 1 if the individual was born in the US., 0 otherwise. Race is modelled as three dummy variables in which the referred races are White (reference category), Black and Other Races (such as Spanish, Asian, Indian). Only for the colonoscopy exam, the gender of the individuals is included and defined as a dummy variable that takes value 1 if the respondent is male, 0 if female. Allowing that the other screening tests included in the analysis are gender-specific, our sample is referred only to that sex in all the other cases. The marital status is categorized into five dummy variables: widowed, separated, divorced, never married individual and married (as reference category). Three levels of education are considered: (1) low education (no educational certificates or primary school certificate or lower secondary education); (2) medium education (upper secondary education or high school graduation) _as reference category_ and (3) high education (university or postgraduate degree). The employment status is defined according to four dummy variables: employed (as reference category), self-employed, student, unable to work, housemaker, and unemployed. We have included the unemployment variable in our regression also because one of different requirements to access to the credit of the Premium Tax policy needs that individual is not eligible for coverage through an employer sponsored plan that provides minimum value. We have, as well, included an indicator of the poor health status of individuals that should proxy the individuals' need of care. The following standard self-assessed health status question was asked: 'Would you say that, in general, your health status is: excellent, very good, good, fair, poor?'. Self-assessed health

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[16] The United States Preventive Services Taskforce (USPSTF) recommends screening for cervical cancer in women aged 21 to 65 years with cytology (Pap smear) every 3 years

status was, therefore, measured on a five-point scale from 'excellent' (score 5) to 'poor' (score 1). We have dichotomized the multiple-category responses to construct a binary indicator with value 1if individuals report fair or poor health status and 0 otherwise (excellent, very good or good) in line with the most-widely used methods of scaling self-assessed health status available in the literature (see, for instance, Browne and Doerpinghauset, 1993; Shibuya et al. 2002; Schneider and Schneider, 2006; Piko and Kereszteset, 2007; Contoyannis and Jones, 2004; Balia and Jones, 2008; Di Novi, 2010; Di Novi, 2013). We employed the self-assessed health (SAH) as outcome variable looking at its ability to draw together health, socio-economic status and lifestyles and its strongly correlation with the health service use (Kenkel, 1994; Contoyannis and Jones, 2004; Unden and Elofosson, 2006; Balia and Jones, 2008, Di Novi, 2010).

Concerning individuals' income, we correct the variable according to the equivalence scale used in the OECD Income Distribution Database to rank individuals by their household income, dividing family income by the square root of the household size.

Finally, the insurance dimension is defined by private insurance, public insurance, or any kind of insurance. At first, we have measured the inequalities in getting screening tests among all the population, jointing private and public insured in one variable, called 'insured', and keeping uninsured as reference category. Subsequently, we have held only the individuals covered by a private health insurance plan to measure what happens after the ACA health insurance exchange policy provision has taken effect. In order to test whether the completeness of the insurance plan has yet a strong influence on preventive care access, even after the ACA reform, we included a variable that proxies the health insurance plan extension. Since MEPS database does not include the insurance plan deductible, coinsurance rate or co-payment, that may be considered as a good proxy of plan extension, we constructed a new variable. Specifically, we computed the share between the reimbursement paid by a health insurance company over the total healthcare expenditure faced by those who are covered by a private health insurance. Indeed, given the reimbursement expected by the reform, our hypothesis is that this ratio will move closer to 1 when the reimbursement (the numerator) increases until to equal the health expenditure held by individuals (the denominator) becoming both equally balanced in the use of care services without any inequity features.

Will use to refer briefly to this variable as the health insurance reimbursement as share of the total healthcare expenditure.

In order to isolate healthcare access inequity that does not reflect individuals' needs (O'Donnell et al., 2008), we have standardized the concentration index by demographic characteristics as age, gender (only for preventive care that is not gender specific, i.e. the colonoscopy

exam), being born in US., race, individuals macro-areas of residence, need of care (proxied by respondents' health status). After standardization, any residual inequality in accessing preventive healthcare is interpretable as horizontal inequity (which could be concentrated among disadvantaged people or advantaged people). Indirectly standardized use of cancer preventive care $\hat{Y}_i^{IS}$ can be obtained by:

$$\hat{Y}_i^{IS} = Y_i - \hat{Y}_i^X + \bar{Y} \tag{5}$$

where Y_i is the actual use of cancer preventive care, $\hat{Y}_i^x$ is the standardised health status and $\bar{Y}$ the sample mean.

The equation (5) represents the Erregeyers Need Adjusted (ENA) index that predicts the use of preventive care for cancer among individuals ($\hat{Y}_i^{IS}$), irrespective of differences in the distribution of demographics characteristics ($\hat{Y}_i^x$).

All estimations are carried out with STATA 16. For details on the computational issues (using STATA), we refer to O'Donnel et al. (2008).

3.4. Results

Table 1 shows the frequency of screening tests in the pre-and post-ACA periods, according to income quintiles and the type of insurance subscribed, whether private or public, whereas Table 2 shows the same frequency, according to insurance holders' income quintiles and education (the latter is identified as an important aspect as regards to prevention) (Ross and Chia-ling Wu, 1995; Cutler and Lleras-Muney, 2006). At a first analysis, Table 1 reveals that since 2012, the use of cancer preventive care is more common among public insurance holders than among private insurance ones. We reckon that the major use of preventive care among public insurance holders is attributable to the previous implementation of these services covered at no cost among public health plans. Indeed, the ACA's emphasis on providing newly required coverage for a wide range of health preventive and screening services without any copayment took place in September 2010 for some newly issued health plans, in particular public health insurance whereas only on January 1, 2014, it applies much more broadly, to plans offered in the individual, small, and some large group markets. Concurrently, different traits for males and females can be inferred from the tables: women as against men appear more likely to use preventive care, regardless of the chosen type of coverage. Stated that the screening frequency gap among people with different levels of education after the implementation of ACA did not decrease; Table 2 reveals that women turned to be more influenced than men by their level of education, even at the same status of wealth: women with a higher educational level (>12 years) were

more likely to be aware of breast exams and Pap smears, compared to those with a lower educational level, whereas the number of low-educated men who took a PSA exam is closer to the amount of the highly educated ones, or even reversed (Damiani et al., 2015; Koç er all., 2018; Coughlin, 2005).

In Table 1, we observe, as well, a low frequency for colonoscopy exams, with a high prevalence among public insurance holders, while in Table 2 it seems that a lower level of education corresponds to a major use of colonoscopy. This fact suggests that male physical exams might be a taboo subject, transverse to men of all races and educational levels, and could lead to misperceptions about colonoscopy. Winterich et al. (2011) has found that numerous men do not appreciate colonoscopy since its preparation is "inconvenient" and "uncomfortable", mainly because it involves a "compromising position", expressing, thus, hesitation out of fear of seeing their masculinity threatened. Indeed, in line with our analysis, the authors observed that as education increased, negative views of colonoscopy among men seemed to increase proportionally, while low-educated men generally described the colonoscopy as a "good" test in line with the culturally dominant view that medical care is important (Winterich et al., 2011).

Table 2 reveals that over the years of observation, less prosperous social classes (first and second quintiles) display a higher frequency of exam usage. This could be the effect of the cost-sharing subsidies provided by the ACA, through which individuals with an income lower than 250% of FPL would receive a subsidy to decrease cost-sharing expenses and, subsequently, benefit from a higher actuarial plan coverage equal to the one of a more comprehensive plan (i.e., Gold or Platinum) (Zhang et al., 2014). Furthermore, a separate out-of-pocket maximum was also expected, depending on the income, regardless of the amount received by an individual in cost-sharing subsidies. As women seem to be more reactive to these subsidies, men do not, remaining the PSA exam prerogative of individuals who are more affluent (fourth and fifth quintiles). Moreover, looking at the result of a more intensive use of medical resource, we can also hypothesize the presence of the ex post moral hazard: the subsidies provided by the reform could have incentivized individuals, who have received the subsidies, to overuse these services.

Finally, as supposed to the expected outcome, the post-ACA period reveals a general increase in the overall use of specific screening tests.

[TABLE 1 about here]
[TABLE 2 about here]

In the following, we will start by presenting the inequality index for the full sample, and the inequality index for private insurance later on. The intent is to highlight how, in relation to the general attitude of insurance people, the private insurance holder work on screening tests. For the latter, because of a difficulty to find a direct measure of personal healthcare expenditures (such as co-payment, co-sharing) on our data source of reference Meps, we have used the health insurance reimbursement as a variable of interest to measure whether the decrease (or the elimination) in cost-sharing payments for screening tests has influenced the inequality index in their use (Table 3 and 4).

In Table 3 we report both the EI and the ENA. The former index measures the inequality in screening tests utilization without any standardization for differences in need whereas the latter compute the horizontal inequity which could be pro-rich or pro-poor (O'Donnell et al., 2008). In our research, we focus on the ENA index. Indee, we note that the magnitude of the ENA index in the access to breast exam and pap smear is not statistically significant until 2015. In this year the inequality index for both the exams becomes strongly significant and achieves its higher value in favour of the poorest women. In 2016 the index returns to be not statistically significant. Conversely, the inequality index for both colonoscopy and PSA remains quite similar in the year before and after the reform, statistically significant and in a pro-rich direction. As for the breast exam and pap test, in 2015 the magnitude of the index in colonoscopy and PSA exam faces an increase, still in a pro-rich direction, and then decreases in 2016. Table 4 depicts the same trend for the inequality index of holders of private insurance. Arguably, the changes highlighted in 2015 may have been caused by the growth of the premium price of qualified ACA-compliant health plans sold in exchange in 2014-2015. In this way, the highest monthly premium with more comprehensive health care plans and lowest cost-sharing expenses remains a privilege of the better-off. The price of such premiums got much higher than that of premiums before 2014 and that did not comply with the ACA (Brookings, 2014; Antos and Capretta, 2020). The reason why the premium prices grew so higher in some counties than in others has been investigated by different authors. Sen and DeLeire have estimated the effect of Medicaid expansion on premiums of plans offered through the Marketplaces in the 2014–2018 period. After controlling for a range of demographic, market, and policy characteristics, they found that in counties where Medicaid has not been expanded there have been higher Marketplace premiums due to adverse selection and sicker private market risk pools, since covering lower income populations through Medicaid expansion leaves private market risk pools healthier and less costly to insure. Even before the expansion took effect, the Center on Budget and Policy Priorities (2012) noted that "failing to expand Medicaid would likely destabilize the private insurance market and drive-up premiums," due to higher cost enrollees, people falling into the "coverage gap" between current

Medicaid eligibility levels and 100% FPL, and a general increase in uncertainty for insurers (Kowalski, 2014; Eibner, 2014). Moreover, there are other potential factors than Medicaid expansion that could explain the difference in premiums we see, county, market, and state characteristics that might be expected to have the greatest impact on premiums, as for example expiration of market stabilization policies, or the federal government's discontinuation of funding for cost-sharing subsidies (Van Parys, 2018). Van Parys has used comprehensive database of information about premiums and market characteristics for rating areas in states with federally facilitated Marketplaces to demonstrate that higher premiums are associated with local health insurance monopolies. Indeed, in July 2015 two major health plans merged in, reducing the national health plans from five to three health plans (Scheffler et al., 2016): more concentrated health plans could be associated with higher premium growth (Melnick et al., 2011; Dafny et al., 2012; Ho and Lee, 2013; Guardado et al., 2013; Starc, 2014; Erickson and Starc, 2015; Trish and Herring, 2015; Scheffler et al., 2016).

Regarding the differences in results, we reckon that the gender pay disparity in the American workforce concerning women's wages has caused a significative number of women with an income less than 250% of FPL and it has also made them more responsive to the cost-sharing subsidies (Gould & al., 2016; Gharehgozli and Atal, 2020). This could allow them to receive a subsidy to decrease cost-sharing expenses and, subsequently, benefit from a higher actuarial plan coverage equal to that of a more comprehensive plan (i.e., Gold or Platinum) (Gharehgozli and Atal, 2020).[17] We also suppose that women could be more motivated to benefit from free health services than men, since the former experience a financial disadvantage due to their greater health-care needs (including reproductive care) with a median income 39% lower than those of men (Lantz, 2013). Since the health insurance premiums were heavily regulated by Federal and State authorities, in 2016 the inequality index decreased, allowing a decrease in premiums.

Since our primary intent is to investigate what type of correlation exists between ACA and socio-economic inequalities in accessing cancer screening tests such as breast exams, pap smears, colonoscopy, PSA test among private insurance holders, in Table 5 we show a disaggregation of the ENA index for all the screening tests analyzed, according to specific individual characteristics (in particular, socio-economic status, level of education and employment status) restricting the sample to a private insurance holder. Looking at this table, we notice that, throughout time, the results of the adjusted family income for all the exams are consistent with the previous literature: a higher level of income is associated with a higher probability to use preventive health care. The CI is constantly

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[17] U.S. Bureau of Labor Statistics, Highlights of women's earnings in 2015, November 2016 | Report 1064

statistically significant with a positive sign, meaning that income is concentrated among high socio-economic classes. The contribution of this variable is always positive, heightening the inequalities in a pro-rich direction. Moreover, in line with the previous information about premium price rise, the magnitude of the contribution reaches a peak in 2015, increasing the inequality status in pro-rich direction, reducing pro-poor inequalities.

Looking at the education index, which is nearly always statistically significant both for low and high educational levels, it reveals its pivotal role in shaping the inequality. Indeed, the main trend of these variable suggests that a lower level of education is associated with a lower chance of getting screening tests, whereas a higher level of education increases the usage of such exams. The concentration of the low education index is negative, while the concentration of high education index is positive. This means that, while low education is concentrated among disadvantaged people, high education is common among the better-off. Together with the results of the ENA index, it appears that for the breast exam and Pap Test, both high and low education contribute to decrease the inequality in getting screening tests whereas for PSA they contribute to increase the inequality. In line with the abovementioned previous literature, we note that colonoscopy is the only exam not statistically affected by lower education and, consequently, the low educated are not liable to have less chances of getting a colonoscopy.

The unemployed variable is nearly more statistically significant than the other employment variables (such as self-employed or student). This is not surprising, since the most private health coverage in the US is employment-based. We note that the unemployment status is more widespread among disadvantaged socioeconomic individuals, since the concentration index has a negative trend and that being unemployed reduces the possibility to get preventive health care, looking at the negative sign of the coefficient of unemployment status. Finally, for the Colonoscopy and PSA exam the contribution of this variable amplifies the inequality among individuals at the expense of poorest individuals whereas for the breast exam and Pap test its contribution reduce pro-poor inequalities in favour of richest individuals. The PSA exam differs from the other exams since the unemployment status is not statistically significant in determining the access to this exam. The other variables inherent to the employment status vary greatly in their contribution. Generally speaking, we can see that being a student has a negative effect on access to breast and pap tests, while being self-employed has a negative effect on colonoscopy. The concentration index of student has a positive sign, showing that the student status is concentrated among the better-off women. The contribution reveals that this variable decreases pro-poor inequality pressing in favour of the better-off. The concentration index of self-employed status has a positive sign. This means that this type of employment is more common

among the richest. The contribution reveals that self-employment contributes to decreasing inequality for all the screening tests analysed.

Looking at the health insurance reimbursement as share of the total healthcare expenditure as variable of interest, we observe that, over the entire period considered, this variable is not statistically significant for the breast exam and pap test. In line with the previous observations, we can hypothesize that the major access to cost-sharing subsidies by women, in addition to a major need of cares, has allowed them to achieve more comprehensive health insurance plans in which any type of cost-sharing payments is reduced. Conversely, for the colonoscopy exam, the variable of interest is almost always statistically significant with a positive sign. Because of expensiveness of this exam (the average cost of a colonoscopy in the United States is $2,750, though prices can range from $1,250 to $4,800), receiving a reimbursement could have a positive influence on getting a colonoscopy.[18] Moreover, the positive sign of the concentration index confirms that receiving a reimbursement is widespread among the better-off. This could be due to the greater economic availability of the richest individuals in purchasing more comprehensive health plans on which reimbursement are included, paying cares and in being also able to await the reimbursement. The combination of these two components and in line with the results of the ENA for colonoscopy strengthen the contribution of this variable toward the pro-rich direction. Finally, the general trend followed by our variable of interest in the PSA exam drafts some relevant differences from the other exams: the variable is almost always statistically significant with a negative sign, meaning that awaiting reimbursement has a negative impact on the access to this exam, whereas the positive sign of the CI confirms that, as said before, paying a full health insurance, in advance for the exam and waiting for the reimbursement favour only the richest individuals. This is in line with the previous literature in which some barriers to prostate cancer screening are highlighted, such as lack of knowledge, fears of losing masculinity, accept the intrusiveness of screening and the ambiguities about the necessity (Weinrich et al., 2000; James et al., 2017). These barriers amplify the impediment due to the potential substantial costs. Pushing from the opposite side of the ENA, the contribution of this variable for this screening test reduces the inequality among individuals.

Finally, a little note deserves the race. Disparities in receipt of cancer screenings by race/ethnicity are highlighted. According to the results and in line with the currently available

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[18] Whereas in the United States the cost for a Pap smear without insurance typically varies from $50 to $150, the average cost for a screening mammogram ranges from about $100 to $250 and a prostate-specific antigen test typically costs $20-$50 for an at-home test or up to $120 or more if performed at a hospital

literature, even if poverty is higher among both black and other minority ethnic groups, black Americans are more likely to report utilization of screenings cancers compared to Hispanics, Asian-Americans, and Pacific Islanders (Sambamoorthi and McAlpine, 2003; Goel et al., 2003; Sabatino et al., 2008; Liss and Becker, 2014; Jadav et al., 2015; Holden et al., 2015; Sabatino et al., 2015; White et al., 2015).

[TABLE 3 about here]

[TABLE 4 about here]

[TABLE 5 about here]

3.5. Conclusions

The results presented in this paper suggest as the elimination of cost sharing payments for preventive screenings expected by the health insurance exchanges has had limited early influence on the income-related disparities. Moreover, our results seem revealing that after the ACA implementation there was an overall increase in the use of these preventive screenings. The income-related inequality index in the access of preventive services did not change substantially after the ACA. Moreover, we observe that women who belong to less prosperous social classes have more propensity for getting screening tests, probably due to the cost-sharing subsidies that were available for private enrolees with incomes 100–250% of the poverty level (Fedewa et al., 2015; Mehta et al., 2015; Scheffler et al., 2016). On the other hand, women are more influenced by their educational level and familiar condition: those who achieve an education level lower than high school and are married are liable to get fewer breast exams or cervical screenings than the college graduate or the unmarried.

We have, likewise, observed a gender gap trend: women get a higher use of preventive services than men do. Women are generally more sensitive to prevention and to health campaigns than men: this sensitivity seems to avoid the culture for which cancer is a taboo (Vlassoff and Garcia-Moreno

2002). Differently, the attitude of men towards colonoscopy is actually adverse, since colonoscopy is perceived as a possible threat to their masculinity.

The results also suggest that in 2015 the premiums increased, making the full insurance coverage prerogative of the richest and heightening the income-related inequalities (high premium for health plans with lowest cost sharing or out-of-pocket expenditures). Furthermore, some economic strategies realized by the insurance firms, such as market concentration, has had mixed impacts on the Marketplace Premiums, with an overall reduction of health plans offered. However, the rate of reimbursement (in ratio with the health expenditure) holds an average constant higher significance (except for the breast exam and Pap smears), highlighting its fixed key role for access to health care that clearly relativized the reduction of cost sharing (and the use of screening tests) to some type of health coverage plans (in a pro-rich direction because of higher premium) and to the cost-sharing subsidies (in a pro-poor direction).

However, since the geographical areas are almost statistically significant, the income-related inequalities also seem to be linked to the states in which individuals live. Indeed, in 2014, 17 states have opted to create their own exchanges, 7 were doing this in partnership with the federal government and 27 were being run by the federal government. Technical problems with both federal and state exchanges have required direct intervention of federal government to provide coverage or incur penalties (Zhang et al., 2014), highlighting the weight of federal authority in mitigating some inequities depicted by state governments choices and market competition.

An important role is played by the U.S. Preventive Services Task Force and its recommendations for clinical preventive services, considered in this paper, pertinent to evidence of effectiveness. Indeed, we suppose that the limitations prescribed for the PSA exam were highly strict, spreading this exam, with the higher magnitude in income-related inequality than the other ones, among the most advantaged individuals. The limitations in prescriptions are mandated to avoid the potential downsides detected in the level of PSA velocity being a part of screening for prostate cancer: elevated PSA levels can have other causes, such as benign prostate enlargement (benign prostatic hyperplasia) or prostate infection (prostatitis), leading to common false positives (Catalona, 2018). However, it seems that after the US Preventive Services Task Force (USPSTF) recommendations, the widespread rejection of screening by many primary care physicians has led to an exclusion from this exam to those who don't have the economic capacity to pay for. As a consequence of this institutional filters in the access of this preventive screening, the great inequality heightened notably and more prostate cancer cases were high-grade and advanced at diagnosis (Moyer, 2012; Catalona, 2018). Indeed, in

2018, the USPSTF has issued a revised draft recommendation, suggesting shared decision making for screening healthy men from 55 to 69.

Our research is the first in which Meps as source of data is used to describe the income-related inequalities in the use of preventive cancer screenings for only holders of private insured and contributes to the literature in different ways. First, we describe the trend of preventive care inequalities for the deadliest cancers in USA, analysing the pre and post ACA period. We also show how the federal governmental intents to make the preventive care affordable without any financial barriers, has been limited by the state's different implementation and, also, the strategic choices of insurance firms that have pressed the income-related inequality through a pro-rich direction. However, we have seen as the reimbursement remains statistically significant for some types of screening tests, despite of expected elimination of out-of-pocket expenditure for prevention care, whereas the cost-sharing subsidies have pressed in some way income-related inequalities in a pro-poor direction. We have also confirmed the relevance of the gender gap and gender taboo in the use of these screening tests, allowing to women mostly adherence to the prevention iter. The strengths of this study include its use of patient-level data from a large national survey that closely represents the diversity of patients across geographic areas, improving its applicability with highly reliable self-reported data. On the contrary, this study may be limited by its not long period of time to appropriately evaluate changes and interventions. Indeed, we were not able to use data from 2017 and 2018, since questionnaire wordings for the variables of interest were not similar across these surveys.

We want also to highlight that our intention was to measure the correlation between the ACA and the income-related inequalities among Americans. We also reckon to our research as a starting point to in-depth analysis about the critical issues and causal effect between the affordability of some preventive cares and the ACA.

We conclude by highlighting the importance of enacting policies targeted at socioeconomic positions that are particularly vulnerable, also observing the important role of federal government to mitigate the Marketplaces' structured competition among health plans that could heighten income-related inequalities.

Since the goal of prevention plans is reducing the death rates and the health costs, tied to expensive cares, we suggest that a national aligned effort by all the American states to implement the ACA recommendation, in order to promote a better understanding of reform's benefits and an increase in the common use of preventive cares. Indeed, we suggest also to invest more in best public communications networks that in particular wealthy men, who seem to be less compliant with screening policy and strike the gender taboo and educational gap. Another option would be for the

government to expand the availability of the ACA cost sharing subsidies to people with higher incomes (over the current threshold, there is an income of 250 percent of poverty). Likewise, we think that the strict regulations adopted by the USPSTF needed to be revised making counselling and screening also for all cancer risk syndromes of healthy individuals and appropriate follow-up without co-payments in order to avoid the risk of forgoing cares for the most disadvantaged individuals.

We conclude by stating that limited to private insurance, the cost-sharing elimination and subsidies policy have not apparently achieved its goal of decreasing inequalities between individuals, not facilitated by the attitudes of insurance companies that, by pursuing market strategies, have raised cost of premiums and exaggerated inequalities in access to services included in more expensive contracts.

TABLES

Table 1 Statistics on the use of cancer's preventive care. A comparison between public insurance and private insurance

	2012			2013			2014			2015			2016		
	full sample	Public Insurance	Private Insurance	full sample	Public Insurance	Private Insurance	full sample	Public Insurance	Private Insurance	full sample	Public Insurance	Private Insurance	full sample	Public Insurance	Private Insurance
Breast exam															
First quintile	45.31	51.91	46.67	52.62	55.97	42.31	50.73	53.49	42.69	48.67	50.17	44.61	46.46	48.41	41.37
Second quintile	42.07	47.64	45.50	45.55	47.34	43.90	45.38	46.97	43.91	44.15	46.44	42.06	44.57	46.64	42.50
Third quintile	41.45	44.88	45.89	43.19	43.82	42.99	43.80	46.37	43.03	42.69	43.34	42.48	42.50	40.04	43.30
Fourth quintile	42.32	45.39	44.52	43.31	41.71	43.49	42.36	38.81	42.82	41.68	37.37	42.28	43.08	42.02	43.22
Fifth quintile	41.81	41.99	42.84	43.06	43.02	43.06	42.40	39.16	42.65	42.54	37.66	42.93	41.55	33.87	42.18
Colonoscopy															
First quintile	21.17	20.81	22.11	21.08	21.26	20.31	19.66	20.05	18.50	21.01	21.68	19.18	22.11	23.10	19.51
Second quintile	23.27	28.57	19.12	23.58	27.95	19.57	23.24	28.27	18.58	22.56	27.06	18.46	23.78	26.77	20.90
Third quintile	23.09	32.02	20.66	23.10	32.53	19.98	23.00	34.29	19.33	23.16	32.18	20.21	24.10	32.97	21.21
Fourth quintile	24.26	41.61	22.26	25.48	39.20	23.92	25.14	39.24	23.31	24.96	35.91	23.44	24.83	40.55	22.71
Fifth quintile	31.56	48.75	30.39	30.20	46.51	29.34	30.15	43.36	29.14	31.70	46.43	30.52	32.71	46.96	31.55
Pap test															
First quintile	49.72	51.28	45.73	52.36	54.96	43.58	50.17	52.65	42.95	47.30	49.29	41.88	44.87	47.22	38.60
Second quintile	43.52	41.43	43.60	42.84	44.44	41.36	42.41	43.26	41.80	41.19	41.23	41.16	39.74	38.59	40.86
Third quintile	41.92	36.09	43.50	40.30	35.65	41.84	40.38	37.34	41.36	38.82	35.75	39.82	38.81	31.73	40.46
Fourth quintile	41.34	35.22	42.04	40.95	34.52	41.63	39.31	30.37	40.49	38.52	29.65	39.76	38.57	31.09	39.59
Fifth quintile	39.20	25.89	39.83	39.81	29.84	40.46	39.43	30.77	40.09	38.48	27.92	39.32	37.47	25.56	38.44
PSA															
First quintile	19.61	18.81	21.68	17.41	15.88	22.61	17.67	16.80	20.43	16.57	16.74	16.06	17.06	16.58	18.47
Second quintile	20.07	21.04	19.31	20.22	21.22	19.35	19.31	19.15	19.45	19.41	20.81	18.17	19.10	20.00	18.29
Third quintile	21.02	24.56	19.98	22.06	24.67	21.05	21.28	24.16	20.33	20.98	21.66	20.73	21.26	22.29	20.88
Fourth quintile	25.10	28.25	24.66	24.61	30.40	23.86	23.55	30.32	22.50	23.31	28.31	22.55	22.93	29.46	21.86
Fifth quintile	29.56	33.17	29.70	29.79	30.26	29.75	27.30	31.43	27.56	28.72	37.97	23.77	28.48	36.68	27.67

Table 2 Statistics on cancer's preventive care frequency (percentage figures) ranking index and educational level. A comparison between and private insurance, from 2012 to 2016.

	Full Sample				Private Insurance			
	2012					2012		
	Low education	Medium education	High education		Low education	Medium education	High education	
Breast								
First quintile	46.14	51.27	55.75		45.83	42.81	51.67	
Second quintile	41.97	45.66	50.66		40.00	43.29	49.40	
Third quintile	38.92	41.77	50.94		37.86	41.46	50.82	
Fourth quintile	33.47	40.25	48.23		27.59	39.96	48.24	
Fifth quintile	37.37	35.00	44.83		37.29	34.11	45.01	
Colonoscopy								
First quintile	22.40	20.08	22.98		23.96	23.32	22.37	
Second quintile	25.92	23.90	21.55		19.55	20.73	18.67	
Third quintile	30.54	22.90	21.38		25.93	21.48	19.34	
Fourth quintile	25.21	29.41	21.86		21.26	27.25	20.21	
Fifth quintile	39.39	31.35	31.73		40.68	31.20	30.37	
Paptest								
First quintile	45.29	52.14	53.24		45.83	41.85	50.39	
Second quintile	36.79	42.39	49.75		38.64	39.94	48.80	
Third quintile	31.77	37.42	48.59		32.92	38.06	49.45	
Fourth quintile	27.27	35.38	45.99		25.29	35.76	46.50	
Fifth quintile	29.29	30.27	41.65		32.20	30.03	42.29	
PSA								
First quintile	20.39	18.82	21.79		15.19	22.27	25.00	
Second quintile	13.93	20.95	21.96		10.59	19.65	21.83	
Third quintile	24.41	20.88	20.68		24.29	19.91	19.64	
Fourth quintile	24.68	26.46	24.44		25.71	26.40	23.88	
Fifth quintile	29.69	30.70	29.82		33.33	31.13	29.31	

	Full Sample				Private Insurance		
	2013				2013		
	Low education	Medium education	High education		Low education	Medium education	High education
Breast							
First quintile	50.64	52.32	55.52		30.60	40.71	48.45
Second quintile	38.62	44.01	51.50		34.23	40.88	49.30
Third quintile	34.91	39.19	48.46		31.75	38.57	48.09
Fourth quintile	31.66	38.62	46.55		29.72	38.65	46.57
Fifth quintile	33.33	35.83	44.90		30.71	34.60	45.06
Colonoscopy							
First quintile	22.40	20.08	22.98		21.62	19.94	21.47
Second quintile	25.92	23.90	21.55		27.12	23.20	21.53
Third quintile	30.54	22.90	21.38		25.13	23.36	22.25
Fourth quintile	25.21	29.41	21.86		27.51	27.97	24.30
Fifth quintile	39.39	31.35	31.73		24.36	29.40	30.63
Paptest							
First quintile	48.72	53.38	55.28		32.09	41.11	50.31
Second quintile	38.01	39.41	48.98		35.00	35.61	47.64
Third quintile	29.85	36.10	46.43		29.08	37.27	47.38
Fourth quintile	27.22	35.28	44.82		27.31	35.87	45.08
Fifth quintile	28.85	30.17	42.16		28.35	29.78	42.84
PSA							
First quintile	15.43	18.86	18.69		15.19	22.27	25.00
Second quintile	20.04	20.56	20.05		10.59	19.65	21.83
Third quintile	22.36	22.49	21.66		24.29	19.91	19.64
Fourth quintile	24.48	25.08	24.44		25.71	26.40	23.88
Fifth quintile	27.78	26.62	30.50		33.33	31.13	29.31

	Full Sample				Private Insurance		
	2014				2014		
	Low education	Medium education	High education		Low education	Medium education	High education
Breast							
First quintile	47.20	50.50	54.91		38.69	41.15	45.21
Second quintile	40.82	42.67	50.11		33.58	39.34	50.18
Third quintile	37.76	37.89	49.28		33.23	35.61	49.04
Fourth quintile	33.14	38.95	44.95		32.54	38.82	45.45
Fifth quintile	21.92	36.72	44.32		19.47	35.65	44.65
Colonoscopy							
First quintile	20.75	19.01	19.10		18.98	19.23	17.82
Second quintile	26.02	23.24	21.55		21.27	18.94	17.48
Third quintile	26.03	24.77	20.97		18.60	21.09	18.57
Fourth quintile	28.49	27.75	23.67		25.79	26.20	21.97
Fifth quintile	19.18	32.83	30.15		15.93	30.64	29.37
Paptest							
First quintile	46.36	49.90	54.70		40.15	41.92	44.68
Second quintile	36.61	38.76	48.57		32.84	35.15	48.99
Third quintile	32.93	34.13	46.52		31.40	33.71	47.52
Fourth quintile	29.07	34.35	42.65		29.76	35.22	43.63
Fifth quintile	23.29	31.98	41.48		21.24	31.41	42.22
PSA							
First quintile	17.72	17.88	17.34		20.00	20.22	20.83
Second quintile	18.66	19.28	19.76		18.63	19.67	19.63
Third quintile	25.13	21.72	19.62		24.19	19.63	19.82
Fourth quintile	23.19	23.64	23.57		21.83	23.16	22.31
Fifth quintile	23.88	25.21	28.51		23.40	25.16	28.06

		Full Sample				Private Insurance			
			2015				2015		
		Low education	Medium education	High education		Low education	Medium education	High education	
			Breast						
First quintile		46.95	49.31	50.99		37.18	42.64	45.33	
Second quintile		37.79	39.72	50.38		33.75	32.76	50.36	
Third quintile		36.95	38.77	47.75		34.12	39.34	46.90	
Fourth quintile		28.11	38.11	44.64		25.35	37.23	44.77	
Fifth quintile		27.50	35.93	43.89		27.27	35.11	44.14	
			Colonoscopy						
First quintile		21.44	20.12	21.36		23.08	19.38	21.03	
Second quintile		24.88	22.70	21.12		16.88	19.66	17.59	
Third quintile		25.42	24.28	20.13		21.76	22.75	16.78	
Fourth quintile		25.95	32.00	23.46		22.54	30.66	22.16	
Fifth quintile		22.50	29.83	32.42		18.18	29.39	31.21	
			Paptest						
First quintile		43.44	47.73	49.73		33.33	38.76	40.19	
Second quintile		33.64	39.18	47.81		31.88	33.45	49.40	
Third quintile		30.85	35.33	44.65		28.82	35.55	45.18	
Fourth quintile		25.41	33.89	43.02		23.94	33.33	43.97	
Fifth quintile		22.50	29.83	41.03		21.21	30.15	41.51	
			PSA						
First quintile		15.82	17.50	18.38		11.48	16.67	20.35	
Second quintile		20.66	17.62	18.71		19.09	16.00	17.87	
Third quintile		19.90	20.28	21.47		21.62	19.71	20.71	
Fourth quintile		25.24	24.77	22.41		25.33	25.27	21.78	
Fifth quintile		13.51	27.72	30.66		11.11	27.33	29.83	

	Full Sample 2016				Private Insurance 2016		
	Low education	Medium education	High education		Low education	Medium education	High education
Breast							
First quintile	46.95	49.31	50.99		45.00	50.50	45.81
Second quintile	37.79	39.72	50.38		41.71	42.96	50.44
Third quintile	36.95	38.77	47.75		36.69	38.69	50.41
Fourth quintile	28.11	38.11	44.64		35.82	39.15	50.00
Fifth quintile	27.50	35.93	43.89		21.74	36.61	45.45
Colonoscopy							
First quintile	24.62	21.48	27.75		16.28	19.21	26.19
Second quintile	22.65	22.54	22.45		18.18	21.06	18.55
Third quintile	27.70	24.17	21.25		18.66	21.58	17.22
Fourth quintile	18.66	26.10	23.02		16.50	23.04	21.28
Fifth quintile	17.39	33.28	33.76		14.29	31.92	32.57
Paptest							
First quintile	43.08	48.62	42.29		34.88	39.30	41.67
Second quintile	35.08	38.94	43.44		36.36	37.42	47.96
Third quintile	30.85	35.33	44.65		33.58	35.25	47.16
Fourth quintile	32.01	34.85	46.13		32.04	32.36	48.30
Fifth quintile	32.84	32.40	47.00		17.14	30.34	42.87
PSA							
First quintile	16.84	15.80	20.38		23.44	23.02	15.38
Second quintile	16.55	19.54	22.12		13.86	19.30	20.74
Third quintile	20.10	22.72	18.83		17.02	22.92	16.89
Fourth quintile	15.85	21.30	20.77		16.67	19.78	19.83
Fifth quintile	30.43	27.49	29.10		28.57	27.00	28.20

Table 3 Screening tests inequality index across socio-economic and need care positions, full sample. Significance levels: *10%, **5%, ***1%

Breast cancer prevention					
	2012	2013	2014	2015	2016
	Full sample				
EI	-0.032	-0.025	-0.022	-0.033	-0.013
Significance	***	***	***	***	**
ENA	-0.016	-0.011	-0.009	-0.025	0.005
Significance	**			***	

Pap Test prevention					
	2012	2013	2014	2015	2016
	Full sample				
EI	-0.067	-0.050	-0.042	-0.057	-0.039
Significance	***	***	***	***	***
ENA	-0.019	0.003	0.006	-0.162	-0.006
Significance	***			*	

Colonoscopy prevention					
	2012	2013	2014	2015	2016
	Full sample				
EI	0.112	0.101	0.098	0.134	0.103
Significance	***	***	***	***	***
ENA	0.075	0.061	0.064	0.106	0.077
Significance	***	***	***	***	***

PSA prevention 40 years old					
	2012	2013	2014	2015	2016
	Full sample				
EI	0.115	0.101	0.091	0.122	0.102
Significance	***	***	***	***	***
ENA	0.142	0.127	0.123	0.160	0.139
Significance	***	***	***	***	***

Table 4 Screening tests inequality index across socio-economic and need care positions, private insurance sample. Significance levels: *10%, **5%, ***1%

Breast cancer prevention					
	2012	2013	2014	2015	2016
	Share reimb				
EI	-0.032	-0.025	-0.022	-0.033	-0.013
Significance	***	***	***	***	**
ENA	-0.027	-0.025	-0.017	-0.042	-0.019
Significance	***	***	**	***	***

Pap Test prevention					
	2012	2013	2014	2015	2016
	Share reimb				
EI	-0.067	-0.050	-0.042	-0.057	-0.039
Significance	***	***	***	***	***
ENA	-0.036	-0.022	-0.011	-0.041	-0.034
Significance	***	**		***	***

Colonoscopy prevention					
	2012	2013	2014	2015	2016
	Share reimb				
EI	0.112	0.101	0.098	0.134	0.103
Significance	***	***	***	***	***
ENA	0.058	0.047	0.056	0.101	0.076
Significance	***	***	***	***	***

PSA prevention 40 years old					
	2012	2013	2014	2015	2016
	Share reimb				
EI	0.115	0.101	0.091	0.122	0.102
Significance	***	***	***	***	***
ENA	0.148	0.133	0.127	0.159	0.134
Significance	***	***	***	***	***

Table 5 Contributions of different socio-demographic characteristics to the EDA index, private insurance sample. Significance levels: *10%, **5%, ***1%

Breast exam

Breast cancer prevention			
	2012		
Variables	β	CI	Contribution
Family Income Adjusted by Family size	1.50e-06 (5.92e-07)**	0.456 (0.001)***	0.024 (0.007)***
age	-0.001 (0.001)	0.023 (0.001)***	-0.002 (0.001)*
poor health status	0.010 (0.058)	-0.273 (0.005)***	-0.000 (0.001)
black	0.206 (0.052)***	-0.180 (0.005)***	-0.006 (0.001)***
other race	-0.058 (0.050)	-0.090 (0.003)***	0.002 (0.001)
northeast	0.107 (0.057)*	0.032 (0.006)***	0.000 (0.000)**
midwest	0.080 (0.053)	0.053 (0.005)***	0.000 (0.000)*
south	0.064 (0.047)	-0.070 (0.003)***	-0.001 (0.000)*
born in usa	0.104 (0.053)**	0.038 (0.001)***	0.003 (0.001)**
never married	-0.397 (0.051)***	-0.177 (0.003)***	0.023 (0.002)***
widowed	-0.301 (0.076)***	-0.135 (0.009)***	0.002 (0.000)***
separated	-0.027 (0.060)	-0.309 (0.013)***	0.000 (0.000)
divorced	0.100 (0.131)	-0.105 (0.008)***	-0.001 (0.001)
low education	-0.056 (0.077)	-0.365 (0.005)***	0.003 (0.004)
high education	0.236 (0.040)***	0.213 (0.003)***	0.025 (0.002)***
unemployed	-0.144 (0.048)***	-0.234 (0.003)***	0.012 (0.002)***
self-employed	-0.041 (0.125)	0.143 (0.016)***	-0.000 (0.000)
student	-0.495 (0.082)***	-0.074 (0.011)***	0.002 (0.000)***
unable to work	-0.246 (0.109)**	-0.369 (0.010)***	0.005 (0.001)***
housemaker	0.239 (0.103)**	-0.192 (0.015)***	-0.001 (0.000)***
Share_reim	-0.047 (0.056)	0.108 (0.002)***	-0.002 (0.002)

Breast cancer prevention					Breast cancer prevention		
	2013					2014	
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	1.93e-06 (5.98e-07)***	0.457 (0.002)***	0.034 (0.008)***		1.21e-06 (5.65e-07)**	0.460 (0.002)***	0.022 (0.008)***
age	0.001 (0.001)	0.025 (0.001)***	0.002 (0.001)		0.003 (0.001)**	0.020 (0.001)***	0.003 (0.001)***
poor health status	-0.015 (0.060)	-0.277 (0.005)***	0.000 (0.002)		0.108 (0.061)*	-0.266 (0.005)***	-0.004 (0.002)**
black	0.172 (0.052)***	-0.169 (0.005)***	-0.006 (0.001)***		0.175 (0.053)***	-0.169 (0.005)***	-0.006 (0.001)***
other race	-0.052 (0.051)	-0.086 (0.003)***	0.002 (0.002)		-0.052 (0.051)	-0.088 (0.003)***	0.001 (0.001)
northeast	0.134 (0.056)**	0.041 (0.006)***	0.000 (0.000)***		0.235 (0.059)***	0.029 (0.007)***	0.001 (0.000)***
midwest	0.128 (0.055)**	0.048 (0.006)***	0.001 (0.000)***		0.126 (0.055)**	0.0633 (0.006)***	0.001 (0.000)**
south	0.092 (0.048)*	-0.070 (0.003)***	-0.002 (0.000)***		0.157 (0.047)***	-0.080 (0.004)***	-0.005 (0.001)***
born in usa	0.080 (0.053)	0.040 (0.001)***	0.002 (0.001)**		0.102 (0.052)*	0.040 (0.001)***	0.003 (0.001)**
never married	-0.339 (0.051)***	-0.174 (0.004)***	0.021 (0.002)***		-0.360 (0.052)***	-0.169 (0.004)***	0.022 (0.002)***
widowed	-0.331 (0.079)***	-0.134 (0.009)***	0.003 (0.000)***		-0.575 (0.077)***	-0.145 (0.010)***	0.006 (0.000)***
separated	-0.007 (0.062)	-0.351 (0.014)***	0.000 (0.000)		-0.097 (0.061)	-0.325 (0.014)***	0.001 (0.000)*
divorced	-0.130 (0.119)	-0.099 (0.007)***	0.001 (0.001)		-0.030 (0.120)	-0.097 (0.007)***	0.000 (0.001)
low education	-0.112 (0.068)*	-0.353 (0.004)***	0.009 (0.004)**		-0.117 (0.068)*	-0.356 (0.005)***	0.009 (0.004)**
high education	0.301 (0.043)***	0.210 (0.002)***	0.036 (0.004)***		0.331 (0.043)***	0.202 (0.003)***	0.040 (0.004)***
unemployed	-0.189 (0.049)***	-0.228(0.003)***	0.017 (0.003)***		-0.090 (0.051)*	-0.240 (0.004)***	0.008 (0.003)**
self-employed	0.083 (0.126)	0.162 (0.015)***	0.000 (0.000)		0.002 (0.122)	0.148 (0.014)***	0.000 (0.000)
student	-0.555 (0.085)***	-0.052 (0.013)***	0.001 (0.000)***		-0.431 (0.086)***	-0.049 (0.013)***	0.001 (0.000)***
unable to work	0.083 (0.119)	-0.377 (0.009)***	-0.001 (0.002)		-0.136 (0.121)	-0.398 (0.009)***	0.003 (0.002)
housemaker	0.187 (0.100)*	-0.175 (0.018)***	-0.000 (0.000)***		0.107 (0.103)	-0.211 (0.017)***	-0.000 (0.000)
Share_reim	0.043 (0.057)	0.125 (0.002)***	0.002 (0.002)		0.049 (0.057)*	0.126 (0.002)***	0.003 (0.003)

	Breast cancer prevention				Breast cancer prevention		
	2015				2016		
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	3.32e-06 (5.73e-07)***	0.453 (0.002)***	0.063 (0.009)***		1.61e-06 (5.05e-07)***	0.457 (0.002)***	0.033 (0.008)***
age	0.001 (0.001)	0.015 (0.001)***	0.001 (0.000)		-0.000 (0.001)	0.014 (0.001)***	-0.000 (0.000)
poor healh status	-0.107 (0.057)*	-0.262 (0.006)***	0.005 (0.002)**		-0.150 (0.057)***	-0.267 (0.005)***	0.007 (0.002)***
black	0.090 (0.053)*	-0.168 (0.005)***	-0.003 (0.001)**		0.150 (0.053)***	-0.165 (0.006)***	-0.004 (0.001)***
other race	-0.250 (0.050)***	-0.095 (0.003)***	0.010 (0.001)***		-0.170 (0.049)***	-0.100 (0.003)***	0.007 (0.001)***
northeast	0.078 (0.059)	0.026 (0.006)***	0.000 (0.000)*		0.066 (0.057)	0.028 (0.007)***	0.000 (0.000)
midwest	0.039 (0.053)	0.048 (0.005)***	0.000 (0.000)		0.000 (0.052)	0.060 (0.005)***	7.00e-07 (0.000)
south	0.150 (0.046)***	-0.070 (0.003)***	-0.004 (0.000)***		0.121 (0.046)***	-0.068 (0.003)***	-0.003 (0.000)***
born in usa	-0.036 (0.052)	0.041 (0.001)***	-0.001 (0.001)		-0.024 (0.051)	0.038 (0.001)***	-0.000 (0.001)
never married	-0.265 (0.051)***	-0.163 (0.004)***	0.015 (0.002)***		-0.404 (0.050)***	-0.174 (0.004)***	0.025 (0.002)***
widowed	-0.447 (0.075)***	-0.171 (0.008)***	0.005 (0.001)***		-0.360 (0.077)***	-0.184 (0.009)***	0.005 (0.001)***
separated	-0.056 (0.059)	-0.371 (0.014)***	0.000 (0.000)		-0.048 (0.058)	-0.359 (0.012)***	0.000 (0.000)
divorced	0.074 (0.121)	-0.111 (0.007)***	-0.001 (0.001)		-0.048 (0.119)	-0.121 (0.007)***	0.000 (0.001)
low education	-0.204 (0.081)**	-0.344 (0.007)***	0.007 (0.002)***		-0.016 (0.095)	-0.378 (0.007)***	0.000 (0.002)
high education	0.101 (0.039)**	0.192 (0.004)***	0.005 (0.001)***		0.119 (0.0443)***	0.317 (0.006)***	0.006 (0.001)***
unemployed	-0.205(0.050)***	-0.232(0.003)***	0.018 (0.003)***		-0.261(0.049)***	-0.236(0.003)***	0.025(0.003)***
self-employed	-0.147 (0.111)	0.209 (0.014)***	-0.001 (0.000)*		-0.070 (0.116)	0.138 (0.018)***	-0.000 (0.000)
student	-0.823 (0.086)***	0.000 (0.013)	-1.03e-06 (0.000)		-0.830 (0.088)***	-0.033 (0.013)**	0.001 (0.000)**
unable to work	0.235 (0.120)*	-0.402 (0.010)***	-0.005 (0.001)***		0.081 (0.121)	-0.441 (0.008)***	-0.002 (0.002)
housemaker	0.421 (0.105)***	-0.224 (0.018)***	-0.002 (0.000)***		0.291 (0.101)***	-0.279 (0.015)***	-0.002 (0.000)***
Share_reim	-0.030 (0.057)	0.124 (0.002)***	-0.001 (0.002)		-0.188 (0.057)***	0.120 (0.002)***	-0.012 (0.002)***

Table 5 continued Pap Test

Pap Test			
	2012		
Variables	β	CI	Contribution
Family Income Adjusted by Family size	5.18e-08 (5.39e-07)	0.456 (0.002)***	0.000 (0.008)
age	-0.019 (0.001)***	0.023 (0.001)***	-0.023 (0.001)***
poor health status	-0.027 (0.055)	-0.273 (0.006)***	0.001 (0.001)
black	0.234 (0.050)***	-0.180 (0.005)***	-0.008 (0.001)***
other race	-0.004 (0.050)	-0.090 (0.003)***	0.000 (0.001)
northeast	0.074 (0.055)	0.032 (0.006)***	0.000 (0.000)*
midwest	0.020 (0.051)	0.054 (0.006)***	0.000 (0.000)
south	0.050 (0.046)	-0.070 (0.003)***	-0.001 (0.001)
born in usa	0.054 (0.053)	0.038 (0.001)***	0.001 (0.001)
never married	-0.395 (0.051)***	-0.177 (0.004)***	0.025 (0.002)***
widowed	-0.298 (0.071)***	-0.135 (0.008)***	0.002 (0.000)***
separated	0.030 (0.057)	-0.309 (0.013)***	-0.000 (0.000)
divorced	0.078 (0.127)	0.108 (0.002)***	-0.001 (0.001)
low education	-0.010 (0.076)	-0.365 (0.005)***	0.000 (0.002)
high education	0.264 (0.038)***	0.213 (0.002)***	0.032 (0.003)***
unemployed	-0.211 (0.046)***	-0.234(0.003)***	0.021 (0.003)***
self-employed	-0.199 (0.113)*	0.143 (0.015)***	-0.001 (0.000)*
student	-0.830 (0.083)***	-0.074 (0.011)***	0.004 (0.000)***
unable to work	-0.196 (0.105)*	-0.369 (0.009)***	0.004 (0.001)**
housemaker	0.414 (0.104)***	-0.192 (0.017)***	-0.002 (0.000)***
Share_reim	0.005 (0.054)	0.108 (0.002)***	0.000 (0.002)

	Pap Test				Pap Test		
	2013				2014		
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	7.02e-07 (5.55e-07)	0.457 (0.002)***	0.013 (0.008)*		5.62e07 (5.34e07)	0.460 (0.002)***	0.011 (0.010)
age	-0.015 (0.001)***	0.025 (0.001)***	-0.020 (0.001)***		-0.015 (0.001)***	0.020 (0.001)***	-0.018 (0.001)***
poor health status	-0.023 (0.059)	-0.277 (0.005)***	0.001 (0.002)		0.017 (0.058)	-0.266 (0.005)***	-0.000 (0.002)
black	0.266 (0.051)***	-0.169 (0.005)***	-0.010 (0.001)***		0.228 (0.049)***	-0.169 (0.005)***	-0.009 (0.001)***
other race	0.006 (0.050)	-0.086 (0.003)***	-0.000 (0.001)		-0.219 (0.056)***	-0.088 (0.004)***	-0.004 (0.000)***
northeast	0.043 (0.055)	0.041 (0.006)***	0.000 (0.000)		0.162 (0.056)***	0.028 (0.007)***	0.000 (0.000)***
midwest	-0.028 (0.053)	0.048 (0.006)***	-0.000 (0.000)		0.053 (0.052)	0.063 (0.005)***	0.000 (0.000)
south	0.012 (0.048)	-0.070 (0.003)***	-0.000 (0.001)		0.112 (0.046)**	-0.080 (0.003)***	-0.003 (0.001)***
born in usa	0.049 (0.053)	0.040 (0.001)***	0.001 (0.001)		-0.010 (0.049)	0.040 (0.001)***	-0.000 (0.001)
never married	-0.416 (0.052)***	-0.174 (0.004)***	0.028 (0.002)***		-0.442 (0.052)***	-0.169 (0.004)***	0.030 (0.003)***
widowed	-0.405 (0.074)***	-0.134 (0.009)***	0.004 (0.000)***		-0.535 (0.074)***	-0.145 (0.011)***	0.006 (0.000)***
separated	0.036 (0.060)	-0.351 (0.014)***	-0.000 (0.000)		-0.054 (0.059)	-0.326 (0.014)***	0.000 (0.000)
divorced	-0.188 (0.117)	-0.099 (0.007)***	0.002 (0.001)		0.091 (0.123)	-0.097 (0.008)***	-0.001 (0.001)
low education	-0.051 (0.068)	-0.353 (0.004)***	0.004 (0.004)		-0.037 (0.068)	-0.356 (0.004)***	0.003 (0.004)
high education	0.322 (0.042)***	0.210 (0.002)***	0.042 (0.004)***		0.334 (0.042)***	0.203 (0.002)***	0.044 (0.004)***
unemployed	-0.223(0.047)***	-0.228 (0.003)***	0.022 (0.004)***		-0.146 (0.049)***	-0.240(0.003)***	0.015 (0.004)***
self-employed	0.088 (0.120)	0.162 (0.015)***	0.000 (0.000)		0.034 (0.119)	0.148 (0.015)***	0.000 (0.000)
student	-0.838 (0.086)***	-0.052 (0.013)***	0.003 (0.000)***		-0.838 (0.086)***	-0.049 (0.013)***	0.002 (0.000)***
unable to work	-0.150 (0.111)	-0.377 (0.009)***	0.003 (0.002)*		-0.208 (0.111)**	-0.399 (0.009)***	0.006 (0.002)**
housemaker	0.339 (0.103)***	-0.175 (0.018)***	-0.001 (0.000)***		0.441 (0.113)***	-0.211 (0.018)***	-0.002 (0.000)***
Share_reim	0.002 (0.057)	0.125 (0.002)***	0.000 (0.003)		0.031 (0.056)	0.126 (0.002)***	0.002 (0.003)

	Pap Test				Pap Test		
	2015				2016		
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	1.47e-06 (5.17e-07)***	0.453 (0.002)***	0.031 (0.008)***		-1.13e-08 (4.50e-07)	0.457 (0.003)***	-0.000 (0.008)
age	-0.018 (0.001)***	0.015 (0.001)***	-0.016 (0.001)***		-0.017 (0.001)***	0.014 (0.001)***	-0.015 (0.001)***
poorhealthstatus	-0.148 (0.055)***	-0.262 (0.006)***	0.007 (0.002)***		-0.248 (0.054)***	-0.267 (0.006)***	0.014 (0.002)***
black	0.141 (0.051)***	-0.168 (0.005)***	-0.005 (0.001)***		0.120 (0.050)**	-0.165 (0.006)***	-0.004 (0.001)***
other race	-0.131 (0.049)***	-0.095 (0.003)***	0.006 (0.001)***		-0.133 (0.048)***	-0.100 (0.003)***	0.006 (0.001)***
northeast	0.121 (0.057)**	0.026 (0.007)***	0.000 (0.000)**		0.026 (0.054)	0.028 (0.006)***	0.000 (0.000)
midwest	0.073 (0.052)	0.048 (0.005)***	0.000 (0.000)**		0.001 (0.050)	0.060 (0.005)***	0.000 (0.000)
south	0.219 (0.045)***	-0.070 (0.004)***	-0.007 (0.001)***		0.120 (0.044)***	-0.068 (0.003)***	-0.003 (0.001)***
born in usa	-0.075 (0.052)	0.041 (0.001)***	-0.002 (0.001)*		-0.092 (0.050)*	0.038 (0.002)***	-0.003 (0.001)**
never married	-0.375 (0.051)***	-0.163 (0.004)***	0.024 (0.002)***		-0.375 (0.050)***	-0.174 (0.004)***	0.026 (0.003)***
widowed	-0.398 (0.072)***	-0.171 (0.008)***	0.005 (0.000)***		-0.343 (0.072)***	-0.184 (0.009)***	0.005 (0.001)***
separated	-0.084 (0.055)	-0.371 (0.013)***	0.001 (0.000)*		-0.085 (0.053)	-0.359 (0.014)***	0.001 (0.000)**
divorced	0.103 (0.119)	-0.111 (0.007)***	-0.001 (0.001)		0.076 (0.119)	-0.120 (0.008)***	-0.001 (0.001)
low education	-0.261 (0.080)***	-0.344 (0.007)***	0.011 (0.002)***		0.044 (0.093)	-0.378 (0.008)***	-0.001 (0.003)
high education	0.149 (0.038)***	0.192 (0.004)***	0.008 (0.001)***		0.123 (0.042)***	0.317 (0.007)***	0.008 (0.002)***
unemployed	0.258 (0.047)***	-0.232(0.003)***	0.027 (0.003)***		-0.261(0.046)***	-0.236(0.004)***	0.029 (0.004)***
self-employed	-0.144 (0.104)	0.209 (0.015)***	-0.001 (0.000)**		0.044 (0.112)	0.138 (0.016)***	0.000 (0.000)
student	-1.035 (0.086)***	-0.000 (0.014)	7.21e-06 (0.000)		-1.136 (0.088)***	-0.033 (0.013)**	0.002 (0.001)**
unable to work	0.117 (0.109)	-0.402 (0.008)***	-0.003 (0.001)*		0.068 (0.113)	-0.441 (0.008)***	-0.002 (0.002)
housemaker	0.563 (0.105)***	-0.223 (0.016)***	-0.003 (0.000)***		0.306***(0.098)	-0.279 (0.018)***	-0.002 (0.000)***
Share_reim	0.026 (0.056)	0.124 (0.002)***	0.001 (0.003)		-0.0571 (0.054)	0.120 (0.002)***	-0.004 (0.003)

Table 5 continued Colonoscopy

Colonoscopy			
	2012		
Variables	β	CI	Contribution
Family Income Adjusted by Family size	2.26e-06 (4.12e-07)***	0.456 (0.001)***	0.033 (0.003)***
age	0.065 (0.001)***	0.023 (0.001)***	0.062 (0.002)***
male	0.054 (0.029)*	0.056 (0.003)***	0.001 (0.000)***
poor health status	0.082 (0.045)*	-0.273 (0.005)***	-0.003 (0.001)**
black	0.251 (0.040)***	-0.180 (0.005)***	-0.008 (0.001)***
other race	-0.038 (0.045)	-0.090 (0.003)***	0.001 (0.000)
northeast	0.141 (0.046)***	0.032 (0.006)***	0.000 (0.000)***
midwest	0.060 (0.043)	0.054 (0.005)***	0.000 (0.000)
south	0.093 (0.039)**	-0.070 (0.003)***	-0.002 (0.000)***
born in usa	0.095 (0.046)**	0.038 (0.001)***	0.002 (0.000)***
never married	-0.211 (0.049)***	-0.177 (0.003)***	0.009 (0.001)***
widowed	-0.632 (0.061)***	-0.135 (0.009)***	0.003 (0.000)***
separated	-0.079 (0.043)*	-0.309 (0.013)***	0.000 (0.000)**
divorced	-0.141 (0.096)	-0.105 (0.008)***	0.001 (0.000)**
low education	-0.070 (0.064)	-0.365 (0.005)***	0.003 (0.002)
high education	0.114 (0.032)***	0.213 (0.002)***	0.010 (0.001)***
unemployed	-0.241 (0.040)***	-0.234 (0.004)***	0.017 (0.002)***
self-employed	-0.035 (0.077)	0.143 (0.016)***	-0.000 (0.000)
unable to work	0.577 (0.084)***	-0.369 (0.010)***	-0.012 (0.001)***
Share_reim	0.185 (0.047)***	0.108 (0.002)***	0.036 (0.004)***

Colonoscopy					Colonoscopy		
	2013					2014	
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	2.02e-06 (4.24e-07)***	0.457 (0.002)***	0.028 (0.003)***		2.20e-06 (4.11e-07)***	0.460 (0.002)***	0.030 (0.004)***
age	0.065 (0.001)***	0.025 (0.000)***	0.064 (0.002)***		0.065 (0.001)***	0.020 (0.001)***	0.051 (0.002)***
male	0.005 (0.030)	0.058 (0.002)***	0.000 (0.000)		-0.044 (0.031)	0.060 (0.003)***	-0.000 (0.000)**
poor health status	0.123 (0.048)**	-0.277 (0.005)***	-0.005 (0.001)***		0.193 (0.047)***	-0.266 (0.005)***	-0.007 (0.001)***
black	0.246 (0.042)***	-0.169 (0.005)***	-0.007 (0.001)***		0.122 (0.042)***	-0.169 (0.005)***	-0.003 (0.001)***
other race	-0.026 (0.046)	-0.086 (0.003)***	0.000 (0.000)		-0.107 (0.046)**	-0.088 (0.003)***	0.003 (0.000)***
northeast	0.207 (0.047)***	0.041 (0.006)***	0.001 (0.000)***		0.308 (0.047)***	0.029 (0.007)***	0.001 (0.000)***
midwest	0.113 (0.045)**	0.048 (0.006)***	0.000 (0.000)***		0.097 (0.046)**	0.063 (0.005)***	0.000 (0.000)**
south	0.092 (0.041)**	-0.070 (0.003)***	-0.002 (0.000)***		0.105 (0.041)**	-0.080 (0.003)***	-0.002 (0.000)***
born in usa	0.077 (0.047)	0.040 (0.001)***	0.001 (0.000)**		-0.000 (0.047)	0.040 (0.001)***	-0.000 (0.000)
never married	-0.235 (0.052)***	-0.174 (0.003)***	0.010 (0.001)***		-0.209 (0.051)***	-0.169 (0.004)***	0.008 (0.001)***
widowed	-0.598 (0.064)***	-0.134 (0.009)***	0.002 (0.000)***		-0.589 (0.064)***	-0.145 (0.010)***	0.003 (0.000)***
separated	0.031 (0.045)	-0.351 (0.014)***	-0.000 (0.000)		0.008 (0.045)	-0.326 (0.013)***	-0.000 (0.000)
divorced	0.036 (0.106)	-0.099 (0.007)***	-0.000 (0.000)		0.005 (0.105)	-0.097 (0.007)***	-0.000 (0.000)
low education	-0.150 (0.062)**	-0.353 (0.004)***	0.008 (0.002)***		-0.090 (0.062)	-0.356 (0.005)***	0.004 (0.002)*
high education	0.167 (0.036)***	0.210 (0.002)***	0.015 (0.001)***		0.144 (0.036)***	0.203 (0.002)***	0.012 (0.002)***
unemployed	-0.205 (0.042)***	-0.228 (0.004)***	0.013 (0.001)***		-0.254 (0.043)***	-0.356 (0.004)***	0.016 (0.002)***
self-employed	-0.049 (0.078)	0.162 (0.015)***	-0.000 (0.000)		-0.048 (0.081)	0.148 (0.015)***	-0.000 (0.000)
unable to work	0.676 (0.088)***	-0.377 (0.009)***	-0.016 (0.002)***		0.523 (0.090)***	-0.398 (0.008)***	-0.013 (0.002)***
Share_reim	0.155 (0.050)***	0.125 (0.002)***	0.047 (0.005)***		0.110 (0.050)**	0.126 (0.002)***	0.033 (0.006)***

Colonoscopy					Colonoscopy		
	2015					2016	
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	2.94e-06 (3.91e-07)***	0.453 (0.002)***	0.044 (0.004)***		2.32e-06 (3.62e-07)***	0.457 (0.002)***	0.039 (0.004)***
age	0.064 (0.001)***	0.015 (0.001)***	0.040 (0.002)***		0.063 (0.001)***	0.014 (0.000)***	0.039 (0.002)***
male	-0.067 (0.030)**	0.061 (0.003)***	-0.001 (0.000)***		-0.041 (0.029)	0.059 (0.003)***	-0.000 (0.000)**
poorhealthstatus	0.109 (0.045)**	-0.261 (0.006)***	-0.004 (0.001)***		0.183 (0.044)***	-0.267 (0.005)***	-0.007 (0.001)***
black	0.169 (0.042)***	-0.168 (0.006)***	-0.004 (0.001)***		0.185 (0.042)***	-0.165 (0.006)***	-0.005 (0.000)***
other race	-0.014 (0.045)	-0.095 (0.003)***	0.000 (0.001)		0.013 (0.044)	-0.100 (0.003)***	-0.000 (0.001)
northeast	0.174 (0.047)***	0.026 (0.007)***	0.000 (0.000)***		0.117 (0.046)**	0.028 (0.007)***	0.000 (0.000)**
midwest	0.002 (0.044)	0.048 (0.006)***	0.000 (0.000)		-0.001 (0.043)	0.060 (0.005)***	-0.000 (0.000)
south	0.044 (0.039)	-0.070 (0.003)***	-0.001 (0.000)		0.068 (0.038)*	-0.068 (0.003)***	-0.001 (0.000)**
born in usa	0.125 (0.046)***	0.041 (0.001)***	0.003 (0.000)***		0.128 (0.044)***	0.038 (0.001)***	0.003 (0.000)***
never married	-0.277 (0.050)***	-0.163 (0.005)***	0.011 (0.001)***		-0.263 (0.050)***	-0.174 (0.003)***	0.011 (0.001)***
widowed	-0.647 (0.062)***	-0.171 (0.006)***	0.004 (0.000)***		-0.654 (0.061)***	-0.184 (0.0101)***	0.004 (0.000)***
separated	-0.089 (0.044)**	-0.371 (0.013)***	0.000 (0.000)***		-0.080 (0.043)*	-0.360 (0.014)***	0.000 (0.000)**
divorced	-0.160 (0.100)	-0.111 (0.007)***	0.001 (0.000)**		-0.091 (0.100)	-0.121 (0.007)***	0.001 (0.000)
low education	-0.067 (0.074)	-0.344 (0.008)***	0.001 (0.001)		-0.363 (0.083)***	-0.378 (0.007)***	0.008 (0.001)**
high education	0.043 (0.032)	0.192 (0.005)***	0.001 (0.000)*		0.064 (0.035)*	0.317 (0.005)***	0.003 (0.001)**
unemployed	-0.224 (0.042)***	-0.232 (0.003)***	0.014 (0.002)***		-0.247 (0.042)***	-0.236 (0.003)***	0.017 (0.002)***
self-employed	0.026 (0.073)	0.209 (0.013)***	0.000 (0.000)		-0.064 (0.079)	0.138 (0.015)***	-0.000 (0.000)
unable to work	0.440 (0.086)***	-0.401 (0.009)***	-0.011 (0.002)***		0.418 (0.088)***	-0.441 (0.010)***	-0.011 (0.002)***
Share_reim	0.103 (0.048)**	0.124 (0.002)***	0.028 (0.005)***		0.139 (0.047)***	0.120 (0.002)***	0.026 (0.005)***

Table 5 continued PSA exam

PSA			
	2012		
Variables	β	CI	Contribution
Family Income Adjusted by Family size	2.80e-06 (6.39e-07)***	0.446 (0.002)***	0.079 (0.009)***
age 40 years old	0.048 (0.002)***	-0.005 (0.000)***	-0.022 (0.002)***
poor health status	0.086 (0.074)	-0.309 (0.005)***	-0.008 (0.004)*
black	0.083 (0.063)	-0.178 (0.005)***	-0.004 (0.002)**
other race	-0.110 (0.069)	-0.109 (0.003)***	0.006 (0.001)***
northeast	0.121 (0.072)*	0.024 (0.006)***	0.000 (0.000)**
midwest	0.088 (0.066)	0.079 (0.005)***	0.002 (0.001)**
south	0.205 (0.060)***	-0.080 (0.003)***	-0.009 (0.001)***
born in usa	0.062 (0.071)	0.049 (0.001)***	0.003 (0.002)*
never married	-0.128 (0.078)	-0.239 (0.007)***	0.005 (0.001)***
widowed	-0.535 (0.128)***	-0.197 (0.007)***	0.016 (0.002)***
separated	-0.032 (0.138)	-0.351 (0.015)***	0.000 (0.001)
divorced	-0.087 (0.068)	-0.143 (0.006)***	0.003 (0.001)**
low education	-0.241 (0.095)**	-0.381 (0.005)***	0.024 (0.004)***
high education	0.181 (0.050)***	0.221 (0.002)***	0.031 (0.004)***
unemployed	0.108 (0.071)	-0.238(0.002)***	-0.017(0.007)***
self-employed	0.053 (0.102)	0.158 (0.014)***	0.000 (0.000)
unable to work	0.162 (0.142)	-0.419 (0.008)***	-0.008 (0.003)**
Share_reim	0.001 (0.070)	0.159 (0.002)***	0.000 (0.003)

PSA				PSA		
	2013				2014	
Variables	β	CI	Contribution	β	CI	Contribution
Family Income Adjusted by Family size	2.88e-06 (6.75e-07)***	0.448 (0.002)***	0.081 (0.010)***	1.55e-06 (6.24e-07)**	0.451 (0.002)***	0.045 (0.012)***
age 40 years old	0.049 (0.002)***	-0.002 (0.000)***	-0.010 (0.002)**	0.045 (0.002)***	-0.005 (0.000)***	-0.024 (0.002)***
poor health status	0.092 (0.076)	-0.313 (0.004)***	-0.009 (0.004)**	0.094 (0.074)	-0.305 (0.005)***	-0.009 (0.004)**
black	0.186 (0.068)***	-0.160 (0.004)***	-0.009 (0.001)***	0.210 (0.067)***	-0.166 (0.006)***	-0.011 (0.001)***
other race	-0.029 (0.070)	-0.112 (0.003)***	0.001 (0.002)	-0.079 (0.071)	-0.106 (0.004)***	0.004 (0.002)*
northeast	0.125 (0.075)*	0.032 (0.006)***	0.001 (0.000)***	0.203 (0.074)***	0.017 (0.006)***	0.000 (0.000)***
midwest	-0.008 (0.069)	0.071 (0.005)***	-0.000 (0.000)	0.113 (0.069)	0.073 (0.005)***	0.002 (0.001)**
south	0.140 (0.062)**	-0.078 (0.003)***	-0.006 (0.001)***	0.123 (0.061)**	-0.088 (0.003)***	-0.006 (0.002)**
born in usa	0.015 (0.071)	0.053 (0.001)***	0.000 (0.002)	0.134 (0.072)*	0.050 (0.002)***	0.007 (0.002)***
never married	-0.220 (0.083)***	-0.249 (0.006)***	0.011 (0.002)***	-0.349 (0.083)***	-0.262 (0.007)***	0.018 (0.002)***
widowed	-0.299 (0.141)**	-0.196 (0.007)***	0.009 (0.002)***	-0.342 (0.135)**	-0.209 (0.007)***	0.011 (0.002)***
separated	0.014 (0.178)	-0.381 (0.016)***	-0.000 (0.001)	0.010 (0.177)	-0.340 (0.013)***	-0.000 (0.002)
divorced	-0.014 (0.072)	-0.140 (0.006)***	0.000 (0.001)	-0.150 (0.071)**	-0.136 (0.006)***	0.005 (0.001)***
low education	-0.287 (0.089)***	-0.381 (0.004)***	0.037 (0.006)***	-0.059 (0.089)	-0.382 (0.005)***	0.007 (0.007)
high education	0.193 (0.056)***	0.219 (0.002)***	0.034 (0.005)***	0.210 (0.056)***	0.220 (0.002)***	0.037 (0.005)***
unemployed	0.015 (0.075)	-0.231(0.003)***	0.004 (0.006)	0.073 (0.076)	-0.243 (0.003)***	0.014 (0.007)*
self-employed	-0.049 (0.104)	0.200 (0.015)***	-0.000 (0.000)	0.055 (0.106)	0.207 (0.014)***	0.000 (0.000)
unable to work	0.365 (0.153)**	-0.423 (0.007)***	-0.019 (0.003)***	0.064 (0.146)	-0.440 (0.008)***	-0.003 (0.005)
Share_reim	-0.159 (0.075)**	0.172 (0.002)***	-0.018 (0.004)***	-0.173 (0.073)**	0.174 (0.002)***	-0.020 (0.005)***

	PSA				PSA		
	2015				2016		
Variables	β	CI	Contribution		β	CI	Contribution
Family Income Adjusted by Family size	2.74e-06 (6.06e-07)***	0.445 (0.002)***	0.081 (0.011)***		2.57e-06 (5.70e-07)***	0.450 (0.002)***	0.080 (0.009)***
age 40 years old	0.047 (0.002)***	-0.006 (0.000)***	-0.030 (0.003)***		0.046 (0.002)***	-0.007 (0.000)***	-0.032 (0.002)***
poor health status	-0.011 (0.071)	-0.300 (0.004)***	0.001 (0.004)		-0.038 (0.071)	-0.296 (0.004)***	0.003 (0.003)
black	0.235 (0.066)***	-0.163 (0.006)***	-0.011 (0.001)***		0.269 (0.067)***	-0.160 (0.005)***	-0.012 (0.001)***
other race	-0.087 (0.070)	-0.109 (0.003)***	0.005 (0.002)**		-0.162 (0.070)**	-0.118 (0.004)***	0.010 (0.002)***
northeast	0.242 (0.074)***	0.017 (0.006)***	0.001 (0.000)***		0.175 (0.073)**	0.025 (0.006)***	0.001 (0.000)***
midwest	0.057 (0.067)	0.058 (0.006)***	0.000 (0.000)*		0.058 (0.068)	0.064 (0.005)***	0.001 (0.000)
south	0.057 (0.059)	-0.076 (0.004)***	-0.002 (0.001)*		0.156 (0.060)**	-0.073 (0.003)***	-0.006 (0.001)***
born in usa	-0.012 (0.071)	0.049 (0.002)***	-0.000 (0.001)		0.059 (0.070)	0.048 (0.001)***	0.003 (0.002)
never married	-0.216 (0.079)***	-0.257 (0.007)***	0.011 (0.002)***		-0.167 (0.081)**	-0.266 (0.007)***	0.008 (0.002)***
widowed	-0.582 (0.125)***	-0.221 (0.008)***	0.019 (0.002)***		-0.344 (0.120)***	-0.230 (0.007)***	0.012 (0.003)***
separated	-0.107 (0.153)	-0.390 (0.014)***	0.002 (0.001)		0.032 (0.171)	-0.384 (0.014)***	-0.000 (0.001)
divorced	-0.077 (0.070)	-0.142 (0.006)***	0.002 (0.001)**		-0.102 (0.072)	-0.155 (0.006)***	0.004 (0.001)**
low education	-0.199 (0.106)*	-0.376 (0.007)***	0.011 (0.003)***		-0.306 (0.114)***	-0.396 (0.007)***	0.017 (0.004)***
high education	0.172 (0.051)***	0.211 (0.004)***	0.014 (0.002)***		0.048 (0.056)	0.323 (0.006)***	0.004 (0.003)
unemployed	-0.078 (0.076)	-0.230 (0.004)***	0.012 (0.007)***		-0.091 (0.076)	-0.234 (0.003)***	0.014 (0.006)**
self-employed	0.037 (0.100)	0.217 (0.013)***	0.000 (0.000)		-0.054 (0.109)	0.165 (0.011)***	-0.000 (0.000)
unable to work	0.321 (0.142)**	-0.439 (0.006)***	-0.019 (0.005)***		0.348 (0.144)**	-0.476 (0.006)***	-0.021 (0.004)***
Share_reim	-0.202 (0.070)***	0.169 (0.003)***	-0.022 (0.004)***		-0.216 (0.070)***	0.164 (0.003)***	-0.023 (0.004)***

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