Life in the Health Lane: The Professional Trajectories of Healthcare Workers in Colombia

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Abstract

This paper provides new insights into the initial career trajectories of Colombian healthcare professionals, analyzing their health risks, labor market outcomes, and graduate school enrollment. Leveraging comprehensive longitudinal administrative records for 77.900 physicians, nurses, dentists, and bacteriologists, we employ a staggered event study framework to examine their early-life trajectories before and after their bachelor studies between 2008 and 2022. Key findings reveal that the prevalence of mental disorders increases for dentists and nurses after graduation, whereas for physicians, it decreases. Furthermore, our analysis sheds light on the limited evidence concerning adverse health trajectories, uncovering increased probabilities of emergency room visits and hospitalizations after graduation, particularly for nurses. Finally, our findings reveal substantial returns in the labor market for health professionals, with persisting gender wage gaps and disparities in postgraduate enrollment.

Keywords: Health Professionals, Mental Health, Health Behavior, Returns to Education, Working Conditions, Earnings, Wage Gap, Professions.

JEL Classification: I11, I12, I26, J28, J31, J44

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1 Introduction

Healthcare professionals shape our well-being, yet we know surprisingly little about what shapes theirs, especially at the onset of their careers. Existing research has examined these professionals in different settings, with a special emphasis on physicians and nurses (Andreassen, Di Tommaso, & Strøm, 2017; Antonazzo, Scott, Skatun, & Elliott, 2003; Badinski, Finkelstein, Gentzkow, & Hull, 2023; Chen, 2021; Doyle, Ewer, & Wagner, 2010; Dunn & Shapiro, 2014; Okeke, 2023). However, less is known about the crucial early years of their professional lives and the heterogeneities within and between healthcare professions.

We address this gap in the literature by examining how the likelihood of an adverse health shock and the risk of mental health disorders evolve after obtaining the degree. Additionally, we analyze healthcare graduates' labor supply decisions, earnings trajectories, and postgraduate human capital accumulation around the time of graduation. We study these trajectories by systematically analyzing detailed longitudinal administrative records of the entire population of Colombian physicians, nurses, dentists, and bacteriologists who obtained their degrees between 2011 and 2017. We focus on these four occupations since they were the only ones required to participate in a compulsory social service upon graduation at the time and are considered of national interest in Colombia (see section 2 for more details).[1] These occupations merit in-depth analysis, as they constitute the majority of the healthcare workforce—the sector with one of the highest returns to education in the country. Tracking their early career trajectories provides valuable insight into societal priorities regarding the recognition and reward of skilled talent.

Our data quality enables us to track these professionals before and after graduation from college across labor market, education, and health dimensions. We exploit individuals' graduation dates in an event study framework to follow their life trajectories relative to the moment of their graduation. To achieve this, we use the Callaway and Sant'Anna (2021) estimator to account for all group-time specific effects while controlling for key individual characteristics and temporal factors surrounding the graduation date.[2] Considering the profound "feminization" of health personnel in Colombia (Ministry of Health, 2018),[3] we present our results and analyses differentiated between majors, and by gender for each profession, which allows us to reveal potential gender gaps.[4]

We build a unique panel that links three Colombian administrative records: the National Registry of Healthcare Talent, known as ReTHUS (Ministry of Health, 2023d), which provides information on the graduation date from any health program; the social security records from Colombia's Ministry of Health and Social Protection, known as

[1] In the Compulsory Social Service, the new graduates must provide professional services in urban and rural areas with limited access to health services. The service is provided once, right after obtaining the professional degree, and is a requirement for obtaining the professional license (Congreso de la República de Colombia, 2007).

[2] We estimate the universal event study aggregation from Callaway and Sant'Anna (2021)'s methodology, which allows us to interpret point estimates in each period relative to the pre-graduation period.

[3] This is a common characteristic in many healthcare systems. According to the World Health Organization (2019), women account for 70% of the health and social care workforce and deliver care to around 5 billion people.

[4] Throughout the paper, the terms 'sex' and 'gender' will be used interchangeably.

Planilla Integrada de Liquidación de Aportes (PILA) (Ministry of Health, 2023a), which contains mandatory contributions to health and pension for all employees in the country; and the Individual National Health Services Registry, known as *Registro Individual de Prestaciones de Salud* (RIPS) (Ministry of Health, 2023c), which captures all medical visits, diagnostics and therapeutic procedures, and other services for every patient in Colombia.

Our empirical analysis delves into the dynamics of post-graduation trajectories, accounting for individual characteristics, temporally aggregated shocks around the graduation date, and specific cohorts of professionals. Our findings underscore the heterogeneity of trajectories across different types of majors and gender. Our reduced-form exercises are implicitly related to the dynamic discrete choice models in the returns-to-education literature.[5] First, this literature shows that the choice of attending college and programs is determined by the forward-looking behavior of individuals, which depends on ex-ante characteristics associated with the varying nature of their ability and skills (Ge, 2013; Heckman, Humphries, & Veramendi, 2018). Second, it also relates to specialization through their choice of college major and their heterogeneous returns on the labor market (Altonji, Arcidiacono, & Maurel, 2016; Arcidiacono, Hotz, Maurel, & Romano, 2020).

We present several key findings from our analysis. First, we examine the trajectories of mental health among healthcare professionals. Ample evidence exists regarding the prevalence of mental illnesses and burnout within this population, with several studies documenting their detrimental effects on well-being (Gold, Sen, & Schwenk, 2013; Johnson et al., 2018; Lai et al., 2020; West et al., 2020; Young et al., 2021). The demanding and stressful nature of healthcare occupations predisposes workers to an elevated risk of developing negative mental states such as depression, anxiety, and stress (Ghazwin et al., 2016; Huang, Wu, Ho, & Wang, 2018; Maharaj, Lees, & Lal, 2019). Importantly, these health problems constitute additional costs borne by healthcare workers, which often go unrecognized.

Our results indicate that dentists and nurses face an increase in their probability of having a mental condition of just over one percentage point by the fourth year after graduation, representing an increase of 39% and 28% relative to the pre-graduation period, respectively. On the other hand, physicians experience a decrease in the probability of almost 1.5 percentage points after four years, consistent with a 37% reduction.[6] One possible explanation for this result is the demanding nature of undergraduate programs in medicine. Although their work can be as stressful as their studies, physicians face promising job prospects once they graduate. An alternative, reasonable explanation is that physicians avoid revealing their mental conditions as a way to steer clear of negative prejudices (Clement et al., 2015; Wong, Collins, Cerully, Yu, & Seelam, 2018). These findings underscore the considerable heterogeneity in health risk and mental health among healthcare professionals, emphasizing the need for targeted interventions to mitigate occupational health hazards.

Second, we analyze the initial health trajectories of healthcare professionals, focusing

[5] Our research is also related to the large literature in economics that focuses on estimating the causal relationship between college education and earnings (Psacharopoulos & Patrinos, 2018).

[6] Given the nature of our health data, we focus on measuring prevalence rather than incidence. Our health claims data measures medical diagnoses of mental illnesses rather than episodes. Once a diagnosis is determined, most mental illnesses are long-term conditions.

on adverse health events after the beginning of their professional careers.[7] The nature of the work carried out by healthcare professionals is associated with higher health risks (Kobo et al., 2023; Mohanty, Kabi, & Mohanty, 2019). Due to constant exposure to various occupational hazards—such as frequent contact with patients, body fluids, biomechanical risks, and activities involving chemical handling—health professionals are often categorized as high-risk occupations in Colombia (Ministry of Labor and Social Protection, 2002). Using our health claims data (RIPS), we measure adverse health events as either an emergency room (ER) visit or a hospitalization (Hansagi, Olsson, Sjöberg, Tomson, & Göransson, 2001).

After graduation, nurses, physicians, and bacteriologists experience a marked increase in ER visits, with nurses showing the largest rise—about 54% in the first year—which persists for up to four years. In contrast, dentists do not exhibit significant changes. While there are occasional periods when women in medicine and bacteriology have more ER visits, no consistent gender gaps emerge, and analyses excluding pregnancy-related cases confirm that pregnancy is not the primary driver. Furthermore, all professionals face higher hospitalization probabilities one year post-graduation, increasing over time—particularly for nurses and bacteriologists. This suggests harsher working conditions in nursing. Although women tend to have higher hospitalization rates overall, part of this gap is attributable to childbirth; once these cases are excluded, notable gender differences remain only among nurses and dentists, yet the overall risk of hospitalization rises for all professionals.

Third, we examine the labor market outcomes of healthcare professionals. These professionals exhibit relatively high pecuniary returns upon completion of their bachelor's degrees. Notably, physicians emerge as the primary beneficiaries in the labor market. Yet there are substantial labor market gender gaps. While men and women in medicine and bacteriology exhibit similar monthly workdays, a notable disparity emerges among nurses and dentists, with women consistently working more days per month. Within the first year of entering the labor market, a noticeable gender wage gap emerges in medicine and nursing, with males consistently earning more than females. This gap widens significantly during the initial semesters but stabilizes towards the end of our analysis period. Interestingly, the gender wage disparity within occupations—such as medicine and nursing—cannot be fully explained by childbirth alone (Bertrand, Goldin, & Katz, 2010; Goldin, 2014; Goldin & Katz, 2011).[8]

Fourth, we look into the enrollment trajectories in health postgraduate programs among physicians and dentists.[9] Across many countries, pursuing postgraduate degrees in health-related fields is important for these professions due to the high demand for their services and the limited availability of workers in these areas. Our analysis unveils a comparable slow-increasing enrollment pattern for physicians and dentists during the initial two years after graduation. Subsequently, while the enrollment rate stabilizes for dentists, it continues to rise for physicians, reaching its peak four and a half years after graduation. By the conclusion of our analysis period, approximately 14 percent of

[7] Such events indicate poor health, where a person's life is at risk and requires immediate attention (ER visits) or prolonged care (hospitalization).

[8] We also show that the trajectory of the probability of being pregnant is similar between professions. There are no systematic differences.

[9] It is worth noting that data for other professionals on this outcome are unavailable.

physicians are enrolled in health postgraduate programs, contrasting with just over seven percent of dentists.

Similar to the wage results, notable gender gaps persist in postgraduate education enrollment. From the first year after graduation, male physicians are more likely to enroll in health postgraduate programs than their female counterparts. Three years post-graduation, the gender disparity in postgraduate enrollment stabilizes at approximately one percentage point, which represents between 11.6% and 26.7% of the increase in male enrollment. This result is consistent with the so-called "glass ceiling", referring to the underrepresentation of women in top positions in society (Goldin, 2014).

Overall, the labor market challenges we identify for healthcare professionals in Colombia, including adverse health outcomes and significant gender gaps in wages and postgraduate education enrollment, are likely not unique to this setting. Similar issues are prevalent in other healthcare systems, particularly in developing and middle-income countries, where healthcare professionals commonly face high workloads, occupational hazards, and persistent wage disparities. By analyzing these early-career trajectories, our findings offer insights that may inform broader policy discussions on workforce management, retention, and well-being in healthcare systems with similar constraints.

The rest of the paper is organized as follows. Details on the specific context of healthcare workers within the Colombian health system are provided in section 2. Then, section 3 describes the main data sources and shows descriptive statistics for our sample. Additionally, section 4 details the empirical strategy used to estimate the trajectories, and section 5 shows the results. Finally, section 6 concludes.

2 Setting

In this section, we describe our setting. We start by describing Colombia's main requirements for working as a health professional and the labor regulations that affect them. Then, we provide the main details about the postgraduate health training system. Finally, we briefly describe the Colombian healthcare system.

2.1 Healthcare workers

There are three main requirements for professionals who wish to practice a healthcare profession in Colombia. First, they should have a degree granted by a legally recognized higher education institution.[10] Recent figures from the National Registry of Healthcare Talent (ReTHUS, by its Spanish acronym)[11] show the number of new professionals in bacteriology, nursing, medicine, and dentistry has grown by an average of 11,154 professionals per year between 2010 and 2020. By 2021 there were 157,096 physicians, 77,997 nurses, 28,128 bacteriologists, and 63,965 dentists.[12] This is consistent with the number of higher education institutions offering a health-related program, which has been rapidly growing. For instance, in 2001, there were 87 bacteriology, nursing, medicine, and dentistry programs; nowadays, there are 238 (SPADIES, 2023). This has led to significant

[10] The Ministry of Education must present the respective validation if a foreigner obtains the degree.

[11] *Registro Único Nacional del Talento Humano en Salud.*

[12] Colombia's population in 2022 was 51,874,024.

heterogeneities in the quality of healthcare professionals, as many of them obtain their degrees in non-accredited or newly-formed institutions.

Second, for professionals in bacteriology, nursing, medicine, and dentistry, they must prove compliance with the Compulsory Social Service (*Servicio Social Obligatorio*, or SSO, by its acronym in Spanish), which is accessed through a national contest. In this compulsory service, new graduates from specific programs must provide professional services in urban and rural areas with limited access to health services for one year before practicing as professionals.[13] The service is provided once, right after obtaining the professional health degree, and is a requirement to obtain the professional practice license (Congreso de la República, 2007).

Third, they must enroll in ReTHUS, which can only happen once individuals have met the two former requirements. Since Law 1164 of 2007, every individual who intends to exercise a healthcare profession or occupation in Colombia, whether at an auxiliary, technical, technological, or professional level, must register in ReTHUS. After successful registration, the professional will be issued the Unique National Identification of Human Talent in Health card. This procedure generates the administrative act (Resolution), which authorizes people to exercise their profession or occupation throughout the national territory. ReTHUS contains detailed information on the individuals who have met the requirements to practice in the health sector.

Once licensed, health professionals in Colombia are governed by the same labor regulations as other citizens. According to Decree 1607 of 2002, all workers in Colombia with a legally constituted contract must be affiliated to the General Occupational Risk System, a subsystem of the General System of Social Security (SGSS, by its Spanish acronym). In accordance to the International Standard Industrial Classification, the company's economic activity determines the risk level.

2.2 Postgraduate degrees in health

Once health professionals graduate and meet the basic requirements to practice their profession (including the SSO), they can pursue postgraduate training, which may include clinical and surgical specialties or research-oriented degrees such as master's and doctorate programs. Postgraduate medical training, overseen by higher education institutions, faces significant constraints due to the limited number of available specialty slots. According to Serna, Martinez, Agudelo, and Prado (2022), one out of every four medical professionals enters graduate school in medicine.[14] Universities have autonomy in the number of places they offer and in the admission process, which may include one or more of the following requirements: knowledge tests, English proficiency, personal interviews, and research experience.

The training for medical and dental specialties lasts two to five years, and sub-specialty training lasts one to two additional years. The full-time student carries out the training exclusively in person. In a specialty such as internal medicine, students must pay an

[13] The SSO was created by Law 50 of 1981, later modified by Law 1164 of 2007, and ultimately regulated in Resolution 774 of 2022. With the latter, as of 2023, seven new professional programs are now required to prove compliance with the service. Given that it is slot-constrained, individuals who do not obtain a slot in the annual call are exonerated and can immediately obtain the professional practice license.

[14] In the U.S., one out of every two physicians has a specialty (Statista, 2024).

amount that can vary between 8,951 to 17,902 USD per academic period (semester or year), with few exceptions (Hernández & Sierra-Merlano, 2018). However, these costs are likely to be recovered quite quickly. For instance, physicians with a clinical specialty had an average monthly salary of approximately 10,037 USD in 2021, while surgical specialists earned 11,168 USD on average.[15] These salaries are equivalent to 18 and 20 times the monthly minimum wage in Colombia, respectively. In the case of dentists, those with postgraduate degrees had an average monthly salary of 2,900 USD in 2021, equivalent to 5.2 times the monthly minimum wage.

When professionals enroll in a postgraduate degree in health, they must contribute to the General Occupational Risk System throughout their training and register under code 21 as postgraduate health students according to Decree 780 of 2016. Physicians and dentists frequently pursue these postgraduate programs to attain a specialty or sub-specialty in their respective fields. However, postgraduate training in nursing and bacteriology differs from that in medicine and dentistry, typically spanning one to two years, and institutions are not required to register them under code 21. Exclusive dedication from the student is not mandatory. Therefore, they can maintain professional ties with a company while completing their clinical or research-based postgraduate studies.

2.3 Healthcare services

The primary care provider (or general practitioner as is often called in Colombia) is the gateway to the health system.[16] Citizens with any health affliction must initially consult the general practitioner, who determines the probable diagnosis and procedures to follow. In that sense, they request complementary diagnostic aids, prescribe medications, and analyze the need to continue the process with a specialist or another health professional. Additional procedures and referrals to other specialties require authorization from the health insurer, who makes the payments for the provided service. Any individual can go directly to a specialist without going through the general practitioner by setting a "private" appointment. However, the diagnostic and medical aid derived from this type of consultation must be paid for in its entirety by the individual.

Regardless of the type of physician that provides the service to an individual or whether it is a private appointment, information is centralized in the Individual National Health Services Registry (RIPS, by its acronym in Spanish).[17] These records are the set of minimum and essential data required by the General System of Social Security in Health for the management, regulation, and control of all health service provider institutions and other actors in the system. Thus, the registration of provided healthcare services information is mandatory for all providers, in accordance with Resolution 3374 of 2000 (Ministry of Health, 2015). This implies that any service requested by a user must be recorded in RIPS, including the diagnostic codes associated with the user's reason for the visit. Diagnoses are coded following the International Classification of Diseases ICD-10 (Ministry of Health, 2015).

[15] Real salaries are calculated using 2018 as the base period and the average 2018 PPP conversion factor for private consumption of 1,464 COP per USD.

[16] For a more detailed description of the health system in Colombia, see Appendix A.

[17] *Registros Individuales de Prestación de Servicios de Salud.*

3 Data

We merge comprehensive national administrative records from all physicians, nurses, dentists, and bacteriologists who were active between 2008 and 2022. In this section, we provide details on the three main data sources and restrictions. Appendix B provides further details on the process we follow to merge the data. For the main empirical exercise, we focus on professionals who graduated between 2012 and 2017.[18]

3.1 ReTHUS: National Registry of Healthcare Talent

ReTHUS contains information on individuals who have met the requirements to exercise their profession within the healthcare system in Colombia. It includes specific details like the individual's gender, type of bachelor's degree obtained and graduation dates, whether the individual obtained a postgraduate degree in health (with graduation dates), and when they obtained the professional license. We identify 77,900 individuals who graduated from the four professions that originally required the SSO (bacteriology, medicine, nursing, and dentistry) between 2011 and 2017.[19]

3.2 RIPS: Individual National Health Services Registry

RIPS is the Colombian national administrative record of all medical consultations, health procedures, emergency room visits, and hospitalizations. It contains individuals' identifications, age, gender, and the diagnosis code corresponding to the pathology that originated the signs and symptoms for which the user needed to visit the healthcare provider. We use yearly information from 2009 to 2022 across all health services and match these registries to ReTHUS to build a longitudinal dataset that tracks the professionals' health outcomes up to five years after graduation.[20] With these data, we can identify whether an individual suffered from a particular disease in a given year, the number of services demanded, and even the types of physicians consulted.

3.3 PILA: Social security records from Colombia's Ministry of Health and Social Protection

The *Planilla Integrada de Liquidación de Aportes* (PILA) offers a thorough record of monthly contributions made by individuals towards healthcare, pension funds, and occupational risk insurance. It contains individuals' identifications, date of birth, gender, and extensive details regarding earnings, the number of days worked, and employer characteristics for all formally employed individuals in Colombia. We collapse the data at the semester level to ensure the tractability of the information.[21] We use information from PILA between 2008 and 2022 and match these registries to ReTHUS to build a longitudinal dataset that tracks the professionals' involvement in the formal labor market up

[18] We choose this window to be able to follow individuals two years before obtaining their degree and up to five years after that.

[19] We only focus on individuals who do not have multiple undergraduate degrees (see Appendix B for details).

[20] We use yearly data to capture low-incidence diseases.

[21] The conclusions remain the same if we use monthly or annual data.

to five years after graduation. We mainly focus on the median monthly real income and the number of days worked per month. As explained in Appendix B, our definition of income includes the sum of all salaries received in the month in cases where individuals have multiple jobs. Additionally, PILA contains information on whether the individual is enrolled in a postgraduate health-related degree. This is possible since all higher education institutions in Colombia are required by law to affiliate their postgraduate students to social security (Ministry of Health, 2016).

3.4 Summary statistics

The summary statistics for our data are shown in Table 1. It shows that 49% of our sample are physicians, with the majority being females, while only 6% are bacteriologists. Overall, 70% of healthcare workers are female, most of whom are physicians or nurses.

Additionally, Table 2 shows the summary statistics for the labor market (panel A) and health variables (panel B) before and after graduation. The average formal real monthly wage was $1,502,145$ COP (equivalent to around 1,026 USD),[22] and around 15% of individuals were enrolled in a health-related postgraduate program. Also, these professionals are 25 years old on average (SD=3.8) when they graduate, so we are in fact analyzing their early careers. Regarding healthcare utilization, 55% went to the ER, and 21% were hospitalized at least once between 2009 and 2022. But most shockingly, 15% received a diagnosis related to a mental illness during this period.

The table also shows summary statistics by gender. Right away, there is a significant wage gap between males and females. While the average formal real monthly wage for men was $1,768,995$ COP (1,208 USD), for women, it was $1,388,444$ COP (948 USD). On the other hand, women appear to be more concerned about their health, since 97% of them went to a medical consultation between 2009 and 2022, while only 92% of men did. Also, more females went to the ER and were hospitalized, on average, than men. Moreover, 16% of women received a mental diagnosis while only 12% of men did.

Finally, Figure B.1 in the Appendix shows the distribution of our sample's graduation dates. The number of graduates has increased over time, and the total sample is distributed proportionally across cohorts. The majority of graduates get their degree in the second semester of every year. This follows the same pattern as high school graduation in the country.[23]

4 Empirical Strategy

We implement an event study approach to identify the association of university studies with several health and labor outcomes. Our first approach follows the two-way fixed effects (TWFE) estimation with individual fixed effects that allow us to control for all time-invariant individual factors and calendar fixed effects, which account for general time trends in the outcomes.

[22] Using the average 2018 PPP conversion factor for private consumption of 1,464 COP per USD.

[23] Colombia has two calendars for secondary education that also affect tertiary education: A and B. Calendar A includes all public and most private schools.

However, this estimation does not consider that specific cohorts may have different trajectories (i.e., there are heterogeneous effects). TWFE may not correctly account for these heterogeneities, creating bias in our estimates (De Chaisemartin & d'Haultfoeuille, 2020; Roth, Sant'Anna, Bilinski, & Poe, 2023). With such heterogeneities, we may include "forbidden comparisons" that could introduce negative weights to the regression and change the point estimates (Goodman-Bacon, 2021). This also implies that the pre-trends evaluation can be misleading since even under parallel trends, pre-treatment coefficients will not necessarily be zero (Roth et al., 2023; Sun & Abraham, 2021).

To overcome these problems, we implement the Callaway and Sant'Anna (2021) estimation method, which avoids the negative weights problem by calculating all group-time-specific effects as:

$$ATT^{ny}_{unc}(g,t) = E\left[Y_t - Y_{g-1} | G_g = 1\right] - E\left[Y_t - Y_{g-1} | D_t = 0\right] \tag{1}$$

where g is the time when a specific cohort graduates, Y_t is the outcome of interest at time t, G_g is a binary variable that is equal to one if a cohort graduated in period g, and D_t is a binary variable that is equal to one for cohorts that have not yet graduated at time t but will eventually graduate. The subscript unc and superscript ny denote that our estimation is unconditional on covariates and that we are using the not-yet-treated cohorts as comparison groups.

A particular advantage of the Callaway and Sant'Anna (2021) procedure is that coefficients can be aggregated to highlight heterogeneity with respect to the time elapsed since graduation (i.e., $e = t - g$) as:

$$\theta_{es}(e) = \sum_{g \in \mathcal{G}} \mathbf{1}\{g + e \leq T\} P(G = g | G + e \leq T) ATT^{ny}_{unc}(g, g + e) \tag{2}$$

This aggregates the group-time coefficients across all the cohorts that eventually graduated for e periods. We essentially plot all the $\theta_{es}(e)$ for different values of e to look at the trajectories of our sampled professionals before and after graduation. Note from Equation 1 that long-differences $(Y_t - Y_{g-1})$ are being used for pre- and post-treatment coefficients. This is also consistent with the way regressions are estimated, so we can analyze the trajectories as conventional event study regressions (Roth, 2024).

While this methodology is frequently used for causal inference, our setting does not allow for a clean identification of a causal estimate. We therefore do not analyze our results as causal effects. In fact, we use this estimation method to understand the evolution of individuals' health, labor, and education trajectories right after pivotal life events, such as the beginning of their professional lives, while minimizing the bias introduced into our point estimates.

5 Results

This section presents the main results. All of our results come from the estimation of Equation 2.[24] Each $\theta_{es}(e)$ in the figures below shows the relative change in the outcome

[24] While not included in the paper, results are robust to estimating through TWFE regressions.

of interest in the e semesters before or after college graduation, compared to one semester before.[25] The coefficients for each profession come from independent regressions.

We organize our findings as follows. In subsection 5.1 we show the results associated with their health-related trajectories, while in subsection 5.2, we show the results associated with the labor market outcomes. Finally, in subsection 5.3, we present the results associated with graduate school.

5.1 Health outcomes

5.1.1 The trajectories of mental health diagnoses

There is evidence of the prevalence of mental illnesses and burnout in health professionals (Gold et al., 2013; Johnson et al., 2018; Lai et al., 2020; Shanafelt & Noseworthy, 2017; Simón Melchor et al., 2022; West et al., 2020; Young et al., 2021). The demanding nature of the occupation exposes health workers to a higher risk of developing negative mental states such as depression, anxiety, and stress (Ghazwin et al., 2016; Huang et al., 2018; Maharaj et al., 2019).

However, mental health problems in the healthcare workforce do not start at the beginning of their working life. There is extensive literature that supports the idea that students in health programs, even from the selection process, may be particularly vulnerable to mental illness due to feelings of rigidity, perfectionism, and excessive devotion to work (Afshar, Wiese, Stiel, Schneider, & Engel, 2022; Ferrel Ortega, Celis Barros, & Hernández Cantero, 2011; Mihailescu & Neiterman, 2019; Parsons et al., 2020). Yet this situation may change upon the completion of university studies. On one hand, individuals may feel less pressure after finishing their bachelor's program, which could lead to a reduced likelihood of developing a mental disorder due to this improved sense of comfort. On the other hand, health workers usually take on a heavy workload and long working hours that could affect their mental health. Further, they may be reluctant to get professional help since a diagnosis of mental illness may create a stigma associated with their ability to practice their profession, decreasing the probability of mental diagnoses through reduced help-seeking (Clement et al., 2015; Wong et al., 2018).

Figure 1 presents the outcome of this analysis for the four health professions. Our health claims data measures medical diagnoses of mental illnesses rather than episodes. Usually, in the diagnostic process, taking the time and effort to get an accurate diagnosis helps determine the appropriate treatment. Once determined, most mental illnesses are long-term conditions.[26] As outlined in subsection B.3 in the Appendix and following some medical literature, we measure prevalence by defining a mental condition as the accumulation of the episodes mentioned above.[27] This implies that from the moment individuals receive a mental illness diagnosis, it is assumed that they will continue to

[25] The mean of the outcome one semester before university studies ended is shown in each figure's legend.

[26] Our main outcome measures any mental health diagnosis. This is because sometimes, as new episodes appear, physicians update the diagnosis and treatment. Our results show that the main illnesses affecting health professionals are depression and anxiety.

[27] Prevalence is commonly defined in medical literature as the number of existing cases at the beginning of the period studied, plus the new cases developed during the interval (GBD 2019 Mental Disorders Collaborators, 2022).

have this condition from this point onward. Intrinsically, these estimates compare the existence of a mental condition in graduated professionals with respect to those who have not yet graduated. Thus, coefficients in Figure 1 can be interpreted as the probability of having a mental condition after graduation relative to the final stage of their bachelor studies.

Figure 1 shows that the likelihood to get a mental health diagnosis for dentists and nurses increases just over one percentage point by the fourth year after graduation, representing an increase of 35% and 26% relative to the pre-graduation year, respectively. There is no effect on bacteriologists. On the other hand, for physicians, we observe a decrease in this probability of almost 1.5 percentage points after four years, consistent with a 37% reduction relative to pre-graduation.

One possible explanation for the latter result is the demanding nature of undergraduate programs in medicine. Although their work can be as stressful as their career, physicians face fairly promising job prospects once they graduate, as we show below (see subsection 5.2). Thus, these professionals may be reducing the prevalence of reported mental illnesses once they graduate, not necessarily because they are healthier, but because they can face these difficulties from a much more comfortable position.[28]

Figure 1 and Appendix Figures C.1 and C.2 show that most professionals have similar trajectories regardless of gender. However, the case of nurses is particularly different. While women's probability of mental illness increases significantly by 36%, men's decreases by the same proportion, although their results are too noisy to be precise.

5.1.2 The trajectories of emergency room (ER) visits and hospitalizations

Using our health claims data (RIPS), we measure adverse health events as either an emergency room (ER) visit or a hospitalization (Hansagi et al., 2001). Such events are associated with a service that indicates poor health, where a person's life is at risk and requires immediate attention (ER visits) or prolonged direct care (hospitalization). Figure 2 shows the results for the probability of having an ER visit, while Figure 3 presents the results associated with the probability of being hospitalized.

We focus on adverse health events since there is evidence that the nature of the work carried out by healthcare professionals is associated with higher health risks (Kobo et al., 2023; Mohanty et al., 2019). In addition, Colombian labor regulations require that all formal workers be protected against potential occupational hazards or risks associated with the work performed. The risk classification varies between 1 and 5, with 5 being the riskiest. Most workers are level 1.[29] High-risk occupations comprise levels 3 to 5. Given the constant interaction with humans, body fluids, bio-mechanical risks, or activities related to handling chemicals, diagnostic imaging, radio-pharmaceuticals, and nuclear medicine, health professionals are usually categorized as high-risk occupations (Ministry of Labor and Social Protection, 2002).

[28] Although we do not have ways to prove this, an alternative reasonable explanation based on existing literature (Clement et al., 2015; Wong et al., 2018) is that physicians avoid revealing their mental conditions as a way to steer clear of negative stigma. Understanding the reasons for this result is beyond the scope of this paper.

[29] Low-risk professionals are those categorized as level 1 and 2; by January 2022, they comprised 68% of all workers. Level 3 includes 14%, while levels 4 and 5 include 8% and 10% respectively

On average, Figure 2 shows that nurses, physicians, and bacteriologists are the professionals with the largest increase in the probability of an ER visit after obtaining their professional degree. In particular, nurses are around 54% more likely to go to the ER one year after graduation relative to the period just before graduation. Such patterns are persistent even after four years. For dentists, we do not observe any significant change after graduation.[30]

When dividing the results by gender (see Figure C.3 in the Appendix), we see that the increase in ER visits for nurses and physicians happens for both men and women. However, although noisier, the estimates show a lower probability for male dentists a few years after graduation. Overall, there is no major gender gap, defined as the difference between the estimated coefficients for males and females in each period and for each profession (see Figure C.4 in the Appendix). We also check whether the increase in probability for women is driven by pregnancy by estimating the same regressions on the probability of going to the ER for a condition unrelated to pregnancy. Results are virtually the same, highlighting that pregnancy does not drive the higher ER access for women (see Figure C.5 in the Appendix).

Figure 3 focuses on the probability of being hospitalized. All professionals are more likely to be hospitalized one year after graduation, and this probability increases over time for all of them, particularly nurses and bacteriologists. While relative to the pre-graduation period dentists are around 77% more likely to be hospitalized four years after graduation, physicians and nurses are 118% and 221% more likely, respectively.[31] This might be indicative of harsher job conditions in the nursing field.

Separating these results by gender shows an interesting heterogeneity (see Figure C.6 in the Appendix). The probability of hospitalization seems to disproportionately increase more for women across professions. When estimating the gender gap within occupations, Figure C.7 in the Appendix shows that for all professions but bacteriology, women's coefficients are larger than men's. Nonetheless, such a gap is partially explained by childbirth, which usually requires hospitalization. Just as in ER visits, we disregard pregnancy-related cases from women's estimates. While overall hospitalizations are an important health risk among professionals, the gender gap against women within occupations is only present for nurses and dentists (see Figure C.8 in the Appendix).

[30] One may consider an alternative hypothesis where worse health outcomes are a product of individuals getting older. Recall from Table 2 that the vast majority of these young professionals are of similar age at graduation (around their mid-20's). It is unlikely that the increases in hospitalization or ER visits that we are capturing with our estimations are related to natural aging dynamics. Our study timeframe is too short for young individuals to experience age-related adverse health events, and the age difference between early-treated and later-treated groups is not a confounding factor. That would imply higher coefficients before graduation as well, which we do not observe in our results. Also, we do not see estimates rising at a constant pace over time, nor is it happening across all professionals. So it is more likely to be related to profession-specific situations that are worsening the health conditions of recent graduates.

[31] This increase is of over 328% for bacteriologists, but the pre-graduation mean is much lower, and the point estimate is much noisier.

5.2 Labor market outcomes

5.2.1 The trajectories of labor supply

We focus on the intensive margins for the labor supply, measured in days worked per month.[32] Figure 4 reports the trajectories for each of the four occupations in the number of days worked. On average, professionals work in jobs that demand one-tenth of a full-time schedule (measured as 30 days) before graduating. This could be related to earlier experience or other work that allows students to cope with their education costs.[33] Bacteriologists are the ones who work the highest number of days at that stage. However, on average, professionals work almost full-time after graduation. Physicians and nurses report working more days after graduation than other professionals, while the opposite happens for dentists. This might be explained by the more time-consuming nature of the medical degree, where professionals can only significantly increase their labor supply upon graduation and completion of the social service. As for dentists, the lower supply might be related to their higher propensity to report being self-employed and under-reporting salaries.

When separating the estimations by gender (see Figure D.2 in the Appendix), there are no significant differences between males and females for physicians and bacteriologists. On the other hand, female dentists and nurses seem to be working more days than their male counterparts (see Figure D.3 in the Appendix for the by-gender estimates).

5.2.2 The trajectories of real monthly wages

Figure 5 shows the dynamics of real monthly wages in PPP U.S. dollars (base year 2018). In our case, wages are formal earnings, so individuals who did not participate in the formal labor market have a real monthly wage of zero. In addition, our definition of wages includes the sum of all salaries received in the month when the individual has multiple jobs. Before graduation, all professions had negligible real monthly wages. Upon obtaining their degree, all occupations experience a sharp increase in formal real wages, as expected. However, this increase is quite modest in the first semesters, consistent with the initial labor market frictions of the first job (Arellano-Bover, 2022). In the semester after graduation ($t = 1$), there is a sharp increase in formal earnings associated with the beginning of the social service (SSO) if selected, which is then partially offset with its culmination ($t = 3$). The decline in wages after the fifth semester for physicians is likely related to their higher probability of enrollment in postgraduate health programs (as shown below). Despite that, physicians significantly out-earn the other three occupations across our time span.

The gender wage gap for all professions is presented in Figure D.4 in the Appendix.[34]

[32] In Colombia, health professionals have high levels of formality (extensive margin). In addition, formal workers in Colombia do not report the number of hours they work. Using household surveys from 2021 to 2023 (information is not available by profession in other years), we show no significant differences in the number of hours reported between males and females within professions (see Figure D.1 in the Appendix). Finally, nurses work more hours than other professionals, while dentists work significantly fewer hours.

[33] Students working in full- and part-time positions has been documented in the literature before, with heterogeneous effects on academic outcomes by type of contract (Darolia, 2014).

[34] Gender disparities are a stark reality, particularly in the health sector (World Health Organization,

Also, separating by gender does not show any differences between males and females before obtaining their degree (see Figure D.5 in the Appendix). Nonetheless, even within the first year in the labor market, males out-earn females in medicine and nursing, and the gap increases significantly in the first couple semesters, stabilizing towards the end of our analysis period.

This within-occupation income gap could be partially explained by childbirth (Bertrand et al., 2010), which disproportionately affects women in jobs with lower workplace flexibility (Goldin, 2014; Goldin & Katz, 2011). In Figure D.6 in the Appendix, we look at the probability of being pregnant for all professions.[35] We find that pregnancy increases right after graduation and continues increasing until it stabilizes by the end of the analysis period between 2.5 and 4.5 percentage points. While this might explain a share of the gender gap, it is still insufficient to account for it in its entirety. In Figure D.7 in the Appendix, we re-estimate Appendix Figure D.4 but only using women who did not get pregnant in our period of analysis.[36] We find that the gap increases for physicians and nurses in relative terms but is slightly reduced for the rest of professionals.[37]

5.3 The trajectories of health graduate school enrollment

As mentioned in section 2, access to postgraduate degrees in health-related areas is particularly important for these occupations, given their limited availability and high returns. Nonetheless, it is not always straightforward to measure such outcomes. An interesting feature of the social security system in Colombia is that it is mandatory for all full-time graduate health students and medical residents, even if not formally employed, to contribute to the social security system through PILA (Ministry of Health, 2016). This regulation applies mainly to medical residencies and dental postgraduate programs where there is contact with patients. This allows us to measure enrollment in health postgraduate programs for physicians and dentists. Nonetheless, it is not a good measure for bacteriologists, nurses, or other postgraduate programs, such as a Ph.D. or a master's in business administration or science. Thus, in this section, we only focus on physicians and dentists.

Figure 6 shows the results on access to these types of degrees. The pre-treatment coefficients are mechanically set to zero since an individual may not enroll in a postgraduate program before obtaining the undergraduate degree (Congreso de la República de Colombia, 2007; Ministry of Health, 2011). Physicians and dentists show a similar increasing pattern in the first two years after graduation (t=4). After that, enrollment is stabilized for dentists but continues to increase for physicians up to four and a half years after graduation. In period t=9, more than 14 percent of physicians are enrolled in a postgraduate program in health, while only above seven percent of dentists are.

2019, 2022).

[35] See subsection B.3 in the Appendix for a detailed description of how this and other variables are constructed.

[36] We acknowledge that this exercise restricts the sample using an endogenous variable, not being pregnant. Still, such descriptive statistics show a powerful pattern worth studying further (see Guarin, Posso, Saravia, and Tamayo (2024) for a design-based evaluation in a similar setting).

[37] In addition, our analysis reveals that, in the case of physicians, a small portion of the gap could be attributed to men holding multiple jobs. When we focus solely on the salary from the primary job, the gender wage gap diminishes marginally, but the main fact remains (see Figure D.8 in the Appendix).

It is important to note that the pattern in postgraduate enrollment coincides with the observed decline in wages for physicians. Hence, postgraduate school should be a key factor in explaining the labor market trajectories of physicians.

The results for each gender are presented in Figure D.9 in the Appendix. Like in the wages subsection, we mainly focus on the gender gap for physicians and dentists, measured as the difference between the estimated coefficients for males and females in each period and profession (see Figure D.10 in the Appendix). Results show that even within the first year after graduation, male physicians are more likely to enroll in a health postgraduate program than females. The gap for physicians is around one percentage point from period t=3 to period t=7, which represents between 11.6% and 26.7% of the increase in male enrollment seen in Appendix Figure D.9. In the case of dentists, the gap is only significant between periods t=3 and t=5, and it is similar to physicians in relative terms.

This result raises a new question: Does the graduate enrollment gap affect the wage gap? To answer this, we re-estimated two variations of Appendix Figure D.4, presenting both estimates in Appendix Figure D.8. First, we only include professionals who never enrolled in graduate studies. Then, we restrict the sample to professionals who started graduate studies within our time span (eventually enrolled). Since Appendix Figure D.4 compares the salary of all professionals, the gap may be skewed due to more men entering graduate school and having different working conditions than general practitioners. We find that gaps for never-enrolled professionals are almost indistinguishable from Appendix Figure D.4, although decreasing in the long run. On the other hand, eventually-enrolled physicians increased their gap dramatically in the latter years.

This result is related to what is referred to as the "glass ceiling" or the fact that women are underrepresented in the upper part of the earnings distribution or top positions in society (Goldin, 2014). In the particular case of health professionals, the top positions and salaries are strictly associated with the possibility of access to postgraduate education. Our methods allow us to provide a setting where innate talent or other fixed characteristics are isolated at the beginning of the professional career. Still, we observe differences between men and women at the beginning of their careers that cannot be explained by access to postgraduate education.

6 Conclusion

In this paper, we study the early career trajectories of Colombian healthcare professionals in their health outcomes, labor market, and graduate school. We take advantage of Colombian administrative data that allows us to capture the entire population of recently graduated professionals in bacteriology, nursing, medicine, and dentistry. Our data quality enables us to track these professionals before and after graduation from college across multiple outcomes. To accomplish this, we exploit the graduation dates of individuals in a staggered event study framework to determine their health and working conditions relative to that moment.

Altogether, we observe significant heterogeneities across professions in health trajectories. While nurses and physicians are more likely to go to the ER after graduation, all professionals face higher odds of being hospitalized, with women, especially nurses,

being disproportionately affected by this. Meanwhile, the prevalence of mental health diagnoses increases for nurses and dentists, while it shows a reduction for physicians. Assuming that mental illness may be a lifelong condition, these professionals may be facing relatively worrisome conditions.

Moreover, the professional trajectories are also heterogeneous by type of professional and gender. We document significant pecuniary returns in their early years for all professionals. Trajectories also depend on demand-side labor market institutions that affect working conditions (non-monetary incentives), like the availability of health-related postgraduate programs. Nonetheless, we find significant wage and postgraduate access gender gaps for physicians and nurses that start upon graduation and are sustained over time.

Studying these early-career dynamics in Colombia provides valuable insights beyond this particular setting. The challenges we identify—ranging from increased occupational health risks and mental health disorders to gender disparities in wages and postgraduate enrollment—are common to many healthcare systems worldwide, particularly in middle- and low-income settings. The detailed characterization presented here thus contributes directly to policy discussions about healthcare workforce retention, occupational safety, and gender equality.

This paper contributes to the existing literature by documenting healthcare professionals' trajectories across the labor market, postgraduate education, and health outcomes immediately after graduation. Using detailed administrative records and a rigorous empirical framework, our findings highlight significant heterogeneities within and between occupations, with implications for workforce management and gender equality policies in healthcare.

Tables

Table 1: Main sample statistics

	All professions	Bacteriologists	Nurses	Physicians	Dentists
Whole sample	77,900	4,849	22,138	38,130	12,783
	(100%)	(6.22%)	(28.42%)	(48.95%)	(16.41%)
Males	23,275	761	2,773	16,243	3,498
	(29.88%)	(0.98%)	(3.56%)	(20.85%)	(4.49%)
Females	54,625	4,088	19,365	21,887	9,285
	(70.12%)	(5.25%)	(24.86%)	(28.10%)	(11.92%)

Notes: The proportions of individuals from each profession and gender with respect to the total sample are shown in parentheses.

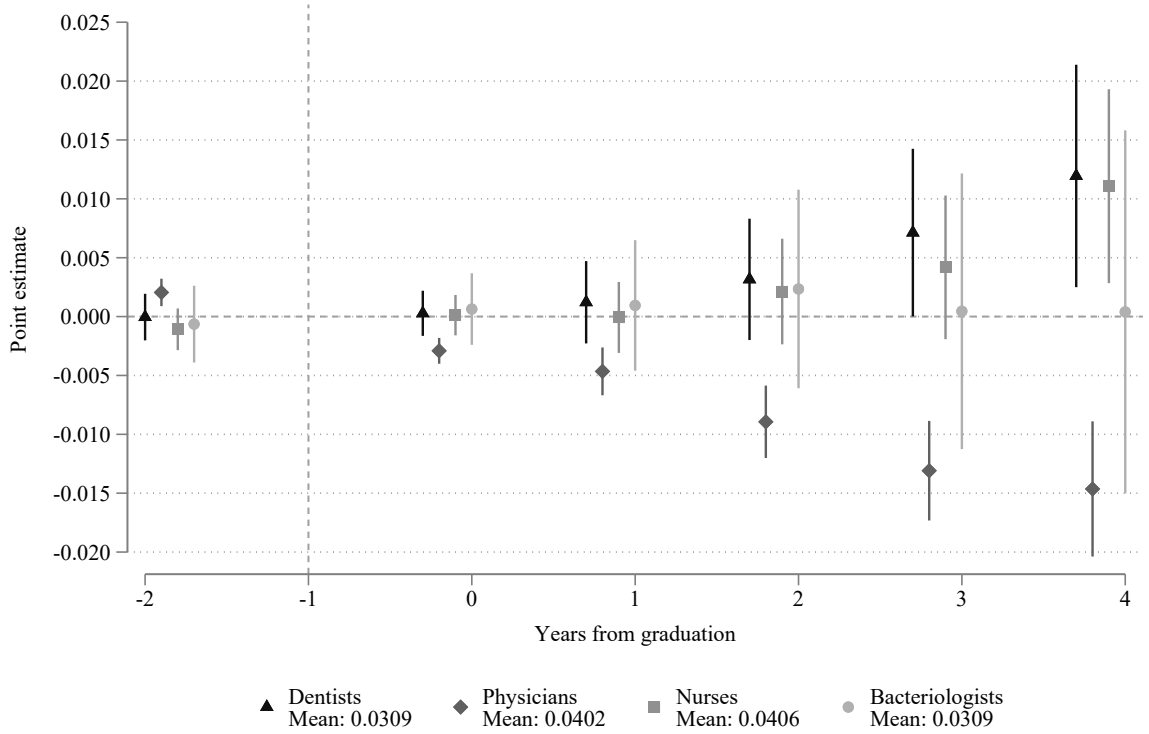
Table 2: Labor and health market statistics

	Whole sample		Males		Females	
	Mean	SD	Mean	SD	Mean	SD
Panel A: PILA (2008-2022)						
Monthly days worked	13.447	6.021	13.271	6.050	13.522	6.007
Formal real monthly wage	1,502,145	1,186,183	1,768,995	1,490,024	1,388,444	1,008,626
Health-related postgrad. enrollment	0.151	0.359	0.214	0.410	0.125	0.331
Age at graduation date	25.450	3.832	26.124	3.995	25.177	3.730
Panel B: RIPS (2009-2022)						
Accessed a health service	0.972	0.166	0.947	0.223	0.982	0.134
Medical consultations	0.956	0.205	0.921	0.270	0.971	0.168
Medical procedures	0.926	0.261	0.863	0.344	0.953	0.211
ER visits	0.554	0.497	0.494	0.500	0.579	0.494
Hospitalizations	0.214	0.410	0.132	0.338	0.250	0.433
Received mental diagnosis	0.152	0.359	0.123	0.328	0.165	0.371

Notes: Summary statistics are for the entire period of each panel. Wages are in Colombian Pesos (COP). Individuals will take a value of one in dummy variables if the condition was met at least one month in the analyzed period. See Appendix B for details on each of the variables.

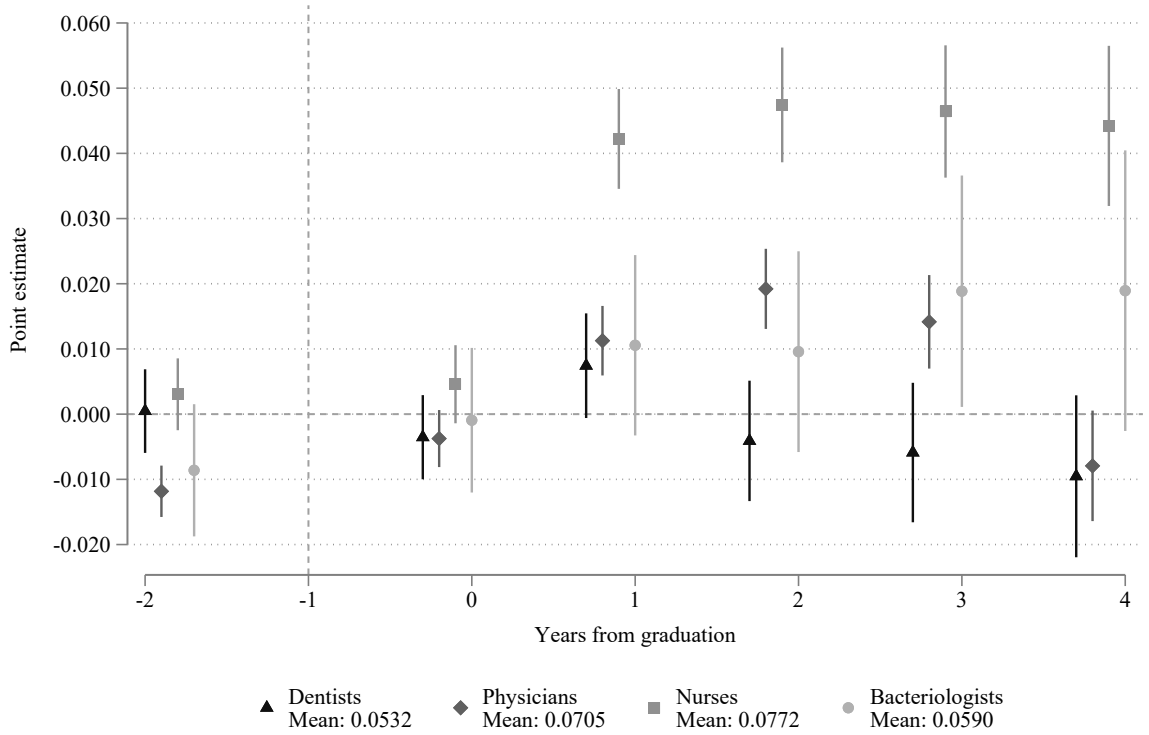
Figures

Figure 1: Probability of having a mental condition



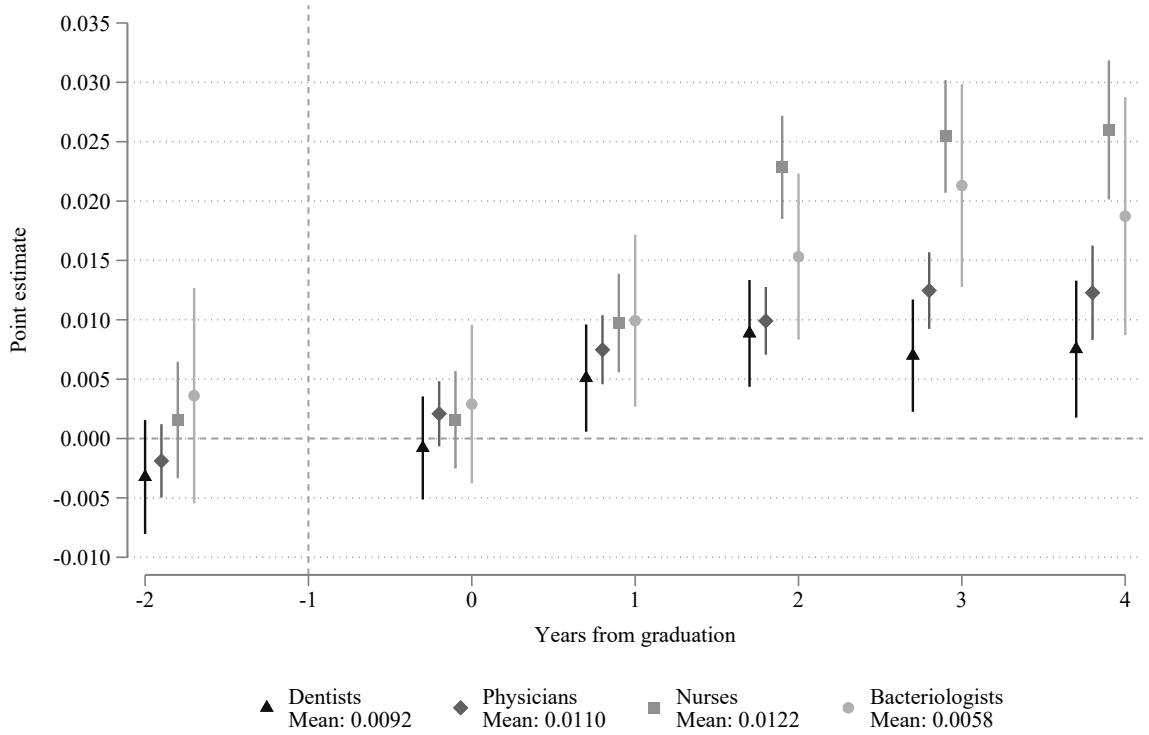
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure 2: Probability of going to the ER



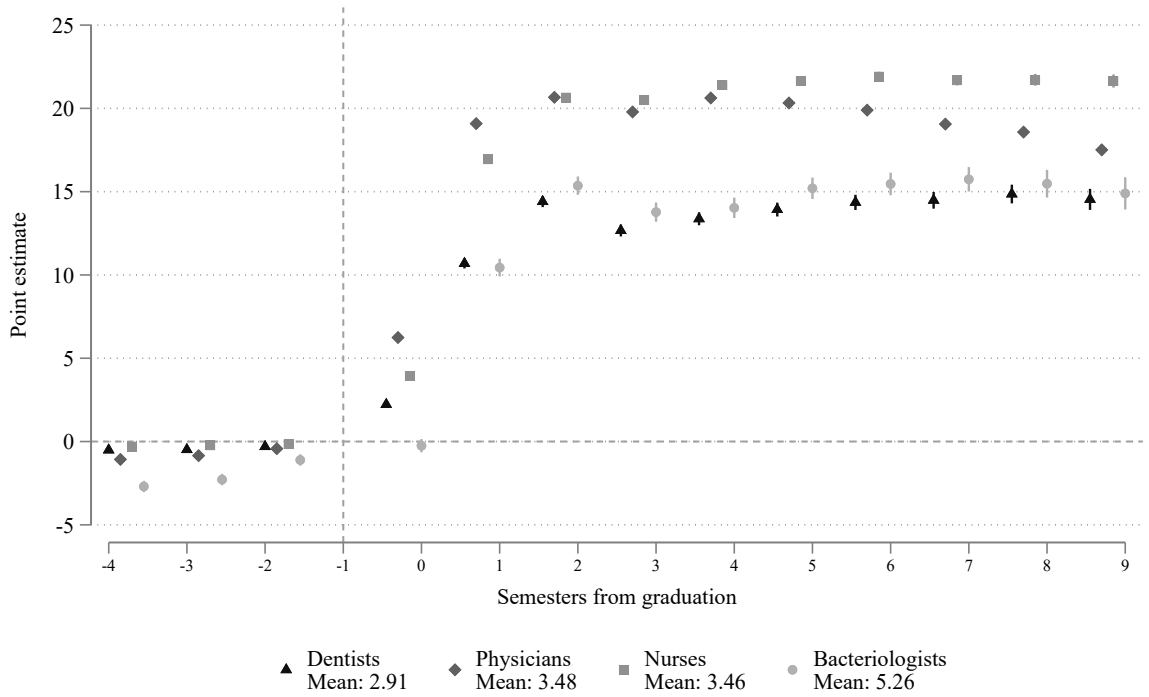
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure 3: Probability of hospitalization



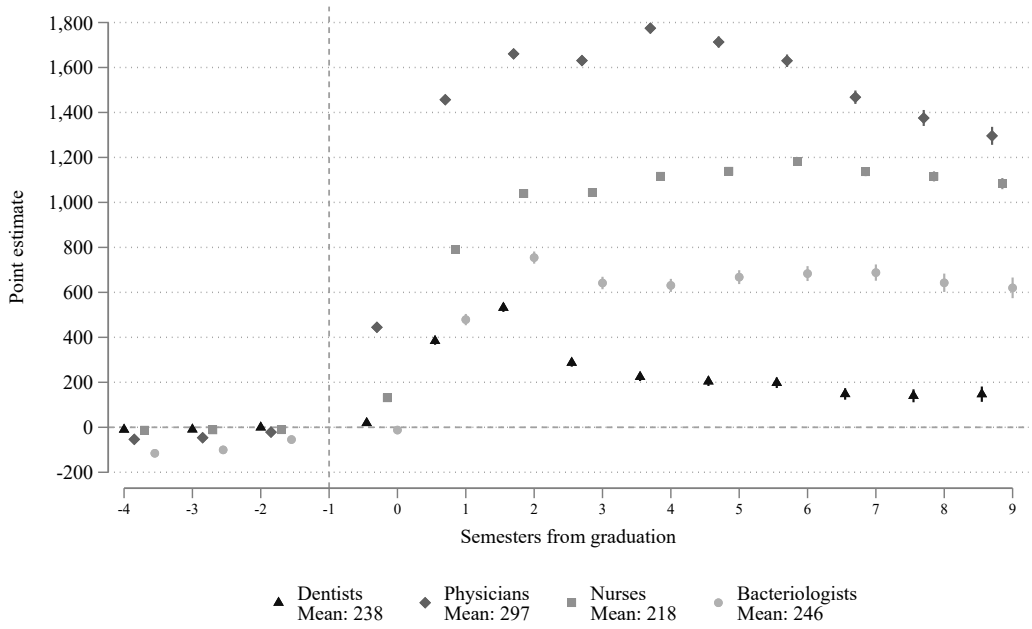
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure 4: Monthly days worked



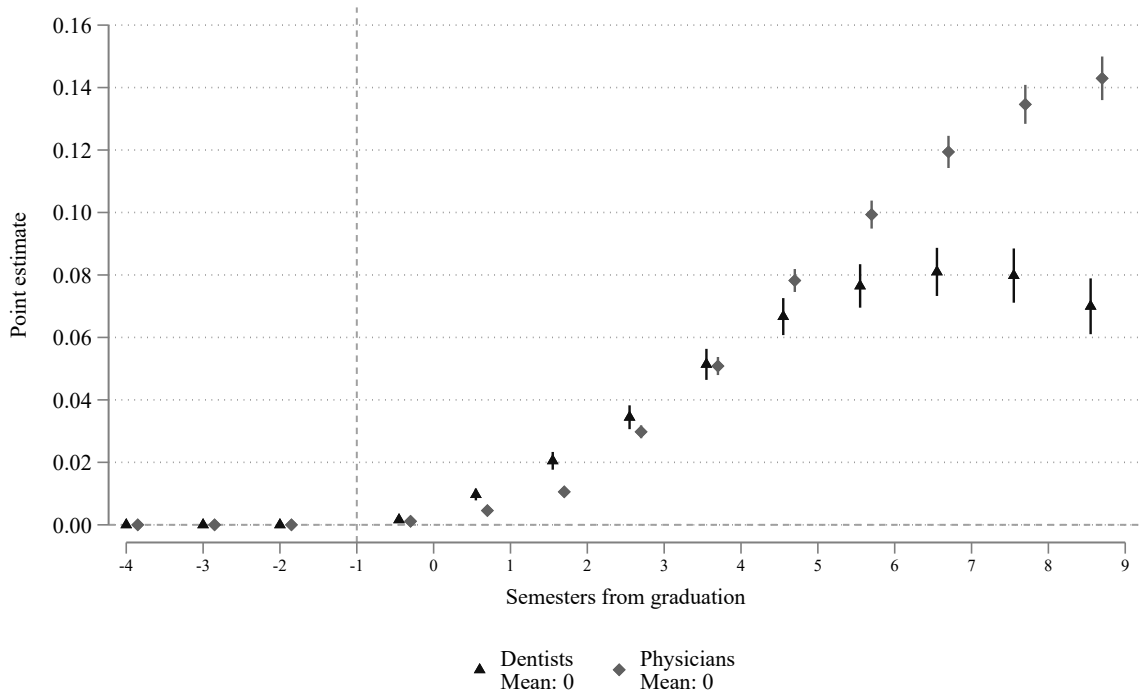
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure 5: Real monthly wages



Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. Wages are in real PPP U.S. dollars (base year 2018). The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure 6: Probability of enrollment in a health-related postgraduate program



Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

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Appendix

A The Colombian healthcare system

Colombia has a social security system that encompasses healthcare, pension, and professional risk management for the formally employed. Within it, there is a subsystem called the General System of Social Security in Health (SGSSS, by its Spanish acronym). It relies on the principles of universality and equity to ensure access to services for the entire population. Health insurance coverage has increased substantially over the last decades, reaching 99.6% in 2022 (Ministry of Health, 2022). This guarantees coverage for a wide range of services, including visits to outpatient general practitioners and specialists, inpatient care, and prescription drugs with little to no co-payments. The system relies on three main actors: government, health insurers (EAPB, by its Spanish acronym), and healthcare providers (IPS in Spanish). Additionally, the SGSSS is structured into special, contributory, and subsidized regimes, with the last two being the most prominent.

Residents in Colombia are necessarily affiliated with an EAPB of either the contributory or subsidized regimes, depending on their economic capacity. The contributory regime encompasses formal employees, retirees, and self-employed individuals who earn at least the minimum wage. It is funded through the contributions of its members, with a portion of these funds allocated to support the subsidized system as well. Conversely, the subsidized regime is designed to provide healthcare services to the most economically disadvantaged population in the country. This group, which lacks the financial means to cover healthcare expenses, receives government subsidies to ensure access to essential medical care. Interestingly, the health benefits plan is the same across regimes.

To get access to health services, individuals in the contributory regime must pay a moderator fee, which is a negligible monetary contribution that regulates the use of health services and encourages their proper use. Its value varies according to the monthly income of the dependent or self-employed worker. In addition, for each health service provided, individuals must make a co-payment, which corresponds to a share of the total value of the service provided and is intended to help finance the system. Co-payments depend on the regime and the individual's monthly income and are very low compared to the cost of the health service (Ministry of Health, 2023b).

People who are part of the contributory regime must make monthly contributions as a function of their wages. These contributions are split between the employer and the employee in the case of dependent workers. On the other hand, self-employed workers must cover the entirety of their required contribution but only using 40% of their wage as the base for calculation (Ministry of Health, 2023b).[38] However, this contribution is self-reported for these individuals, and the only requirement is that it should at least be equal to the monthly minimum wage, even if 40% of their income falls below it. All of these contributions are recorded in PILA.

[38]The required contributions are of 12.5% of the base to health, 16% of the base to pension funds, and a varying rate to risk managers between 0.522% and 6.98% depending on the occupational risk of the individual. For dependent workers, 75% of the contribution is handled by the employer.

B Data construction appendix

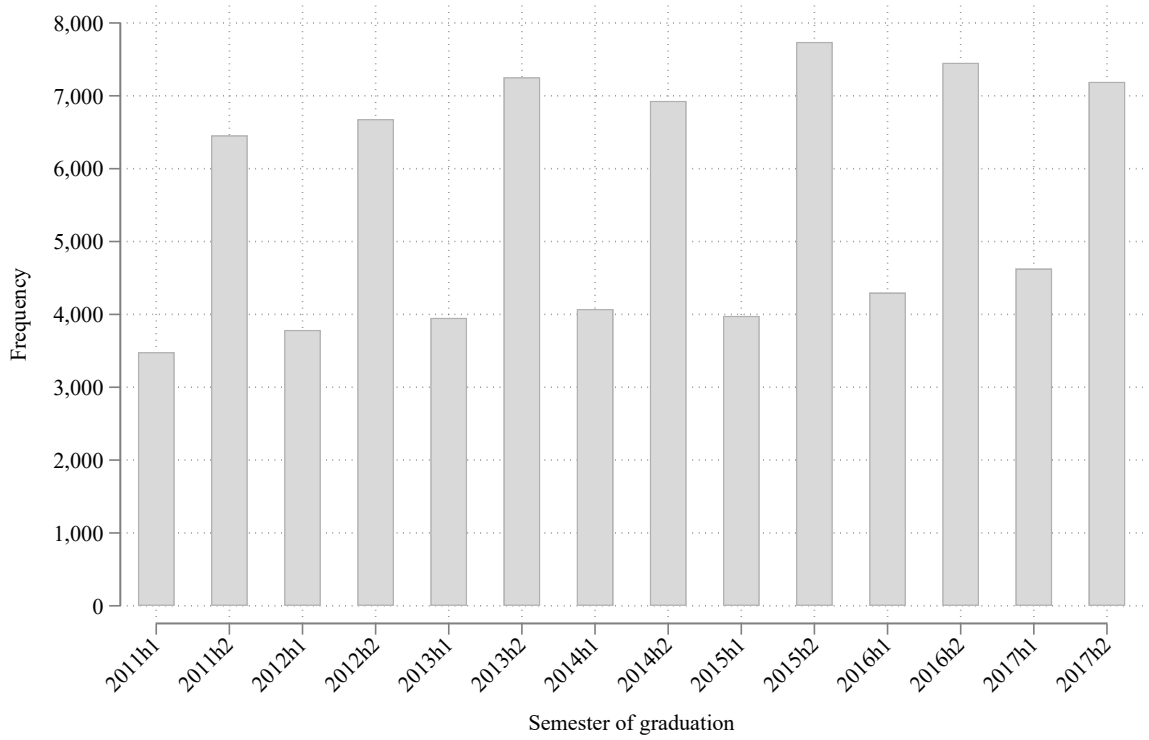
In this section, we outline our main approach to data construction. As such, we provide a detailed description of the restrictions we placed on our datasets and how we constructed the time-to-event and outcome variables. Additionally, we explain how the rest of the Ministry of Health and Social Protection's data were matched to create a unique individual-level longitudinal dataset with all the information on the formal labor market, graduate education and health outcomes for the selected healthcare workers in the country.

B.1 ReTHUS

We begin by restricting the ReTHUS data to the four occupations requiring the SSO: bacteriologists, physicians, nurses, and dentists. We also keep observations for individuals who graduated from only one major. Multiple-degree professionals are not considered to maintain consistency in our estimations. Additionally, we focus on people who obtained their degree between 2011 and 2017 to see enough periods pre- and post-graduation. Overall, these restrictions leave us with a total sample size of $77,900$.

We call this our main sample since it contains all legally registered professionals in the country in our selected occupations. The main variables gathered from this source are occupation code, graduation dates, gender, and *personabasicaid*. The first one is a categorical variable indicating each individual's occupation in the following way: P01 refers to bacteriologists, P03 to nurses, P07 to physicians, and P09 to dentists. Graduation dates are when the person received the undergraduate and postgraduate degrees, respectively. The former will be crucial to identify cohorts in the Callaway and Sant'Anna (2021) estimation. The gender variable will allow us to examine potential heterogeneities between males and females. As for *personabasicaid*, this is an anonymized personal identifier that tracks individuals across the Ministry of Health and Social Protection's datasets.

Figure B.1: Distribution of graduation dates



Notes: Each bar shows the number of individuals from our sample who graduated in that given semester.

B.2 PILA

To construct our labor market outcomes, we merge our main sample with the *Planilla Integrada de Liquidación de Aportes* (PILA) using the *personabasicaid*. PILA contains all the monthly social security payments made by all formal workers in the country. We have access to these data from 2008 to August 2022. The dataset construction works in the following way. First, we call the year-month PILA dataset and merge it with our main sample, only keeping matched observations. Using the type of contributor code, we identify whether an individual is enrolled in a health-related postgraduate program. The specific codes are shown in Table B.1.

Table B.1: PILA contributor codes

Type of contributor	Code	Variable
Domestic Service	2	Self-employed
Self-employed	3	
Self-employed member or associate	16	
Independent contributor paying only health	42	
Self-employed voluntary contributor to the Labor Risks System	57	
Self-employed with a service contract of more than 1 month.	59	
Self-employed linked to the social protection floor	66	
Graduate student in health and resident	21	Postgraduate in health
Rest of codes		Dependent

Notes: These definitions come from the technical annex of PILA.

To create the monthly nominal wage variable, we take a look at the reported base of contribution (IBC, for its Spanish acronym)[39] across four sub-accounts: health, pension, cooperatives, and professional risks. For dependent workers, this base corresponds to 100% of their monthly income, while for self-employed, it is 40%. If an individual contributes to all sub-accounts, the IBC would be the same. However, people may only contribute towards some of them depending on their type of contributor code. We take the maximum value across the four sub-accounts to circumvent this issue and name this new variable the *IBC_max*. Note that the IBC should always be at least the monthly legal minimum wage.[40] Yet it is quite common for some companies or self-employed individuals to mistakenly contribute the former year's minimum wage during January's contribution. Since these are common mistakes, we decided to replace the *IBC_max* for the current year's minimum wage for workers who reported the previous year's as their IBC.

Ultimately, *IBC_max* is divided by 0.4 if the person is self-employed and has an income above that year's minimum wage to account for the fact that the IBC is 40% of their income but cannot be lower than the minimum wage. We then compare this variable to another one also reported in PILA, which is called the basic salary. After doing the same minimum wage correction for January's cases, we compare it against *IBC_max* and find that in some cases, when one variable might be null or misspecified, the other contains a plausible value. Thus, we take the maximum value between the basic salary and *IBC_max*, and this is our nominal monthly wage variable. To calculate the real wage, we divide the nominal variable by the consumer price index in that given year and multiply it by 100. This gives us the real monthly wages using December 2022

[39] *Índice Base de Cotización.*

[40] Aside from very specific exemptions like domestic service workers.

as the base month. Finally, to convert wages to U.S. dollars, we divide real wages in Colombian pesos by the 2018 purchasing power parity conversion factor based on private sector consumption (1,464 COP per USD).

However, individuals may appear to make more than one contribution per month. For dependent workers with contributions made by the same employer, we take the highest reported real wage since this is most likely a correction or mistake. For self-employed individuals and dependents with multiple jobs in different companies, we will add their reported wages and consider it their real monthly wage. After these corrections, we remove duplicates to have unique observations each month but create a dummy that allows us to see whether the individual had several simultaneous jobs.

We do these processing steps for each of the months within a loop. Finally, we end up with a dataset that has all the information for the entire period. Notice that this dataset has as many observations per person as months contributed to social security, i.e., it is an unbalanced panel. Also, note that individuals from our main sample who did not enter the formal labor market in the analyzed period are not yet included. Thus, we proceeded to include them and balance the panel by filling the months where no contribution was made with zeroes, meaning that the person did not work any days as a formal worker and had no formal real wage.

While we could use this dataset to perform the estimations, we decided to analyze labor market outcomes in broader periods, so we collapse it at a semiannual level. This ensures more comparability with the health data (explained in subsection B.3) and leverages the fact that there is not much variation in labor market outcomes by semester. The collapse is done at the individual-semester level, where we keep the median values for the real wage and the number of days worked. The resulting dataset is used for the estimations.

B.3 RIPS

Lastly, we merge our main sample with RIPS to get the health history of these professionals using the *personabasicaid*. These data are divided into four modules, namely consultations, procedures, hospitalization, and emergencies. We have access to these records from 2009 until 2022 and loop through each of them by year in the following way to process them.

First, we only keep variables necessary for our study to reduce computing times. Those variables are the main and three secondary diagnosis codes, the specific date of the provided service, and the consultation code in the case of the first module. The diagnosis codes use the ICD-10 conventions, while the last variable identifies the type of health professional that provided the service to the individual. After calling the dataset, we drop observations with missing *personabasicaid*, which are a negligible amount of cases that we would not be able to match to our sample.

Once we have these data, we merge them into our main sample, only keeping matched observations for further processing. We do not keep the unmatched individuals from our main sample at this stage to reduce the dimensionality of the datasets, but they will be recovered at a further stage. Now that we have our matched samples for each year of RIPS, we append them all together to create our variables of interest.

Using the four diagnosis codes (main and three secondary), we create dummy vari-

ables indicating whether the individual was diagnosed with a mental health disorder and whether a woman was pregnant. We additionally construct a dummy for the prevalence of mental disorders that takes the value of one for all subsequent periods after the individual's first diagnosis. The specific codes used for each variable can be found in Table B.2. If any of the four codes (main and three secondary) refers to that specific condition, the dummy will take a value of one. In addition to these specific variables, we also count the number of services for each module in three ways: unconditional, excluding pregnancy-related diagnoses, and only counting those related to mental health.

Table B.2: ICD-10 codes used for RIPS dummies

Variable	Chapter	Chapter code	Specific blocks
Mental diagnosis	Mental and behavioral disorders	F	All
Pregnancy	Pregnancy, childbirth and the puerperium	O	All excl. O00-O08 (Pregnancy with abortive outcome)
	Supervision of normal pregnancy	Z	Z34: Supervision of normal pregnancy

Notes: Chapters and specific blocks are defined in accordance to the 2019 update of the ICD-10 classification (World Health Organization, 1992), which can be accessed *here*.

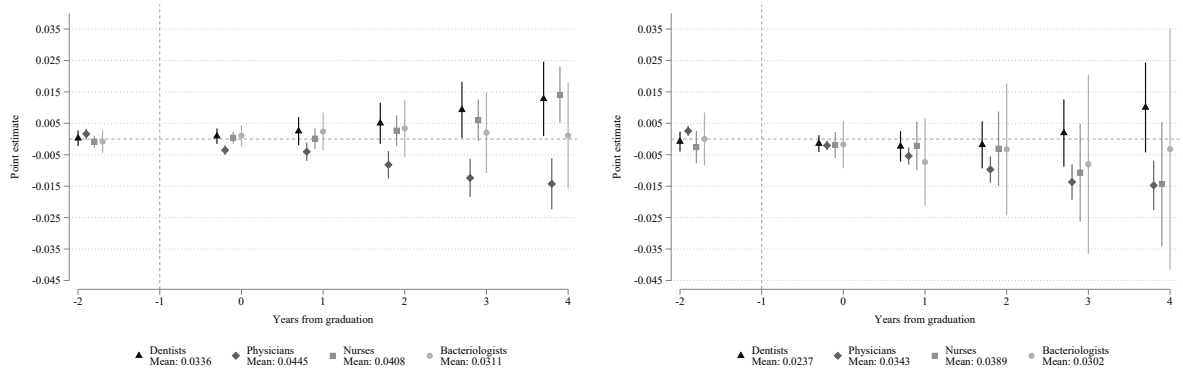
Given the low incidence of mental health, we will focus on annual outcomes, so we will keep a single observation per person-year-module, with variables taking the maximum value per group. Once we have these unique observations, we reshape the data from long to wide format to get an individual-level panel. Now, there will be one observation per person-year, and the number of services per module are recorded as separate variables within the same observation.

In the case of individuals who did not appear in a specific module, they will have a missing value in the number of services. These values are replaced with zeros, accurately reflecting the absence of services required from that module. However, notice that at this point, the panel is unbalanced since people who did not use the health system in a given year will not have an observation for those years. Also, people from our main sample who were unmatched are not included either. We thus proceed to recover those individuals and balance the panel, making sure that there is an observation for each person from 2009 to 2022 and that any gaps are filled with zeroes, indicating that the person did not use any services.

Finally, we create dummy variables with the balanced panel that will be used for estimation indicating access to any service (any of the four modules), access to each of the four services individually, and visits to the ER and hospitalizations, including and excluding pregnancy-related diagnoses. These dummies take the value of one if the intensive variables show a value of at least one. For example, if a woman had one ER visit because she broke her arm, the ER-visit and ER-visit-unrelated-to-pregnancy variables will take a value of one. This will be our final dataset. It will be used for the event study estimations to look at health trajectories across the four professions.

C Health trajectories appendix

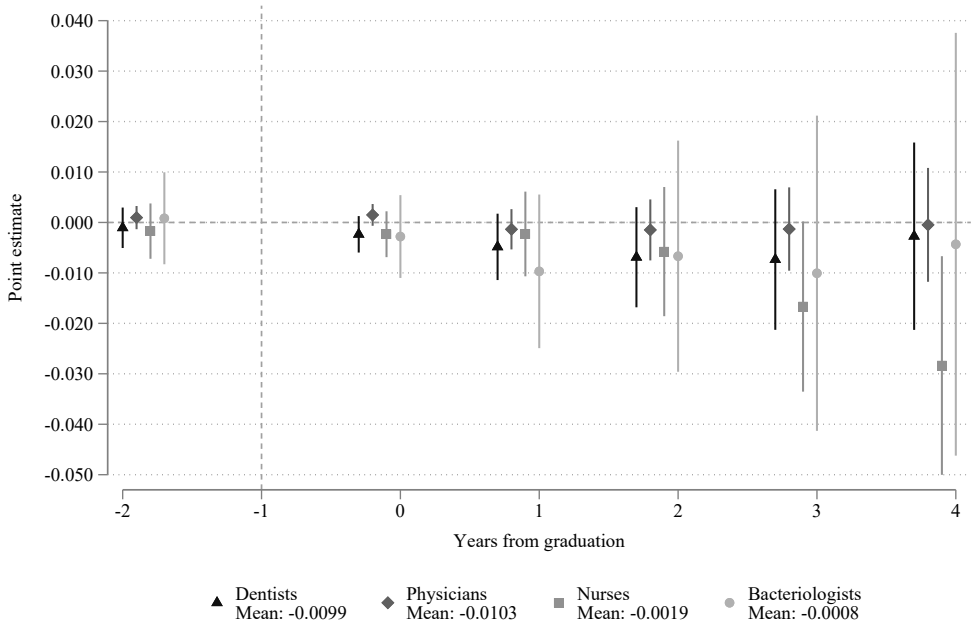
Figure C.1: Probability of having a mental condition by gender



(a) Females (b) Males

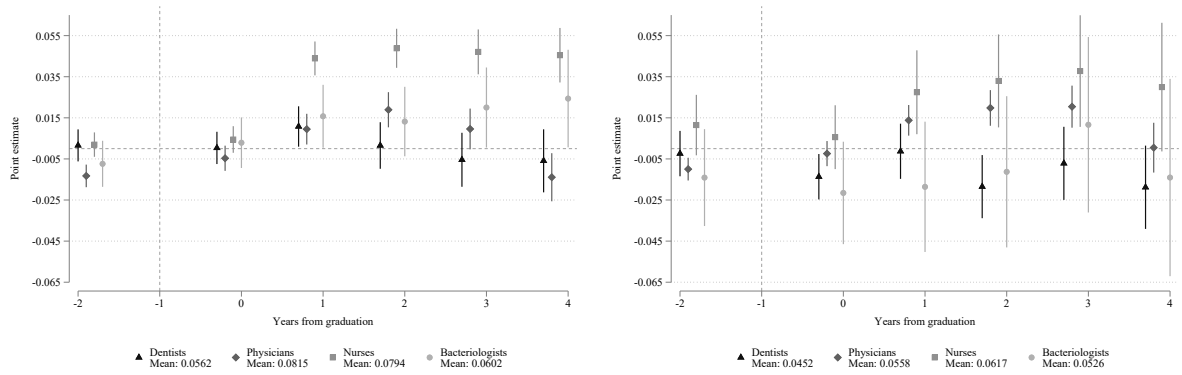
Notes: Each point represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure C.2: Probability of having a mental condition (gender gap)



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

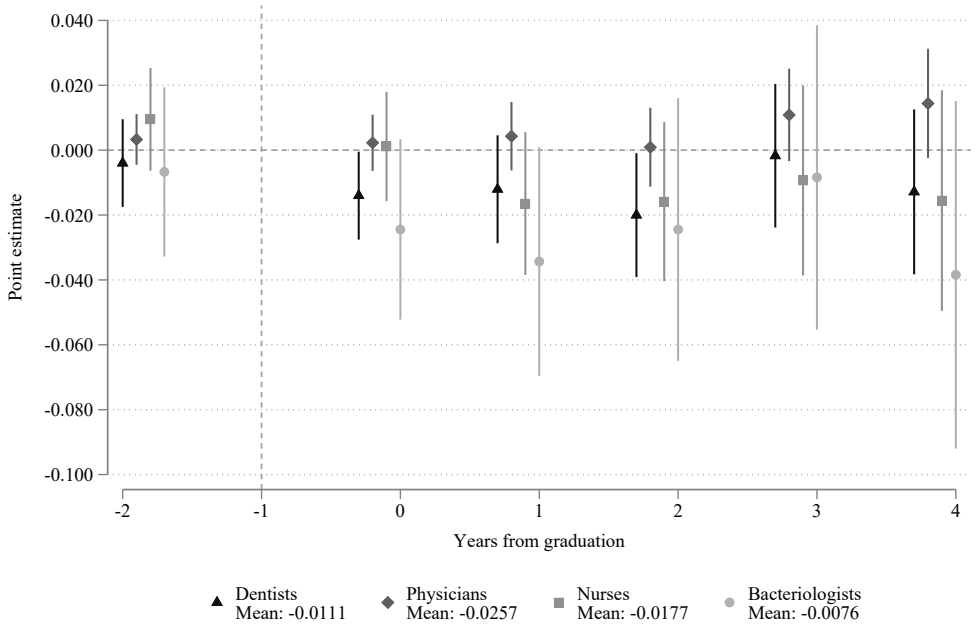
Figure C.3: Probability of going to the ER by gender



(a) Females (b) Males

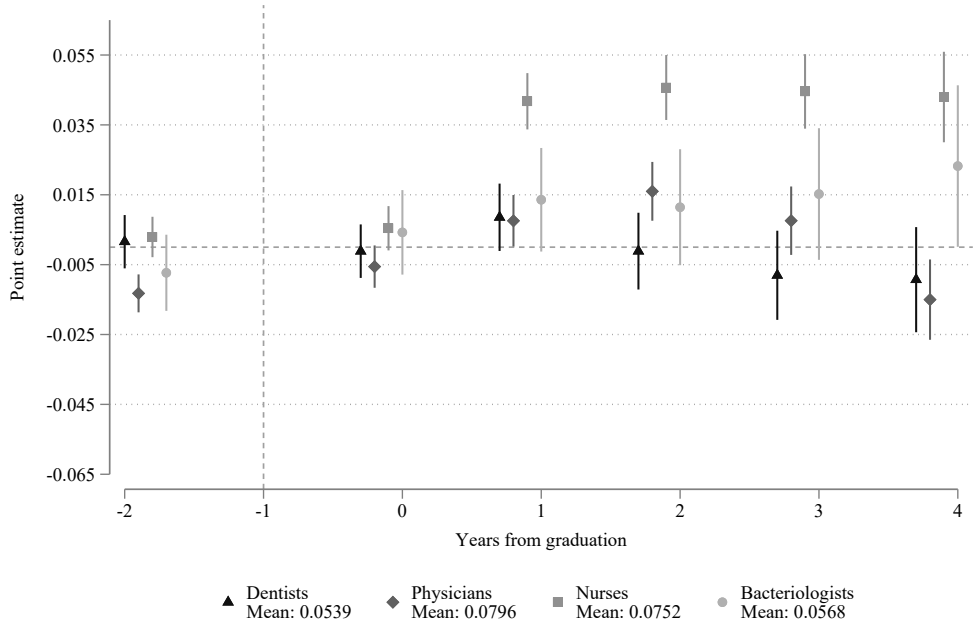
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure C.4: Probability of going to the ER (gender gap)



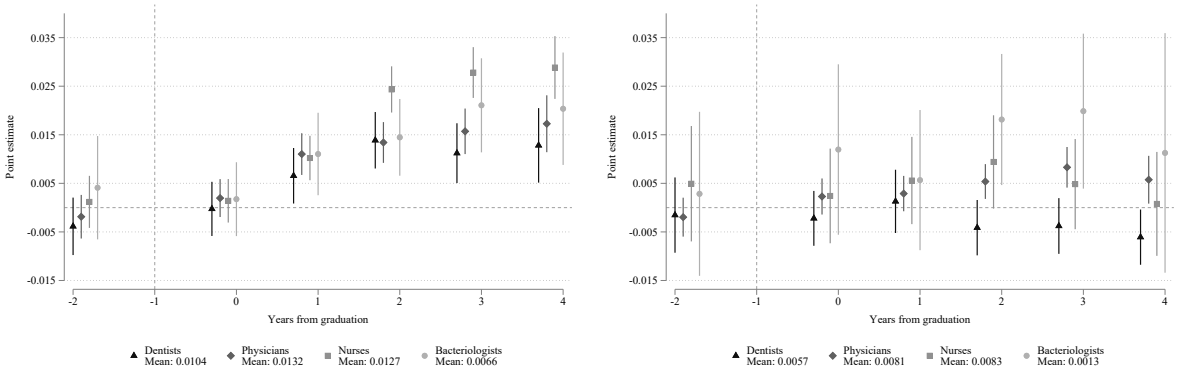
Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

Figure C.5: Probability of going to the ER from non-pregnancy causes for women



Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

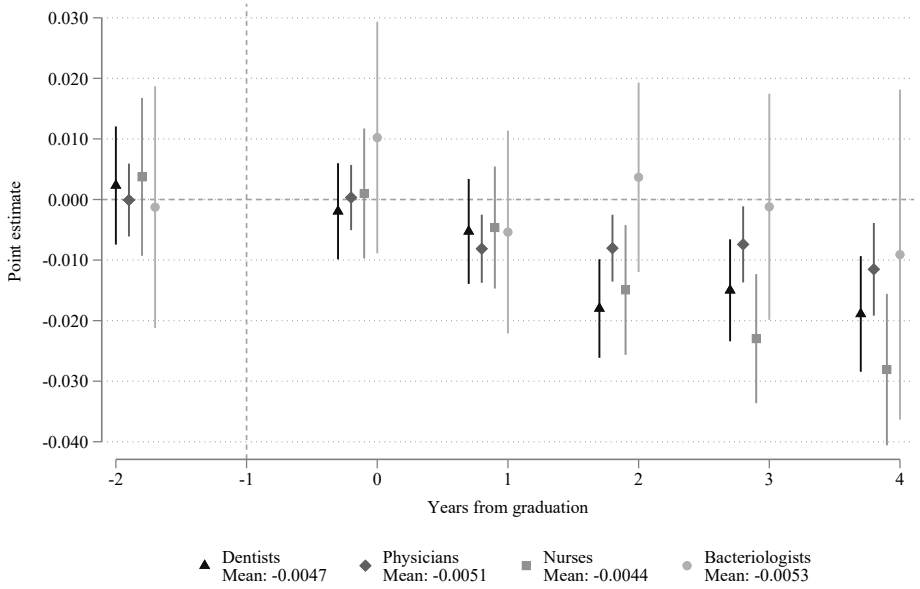
Figure C.6: Probability of hospitalization by gender



(a) Females (b) Males

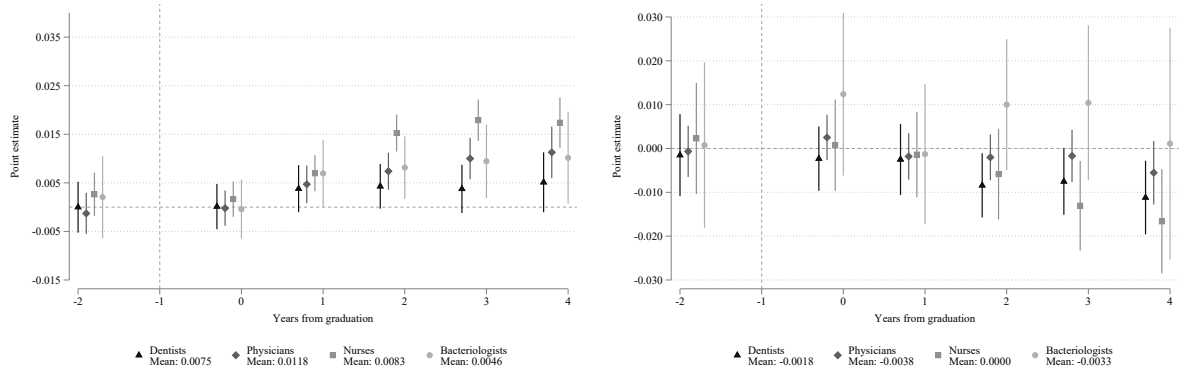
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure C.7: Probability of hospitalization (gender gap)



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

Figure C.8: Probability of hospitalization from non-pregnancy causes for women and gender gap

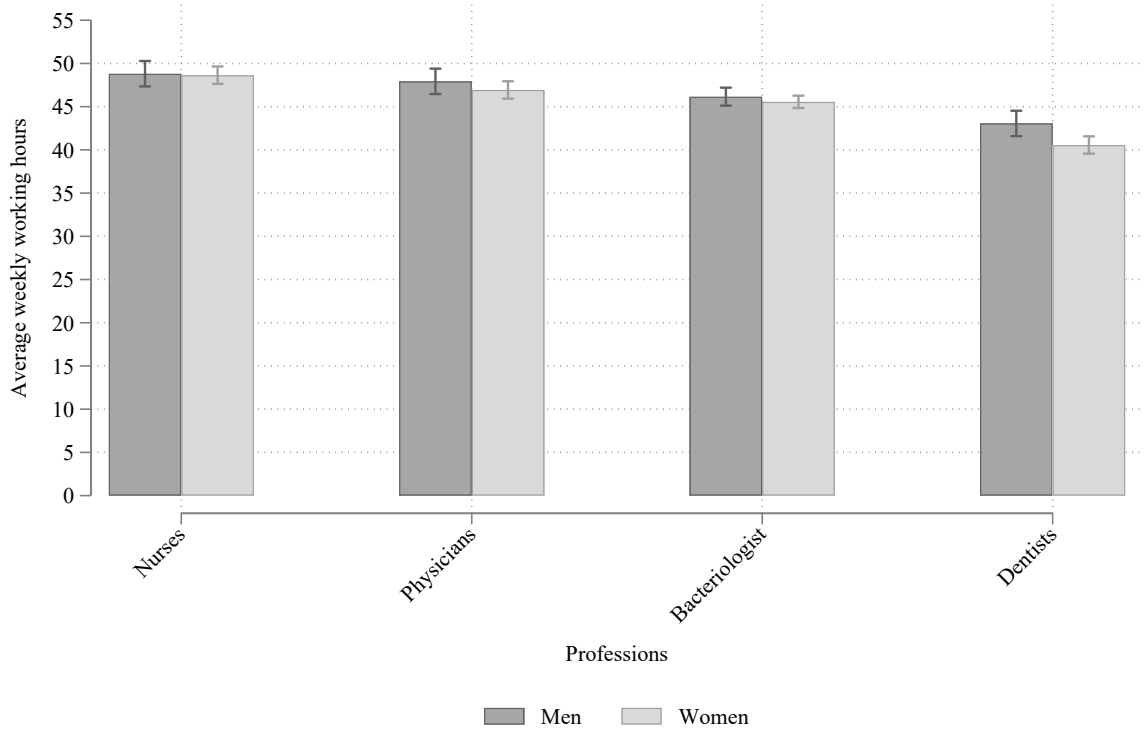


(a) Probability (b) Gap

Notes: In the left figure, each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend. In the figure to the right, each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

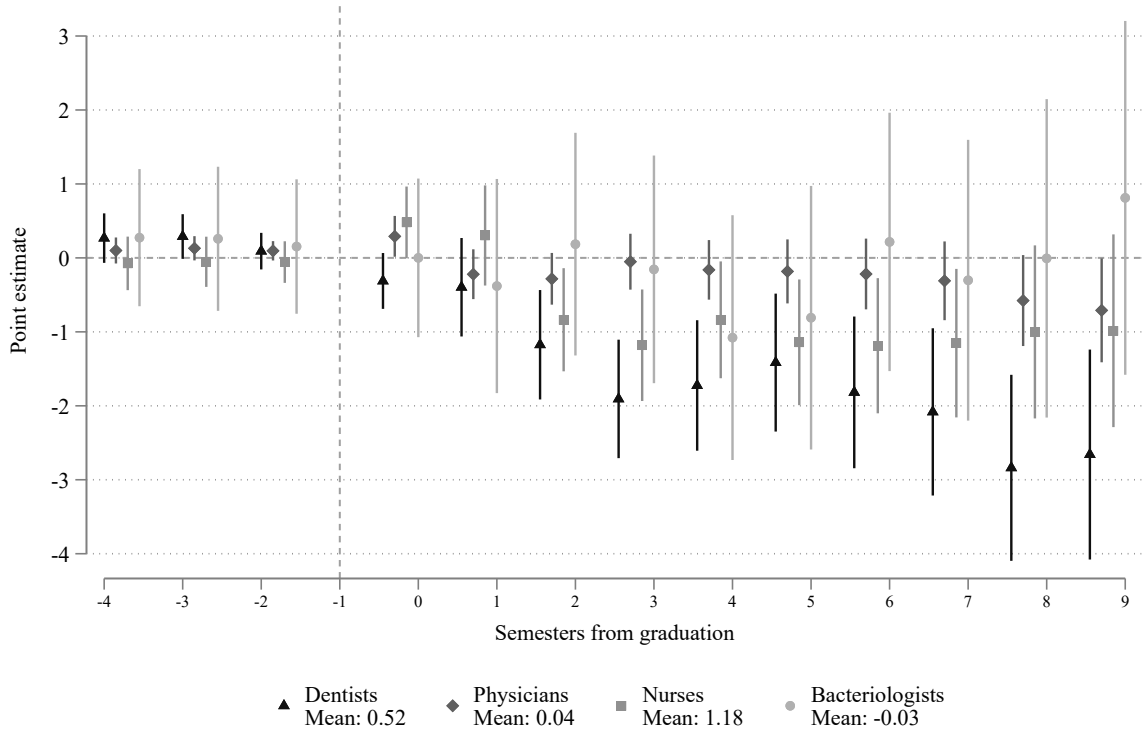
D Labor market trajectories appendix

Figure D.1: Working hours



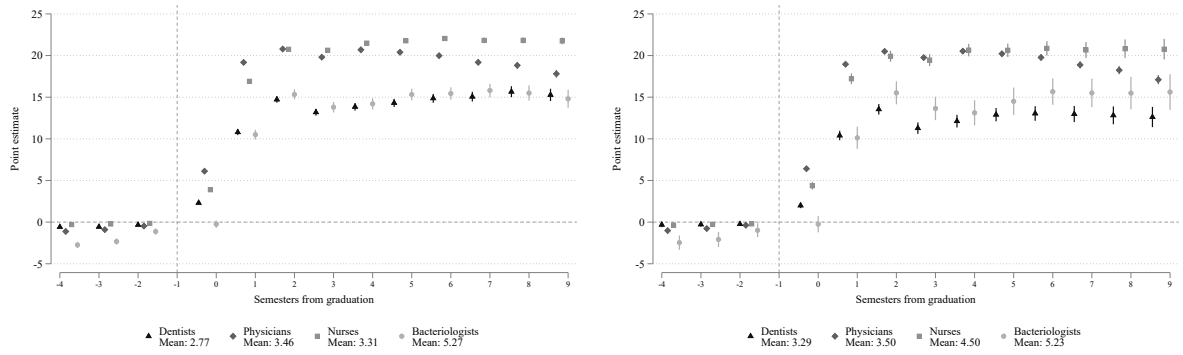
Notes: Each bar shows the average weekly working hours of the four professions, using data from the GEIH (2021 to 2023). Confidence intervals are at the 95% level.

Figure D.2: Monthly days worked (gender gap)



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

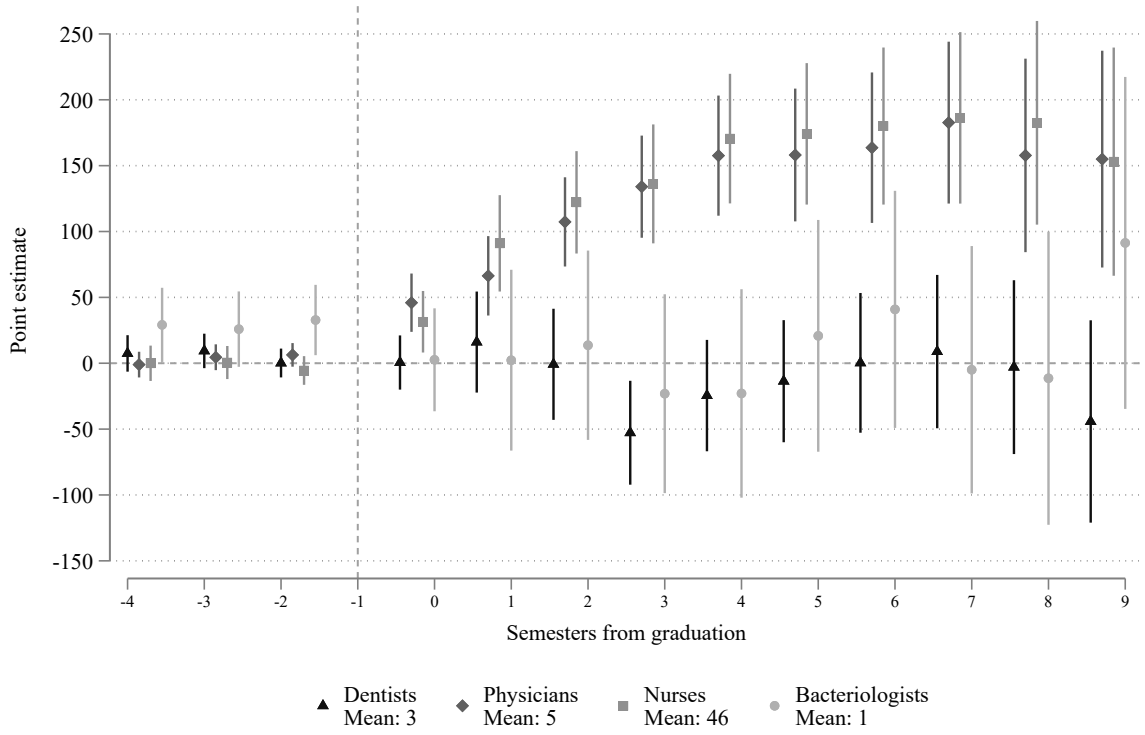
Figure D.3: Monthly days worked by gender



(a) Females (b) Males

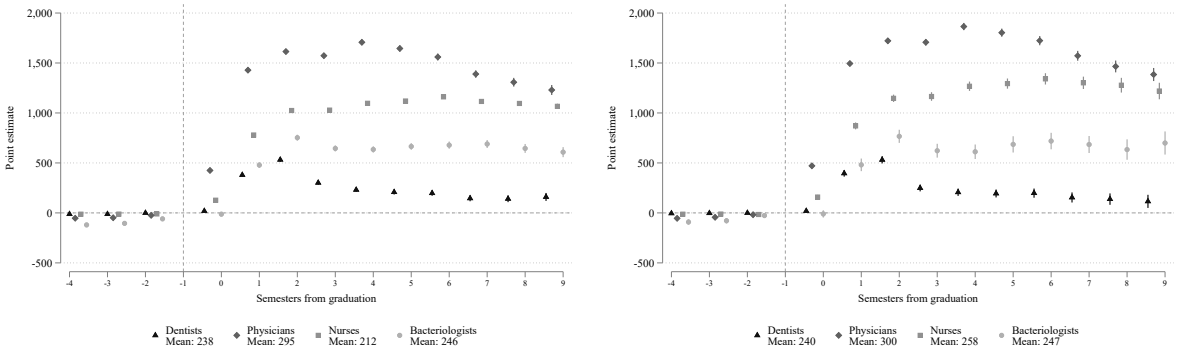
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure D.4: Real monthly wage (gender gap)



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. Wages are in real PPP U.S. dollars (base year 2018). The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

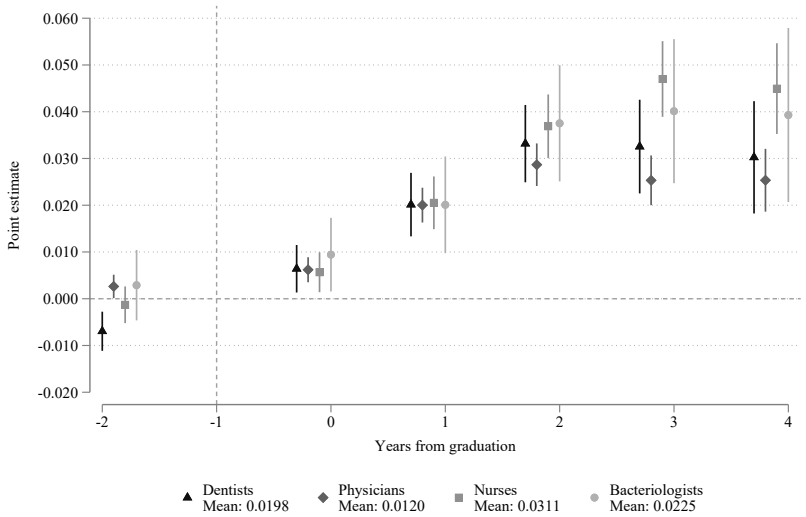
Figure D.5: Real monthly wages by gender



(a) Females (b) Males

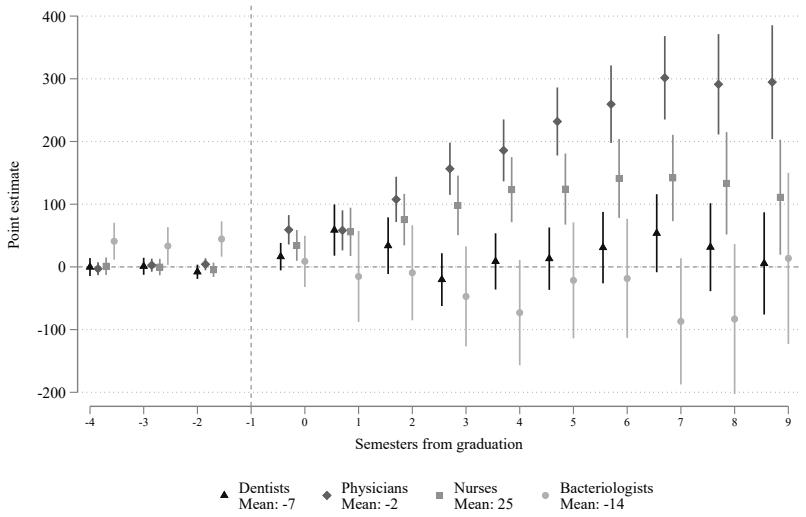
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. Wages are in real PPP U.S. dollars (base 2018). The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure D.6: Probability of being pregnant



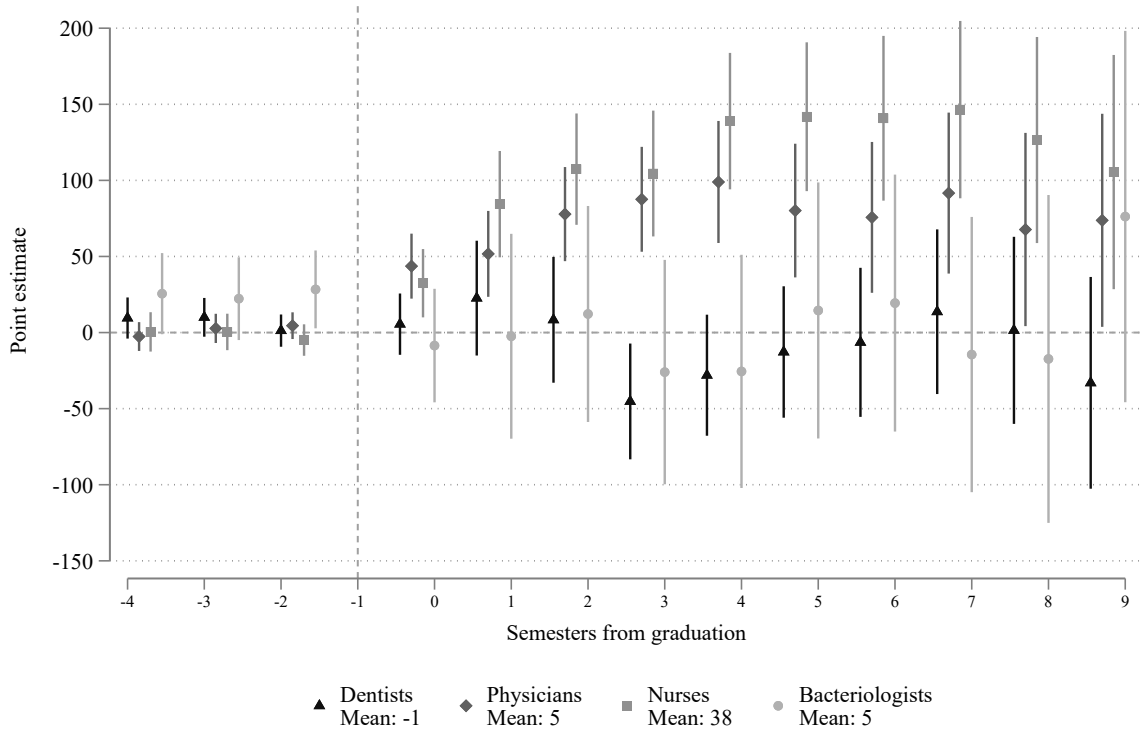
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure D.7: Real monthly wage without ever-pregnant women (gender gap)



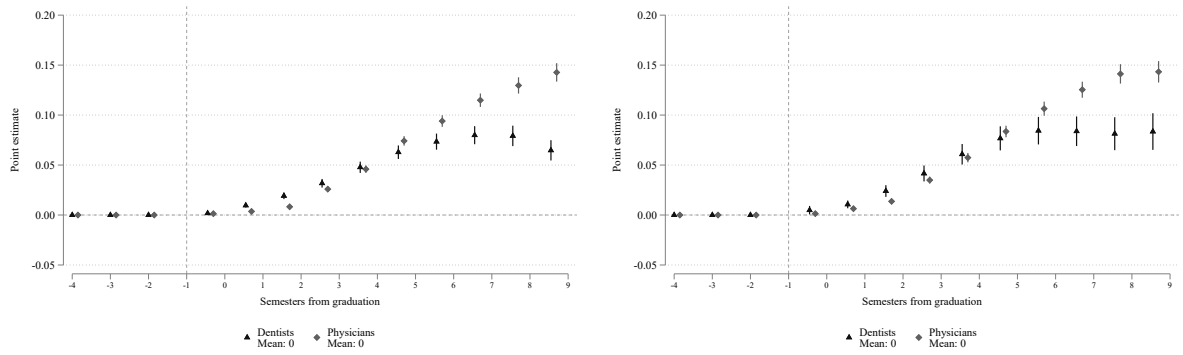
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. Wages are in real PPP U.S. dollars (base year 2018). The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure D.8: Alternative gender wage gap



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. Wages are in real PPP U.S. dollars (base year 2018). The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men. In this figure, the maximum wage across jobs per person is used, instead of the sum.

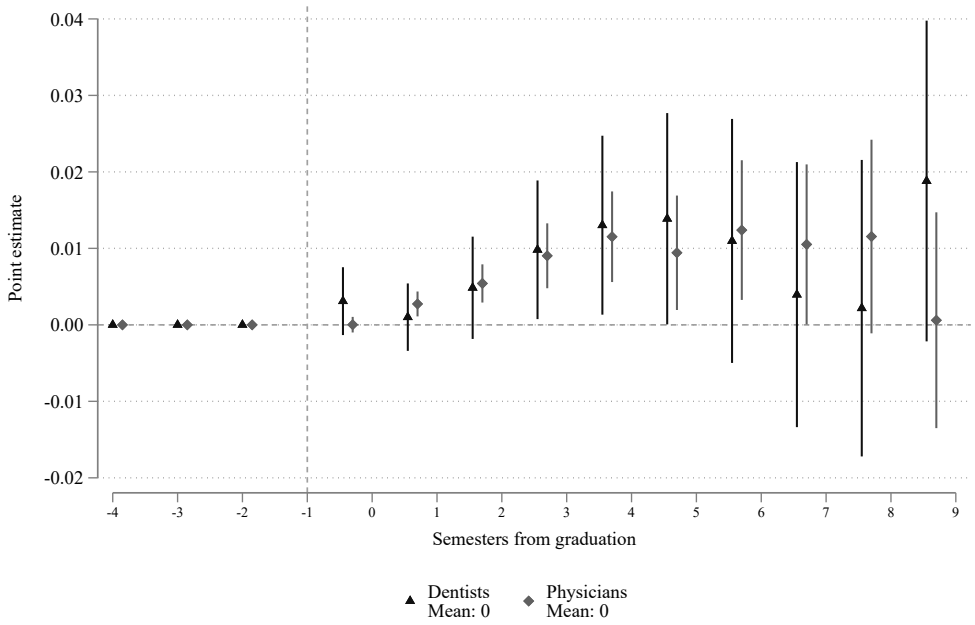
Figure D.9: Probability of enrollment in a health-related postgraduate program by gender



(a) Females (b) Males

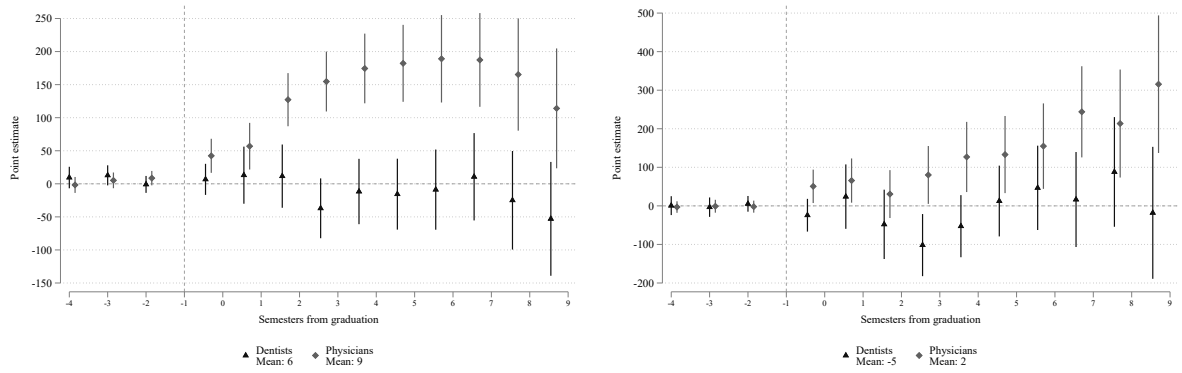
Notes: Each dot represents a coefficient from the Callaway and Sant'Anna (2021) estimation. The lines across the coefficients are confidence intervals at the 95% level. Standard errors are clustered at the individual level. The outcome's mean at the baseline period (-1) for each profession is reported in the legend.

Figure D.10: Probability of enrollment in a health-related postgraduate program (gender gap)



Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men.

Figure D.11: Real monthly wages conditional on postgraduate enrollment (gender gap)



(a) Never-enrolled

(b) Eventually-enrolled

Notes: Each dot and confidence interval comes from a difference-in-means Welch t-test from the Callaway and Sant'Anna (2021) estimations. Wages are in real PPP U.S. dollars (base year 2018). The confidence intervals are at the 95% level. The gap at the baseline period (-1) for each profession is reported in the legend. Positive values indicate a gap in favor of men. In this figure, the maximum wage across jobs per person is used, instead of the sum.