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DISCUSSION PAPER SERIES

IZA DP No. 16772

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ABSTRACT

Nursing before and after COVID-19: Outflows, Inflows and Self-Employment

We study nurses' labour dynamics in light of continuing nurse shortages and the COVID-19 pandemic. Using Dutch monthly administrative microdata, all nursing-qualified persons observed in January 2016 and/or in January 2020 are compared and followed for one year before and three years after both baseline months. Compared to the 2016 Cohort, women and men in the 2020 Cohort who were employed in the healthcare sector at baseline were 0.3 and 1 percentage point more likely to have left employment; and, conditional on still being employed, 0.8 and 1.2 percentage points more likely to have left healthcare employment after three years. The 2020 Cohort women and men were also 1 and 1.7 percentage points more likely to transition from salaried employment to self-employment, and they reduced working hours by 0.6% and 1.5% more by December 2022. Except during COVID outbreaks, there is no higher inflow into healthcare employment by nursing-qualified women and men who were not employed in healthcare at baseline. Finally, other healthcare professionals fared better, with similar healthcare sector retention rates in 2019-2022 compared with 2015-2018. Overall, the pandemic accelerated nurse shortages through reduced retention and increased self-employment, and its impact is still felt at the end of 2022.

JEL Classification: I11, J16, J20, J44, J62

Keywords: nurses, labour dynamics, self-employment, healthcare, gender, COVID-19

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Nursing before and after COVID-19: outflows, inflows and self-employment*

1. Introduction

Many countries are facing a looming labour shortage of healthcare workers over the next decades due to an increased demand by an ageing population which at the same time limits the supply of workers (including healthcare workers).[1] The situation in the Netherlands is no different from the rest of the world; e.g. see Darzi and Evans (2016) and Michaeli et al. (2022). A report on the Dutch healthcare sector by Ernst and Young (2022) shows that in 2021, the rate of sick leave was just above 7%, staff turnover was nearly 15%, nearly 8% of care was provided by externals and one in every 25 jobs in the care sector is vacant.[2] Importantly, such nurse staffing issues can reduce team productivity (Bartel et al., 2014). These numbers highlight the urgent policy issue of ensuring adequate levels of healthcare staffing to maintain high care-quality.

The focus of this paper is on the largest subgroup of healthcare workers, nursing-qualified workers, with projections of nurses shortages between 2022 and 2030 for the Netherlands showing that similar to other healthcare workers there are shortages, and further shortages are expected across the board.[3] That is, by 2030, there is an expected shortage of 14,500 to 17,700 vocationally educated nurses, 7,000 to 8,300 tertiary-educated nurses (including midwives), 14,100 to 16,900 general hospital and other medical specialty nurses, 2,200 to 3,100 university hospital nurses, and 15,600 to 19,400 home care nurses.[4] Using the lower values in these ranges this shortage is equivalent to about 25% of the 2020 population of nursing-qualified men and

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[1] For example, for the US, a post by Brill and Seiter of the American Enterprise Institute reports on the substantial shortfall of healthcare workers by comparing the employment gap in projected need for healthcare workers and employed healthcare workers with the number of available qualified unemployed workers. This gap was highest immediately after the start of the pandemic when the health workforce decreased by over 1.5 million workers, but is still high in January 2023 (at a shortfall of 767,000 workers), and the number of experienced unemployed workers is not sufficient to fill this gap. See https://www.aei.org/economics/health-care-workforce-shortages-an-updated-look/ (viewed on 13 July 2023).

[2] Around 20,000 workers responded to the call for extra care providers in the health sector (in Dutch: "extra handen voor de zorg") during the first wave of COVID-19 infections, but this was a temporary solution. See https://www.nursing.nl/praktijk/organisatie-van-zorg/extra-handen-voor-de-zorg-in-1-week-450-zorgverleners-gevraagd/ (viewed on 22 August 2023).

[3] This is no different in other countries. E.g. in France they talk about "Nurses deserts" as they have areas with too few nurses despite the number of nurses increasing overall in France since 2006 (Chevillard et al., 2018).

[4] See https://emtg.nl/blog-en-high-demand-for-nurses-in-the-netherlands/ (viewed on 13 July 2023).

women. Despite these dire predictions, the situation in the Netherlands appears better than in many other OECD countries, indicating how widespread these shortages are.[5]

Another major important development in the healthcare sector has been the "flexibilisation" of work through increased self-employment which is replacing employment for wages and salaries. In the Netherlands, self-employment has grown more strongly in the healthcare sector than overall: from 6.9% in quarter 1 of 2013 to 11.6% in quarter 1 of 2023 versus an increase from 11% to 13.1% for the overall workforce over the same period (Centraal Bureau voor de Statistiek (CBS), 2023).[6]

Self-employment may be attractive as it provides more autonomy and more freedom to negotiate salaries. However, this increased self-employment may create problems for the healthcare sector if it increases the cost of providing care through higher hourly wage rates and/or through an additional fee for the intermediary agency which organises the self-employed workers. As reported by some hospitals in the Netherlands, the proportion of self-employed workers in some departments increased to 60%.[7]

The COVID-19 pandemic has accelerated both developments in the healthcare workforce, with health workforce shortages becoming very apparent and, after a drop in the increase in self-employment during the pandemic, a steeper increase in self-employment afterwards, from 2022 onwards (CBS, 2023). This paper aims to analyse these patterns at the micro level by examining monthly administrative unit record data covering the period around the pandemic (2019-2022) and comparing this to a period of the same length before the pandemic (2015-2018) using a monthly Difference-in-Differences specification. All nursing-qualified persons in the baseline month January 2016 (186,838 persons) and January 2020 (195,911 persons) are thus followed over the period 2015-2018 and 2019-2022, respectively. A triple differences specification is used to identify what characteristics are associated with these labour supply dynamics.

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[5] OECD data for 2019 show that the number of practicing nurses per 1,000 population was 10.7 in the Netherlands which is just inside the top third of OECD countries and well above the OECD average of 8.8 (OECD, 2021:p.221). In terms of the number of nursing graduates per 100,000 population, the Netherlands also do relatively well at 58.6 in 2019, just outside the top quartile of OECD countries and well above the OECD average of 44.5. However, this does not take into account the higher prevalence of part-time work in the Netherlands compared to most other countries.

[6] Also see Eurofound (2020) which notes significant increases in the number of self-employed workers in retail, hospitality, the health sector and schools in the period just before COVID-19. All these sectors are female dominated.

[7] As reported by the Dutch broadcaster NOS on https://nos.nl/nieuwsuur/artikel/2477448-ziekenhuizen-bezorgd-personeelsmarkt-ontdekt-door-private-investeerders (viewed on 23 November 2023).

Findings based on Dutch data are likely to be relevant more broadly as many characteristics of the nursing profession in the Netherlands are similar to those in other countries. For example, 85% of nurses are female (CBS, 2023) which makes it one of the most female-dominated sectors in the Netherlands. This is similar to the average proportion of women employed in personal care across 121 countries (of 88%) as reported by the International Labour Organization.[8] There is a similar increase in the proportion of nurses (and healthcare workers) who are self-employed in some countries, like the US (Katz and Krueger, 2019), but not others, like the UK where self-employment in nursing is rare (Royal College of Nursing, 2021). A better understanding of outflows, inflows and self-employment of nurses, and how COVID-19 changed these dynamics, is likely to be useful in designing policies to encourage nurses' labour supply and reduce nurse shortages.

We extend the literature in three ways. First, we add to the literature on the role of outflows and inflows of nurses by focussing on qualified healthcare workers (nurses, and non-nurses for comparison) entering and exiting employment in the healthcare sector. Previous research, mainly based on survey data, documents nurses' labour supply patterns, and relates this to the role of wages and non-wage job attributes.[9] We extend this evidence base by using Dutch administrative data including recent information on the entire stock of qualified nurses, allowing more in-depth analysis than existing research of specific aspects and for specific groups. This includes exit from employment in healthcare sector jobs, as well as entry in healthcare jobs (e.g. inflow into the healthcare sector by non-employed nursing-qualified people or by nursing-qualified people working in other sectors). In addition, we analyse the factors that are associated with exits and entries, such as, differences based on sex, own age, and the presence and age of children. We also study labour market outcomes such as paid working hours and hourly wages. These are important factors to understand when considering what is needed to reduce labour shortages in healthcare.

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[8] See https://ilostat.ilo.org/these-occupations-are-dominated-by-women/ (viewed on 13 July 2023).

[9] Although estimated labour supply elasticities are often found to be relatively low, Hanel et al. (2014) use Australian survey data on nursing-qualification holders to find it higher than previously estimated. They estimate a discrete labour supply model for the choice between different hours of work and between nursing and non-nursing occupations, where the latter appears to explain their higher elasticity of labour supply in nursing. For literature on nurses' labour supply more generally, see Andreassen et al. (2017), Antonazzo et al. (2003), Askildsen et al. (2003), Di Tommaso et al. (2009), Frijters et al. (2007), Kankaanranta and Rissanen (2008), Kugler (2022) and Shields (2004).

A second contribution is through an ability to study self-employment dynamics in the healthcare sector and examine heterogeneity effects to understand which nurses are more likely to choose self-employment. At present, surprisingly, to the best of our knowledge, there is only limited (and mostly qualitative) research available studying the flexibilisation of the healthcare labour force although this topic is becoming increasingly important in some countries, including the US and the Netherlands.

A third contribution is that we study how the COVID-19 pandemic changed the dynamics of outflows and inflows of nurses in the healthcare sector and in self-employment. The extensive literature on COVID-19, predominantly based on survey data, analyses the experiences of nurses and other healthcare workers including impacts on mental health.[10] Relatively little research has been devoted to a comprehensive analysis of how COVID-19 affected retention and attraction of nurses in the healthcare sector. Using a Difference-in-Differences strategy and detailed administrative data, we limit estimation bias due to unobservable factors by comparing outcomes for the stock of registered healthcare professionals who were in jobs in the healthcare sector in January 2020 with outcomes for the stock of registered healthcare professionals who were in jobs in the healthcare sector in January 2016, following a similar approach as in Meekes et al. (2023). In sum, we contribute to the literature on COVID-19 by analysing COVID-19 impacts on employment in the healthcare sector as well as on nurses' paid working hours and hourly wages.

The results show that the 2020 Cohort of nursing-qualified workers, compared to the 2016 Cohort, are 0.3 to 1.6 percentage points more likely to have left employment after three years. Conditional on employment, the 2020 Cohort is 0.8 to 1.2 percentage points more likely to have left employment in healthcare by December 2022. Transitions from salaried employment to self-employment were increasing for nursing-qualified men and women by 1 to 1.7 percentage points. At the same time working hours decreased by 0.6 to 1.5% and real hourly wages decreased by 4% by 2022 compared to the 2016 Cohort. These impacts are generally larger for men than for women. The impact of children under 12 is particularly large for single mothers, increasing their transition to self-employment and reducing their working hours. For the cohorts of nursing-qualified men and women who were not employed or who were employed outside the healthcare sector, we do not find higher inflow rates into healthcare sector

[10] For example, see Duijs et al. (2023), Fernandez et al. (2020), Li et al. (2022), Muller et al. (2020), Raso et al. (2021) and Zhang et al. (2022).

employment for the 2020 Cohort, except during the worst months of the COVID pandemic. Finally, we show that other professionals in the healthcare sector seem to fare better, with similar retention rates in 2019-2022 compared with 2015-2018.

2. Conceptual framework – background and literature review

The evolution of the labour force in the healthcare labour market can be attributed to demand-side mechanisms and supply-side mechanisms.

The demand for labour in the healthcare sector is growing in Western countries, because of population ageing through increases in life expectancy. The recent COVID-19 pandemic also affected the demand side of the labour market. COVID-driven demand-side impacts include a large increase in demand for nurses given the increased use of healthcare services and changes in responsibilities for subgroups of healthcare professionals given differential COVID-19 demand impacts within the healthcare sector.

On the supply side, individuals decide on whether they would like to work in the healthcare sector. Our conceptual framework starts from a population of nursing-qualified workers and a simple job search model. For nursing-qualified workers, we distinguish three different labour supply outcomes: employment in the healthcare sector, employment outside the healthcare sector, and non-employment. The individual's labour supply choice depends on trade-offs between leisure, wages and non-wage job characteristics. Relevant non-wage job characteristics include, among others, job flexibility (e.g., paid working hours flexibility, number of weekly working days, work shifts, working-from-home arrangements, etc.), work pressure, emotional pressure, and the commuting distance. Based on the trade-offs, nursing-qualified workers may decide to exit or enter (healthcare) employment. These trade-offs are likely to differ between subpopulations: e.g., men and women, or older and younger persons are likely to value different job characteristics and thus to make different trade-offs. An important, additional labour supply choice is between self-employment and salaried employment. Furthermore, with a decreasing birth rate, the overall size of the labour force relative to the size of the older population is declining, leading to likely reductions in healthcare labour supply (relative to demand).

In the Netherlands, flexibilisation increased overall through self-employment which benefits employers because of reduced risks. For employees, self-employment can also be attractive. For healthcare sector workers, key reasons to be(come) self-employed include increased autonomy and flexibility in terms of decisions on (i) employment (extensive margin), (ii)

amount and timing of paid working hours (intensive margin), and (iii) pension schemes and disability insurance (e.g. see Wall, 2013; Duijs et al., 2023). In contrast, key reasons to be(come) a salaried employee include a stable income and thus less risk from, for example, reduced labour demand; and less administrative work compared to being self-employed although the burden of administration for salaried workers also increased over time. However, Duijs et al. (2023) also report instances where self-employment leads to more financial security for some women through their ability to choose more regular working times (and thus easier access to affordable childcare).

Labour market shortages have increased in the healthcare sector, because of increases in life expectancy which imply there are fewer workers to care for more people over time, holding migration and retirement age constant. Related to this is the ageing of the labour force itself, increasing the rate of exits out of the healthcare labour force. As labour market shortages increase in the healthcare sector, which reduce risk from potential low labour demand, there is a stronger incentive to become self-employed and to bargain for better wages and non-wage job characteristics.

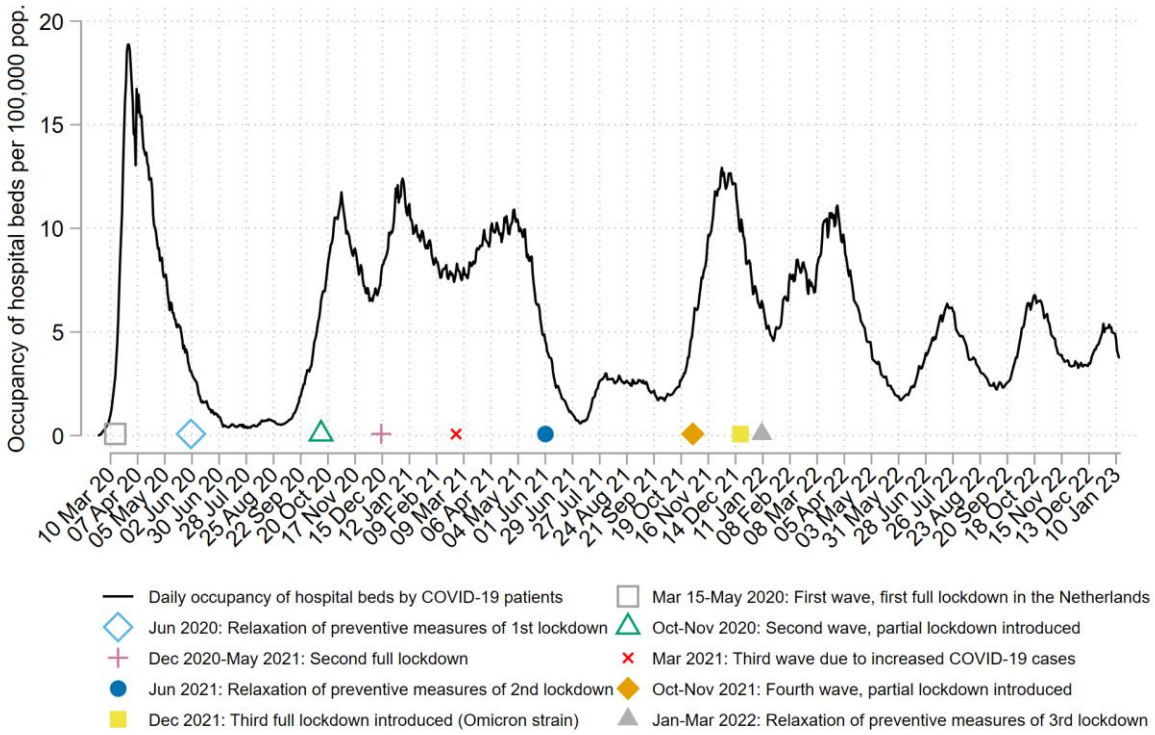
Impacts of the COVID-19 pandemic on the supply side include higher work pressure and an increased mental load causing increased absenteeism (Zhang et al., 2022). Figure 1 shows the COVID workload over time. Nurses were impacted strongly in terms of work and emotional pressure (Sheppard et al., 2022). Impacts likely differed by demographic and household characteristics. For example, labour supply may be more constrained for mothers, and especially for single parents, through the need to balance family and paid work (Meekes et al., 2023); and for older workers through perceived healthcare risks of COVID-19 (Raso et al., 2021). Consequently, new trade-offs between changed leisure, wage and non-wage job characteristics may lead to changes in entry and exit from employment in the healthcare sector.[11]

Earlier literature, such as a general job search paper by Sullivan and To (2014), has shown the importance of non-wage job characteristics for young, unmarried and low-skilled men at the start of their career, while Di Tommaso et al. (2009) show the importance of other job attributes relative to wages for female nurses. This indicates a broader relevance of non-wage job

[11] For example, in their modelling, Di Tommaso et al. (2009) allow other job characteristics beside wages to influence nurses' labour supply choices while Crawford et al. (2015) suggest that a reason for nurses taking up lower-paid employment outside the National Health Service (NHS) in the UK could be to take up a part-time position in the private sector.

characteristics, although there are likely differences in impacts between different populations. Indeed, Shields and Ward (2001) examine the impact of job dissatisfaction (overall and with a range of job aspects) on the probability of a nurse quitting and show that pay is important but opportunities for career advancement in the form of training and promotion are even more important. They also find that young, male, ethnic minority and highly educated nurses are the most dissatisfied.

Figure 1 Occupancy of hospital beds by COVID-19 patients and COVID-19 crisis timeline in the Netherlands



Notes: The daily occupancy of hospital beds by COVID-19 patients is provided per 100,000 population, as well as key events during the COVID-19 crisis. See Rijksoverheid (2024) for the occupancy of hospital beds data as provided by the National Coordination Center for Patient Distribution; they note that the data before 1 June 2020 may be less reliable as they were working on setting up the registration system. The Dutch population on 1 January 2020 is used and equals 17,407,585 (CBS, 2023).

Although wages appear relatively unimportant for nurses' labour supply (Antonazzo et al., 2003; Shields, 2004), higher average wage elasticities are observed in specific locations (Crawford et al., 2015) and when allowing for exit and entry into the profession (Hanel et al., 2014). Elliott et al. (2007) show regional differences in vacancy rates for nurses in the UK that can be linked to the wage differential in the local market between nurses and comparator occupations in which a nurse could be employed. This indicates wages are important to some extent.

Taken together, labour-demand mechanisms imply an increase in healthcare employment opportunities for nursing-qualified workers. In contrast, labour-supply mechanisms suggest a decrease in the capacity of nursing-qualified persons to work in the healthcare sector. To determine net impacts, we investigate changes over time and the impact of COVID-19 on:

- Rate of outflow of nursing-qualified workers from healthcare employment to non-healthcare employment and non-employment.
- Inflow of nursing-qualified workers into healthcare employment from non-healthcare employment and nonemployment.
- In- and outflow rates of self-employment for nursing-qualified workers.
- Heterogeneity effects in the aforementioned outcomes. Considering for example sex, age, country of birth, presence and age of children

3. Data

Administrative data from Statistics Netherlands (Centraal Bureau voor de Statistiek, CBS) that cover the entire Dutch population are used (see Appendix A for more information about the specific datasets included). For the analyses we select everyone who holds a nursing qualification at the reference dates of January 2020 (treatment group) and January 2016 (control group), as observed through their presence in the BIG register. The BIG register stands for “Beroepen In de Gezondheidszorg” (healthcare occupations) register. These data allow us to identify people who have nursing qualifications; and based on this we identified 195,911 nursing-qualified persons in 2020 and 186,838 nursing-qualified persons in 2016 (see Tables B.1 and B.2 of Appendix B). The sample of analysis does not contain persons who were registered after the reference months; Appendix Figure B.1 shows an annual inflow of newly registered nurses of about 9,000 to 10,000 a year.

By linking to the dataset with employees and to the dataset with self-employed people, we determine whether someone is an employee or self-employed at that date. If they are not linked to either dataset, they are assumed to be unemployed or out of the labour force; this group is potentially available to enter the labour force as a nurse at a later date.

Monthly microdata on labour market outcomes are collected from income statements available in the Job and Wages Register over the period from 2015 to 2022 using calendar months January to December. The data are based on employed workers’ monthly income statements. The data are linked to the BIG register and to administrative data on self-employed workers so we can make the required sample selections.

3.1. Key variables

The key outcome variables are all measured on a monthly basis and include: employment (yes/no), employment in the healthcare sector (yes/no), employed in salaried employment (yes/no), self-employed (yes/no), monthly paid working hours and nominal/real monthly hourly wages. These variables are defined below.

The indicator variable employment equals one for the employed (including self-employed people) even if they currently work zero hours, and zero for the non-employed. The indicator variable employed as an employee equals one for employees, and zero for anyone else. The indicator variable self-employed equals one for self-employed workers which are identified using data on firm-spells from the Dutch Chamber of Commerce, and zero for anyone else. There are no missing values for these three employment variables. The indicator variable employment in the healthcare sector equals one for the employed (including self-employed) who work in Standard Industrial Classification (SBI) sectors with codes ranging between 86000 and 89999, and zero for those employed elsewhere.[12] The latter variable is conditional on being employed and is thus missing for individuals who are not employed. The various employment variables allow us to analyse entry and exit from different types of employment, and to determine what factors are associated with this.

The number of paid working hours is unaffected by paid leave, holidays, short-time work covered by the Temporary Emergency Measure for the Preservation of Jobs (NOW scheme), and overtime hours, but it decreases if employees have reduced paid working hours and/or take unpaid leave.[13] Reductions in actual working hours paid for through the short-time work scheme do not show up in the data as reduced working hours, because we use data on paid working hours and these employees are paid their full wage. Hourly wage is computed by dividing monthly gross (inflated) wages by monthly working hours.[14] This allows us to study

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[12] See Appendix A for more information on the SBI.

[13] The NOW I is a short-time work scheme allowing firms facing reduced labour demand to reduce employees' working hours temporarily. NOW I superseded the similar Regulation for Reduction in Working Hours (which had been in place since the 2008 Global Financial Crisis) to cope with the significant decrease in employers' labour demand at the start of the COVID-19 pandemic. NOW I covered up to 90% of the employer's wage bill for March, April and May of 2020 covering all employee types including those in flexible jobs, and was followed by comparable but slightly different NOW arrangements (up to NOW VI) until June 2023. Participating employers commit to not dismissing employees for economic reasons during the period covered by the allowance.

[14] All real salary variables are inflated to 2022 euro values (December 2022=100) using monthly CPI numbers from the CBS. See https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83131NED/table?ts=1679908720157.

changes in compensation per hour worked. The latter two variables are missing for individuals who are not employed or who are self-employed. Both variables are winsorised by replacing the bottom and top 1% of values by the value of the first and 99th percentiles respectively. We analyse the natural logarithm of these two outcome variables, only including values larger than zero (i.e., for those who are an employee).

The covariates included in the regression models are measured either at baseline in the reference months of January 2020 or January 2016, or at the end of the previous year (i.e., 2019 and 2015, respectively) and kept constant over the 4-year period. This ensures that all covariates are measured before the COVID-19 shock for the later cohort. Demographic and household characteristics are as observed on 31 December of the previous year, including data on the person's sex, date of birth, country of birth (Netherlands: yes/no), marital status (single versus married or de facto partnership), presence and date of birth of the youngest child, and province of residence (12 provinces). The individual's age category of $[18, 25)$, $[25, 35)$, $[35, 45)$, $[45, 55)$, $[55, 60)$, $[60, 65)$, or 65+ years and youngest child's age category of [0,4], (4,12], (12,18] or no children or children aged over 18 are determined based on their age in years and months as at January of 2020 (treated) and January of 2016 (controls). Marital status is interacted with the age of youngest child to create eight household categories.

Job characteristics are measured at baseline in January 2020 or January 2016, including information on: type of contract (permanent contract, fixed-term contract and other contract), type of job (regular job, and other job), and full-time/part-time employment status ($\geq$35 weekly hours, 20 $\leq$ hours $<$35, and $<$ 20 hours). Firm characteristics are based on the annual firm-level data measured in the preceding year, including information on firm size (0-19, 20-199, 200-499, and 500+ employees).

All categorical variables also include a dummy for missing values so that all observations can be included in the regressions avoiding sample selection issues.

3.2. Sample selection

We create a monthly panel for individuals who were in the BIG register and at least 18 years old in January 2020 or in January 2016 (the two baseline months). They can be employees, self-employed workers or non-employed persons, depending on the sample. Cohorts from both time periods are followed 12 months back in time up to January 2019 or January 2015, as well as three years after the baseline. The time periods for the two samples do not overlap. Should two jobs in salaried employment be observed in the same month for the same individual, only

the information for the main salaried job is retained to make the panel month-individual unique. The main job is the job with the highest number of paid working hours.

The two cohorts are constructed in this way so that the impact of COVID-19 on nursing - qualified workers'/healthcare workers' labour supply can be examined. Confirmed COVID-19 cases started spreading across the Netherlands from March 2020 onwards, and the lockdown imposed by the Dutch government also started in March 2020 (see Figure 1).

Starting from these two cohorts, four different samples are selected for the analyses:

1. To allow analysis of the exit from employment and exit from the healthcare sector, the first sample includes nursing-qualified workers who are employed (i.e., in salaried employment or self-employed) in a healthcare sector job at baseline.
    a. For the two cohorts, we have about 15 million observations over the four years for 200,000 employees on wages/salaries, about 324 thousand observations for 5,000 self-employed workers, and 350,000 observations for 5,800 nursing-qualified workers who fall in both categories.
2. To allow analysis of exit from other employment and entry into healthcare sector employment, a second sample includes nursing-qualified workers who are employed in non-healthcare sectors at baseline (about 1.23 million observations for 20,000 individuals).
3. To allow analysis of entry into employment overall and in the healthcare sector, a third sample includes nursing-qualified people who are not employed at baseline, neither as an employee or self-employed worker (about 675,000 observations for 14,000 individuals).
4. To enable a comparison to the first sample of nursing-qualified workers and to determine whether the results for nursing-qualified workers apply more broadly to health sector workers, a fourth sample includes healthcare sector professionals with a non-nursing BIG registration (about 9.9 million observations and 125,000 individuals).

3.3. Summary statistics

The dynamics for key outcome variables "employment" and "employment in the healthcare sector" for nursing-qualified workers in the healthcare sector at baseline (sample 1. above) are presented in Appendix Figure B.2. This shows the increased outflows from employment and from healthcare employment if remaining employed for men and women in the later cohort.

Due to the way the sample is constructed, everyone is employed in healthcare in January 2016 and January 2020. The patterns in 2015 and 2019 are very similar, except for a slightly higher inflow into healthcare employment for men in 2019. Overall, less than 2% entered employment or employment in healthcare in the previous year. The outflow from employment and from healthcare employment is quicker in 2020 than in 2016, especially for men.

Appendix Table B.1 (for women) and B.2 (for men) provide mean values for a number of key outcomes and individual and job characteristics for our four baseline samples (healthcare employees, self-employed healthcare workers, non-employed persons and workers outside healthcare) by cohort and sex where all individuals included have a nursing qualification. Although the Netherlands are representative of the developed world and similar to other countries with respect to healthcare workforce shortages, they are different from other countries in the high prevalence of part-time work. This is important context when interpreting results and assessing potential extrapolation of results to other countries. Among female employees 52.3% work part-time in 2022 in the Netherlands versus 24% in the OECD on average, and men also tend to be substantially more likely to work part time in the Netherlands than elsewhere (19.7% of male employment versus 9.6% for the OECD on average).[15] These proportions are even higher when considering nursing-qualified workers: over 80% for women and around 50% for men (see Appendix Table B.1 and B.2).

From 2016 to 2020, the population of nursing-qualified workers in the healthcare sector has become more female-dominated with the number of women increasing in all samples (except in the non-employed group) while the number of men decreased in all groups except for the self-employed which increased by nearly 50% (from a low base). The group of self-employed female nursing-qualified workers in healthcare also increased substantially by just over 40%.

For women, hours have increased in and outside the healthcare sector, but monthly work hours are 6 and 9 hours lower outside healthcare jobs in 2020 and 2016 respectively. Men work more hours than women in and outside healthcare and in both periods, but hours outside healthcare are also lower than in healthcare by about 6 to 8 hours per month. Real hourly wages and monthly earnings have declined from 2016 to 2020, and wages are slightly lower outside healthcare for women and men.

[15] See OECD data on the part-time employment rate (indicator) on https://doi.org/10.1787/f2ad596c-en (viewed on 13 July 2023).

For more information about the sample of analysis, see Appendix B and tables B.1 and B.2.

4. Methodology – Empirical model specifications

Using monthly information, we compare a range of outcomes for the universe of nursing-qualified workers in healthcare jobs in January 2020 to the universe of nursing-qualified workers in healthcare jobs in January 2016. By comparing outcomes of the stock of registered healthcare professionals who were in jobs in the healthcare sector in January 2020 with the stock of registered healthcare professionals who were in jobs in the healthcare sector in January 2016, any selection or confounder that is identical across the two cohorts is controlled for, limiting estimation bias due to these unobservable factors and making causal interpretation of the impact of COVID more plausible. Both salaried employees and self-employed workers are included. We follow these individuals for four years: one year before January 2020/2016 and three years after January 2020/2016.

This monthly information allows us to analyse the short- to mid-term consequences (up to the end of 2022) of the coronavirus waves and national lockdowns in the Netherlands over 2020 and 2021 on the nursing workforce. We analyse the impact of COVID-19 on the dynamics of employment, salaried employment, self-employment, employment in the healthcare sector, working hours, and hourly wages of nursing-qualified workers. A monthly Difference-in-Differences linear regression equation is specified:

$$y_{i\tau c} = \sum_{\substack{t=1 \\ t\neq 13}}^{48} \gamma_t DY_{2020}(c = 2020) \text{ x } DM_t(\tau = t) + \sum_{\substack{t=1 \\ t\neq 13}}^{48} \beta_t DM_t\,(\tau = t) + \delta DY_{2020}(c = 2020) + \eta' X_{ic} + \alpha_i + \varepsilon_{i\tau c} \quad (1)$$

$$i \in 1, \ldots, N; \tau \in 1, \ldots, 48;\ c = 2016, 2020$$

where (1) is a generic model for each outcome variable. The subscripts i, τ and c refer to individual, month and cohort year, respectively. January 2015 and January 2019 are month 1, while December 2018 and December 2022 are month 48. The vector γ includes the parameters of interest, measuring the impact on the outcome variable by month τ for the period 2019-2022 relative to January 2020, compared with the outcomes in the period 2015-2018 relative to January 2016. DY and DM are 0-1 indicator variables for cohort year and for month. Reference cohort year is 2016 and reference month is January 2016/2020 (or month $\tau = 13$). The variables in vector X_{ic} are time constant within the four years a cohort is observed but may

vary between 2015-2018 and 2019-2022; these variables are measured before baseline for both cohorts (see section 3.1) and are included to reduce variation that can be explained by differences in observables for the individuals included for the two periods.[16] Vector X_{ic} includes dummy variables for individual characteristics (own age, presence and age of children, and province of residence), job characteristics (type of contract, type of job, and full-time/part-time status), and firm characteristics (firm size). Individual fixed effects are represented by α. The parameter ε represents an idiosyncratic error term. Equation (1) is estimated by Ordinary Least Squares with the standard errors clustered by individual, and the samples are stratified by sex.[17] This specification controls for trends in inflows and outflows that are identical in the period 2015-2018 and 2019-2022, and differences between both cohorts in pre-baseline estimates signal a change in trend over time regardless of COVID-19.

To determine how the impact of COVID-19 varies among employees with different characteristics, we estimate a triple differences model. For ease of reporting, we estimate the triple differences model with a pre- versus post-COVID-19 dummy replacing the 48 dummy variables for the months, where the dummy "*post*" is defined as one if the month τ equals 15 or more (averaging the impact over all months after the start of the COVID-19 pandemic):

$$\begin{aligned} y_{i\tau c} = \alpha_i + [(\lambda' X^*_{ic}) \text{ x } DY_{2020}(c = 2020) \text{ x } post \\ + \gamma DY_{2020}\,(c = 2020)\text{x } post + (\kappa' X^*_{ic}) \text{ x } post + \beta\, post] \\ + (\mu' X^*_{ic}) \text{ x } DY_{2020}(c = 2020) + \delta DY_{2020}(c = 2020) \\ + \eta' X_{ic} + \varepsilon_{i\tau c} \end{aligned} \qquad (2)$$

$$i \in 1, \ldots, N; \tau \in 1, \ldots, 48;\ c = 2016, 2020$$

Where λ is the parameter of interest which represents the average difference in impact of COVID-19 between specific groups of interest relative to a reference group over the 34 months after the first lockdown due to COVID-19 in March 2020. Vector X^*_{ic} now also contains the person's time-constant country of birth (born in the Netherlands yes/no) in addition to the variables in X_{ic} of equation (1). Equation (2) is estimated for various samples stratified by sex.

[16] Results are robust to excluding the variables in X_{ic} from the regression equation.

[17] Year fixed effects cannot be included in this specification due to the cohort year and month dummies that have already been included.

5. Results

5.1. Nursing-qualified workers in the healthcare sector: inflows and outflows

5.1.1 Analysis of baseline sample of nursing-qualified workers in healthcare

Starting from the sample of nursing-qualified workers who had a BIG registration and who were an employee or self-employed in the healthcare sector at baseline in January 2020 (treatment cohort) or in January 2016 (control cohort), we trace the difference in inflows (in the first year: 2019 compared to 2015) and outflows over the three years after the baseline date (from January 2020 onwards compared to from January 2016 onwards).

Using Equation (1), estimated impacts on overall employment (again including employees and self-employed) and employment in the healthcare sector conditional on being in employment (including employees and self-employed) are presented in Figure 2 with results for women and men presented side by side.

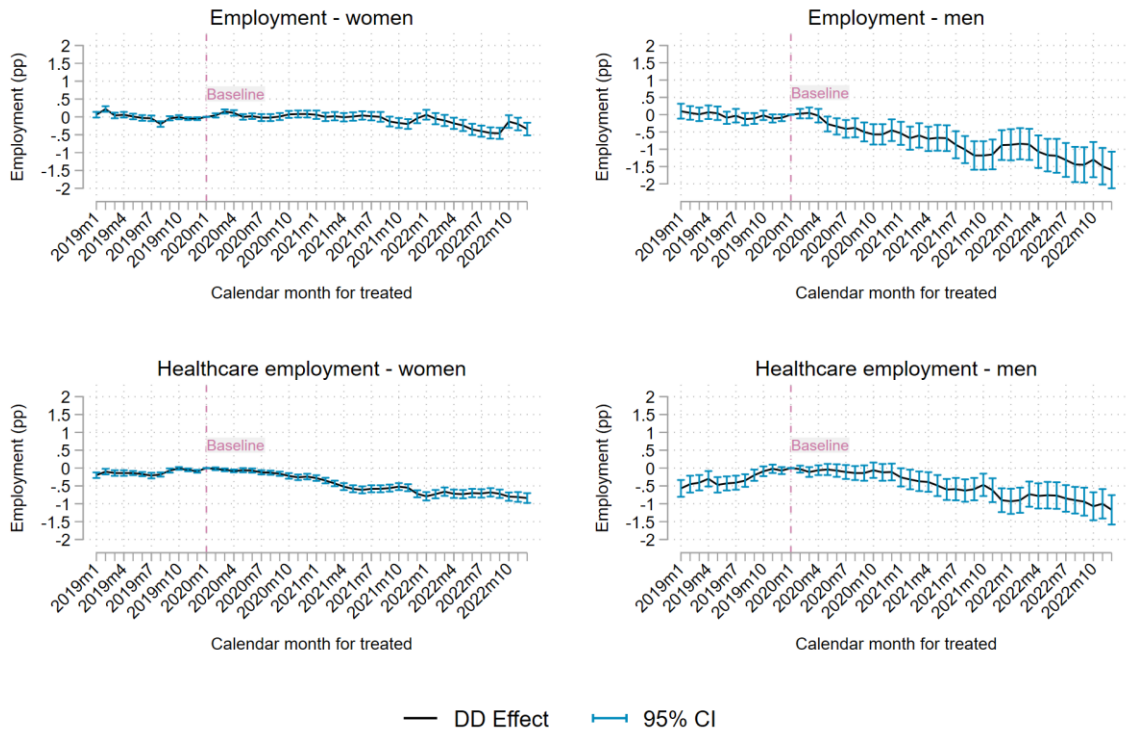
The graphs for women show that the trends in the year before the baseline month were the same for women in 2015 as for women in 2019 before COVID-19 commenced. These parallel trends indicate that the pattern of inflow into employment and healthcare employment by nursing-qualified workers was very similar in 2015 and 2019. Parallel trends are also observed for men's employment but not for men's employment in the healthcare sector. Figure 2 indicates that men's employment in the healthcare sector (conditional on being in employment) was increasing more quickly in 2019 than in 2015, since fewer of the men employed in the healthcare sector in January 2020 were employed in the healthcare sector one year earlier compared to men employed in the healthcare sector in January 2016.

In the third year after the baseline month, there is some evidence that the post-COVID treatment group of women is leaving employment slightly faster than the pre-COVID control group of women, so that by the end of 2022 there is an additional 0.3 percentage point increase in the proportion of women who have left employment (and thus the healthcare sector). And conditional on being employed, there is substantial evidence that even those who remain employed are leaving employment in the healthcare sector more quickly from mid-2020. As a result, by the end of 2022 they are 0.8 percentage points more likely to have left (than the 2016 Cohort is to have left by the end of 2018).

The patterns are similar but the impacts are much larger for men than for women, so that these impacts are still significant despite the larger standard errors around the point estimates because of the smaller sample size for men. Men in the treatment group are 1.6 percentage points less

likely to still be in employment by the end of 2022, and if still employed, they are 1.2 percentage points more likely to have left the healthcare sector. The difference in healthcare employment between the 2016 and 2020 Cohorts is significant for men (at the 5% level) only from February 2021. For women, the difference in healthcare employment between the two cohorts is significant from July 2020.

Figure 2 Impacts on employment and healthcare employment for nursing-qualified workers in healthcare at baseline



Notes: 1) Graphs are based on results from estimating equation (1) for women and men separately. Baseline is January 2020 for the 2020 Cohort and January 2016 for the 2016 Cohort, and the period under observation is January 2019 up to December 2022 for the 2020 Cohort which is compared with January 2015 up to December 2018 for the 2016 Cohort. Blue vertical lines indicate the confidence intervals for the point estimates.
2) The employment outcome equals one for employees and self-employed, and zero for the non-employed. The employment in healthcare outcome is conditional on being employed, and is missing for non-employed persons. The *y*-axis depicts the difference in the change in probability of being employed (relative to the respective baselines) over time between the 2020 Cohort and the 2016 Cohort.
3) All workers were nursing-qualified and employed in the healthcare sector at baseline. The female employment graph is based on 14,688,864 observations for 183,095 women; the male employment graph is based on 2,124,528 observations for 26,756 men; the female employment in healthcare graph is based on 14,225,897 observations for 183,087 women; and the male employment in healthcare graph is based on 2,040,695 observations for 26,756 men.

Estimates from the triple differences model of Equation (2) assist in better understanding some of the patterns in labour supply by showing for whom the changes are largest and smallest. We examine the coefficients of the triple interaction terms which include the "DY" variable indicating the cohort, the "post" variable indicating the period during and after the COVID-19 pandemic, and the observed individual characteristics (see Appendix Table B.3 for the results

for women). The estimate for each age category, for example, measures the impact of treatment (i.e., 2020 Cohort compared to 2016 Cohort) averaged over the three years since baseline, taking into account pre-baseline changes for the 2020 Cohort compared to the 2016 Cohort, relative to the reference group of 35- to 45-year-old women. Based on this analysis, a few observations can be made.

Compared to the reference group, women between 55 and 65 appear more likely to remain employed overall (i.e., in any sector) in the post-COVID period (by 0.8 to 4.3 percentage points) than in the earlier period compared to younger women (where there was no change or a smaller impact of 0.3 percentage points) and compared to women over 65 (whose employment decreased by 8.4 percentage points).[18]

However, conditional on employment, younger (18 to 25) and older (60 and older) nursing-qualified female workers were more likely to leave the healthcare sector in the later period (by 0.5 to 0.6 percentage points over the reference 1.3 percentage point increase in leaving for 35- to 45-year-old women) especially if they were over 65 years of age when the probability of leaving increased by an additional 6.2 percentage points post COVID, compared to the reference group of 35- to 45-year-old women. In addition, workers over 65 also reduce their hours of work by 10.8 percentage points more than in the later period, while young workers aged 25 to 35 increase their hours by 0.7 percentage points more.

Similar to what is observed for women, older men (55 to 65) are 0.8 to 2.8 percentage points more likely to remain employed while men over 65 are 8.4 percentage points less likely to remain employed in the later period, compared to the reference group of 35- to 45-year-old men (see Appendix Table B.4 for the results for men).[19] Finally, conditional on employment there is no significant heterogeneity effect on leaving the healthcare sector for those under the age of 65. In contrast, compared to the reference category, men over 65 are 6.8 percentage points less likely to remain working in the healthcare sector in the post-COVID period and they

[18] In January 2020 1.1% of female workers in the healthcare sector are over age 65 while this was only 0.4% in January 2016 (although this still adds up to just over 500 workers). This increase is likely at least partly due to the increase in age pension age from 65 and 3 months in January 2016 to 66 and 4 months in January 2020. This may have led the group of women just below this age to delay leaving employment while the potentially changed group composition of the women over 65 may have led to an increase of women leaving employment as soon as they become eligible for age pension in 2020, while in 2016 the smaller group of women still working over 65 were more likely to do so by choice.

[19] The increase in men working beyond age 65 is even larger than for women, with 0.5% of healthcare sector workers over 65 (just over 100 workers) in 2016 compared to 2.9% of healthcare sector workers in 2020.

reduce their hours worked by 17.7 percentage points more than men working in the healthcare sector in the earlier period.

These triple difference results are consistent with the Difference-in-Difference results discussed earlier in this section and they indicate that among nearly all age groups (with the exception of 55- to 65-year-old men and women), workers in the healthcare sector are more likely to leave in the post-COVID period than in the earlier period, and for men and women over 65, if they are not leaving, they are reducing their hours worked.

The presence of a partner and children appears relevant for limited observed impacts, where partnered women with children under 12 were 0.4 percentage points less likely to remain employed anywhere compared to the impact on overall employment for single women. The impact on employment in the healthcare sector is the same for all women regardless of household composition.

There is no heterogeneity impact on employment in the healthcare sector for men considering household composition, but there are various heterogeneity effects on overall employment for men. Single nursing-qualified fathers with children aged 4 to 12 who were employed in healthcare at baseline were 2.9 percentage points less likely to remain employed post-COVID compared to single men without children under 18, while partnered nursing-qualified men without children (under 18) were 0.8 percentage points less likely to remain employed.

Other important characteristics include the type of contract, with women on a fixed-term contract being 0.9 percentage points more likely to remain employed in the post-COVID period compared to women on a permanent contract. Women with a small part-time job (20 hours or less) were 0.5 percentage points less likely to remain in healthcare (conditional on remaining in employment) than women working more than 20 hours a week. Size of the employer also seems to matter to some degree, but only for women, with a larger employer (a firm with 20 or more employees) making it 0.8 to 1 percentage point more likely for women to remain in the healthcare sector in the post-COVID period compared to women employed at a firm with less than 20 employees. Women working for a medium-sized employer (20 to 199 employees) are 0.9 percentage points more likely to remain employed in the post-COVID period. Whether or not someone was born in the Netherlands generally seems irrelevant for nursing-qualified women and men born elsewhere in terms of employment outcomes post-COVID.

Men who were self-employed at baseline, are 1.1 percentage points more likely to remain employed in the post-COVID period than men who were employees. These men were also 1.6

percentage points more likely to remain in the healthcare sector conditional on being in employment (or 2.4 percentage points more likely to remain in the healthcare sector considering the full sample of men including those in non-employment; this result is available upon request). Although women who were self-employed at baseline were not more likely to remain employed in the post-COVID period, conditional on being in employment, they are 0.9 percentage points more likely to remain in the healthcare sector and their working hours increased by 1.9 percentage points more than women who were employees. This finding suggests self-employed women in the later period are more likely to move to salaried employment or combine self-employment with salaried employment. Overall, this seems to indicate that self-employment could potentially strengthen nursing-qualified workers attachment to the health workforce.

5.1.2 Flows between salaried employment and self-employment

Focussing on the flows to and from self-employment, Figure 3 shows that in the year preceding the baseline, parallel trends in self-employment and in salaried employment are observed for male and female nursing-qualified employees in the healthcare sector in the 2020 and 2016 cohorts relative to the baseline month (January 2020 and 2016 respectively).[20] This indicates that the two groups experienced very similar percentage point changes in self-employment and salaried employment, thus confirming the suitability of the control group for analysing the impact of COVID. That is, the Difference-in-Differences approach can account for the already existing upward trend in self-employment.

From April 2020 onward (after the pandemic started), the share of the sample in self-employment increased more quickly in 2020 than in 2016, with the rate of additional increase becoming substantially larger from September 2021 onwards.[21] At its peak, the additional increase in female self-employment was 1.4 percentage points more in June 2022 than in June 2018. The increase in self-employment remains higher post-COVID than was the trend before COVID, but compared to its peak, the additional increase is smaller from July 2022 onwards (decreasing to 1 percentage point in December 2022). This, combined with the bottom graph for women in Figure 3, showing a decrease in salaried employment by 0.9 percentage points in

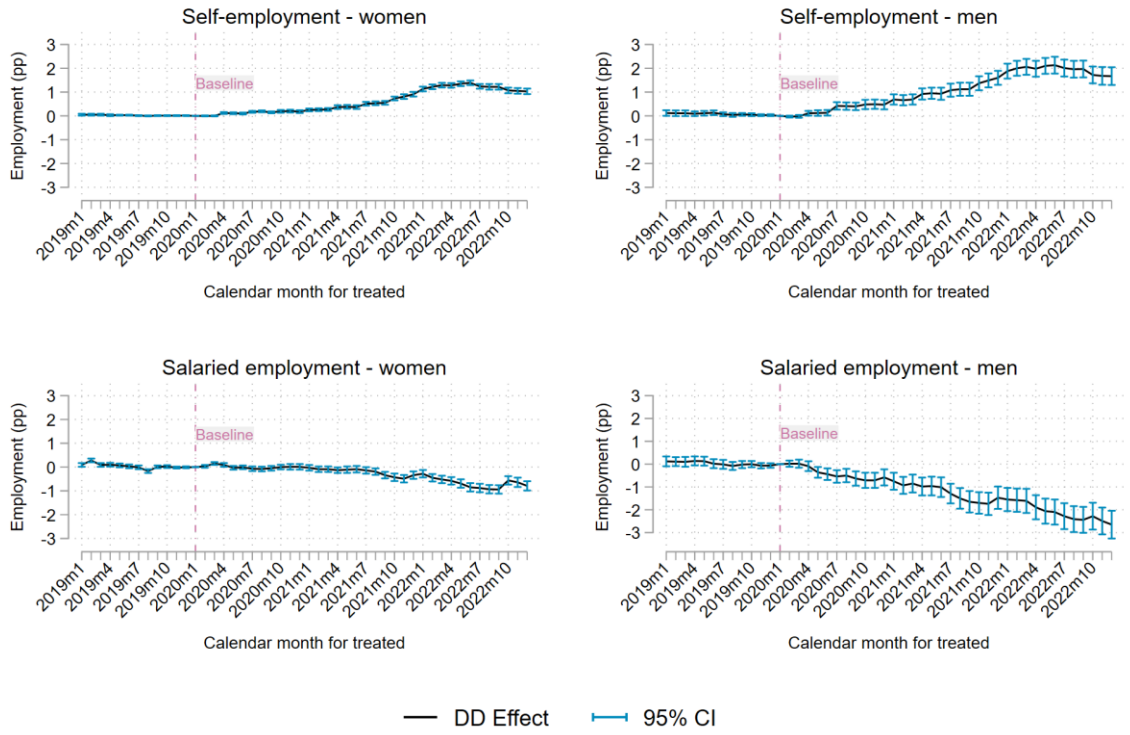
[20] Employees who were also self-employed in another job at the same time were excluded from this sample.

[21] Self-employment and salaried employment before or after the baseline month can be in the healthcare sector or in another sector. Workers could also be an employee and self-employed at the same time.

September 2022 which improves in the final months of 2022, indicates a slight recovery of the proportion in salaried employment in the final months of 2022.

For male employees in the healthcare sector (who were not a self-employed worker at the same time at baseline), the larger increase in the proportion of self-employed workers of 2.1 percentage points in May-July 2022 (decreasing to 1.7 percentage points increase by the end of 2022) is smaller than the around 2.7 percentage point larger decrease in salaried employment by the end of 2022 for this cohort of men. This suggests that a larger share of male nursing-qualified workers of the January 2020 Cohort may have left salaried (and self-) employment for non-employment by the end of the observation period than is the case for the January 2016 Cohort. The results in Section 5.1.1 show that this was indeed the case with the proportion in any employment decreasing by 1.6 percentage points more towards the end of 2022 compared to the earlier period.

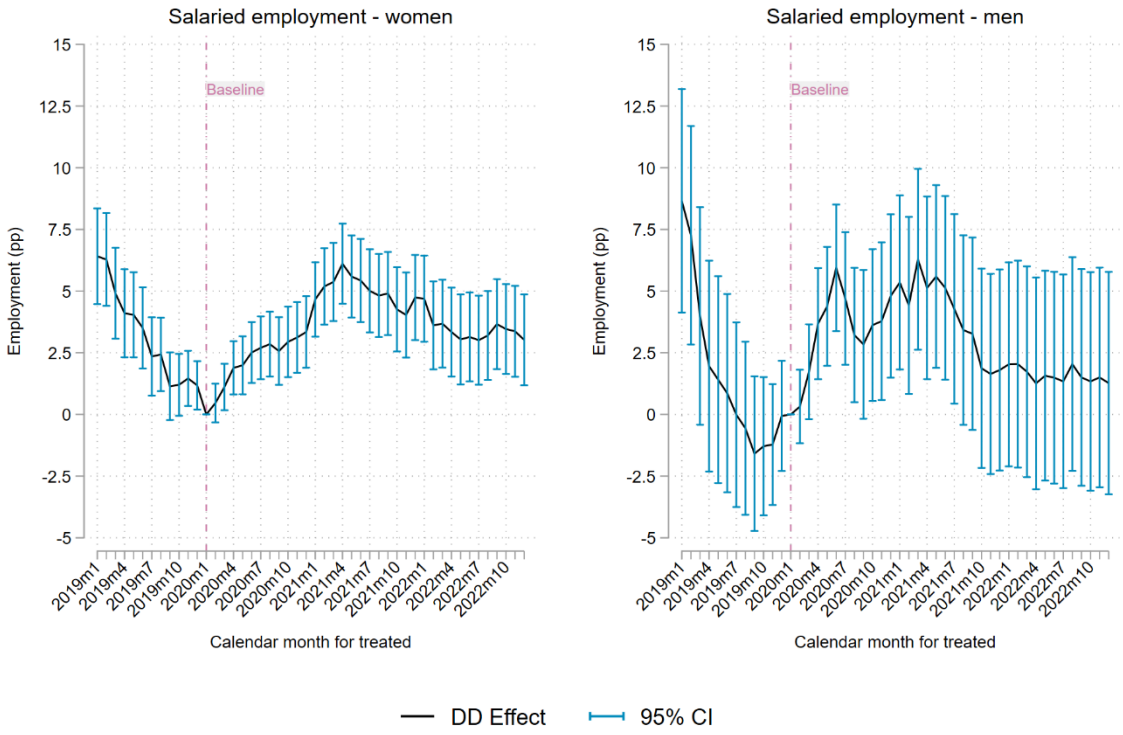
Figure 3 Impacts on self-employment and salaried employment for nursing-qualified workers in salaried employment at baseline (and <u>not</u> self-employed at the same time)



Notes: 1) See note 1 to Figure 2.
2) All workers were nursing-qualified and an employee in the healthcare sector at baseline. The *y*-axis depicts the difference in the change in probability of being self-employed (in the two top graphs) or being in salaried employment (in the two bottom graphs) over time in months (relative to the respective baselines) between the 2020 Cohort and the 2016 Cohort. At baseline, employees who are also self-employed are excluded from the sample. However, in earlier or later months, observations where someone is an employee as well as self-employed in another job at the same time are included. The female graphs are based on 13,936,896 observations for 175,782 women; the male employment graphs are based on 1,940,160 observations for 24,896 men.

The additional self-employment has largely come from salaried employment, where employment has reduced by almost 1 percentage point for women by December 2022. Figure 4 shows that self-employed female nursing-qualified workers who were in healthcare at the 2020 baseline (and not also an employee at that time) experienced a larger increase in (also) working as an employee after the baseline which is at its highest in April 2021 (6.1 percentage points more than for the 2016 Cohort) after which it decreases to 3 percentage points above the trend for the 2016 Cohort by the end of 2022.

Figure 4 Impacts on salaried employment for nursing-qualified workers who were self-employed at baseline (and <u>not</u> in salaried employment at the same time)



Notes: 1) See note 1 to Figure 2.
2) All workers were nursing-qualified and self-employed in the healthcare sector at baseline. The y-axis depicts the difference in the change in probability of being an employee over time in months (relative to the respective baselines) between the 2020 Cohort and the 2016 Cohort. At baseline, self-employed workers who are also an employee are excluded from the sample. However, in earlier or later months, observations where someone is an employee as well as self-employed in another job at the same time are included. The female graphs are based on 272,688 observations for 4,331 women; the male employment graphs are based on 51,408 observations for 817 men.

Similar to the outcomes of female workers in the healthcare sector who were self-employed in January 2016/2020, we see that a larger proportion of male workers have transitioned from salaried employment to self-employment in 2019 than in 2015. For men this was 8.7 percentage points more in 2019 than in 2015. There is a steep increase in the later period in the proportion of self-employed workers who return to salaried employment (or at least combine self-

employment with salaried employment) after the baseline month. This increase is quicker and steeper than for women but levels out after June 2020 (after a high of 5.9 percentage points) and declines after March 2021, until it remains at a steady (but insignificant) 1 to 2 percentage point higher increase in 2022 (compared to the earlier cohort in 2018).

These large percentage increases in salaried employment starts from a relatively low base of self-employed workers (of around 4,000 self-employed female workers and 800 self-employed male workers compared to the 175,000 female employees and 25,000 male employees), and the increase in self-employed workers transitioning from salaried employment is therefore still much larger than this reverse flow back to salaried employment. In addition, in the year before baseline, there was a 6.4 percentage point larger inflow in self-employment from employees during the later period, although this could just be workers combining salaried employment with self-employment before the baseline month, who left their salaried employment in the year preceding the baseline month. As a result, the proportion of workers in self-employment grows overall.

The patterns observed for men are similar to those for women, except that the relative decrease in salaried employment is much larger for men than for women, and the relative increase in self-employment is also larger with the decrease in salaried employment nearly fully compensated by the increase in self-employment up to June 2022.

Estimates from the triple differences model may assist in better understanding some of the patterns of entering self-employment for nursing-qualified workers in salaried employment at baseline. Among post-COVID women, younger (18 to 35) nursing-qualified workers were 0.5 percentage points more likely to become self-employed, whereas older (45 to 65) nursing-qualified workers were 0.5 to 0.6 percentage points less likely to become self-employed, compared to the reference group of 35- to 45-year-old nursing-qualified workers (see Appendix Table B.5). This is complemented by older women (aged 55 to 65) being 1 to 4.6 percentage points more likely to remain in salaried employment post-COVID than 35- to 45-year-old post-COVID women.

In addition, nursing-qualified single mothers with children up to 12 years were 1.3 to 2.1 percentage points more likely to become self-employed, relative to single nursing-qualified workers of the 2020 Cohort. Partnered women without children or with children aged 0 to 4 are slightly less likely to become self-employed compared to single women without children under 18 years of age. Nursing-qualified female workers who were not born in the Netherlands

were 1.7 percentage points more likely to become self-employed relative to workers in the 2020 Cohort who were born in the Netherlands compared to similar groups of workers in the 2016 Cohort.

Again, similar patterns are observed for men. We find that older (55 to 65) nursing-qualified workers were 1.2 to 1.4 percentage points less likely to become self-employed and nursing-qualified workers aged 60 to 65 were 2.5 percentage points more likely to remain in salaried employment, while younger workers (under 25) were 1.5 percentage points less likely to remain in salaried employment, compared to the reference group of 35- to 45-year-old men (see Appendix Table B.5). Otherwise, there are few to no significant triple interaction effects for other groups, with an overall insignificant effect estimated for the reference category and insignificant coefficients for most variables.

5.1.3 Impacts on working hours, and on nominal and real hourly wages

To complement the analysis on entry and exit from employment, Figure 5 presents impacts on log paid working hours, log nominal hourly wages and log real hourly wages, for all nursing-qualified women and men who worked in the healthcare sector at baseline (i.e., the same population as in Section 5.1.1). This can further assist in understanding the observed changes.

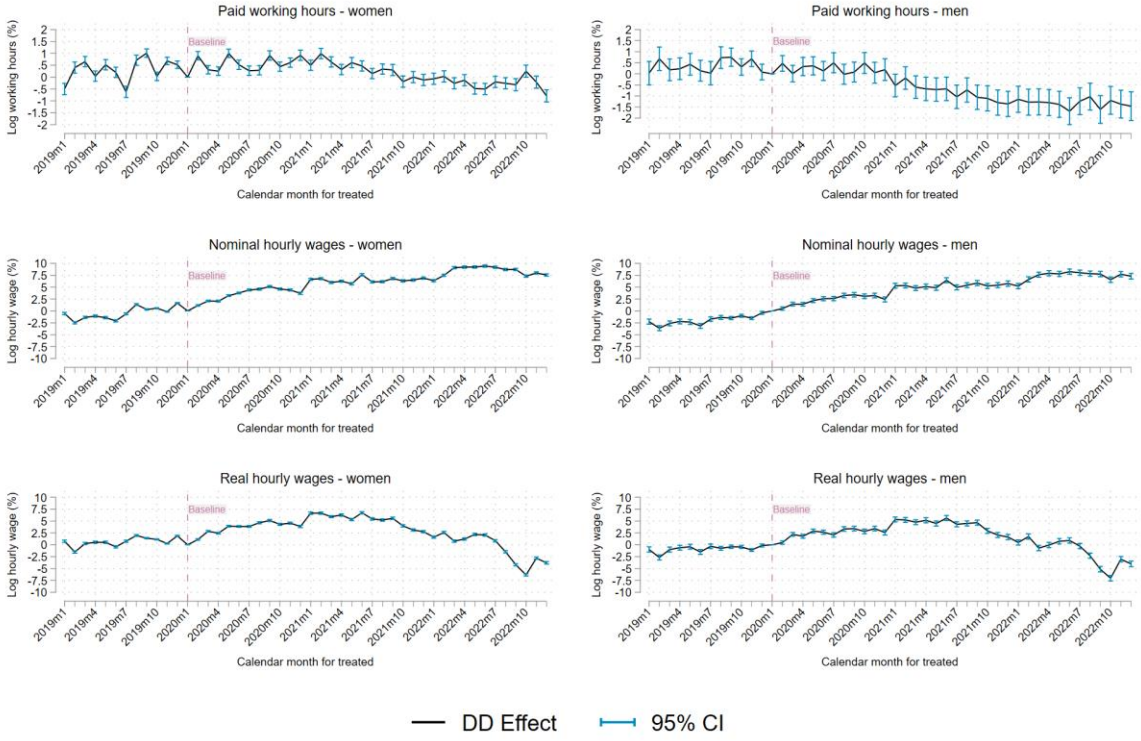
The pattern in paid working hours is quite different for men and women, with men experiencing a large (significant) decrease of 1.5% towards the end of 2022, while women experience little change in working hours, with changes fluctuating around zero. Most changes are not significantly different from zero for women, except for a light increase during the COVID period from February 2020 to June 2021, and a light decrease of up to 0.8% towards the end of 2022.[22] This different pattern may be (partly) an artefact of men being more likely to combine salaried employment with self-employment;[23] and with self-employment increasing, a larger share of men work relatively fewer hours in salaried employment (while hours worked in self-employment are not reported). However, the number of self-employed workers is still relatively small and would have a small impact only, so men appear to not only have been more likely to

[22] In a robustness check, similar but slightly larger negative impacts are observed when including non-employed persons with zero hours where an hours model is specified in levels. These results are available upon request.

[23] At baseline, 1,100 out of 26,756 male nurses (4.11%) and 4,702 out of 183,095 female nurses (2.57%) combined salaried employment with self-employment in the healthcare sector.

leave salaried employment in healthcare but also to work fewer hours compared to the earlier period, if not leaving.[24]

Figure 5 Impacts on working hours, and nominal and real wages for all nursing-qualified workers in the healthcare sector at baseline



Notes: 1) See note 1 to Figure 2.
2) All workers were nursing-qualified and in salaried employment or self-employed in the healthcare sector at baseline. The *y*-axis depicts the difference in the change in working hours, nominal hourly wages and real hourly wages (relative to the respective baselines) over time between the 2020 Cohort and the 2016 Cohort. Working hours and wages are only observed for salaried employees. The female graphs are based on 13,977,331 observations for 181,408 women; the male graphs are based on 1,986,798 observations for 26,449 men. There are slightly fewer observations for the hourly wage analyses than for the working hours analyses.

Figure 5 also presents information on nominal and real hourly wages. This shows that the patterns of nominal and real hourly wages are very similar for men and women with the rate of increase of the nominal wage more since the start of the pandemic (compared to four years ago), while they were more or less the same in the year before baseline (compared to four years

[24] This is evident when repeating the analysis for nursing-qualified male and female employees in the healthcare sector (excluding self-employed workers). The overall negative effect for this group (who are less likely to combine self-employment and salaried employment) is similar or slightly larger at -0.8 percentage points for women and -1.8 percentage points for men in December 2022. This indicates that for this group with fewer people combining self-employment and salaried employment results still show the same or larger decrease in average working hours in the post-COVID period.

ago).[25] In December 2022, nominal wages are around 7.5% higher for the January 2020 Cohort than for the January 2016 Cohort (slightly down from a high of close to 10%).

However, high inflation in the later months of the 2020 Cohort severely affects real hourly wages: a large increase by 7.5% in the first half of 2021 declined to around zero in March 2022, and by the end of 2022 there was a decrease of around 4% compared to the period before COVID. The large nominal wage increase has been more than wiped out by the high inflation during this period. Employees in the healthcare sector without a nursing qualification and employees with a nursing qualification outside the healthcare sector experienced much lower (and less persistent) relative increases, and they had a larger decrease by the end of 2022 of 6.3% for women outside healthcare and around 8% for the other three groups.[26] This suggests that it has become slightly more financially attractive to work in nursing relative to other occupations in the later period than in the earlier period.

We test the importance of pay in job choice empirically by examining wage changes for those who switch from healthcare employment to non-healthcare employment. Appendix Figures B.3 to B.5 present results on hours worked, and real hourly wages and monthly earnings for men and women employed in healthcare versus men and women who transitioned to employment outside of healthcare.[27] At baseline, all men and women had a nursing qualification and were employed in the healthcare sector. The graphs show that those who exit the healthcare sector soon after baseline in the 2020 Cohort, experienced an increase in hours and wages in the non-healthcare sector compared to those who left soon after baseline in the 2016 Cohort. Wages also increased for those remaining in the healthcare sector, but wages increased by more for those who moved outside the healthcare sector. This suggests that men and women who left the healthcare sector for employment outside healthcare in 2020 moved to employment with, on average, more hours and higher pay than those who moved in 2016. This indicates that, in

[25] They are not exactly zero as the relative change in wages depends on the exact point in time that a wage increase is implemented which occurs in discrete steps so if wages increased steadily, you would expect the graph to show a line fluctuating around zero.

[26] These results are available from the authors upon request.

[27] These are descriptive results (and do not imply any causal relationships) as we do not take into account selection into other employment but treat it as an exogenous event in this analysis.

the first year after baseline, real wages in healthcare had increased by less (decreased by more) than real wages in jobs available to nursing-qualified workers outside healthcare.[28]

Due to the relatively small size of the groups leaving healthcare, the confidence intervals around point estimates are rather large making many results insignificant (especially for men). Following the initial period (after January 2021 for hours worked and after July/August 2021 for hourly wages), the sample of those who work outside the healthcare sector increases leading to more narrow confidence intervals. However, the impacts on hours and real wages also change, so that those in the 2020 Cohort who exited in this later period work on average fewer hours a month and have the same or a lower earnings increase (or a larger decrease) than those in the 2016 Cohort who exited in the later period. This holds for both men and women. It is not clear why those who exit from the healthcare sector in 2021 and 2022 exit to lower hours (compared to 2017 and 2018) than those who exit in 2020 (compared to 2016). The changed impact on real hourly wages for those who exit in late 2021 and 2022 is likely due to the substantial wage increases in healthcare that were provided in 2021 and 2022 (see Figure 5 in Section 5.1.3). These increases were larger than those provided in other sectors.[29]

5.2. Inflow of nursing-qualified people from non-healthcare employment and non-employment

Outflow from current healthcare workers is just one side of the equation, and therefore inflow of healthcare workers from other occupations and from non-employment is also analysed. The results discussed in Section 5.1.3 imply that employment in the healthcare sector should have become more attractive financially in the later period. The question is whether this has had an impact on nursing-qualified people entering healthcare. The analysis in this section is based on two samples of nursing-qualified people with a BIG registration: one group who are employed or self-employed in the non-healthcare sector, and another group who are non-employed. Both groups are potentially immediately available to work in the healthcare sector as a nurse as they have the required qualifications and are registered. The outcome variables of interest are

[28] This is supported by the average wage reported for nursing-qualified women and men employed in and outside the healthcare sector (see Appendix Table B.1 and B.2). The decrease in average real wage from January 2016 to January 2020 for workers employed in the healthcare sector was larger than the decrease for workers outside the healthcare sector.

[29] In 2021, the healthcare sector had the highest increase in collective labour agreement wages at 2.9% compared to an average increase by 2.1%, while in 2022, the wage increase was among the highest at 3.3% compared to an average of 3.2% with only four out of the 19 sectors experiencing higher wage increases (CBS, 2023).

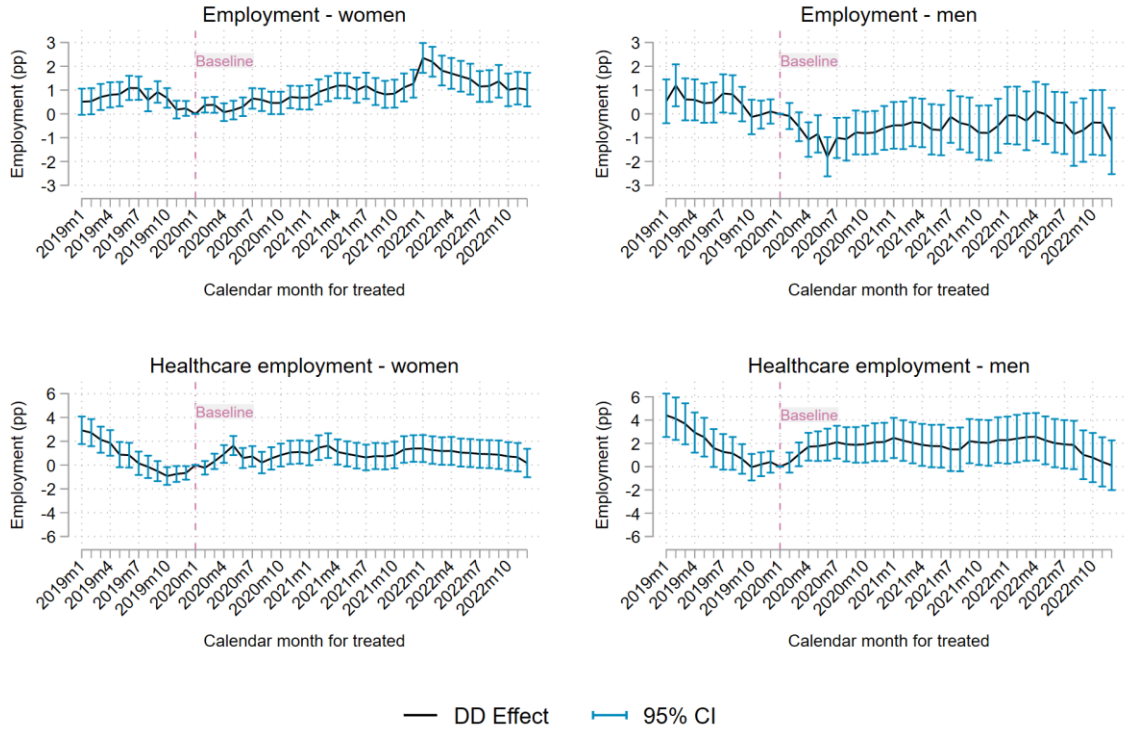
employment and employment in the healthcare sector, to examine entry into healthcare by nursing-qualified individuals.

Figure 6 presents the results for employed nursing-qualified workers outside the healthcare sector. We observe that fewer women with a nursing qualification leave employment after COVID than before (with significant differences of 1 to 2 percentage points from July 2021). There was also a slight tendency for lower inflow into employment in 2019 than in 2015 (i.e., a larger proportion of women was already employed before the year preceding the baseline). Not much is significant for men, except during the first few months of COVID (from March to November 2020) when employment decreased more than in the earlier period, which is in line with what was observed more generally in the Netherlands during COVID (Hassink et al., 2021; Meekes et al., 2023). These results differ from what is observed for nursing-qualified workers in the healthcare sector, where, for male workers in particular, an increased outflow from employment is observed in the 2020 Cohort with the outflow from employment steadily increasing relative to the 2016 Cohort. These stronger employment outcomes for women outside the healthcare sector are in line with the lower unemployment rates in the later period: 4.4% in 2019 reducing to 3.5% in 2022 (4.9% in 2020) versus 7.9% in 2015 reducing to 4.9% in 2018 (CBS, 2023).

The changes in healthcare employment in the year before baseline are larger than for overall employment. There is a continuing decline in healthcare employment, with a higher outflow from healthcare jobs in the year preceding the baseline in 2019 than in 2015. This is consistent with the increased outflow from healthcare sector employment observed for men and women in the later period in Figure 2. There are hardly any significant differences between the earlier and later group for women in the three years following the baseline, although there is a larger inflow in healthcare employment in the later period with an occasional significant impact. For men, the increase in inflow in healthcare is just significant from March 2020 to July 2021 and varies between 1 and 2.5 additional percentage points, and then again during several months in 2022 with around 2 percentage point higher inflows in the later period. These increases could be due to COVID with push factors (increased unemployment in non-essential sectors) and pull factors (increased demand in healthcare) playing a role, but by the end of 2022 there is no longer a difference.

Triple difference results (not included but available upon request) do not show any significant patterns for this group. This may be partly due to its relatively small sample size.

Figure 6 Impacts on employment and healthcare employment for nursing-qualified workers employed outside the healthcare sector at baseline

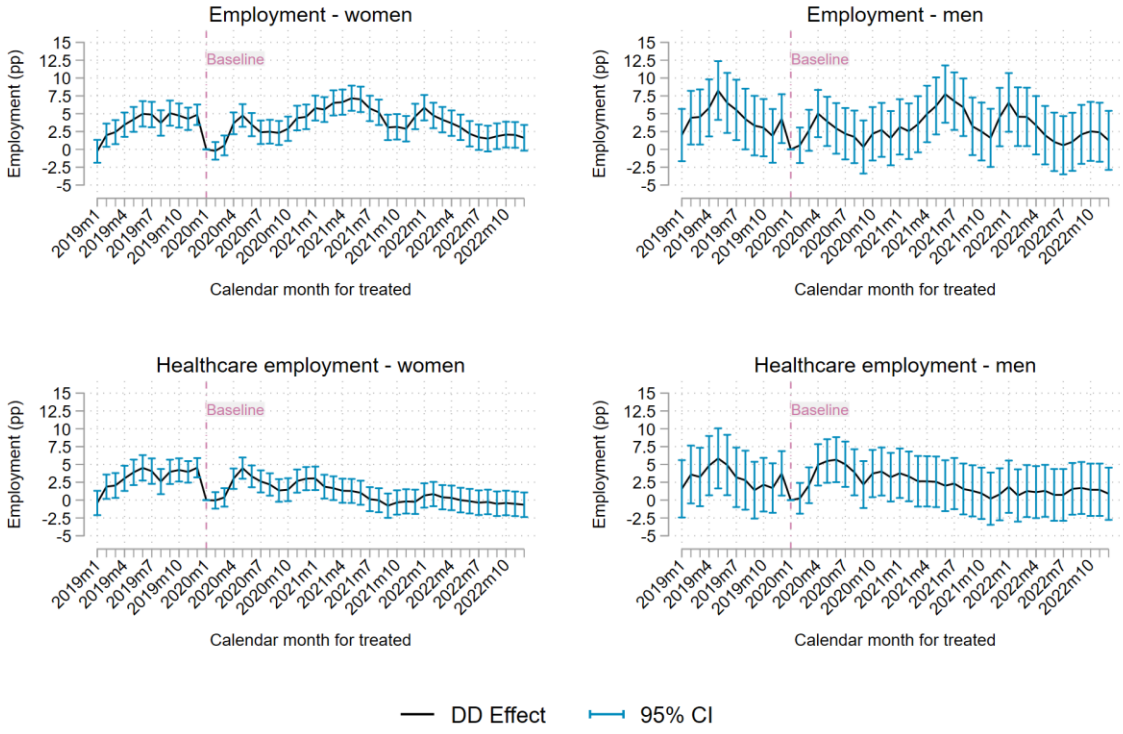


Notes: 1) See notes 1 and 2 to Figure 2.
2) All workers were nursing-qualified but employed outside of the healthcare sector at baseline. The female graphs are based on 969,744 observations for 15,926 women; the male employment graphs are based on 263,568 observations for 4,118 men. There are slightly fewer observations for the healthcare employment analyses.

The results for nursing-qualified men and women who were not employed at baseline are presented in Figure 7. A larger proportion of these men and women were employed in the year preceding baseline in the later period than in the earlier period, although the difference again becomes smaller exactly one year ago: no difference for women and an insignificant difference of 2.0 percentage points more for men, after a difference of up to 5.1 percentage points for women and 8.3 percentage points for men closer to the baseline. In the three years following baseline, women's employment increases by more in the later period, up to a maximum of 7.2 percentage points more in May 2021, but this declines to around 2 percentage points more by the end of 2022. The impacts for men vary between no impact by the end of 2022 and 7.8 percentage points (in June 2021) with many impacts insignificant due to the smaller sample size leading to larger confidence intervals. The positive results for women, which are significant in most months, seem to indicate that non-employment is more likely to be a temporary situation in the later period compared to the earlier period.

The results for the year preceding the baseline are very similar for the probability of being in employment and the probability of being in healthcare employment.[30] In the three years after baseline, relatively few differences in healthcare employment between the two periods are significant, except for the months between April 2020 and March 2021 for women when there is a 1.4 to 4.5 percentage point larger increase in the inflow into healthcare employment in the later period. For men, there is a larger inflow (of up to 5.7 percentage points) into healthcare employment in most months between April 2020 and February 2021.These impacts seem to point to an increased inflow in healthcare when the COVID-19 pandemic was at its peak.

Figure 7 Impacts on employment and healthcare employment for nursing-qualified persons who were not employed at baseline



Notes: 1) See notes 1 and 2 to Figure 2.
2) All workers were nursing-qualified but not in salaried employment or self-employment at baseline. The female graphs are based on 573,696 observations for 11,671 women; the male employment graphs are based on 102,480 observations for 2,084 men. There are slightly fewer observations for the healthcare employment analyses.

The triple differences results for the non-employed sample (available upon request) show very limited variation in impacts by personal and household characteristics with just a few exceptions (again, possibly due to the relatively small sample sizes). For women, the impact

[30] For this specification we do not condition on being in employment as the model would have zero observations at baseline due to the specific sample of analysis.

on employment varies slightly depending on the province of residence. For men under 25, the probability of employment has increased by 20 percentage points more than for the reference group of 35- to 45-year-old men in the 2020 Cohort. Compared to the reference group, the results show that nursing-qualified non-employed men aged between 45 and 55 had a 25.8 percentage point higher decrease in healthcare employment post-COVID while for men over 65 the decrease was 17.2 percentage points higher.

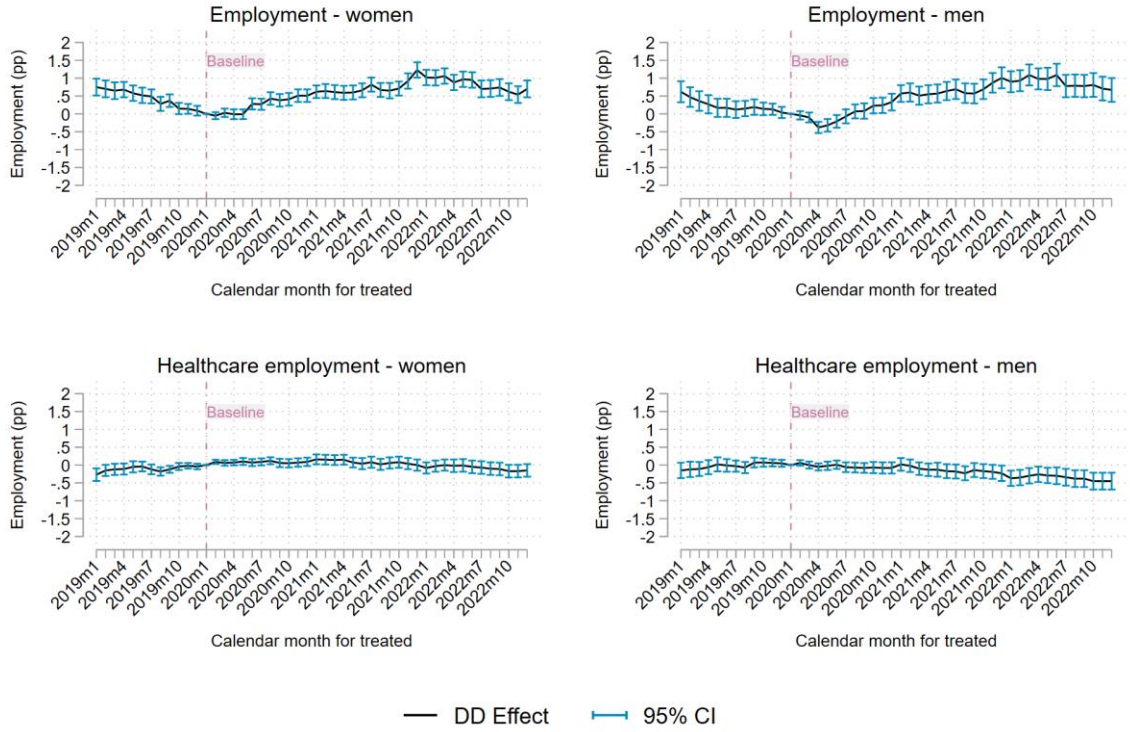
5.3. Nursing-qualified workers versus other healthcare professionals

The question of whether the observed patterns of employment and employment in healthcare are unique to nursing-qualified workers or whether they are observed more broadly in the healthcare sector is addressed by comparing the nursing-qualified workers' outcomes to the same outcomes for other health professionals.

Figure 8 shows that any impacts for other health professionals compared to those observed for nursing-qualified workers are small and often insignificant. In 2020, non-nursing qualified women who were employed in the healthcare sector at baseline are 0.8 percentage points more likely to already have been employed one year ago, and they are also up to 1 percentage point more likely to remain employed by early 2022, which reduces slightly to 0.7 percentage points by the end of 2022. Conditional on being in employment any differences in the proportion in healthcare employment between the 2016 and 2020 Cohorts are minimal (0.1 to 0.2 percentage points) and often insignificant. There was a 0.3 percentage point larger new inflow in 2019 than in 2015, and by the end of 2022 there was a 0.2 percentage point larger outflow than in 2018.

Similar small impacts are observed for non-nursing-qualified men. In 2019 there was a 0.6 percentage point smaller inflow into employment (i.e., at baseline they were 0.6 percentage points more likely to already have been employed one year ago), and from April to October 2020 there was a 0.2 to 0.4 percentage point larger decrease in employment relative to the baseline than in 2016 (likely due to the impact of COVID-19 lockdowns). From October 2020, small significant increases in employment relative to the baseline of 0.2 to 1.1 percentage points are observed for the 2020 Cohort compared to the 2016 Cohort. There are very few differences between the two cohorts in terms of healthcare employment, and until August 2021 none of the small differences are significant. From August 2021, the decrease in healthcare employment (relative to baseline) was 0.2 to 0.5 percentage points larger for the later cohort.

Figure 8 Impacts on employment and healthcare employment for healthcare professionals (with a non-nursing qualification) working in healthcare at baseline



Notes: 1) See notes 1 and 2 to Figure 2.
2) All workers were qualified (with a qualification other than nursing) and employed in the healthcare sector at baseline. The female graphs are based on 6,104,736 observations for 77,149 women; the male employment graphs are based on 3,760,032 observations for 47,636 men. There are slightly fewer observations for the healthcare employment analyses.

This analysis and comparison to the analysis for nursing-qualified individuals suggests that difficulties in retaining other healthcare professionals are not increasing at the same rate as the difficulties in nursing staff retention.

6. Conclusion

Analyses in this paper, based on the entire population of registered nurses in the Netherlands, compare a January 2020 Cohort and a January 2016 Cohort which are each followed for one year before and three years after this baseline month. Results confirm that outflows of nursing-qualified workers have been increasing recently.

Increases in outflow are evident with female and male nursing-qualified workers in the healthcare sector in 2020 being 0.3 percentage points and 1.6 percentage points more likely, respectively, to have left employment after three years than similar workers in 2016, and conditional on employment they were 0.8 percentage points and 1.2 percentage points more likely to leave employment in healthcare after three years. In total, there was an additional 1.1

and 2.5 percentage point decrease in the January 2020 stock of nursing-qualified workers in the healthcare sector (compared to the January 2016 stock) for women and men, respectively.

Amongst the groups more likely to leave healthcare were partnered women with children under 12 and women with part-time jobs of fewer than 20 hours per week (with these two groups likely overlapping to some extent). Less likely to leave were men born elsewhere, self-employed men and women, and men and women aged 55-65 (possibly due to age pension changes).

These increases come on top of the observed changes in 2019 compared to 2015, where nursing-qualified workers outside of the healthcare sector were around 4 percentage points more likely to have come from the healthcare sector. These findings indicate that current shortages are likely to increase further.

The increased outflows were not compensated by increased working hours or increased inflows. Men in the 2020 Cohort experienced a 1.5 percentage point larger decrease in working hours by the end of 2022 than men in the 2016 Cohort. For women there was limited change except for a light increase from February 2020 to June 2021 (likely in response to increased needs during COVID-19 waves), and a 0.8 percentage point decrease by the end of 2022.

Examining inflows from nursing-qualified persons working in the non-healthcare sector reveals a somewhat higher probability of transitioning to the healthcare sector for men during COVID-19 waves. However, by the end of 2022, nursing-qualified men and women, who were outside the healthcare sector at baseline in January 2020, are no more likely to work in the healthcare sector than the 2016 Cohort by the end of 2018. Similarly, although inflow from non-employed nursing-qualified women into employment increased, inflow into healthcare employment has not increased, except temporarily during COVID-19. Non-employed nursing-qualified men were also more likely to enter healthcare employment during COVID-19. By the end of 2022, any difference with the earlier cohort had disappeared. In addition, more non-employed men and women in the 2020 Cohort were recently in healthcare employment than in the 2016 Cohort, indicating an increased outflow to non-employment for the later cohort.

From the results in this paper, changes over time, limiting the supply of nursing-qualified workers, appear larger for nursing-qualified men. As the subpopulation of male nursing-qualified workers is quite small, the overall impact this has on supply is fairly limited. However, although impacts are smaller for women than for men, they are in the same direction, reducing the supply of nursing-qualified workers. The additional supply through entry into

healthcare employment from unemployment and non-healthcare sectors which occurred in response to the additional need for nurses during the COVID-crisis was reassuring but not enough to overcome the shortage, and was shown to be temporary.

At the same time transitions from salaried employment to self-employment in the healthcare sector were increasing for nursing-qualified men and women in the 2020 Cohort by 1.7 percentage points and 1 percentage point, respectively, by the end of 2022 compared to similar men and women in the 2016 Cohort. This was most prevalent among single mothers of a child under the age of 12, younger female workers (under 35), and women who were not born in the Netherlands. It was less prevalent among older male and female workers (aged over 55 and over 45 respectively).

Considering the potential advantages and disadvantages of self-employment, it appears ideal for employers as it reduces associated risks with attracting more personnel (no annual or sick leave, employer premiums, pension, etc.), but employers have indicated it increases the cost of health. Furthermore, as the bargaining position of self-employed workers is strong due to the shortages, they can negotiate what times they want to work at what pay. As a result, unpopular shifts may fall more and more on salaried nurses, making it more difficult to attract and retain salaried nurses. On the other hand, self-employment may also not be ideal for nurses, especially those from vulnerable groups, as they may have to choose between two bad outcomes: one where they have limited say in amount of work and working times versus another where they have no job security and access to paid leave and disability insurance. This seems borne out in the choice by single mothers of young children to become self-employed: here the immediacy of needing the ability to say no to particular working times through self-employment seems to win out over the need for financial security through permanent salaried employment. Similarly, men and women who were not born in the Netherlands seem more likely to “choose” self-employment foregoing the security of salaried employment preferring increased autonomy.

Since other professionals in the healthcare sector seem to fare better, with more stable retention rates, while nursing-qualified workers have clearly declining retention rates, this indicates that shiftwork, which features heavily in nursing (and is often less relevant in other healthcare professions), may be an important component of the issue. At first, during our observation period, from 2016 to 2020, real wages for nurses had increased by less than real wages in alternative occupations for nurses. This appears in line with an observation by Harris (2022) that an increasing share of women in an occupation may put downward pressure on wages. But later, in 2021 and 2022 (perhaps as a result of the pressure on nurses during COVID-19, and

the public's appreciation for their work during the pandemic), nurses' real wages improved more than real wages in alternative occupations for nursing-qualified workers. This should have made the nursing occupation more attractive relative to alternative possible occupations, but there is no evidence of this yet in retention or inflow patterns.[31] The relative pay rises for nurses are unlikely to have been enough to compensate for the lack of flexibility and autonomy, so non-wage employment characteristics need to change too, which is an important observation for policy and practice.

Considering what may work to improve the supply of nursing-qualified workers, given the increase in self-employment and the relative decrease in hours and monthly wages for those leaving healthcare employment, flexibility appears to be the key, while wages seem less relevant. The question arises whether self-employment can be a solution (with employment and financial security provided in other ways), or can salaried employment provide more of what self-employment provides (e.g., more autonomy, some say in timing of work) or provide support in finding/paying for childcare. Potential reforms to salaried employment could offer higher pay for the less popular shifts to induce some workers to voluntarily put their hand up for these shifts, leaving employees who cannot work such shifts due to personal circumstances free to work more amenable shifts (for the normal pay). Alternatively (or additionally), large employers, like hospitals, could do more in terms of providing in-house childcare at low cost to employees. Cottini et al. (2011) shows how High Involvement Work Practices (defined as a "cluster of complementary human resource management practices designed to promote employee involvement") may improve high turnover rates in organisations facing adverse workplace conditions such as night shifts, physical work hazards and workplace violence and harassment. Such practices could potentially be used to solicit employees' input into designing a better work environment.

One of the observations from the analyses was that outflows had declined for the group of 55- to 65-year-old nursing-qualified workers, indicating that turn-arounds are possible. However, this was likely due to the increase in the age of age pension eligibility by just over one year between the 2016 and 2020 Cohorts which is a punitive approach. The question is whether the

[31] There is also some evidence that the higher wages may have reduced the number of jobs in healthcare. In 2019, the chair of the Dutch Hospital Association (NVZ), Ad Melkert, asked for additional government funding to avoid redundancies in case the unions' demand for higher wages was successful. In addition, in 2023, the Dutch hospital HagaZiekenhuis Zoetermeer announced a likely 150 redundancies to get the hospital back to financial health. Higher costs than expected had arisen through increased wages, inflation and the need to hire more external staff than anticipated.

healthcare sector could hold on to older workers through a more positive approach by providing a “carrot” instead of a “stick”? For example, could it be made more attractive to combine working short part-time hours with part-time retirement (allowing workers to collect part of their age pension / superannuation pay). Similarly, given the responses from nursing-qualified staff to the needs that arose during the pandemic, could the long-term needs of the healthcare sector be leveraged to solicit additional supply in a similar, but more permanent, way to the shorter-term and immediate needs resulting from COVID-19? In addition to wage increases for nurses, could public expressions of the value of this occupation, and the appreciation for workers in it, make a career in nursing more rewarding and less emotionally exhausting? Currently, nurses’ exposure to violence in different forms is widespread (Pariona-Cabrera et al., 2020; Spector et al., 2014). Changing the workplace environment would require a broader shift in culture, not just among employers and government but also among the general public who make use of healthcare services, and interact with nurses.

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Appendix A: Overview of datasets used

The following datasets are used in the paper, with variables used in the analysis mentioned in single quotation marks:

- BIGTAB: BIG stands for 'Beroepen in de Gezondheidszorg' (healthcare occupations). The BIG register contains an anonymised individual identifier ('rinpersoon'), the type of occupation ('bigberoep', 12 categories including nurse) and the BIG spells including start and end date of the registration ('bigdatum1einschr'). Due to data limitations with regard to the end date, we do not analyse BIG outflows. Since individuals do not 'actively' deregister, an individual is often only deregistered after several years.
- SPOLISBUS: Job and Wages register that contains an individual identifier ('rinpersoon') and information on gross wages ('basisloon'), hours worked ('basisuren'), type of contract ('contractsoort'), type of job ('soortbaan', 'scdaard', 'arbeidsrelatie') and firm identifier ('beid') for the universe of employment spells including start and end dates. Hourly wage is computed by dividing gross wages ('basisloon') by working hours ('basisuren').
- GBAPERSOONTAB: contains an individual identifier ('rinpersoon') and individuals' demographic characteristics including sex ('gbageslacht'), birth year/month/day ('gbageboortejaar', 'gbageboortemaand' and 'gbageboortedag') and country of birth (Netherlands: yes/no, 'gbageboorteland') for the universe of individuals.
- GBAHUISHOUDENSBUS: contains an individual identifier ('rinpersoon') and information on individuals' household composition and the presence and birth dates of children ('gebjaarjongstekindhh', 'gebmaandjongstekindhh' and 'gebdagjongstekindhh') for the universe of household spells including start and end dates.
- PARTNERBUS: contains an individual identifier ('rinpersoon') and information on individuals' marital status, being married or de facto partnership, for the universe of partnership spells including start and end dates.
- GBAADRESOBJECTBUS: contains an individual identifier ('rinpersoon') and the anonymised individuals' home address ('rinobjectnummer') for the universe of housing spells including start and end dates.
- VSLGWBTAB: contains the home address ('rinobjectnummer') and regional identifiers ('provcode') for the universe of house addresses.
- ABR: contains an anonymised firm identifier ('beid') and information on economic sector ('sbigecoordineerd')[32] and firm size ('gksbsgecoordineerd') for the universe of firms based on data from the Dutch Chamber of Commerce. In addition, an identifier is present ('persoon_identificatie') which enables a link to KOPPELTABELZELFSTANDIGEN, as the identifier persoon_identificatie is identical to the identifier vep_identificatie (see further CBS documentation of KOPPELTABELZELFSTANDIGEN).
- KOPPELTABELZELFSTANDIGEN: contains an individual identifier ('rinpersoon') and an identifier for the linking the individual to a firm ('vep_identificatie').

[32] The Dutch Standard Industrial Classification (in Dutch: Standaard Bedrijfsindeling (SBI)) is based on the European Union Nomenclature statistique des activités économiques dans la Communauté Européenne (NACE). The 4-digit SBI code is consistent with the 4-digit NACE Rev. 2 classification. See https://www.cbs.nl/en-gb/our-services/methods/classifications/activiteiten/standard-industrial-classifications--dutch-sbi-2008-nace-and-isic-- for more information.

These datasets are linked using the identifiers ‘rinpersoon’, ‘beid’, ‘rinobjectnummer’, ‘persoon_identificatie’ and ‘vep_identificatie’. Further documentation (only in Dutch) is available on https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen/catalogus-microdata.

Appendix B: Additional tables and figures

Tables B.1 and B.2 show that employees are the youngest group among men and women, and their age has slightly declined from 2016 to 2020. Men are on average older than women in all groups except among self-employed workers. Self-employed healthcare workers are the oldest amongst women followed by non-employed women and women employed outside healthcare, while amongst men the group which is not employed are oldest followed by the self-employed. The average age is lower in 2020 than in 2016 for all groups.

Female and male employees are most likely to have been born in the Netherlands, while self-employed women are least likely to have been born in the Netherlands, with the proportion of foreign-born self-employed women and men increasing from 2016 to 2020. Single women and single mothers with a child under 12 are overrepresented among the self-employed workers in healthcare, while partnered women with children are underrepresented in self-employment in both years. Household composition differs much less over the four groups for men.

Employment in healthcare is more secure (about 85% of women and 87% of men have a permanent contract) than employment outside healthcare (about 66% of women and 70% of men have a permanent contract). Female and male healthcare employment is more likely to be between 20 and 35 hours per week than non-healthcare employment but the proportion has been increasing for both groups, with the proportion working longer and shorter hours both decreasing. For men the group working 35 or more hours is most prevalent in 2016 but decreasing from 2016 to 2020, with part-time hours now more common than full-time hours for male healthcare workers.

Appendix Table B.1 Summary statistics for nursing-qualified women at baseline

	Employees in healthcare		Self-employed in healthcare		Non-employed		Employed outside healthcare	
	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)
Work hours (monthly hours)	117.0136	115.4078	NA	NA	NA	NA	111.1850	106.3331
Real hourly wage (€)	16.8638	17.2552	NA	NA	NA	NA	16.8214	17.0676
Real gross wage (€ per month)	1,976.1924	1,994.2081	NA	NA	NA	NA	1,936.6753	1,874.9041
Age	42.0189	42.6971	50.3468	52.7322	47.7831	48.1455	43.5108	44.6977
Born in the Netherlands	0.9561	0.9540	0.8109	0.8475	0.9333	0.9230	0.9406	0.9430
Household composition								
Single: no kids $\leq$ 18 years	0.2070	0.1864	0.2507	0.2566	0.2562	0.2579	0.2018	0.1906
Single: child age $\leq$ 4 years	0.0049	0.0046	0.0159	0.0076	0.0048	0.0083	0.0068	0.0045
Single: 4 $<$ child age $\leq$ 12	0.0171	0.0164	0.0249	0.0191	0.0127	0.0135	0.0224	0.0194
Single: 12 $<$ child age $\leq$ 18	0.0304	0.0282	0.0307	0.0302	0.0263	0.0248	0.0285	0.0329
Partnered: no kids $\leq$ 18 years	0.3822	0.3706	0.4148	0.4354	0.4613	0.4547	0.3725	0.3705
Partnered: child age $\leq$ 4 years	0.1331	0.1346	0.0781	0.0514	0.1073	0.0983	0.1252	0.1115
Partnered: 4 $<$ child age $\leq$ 12	0.1293	0.1447	0.1010	0.0930	0.0688	0.0719	0.1407	0.1405
Partnered: 12 $<$ child age $\leq$ 18	0.0955	0.1142	0.0806	0.1054	0.0344	0.0476	0.1009	0.1292
Type of contract								
Permanent contract	0.8609	0.8402	NA	NA	NA	NA	0.6829	0.6410
Fixed contract	0.1381	0.1589	NA	NA	NA	NA	0.2636	0.2980
Other contract	0.0010	0.0009	NA	NA	NA	NA	0.0118	0.0174

	Employees in healthcare		Self-employed in healthcare		Non-employed		Employed outside healthcare	
	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)
Type of job								
Regular job	0.9219	0.9592	NA	NA	NA	NA	0.8118	0.8414
Other job (all other categories)	0.0781	0.0408	NA	NA	NA	NA	0.1465	0.1150
Full-time/part-time status								
≥ 35 work hours a week	0.1339	0.1559	NA	NA	NA	NA	0.1880	0.1917
$20 \leq$ hours a week < 35	0.7468	0.6916	NA	NA	NA	NA	0.5979	0.5364
Hours a week < 20	0.1193	0.1525	NA	NA	NA	NA	0.1723	0.2282
Number of individuals	149,593	140,759	3,327	2,354	5,667	6,285	12,680	11,569

Notes: Wages are in 2022 euros. NA indicates "not applicable". Sample means for individual characteristics are provided for January 2020 (treatment) and January 2016 (control). Summary statistics are not provided for all variables in the modelling: e.g., residential location (12 provinces) and firm size (4 unique firm size groups) are included in the model, but not in this table.

Source: Authors' calculations based on administrative data provided by the CBS.

Appendix Table B.2 Summary statistics for nursing-qualified men at baseline

	Employees in healthcare		Self-employed in healthcare		Non-employed		Employed outside healthcare	
	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)
Work hours (monthly hours)	139.8891	141.7871	NA	NA	NA	NA	134.0468	134.1308
Real hourly wage (€)	18.5423	18.9209	NA	NA	NA	NA	18.5360	18.5990
Real gross wage (€ per month)	2,611.4280	2,699.3210	NA	NA	NA	NA	2,574.2614	2,586.0746
Age	46.3094	47.2953	50.4596	52.8507	55.1109	54.4212	46.5835	47.4964
Born in the Netherlands	0.9483	0.9461	0.8549	0.8791	0.9275	0.9300	0.9410	0.9466
Household composition								
Single: no kids ≤ 18 years	0.2079	0.1844	0.2200	0.2116	0.2402	0.2368	0.1700	0.1702
Single: child age ≤ 4 years	0.0009	0.0005	0.0047	0.0047	0.0010	0.0009	0.0006	0.0011
Single: 4 < child age ≤ 12	0.0055	0.0046	0.0124	0.0116	0.0029	0.0027	0.0050	0.0031
Single: 12 < child age ≤ 18	0.0143	0.0127	0.0094	0.0140	0.0127	0.0117	0.0156	0.0106
Partnered: no kids ≤ 18 years	0.4791	0.4671	0.4509	0.5070	0.6137	0.6206	0.4519	0.4422
Partnered: child age ≤ 4 years	0.1046	0.0961	0.1014	0.0814	0.0373	0.0260	0.1154	0.1080
Partnered. 4 < child age ≤ 12	0.1042	0.1195	0.1279	0.0860	0.0304	0.0404	0.1346	0.1380
Partnered. 12 < child age ≤ 18	0.0824	0.1143	0.0733	0.0837	0.0333	0.0430	0.1033	0.1245
Type of contract								
Permanent contract	0.8773	0.8550	NA	NA	NA	NA	0.7311	0.6498
Fixed contract	0.1197	0.1431	NA	NA	NA	NA	0.1957	0.2802
Other contract	0.0030	0.0019	NA	NA	NA	NA	0.0192	0.0160

	Employees in healthcare		Self-employed in healthcare		Non-employed		Employed outside healthcare	
	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)	Treatment (Jan 2020)	Control (Jan 2016)
Type of job								
Regular job	0.9493	0.9727	NA	NA	NA	NA	0.8081	0.8578
Other job (all other categories)	0.0507	0.0273	NA	NA	NA	NA	0.1378	0.0883
Full-time/part-time status								
$\geq$ 35 work hours a week	0.4641	0.5282	NA	NA	NA	NA	0.5050	0.5427
$20 \leq$ hours a week $<$ 35	0.4952	0.4344	NA	NA	NA	NA	0.3515	0.3128
Hours a week $<$ 20	0.0407	0.0374	NA	NA	NA	NA	0.0894	0.0905
Number of individuals	19,595	20,825	641	430	1,020	1,115	3,388	3,501

Notes: See notes to Table B.1.

Source: Authors' calculations based on administrative data provided by the CBS.

Table B.3 Triple differences model of the probability of employment and healthcare employment (conditional on employment), and log working hours for female nursing-qualified workers in healthcare at baseline

	Employment (=1) (1)	Healthcare employment (=1) (2)	Paid working hours (log) (3)
DY × *POST*	-0.0037	-0.0126***	0.0031
	(0.0039)	(0.0037)	(0.0056)
Triple interaction term: DY × *POST* ×			
AGE: relative to 35 ≤ age < 45			
18 ≤ age < 25	-0.0007	-0.0059***	-0.0061
	(0.0020)	(0.0022)	(0.0042)
25 ≤ age < 35	0.0033**	0.0016	0.0071***
	(0.0013)	(0.0015)	(0.0021)
45 ≤ age < 55	0.0010	0.0021	-0.0021
	(0.0012)	(0.0014)	(0.0019)
55 ≤ age < 60	0.0082***	0.0013	-0.0033
	(0.0018)	(0.0016)	(0.0024)
60 ≤ age < 65	0.0431***	-0.0055***	0.0002
	(0.0042)	(0.0019)	(0.0035)
65 ≤ age	-0.0844***	-0.0617***	-0.1076***
	(0.0150)	(0.0068)	(0.0256)
FOREIGN BORN: relative to born in the Netherlands	-0.0255	0.0083	0.0268
	(0.0315)	(0.0200)	(0.0283)
HOUSEHOLD COMPOSITION: relative to single and no kids ≤ 18 years			
Single, child aged ≤ 4 years	0.0020	-0.0048	0.0065
	(0.0072)	(0.0070)	(0.0106)
Single, 4 < child age ≤ 12	-0.0052	-0.0016	-0.0182***
	(0.0034)	(0.0035)	(0.0063)
Single, 12 < child age ≤ 18	-0.0032	0.0001	-0.0081
	(0.0025)	(0.0029)	(0.0059)
Partnered, no kids ≤ 18 years	-0.0007	-0.0007	-0.0034*
	(0.0016)	(0.0012)	(0.0020)
Partnered, child aged ≤ 4 years	-0.0035**	-0.0014	-0.0013
	(0.0017)	(0.0018)	(0.0028)
Partnered, 4 < child age ≤ 12	-0.0041**	-0.0025	-0.0065**
	(0.0017)	(0.0017)	(0.0026)
Partnered, 12 < child age ≤ 18	-0.0028	-0.0025	-0.0112***
	(0.0017)	(0.0016)	(0.0025)
CONTRACT: relative to permanent contract			
Fixed contract	0.0085***	0.0030	0.0229***
	(0.0018)	(0.0019)	(0.0028)
Other contract	0.0120	-0.0056	0.0353
	(0.0192)	(0.0171)	(0.0252)

	Employment (=1) (1)	Healthcare employment (=1) (2)	Paid working hours (log) (3)
TYPE OF JOB: relative to regular job			
Flexible job	-0.0055	-0.0023	-0.0611***
	(0.0042)	(0.0032)	(0.0076)
Internship	-0.0188***	-0.0265***	-0.0025
	(0.0042)	(0.0053)	(0.0105)
FT/PT STATUS: relative to ≥ 35 hours a week			
20 ≤ hours a week < 35	-0.0017	0.0016	-0.0041**
	(0.0013)	(0.0012)	(0.0018)
Hours a week < 20	0.0004	-0.0053***	0.0047
	(0.0023)	(0.0018)	(0.0034)
FIRM SIZE: relative to 0 to 19 employees			
20 ≤ employees ≤ 199	0.0089**	0.0088**	-0.0065
	(0.0041)	(0.0040)	(0.0059)
200 ≤ employees ≤ 499	0.0005	0.0102***	-0.0022
	(0.0039)	(0.0038)	(0.0057)
500 ≤ employees	0.0044	0.0083***	0.0043
	(0.0033)	(0.0030)	(0.0048)
SELFEMPLOYED: relative to salaried	0.0019	0.0094***	0.0189***
employment at baseline	(0.0015)	(0.0033)	(0.0052)
Number of individuals	183,095	183,087	181,408
Number of observations	14,688,864	14,225,897	13,977,331

Notes: Triple differences model from Equation (2) showing heterogeneity effects in the changes in outcomes for the 2020 Cohort compared to changes in outcomes for the 2016 Cohort relative to their baselines, based on a sample of women who had a nursing qualification and were employed in the healthcare sector at baseline. Parameter estimates of the triple interaction terms between treatment year DY (2019-2022 for treated and 2015-2018 for controls), POST (equals one for months 15 (March 2020/2016) up to 48 (December 2022/2018) and zero for months 1 (January 2019/2015) up to 14 (February 2020/2016)) and each of the covariates are reported. Each column represents a single regression for a different outcome variable. Reference group (DY) is 2015-2018 and reference group POST is months 1 (January 2019/2015) up to 14 (February 2020/2016). The reference category of each covariate is reported in the table. Main effects and two-way interaction effects are not reported. Main, two-way and three-way interaction terms are also included for residential location (province) and categories of variables for which no data was observed. These results are available from the authors upon request. Standard errors, clustered by individual, are in parentheses. ***, **, *, correspond to the significance level of 1%, 5%, 10%, respectively.

Source: Authors' calculations based on administrative data provided by the CBS.

Table B.4 Triple differences model of the probability of employment and healthcare employment (conditional on employment), and log working hours for male nursing-qualified workers in healthcare at baseline

	Employment (=1) (1)	Healthcare employment (=1) (2)	Paid working hours (log) (3)
DY × POST	-0.0009	-0.0111	-0.0176
	(0.0154)	(0.0159)	(0.0198)
Triple interaction term: DY × POST ×			
AGE: relative to $35 \leq$ age < 45			
$18 \leq$ age < 25	-0.0039	0.0057	-0.0159
	(0.0063)	(0.0091)	(0.0140)
$25 \leq$ age < 35	0.0003	0.0029	-0.0068
	(0.0032)	(0.0052)	(0.0049)
$45 \leq$ age < 55	-0.0018	-0.0046	-0.0042
	(0.0030)	(0.0044)	(0.0042)
$55 \leq$ age < 60	0.0078*	0.0022	0.0008
	(0.0041)	(0.0046)	(0.0049)
$60 \leq$ age < 65	0.0275***	-0.0042	0.0001
	(0.0076)	(0.0051)	(0.0073)
$65 \leq$ age	-0.0841**	-0.0678***	-0.1765***
	(0.0337)	(0.0201)	(0.0549)
FOREIGN BORN: relative to born in the Netherlands	-0.0051	0.0108*	0.0055
	(0.0069)	(0.0064)	(0.0078)
HOUSEHOLD COMPOSITION: relative to single and no kids $\leq$ 18 years			
Single, child aged ≤ 4 years	0.0599	-0.0702	0.0284
	(0.0560)	(0.0645)	(0.0600)
Single, $4 <$ child age ≤ 12	-0.0293*	-0.0280	-0.0128
	(0.0161)	(0.0185)	(0.0291)
Single, $12 <$ child age ≤ 18	-0.0076	-0.0116	-0.0329
	(0.0088)	(0.0120)	(0.0209)
Partnered, no kids ≤ 18 years	-0.0079*	-0.0008	-0.0102**
	(0.0044)	(0.0036)	(0.0049)
Partnered, child aged ≤ 4 years	-0.0044	-0.0087	-0.0077
	(0.0041)	(0.0059)	(0.0061)
Partnered, $4 <$ child age ≤ 12	-0.0052	0.0068	-0.0070
	(0.0045)	(0.0049)	(0.0056)
Partnered, $12 <$ child age ≤ 18	-0.0026	-0.0001	-0.0109*
	(0.0050)	(0.0049)	(0.0060)
CONTRACT: relative to permanent contract			
Fixed contract	0.0065	0.0073	0.0260***
	(0.0052)	(0.0063)	(0.0072)
Other contract	0.0097	-0.0041	0.0433
	(0.0338)	(0.0276)	(0.0394)

	Employment (=1) (1)	Healthcare employment (=1) (2)	Paid working hours (log) (3)
TYPE OF JOB: relative to regular job			
Flexible job	-0.0044	0.0102	-0.0038
	(0.0157)	(0.0152)	(0.0269)
Internship	-0.0159	-0.0361*	0.0087
	(0.0141)	(0.0195)	(0.0338)
FT/PT STATUS: relative to $\geq$ 35 hours a week			
20 $\leq$ hours a week $<$ 35	-0.0045	0.0013	-0.0022
	(0.0030)	(0.0026)	(0.0031)
Hours a week $<$ 20	0.0067	0.0011	0.0033
	(0.0122)	(0.0101)	(0.0201)
FIRM SIZE: relative to 0 to 19 employees			
20 $\leq$ employees $\leq$ 199	0.0169	-0.0152	-0.0085
	(0.0162)	(0.0170)	(0.0209)
200 $\leq$ employees $\leq$ 499	0.0063	0.0188	0.0180
	(0.0152)	(0.0157)	(0.0195)
500 $\leq$ employees	-0.0004	0.0083	0.0186
	(0.0145)	(0.0149)	(0.0187)
SELFEMPLOYED: relative to salaried	0.0105***	0.0158**	0.0006
employment at baseline	(0.0033)	(0.0075)	(0.0091)
Number of individuals	26,756	26,756	26,449
Number of observations	2,124,528	2,040,695	1,986,798

Notes: This table is similar to Table B.3 but it reports the results for men instead of women. See notes to Table B.3.

Source: Authors' calculations based on administrative data provided by the CBS.

Table B.5 Triple differences model of the probability of being an employee or self-employed for nursing-qualified employees in healthcare at baseline

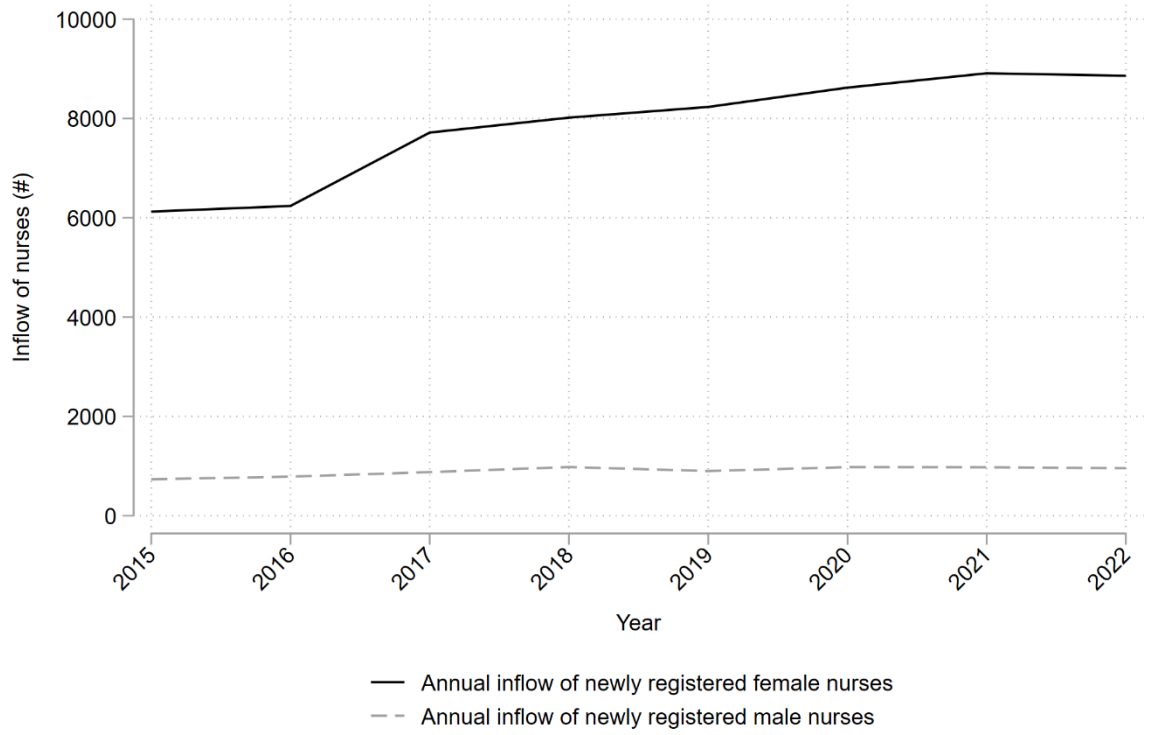
	Women		Men	
	Salaried employment (=1)	Self-employment (=1)	Salaried employment (=1)	Self-employment (=1)
DY × POST	-0.0077*	0.0059*	-0.0010	0.0197
	(0.0044)	(0.0032)	(0.0200)	(0.0128)
Triple interaction term: DY × POST ×				
AGE: relative to 35 ≤ age < 45				
18 ≤ age < 25	-0.0016	0.0054***	-0.0146**	0.0058
	(0.0022)	(0.0017)	(0.0072)	(0.0071)
25 ≤ age < 35	0.0024*	0.0048***	-0.0051	0.0072
	(0.0015)	(0.0013)	(0.0040)	(0.0048)
45 ≤ age < 55	0.0024*	-0.0024*	-0.0030	-0.0041
	(0.0014)	(0.0013)	(0.0037)	(0.0046)
55 ≤ age < 60	0.0103***	-0.0045***	0.0071	-0.0118**
	(0.0020)	(0.0015)	(0.0048)	(0.0047)
60 ≤ age < 65	0.0464***	-0.0058***	0.0246***	-0.0141***
	(0.0045)	(0.0015)	(0.0085)	(0.0047)
65 ≤ age	-0.0113	-0.0061	-0.0144	0.0013
	(0.0191)	(0.0046)	(0.0435)	(0.0073)
FOREIGN BORN: relative to born in the Netherlands	-0.0021	0.0173***	-0.0067	0.0081
	(0.0031)	(0.0026)	(0.0084)	(0.0071)
HOUSEHOLD COMPOSITION: relative to single and no kids ≤ 18 years				
Single, child aged ≤ 4 years	-0.0039	0.0213***	0.0514	-0.1029
	(0.0085)	(0.0076)	(0.0585)	(0.0684)
Single, 4 < child age ≤ 12	-0.0075*	0.0130***	-0.0305	-0.0093
	(0.0041)	(0.0041)	(0.0200)	(0.0178)
Single, 12 < child age ≤ 18	-0.0026	0.0005	-0.0023	-0.0135
	(0.0028)	(0.0024)	(0.0099)	(0.0102)
Partnered, no kids ≤ 18 years	0.0005	-0.0019**	-0.0085*	0.0026
	(0.0017)	(0.0010)	(0.0049)	(0.0032)
Partnered, child aged ≤ 4 years	-0.0022	-0.0035**	-0.0027	-0.0031
	(0.0019)	(0.0014)	(0.0050)	(0.0053)
Partnered, 4 < child age ≤ 12	-0.0030	-0.0015	-0.0028	-0.0013
	(0.0019)	(0.0016)	(0.0052)	(0.0051)
Partnered, 12 < child age ≤ 18	-0.0018	-0.0023	0.0003	0.0107**
	(0.0019)	(0.0015)	(0.0057)	(0.0051)
CONTRACT: relative to permanent contract				
Fixed contract	0.0068***	0.0040***	0.0051	0.0049
	(0.0020)	(0.0014)	(0.0060)	(0.0046)
Other contract	0.0256	-0.0263	0.0377	-0.0477
	(0.0268)	(0.0203)	(0.0500)	(0.0372)

	Women		Men	
	Salaried employment (=1)	Self-employment (=1)	Salaried employment (=1)	Self-employment (=1)
TYPE OF JOB: relative to regular job				
Flexible job	-0.0095**	0.0008	-0.0112	-0.0108
	(0.0046)	(0.0025)	(0.0192)	(0.0105)
Internship	-0.0218***	-0.0014	-0.0053	-0.0269***
	(0.0045)	(0.0025)	(0.0149)	(0.0096)
FT/PT STATUS: relative to ≥ 35 hours a week				
20 ≤ hours a week < 35	-0.0023	0.0010	-0.0061*	0.0035
	(0.0014)	(0.0010)	(0.0033)	(0.0024)
Hours a week < 20	-0.0000	0.0023	0.0081	0.0044
	(0.0024)	(0.0015)	(0.0145)	(0.0075)
FIRM SIZE: relative to 0 to 19 employees				
20 ≤ employees ≤ 199	0.0109**	0.0021	0.0268	-0.0176
	(0.0046)	(0.0032)	(0.0212)	(0.0135)
200 ≤ employees ≤ 499	0.0024	-0.0004	0.0085	-0.0126
	(0.0044)	(0.0031)	(0.0198)	(0.0124)
500 ≤ employees	0.0067*	0.0006	0.0030	-0.0114
	(0.0037)	(0.0027)	(0.0192)	(0.0116)
Number of individuals	175,782	175,782	24,896	24,896
Number of observations	13,936,896	13,936,896	1,940,160	1,940,160

Notes: Triple differences model from Equation (2) showing heterogeneity effects in the changes in outcomes for the 2020 Cohort compared to changes in outcomes for the 2016 Cohort relative to their baselines, based on a sample of workers who had a nursing qualification and were in salaried employment in the healthcare sector at baseline. Parameter estimates of the triple interaction terms between treatment year DY (2019-2022 for treated and 2015-2018 for controls), POST (equals one for months 15 (March 2020/2016) up to 48 (December 2022/2018) and zero for months 1 (January 2019/2015) up to 14 (February 2020/2016)) and each of the covariates are reported. Each column represents a single regression for a different outcome variable. Reference group (DY) is 2015-2018 and reference group POST is months 1 (January 2019/2015) up to 14 (February 2020/2016). The reference category of each covariate is reported in the table. Main effects and two-way interaction effects are not reported. Main, two-way and three-way interaction terms are also included for residential location (province) and categories of variables for which no data was observed. These results are available from the authors upon request. Standard errors, clustered by individual, are in parentheses. ***, **, *, correspond to the significance level of 1%, 5%, 10%, respectively.

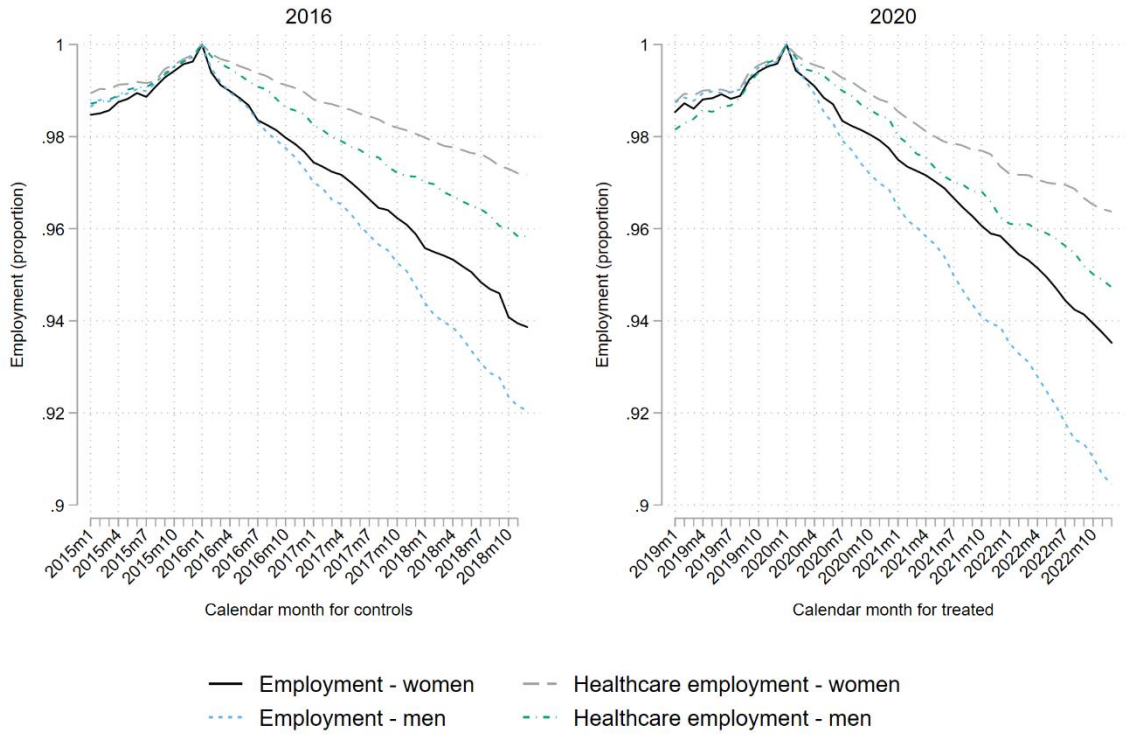
Source: Authors' calculations based on administrative data provided by the CBS.

Figure B.1 Annual inflow of newly registered nurses, by sex



Notes: Authors' calculations based on the BIG data provided by the CBS.

Figure B.2 Health workforce dynamics for the 2016 Cohort and 2020 Cohort by sex

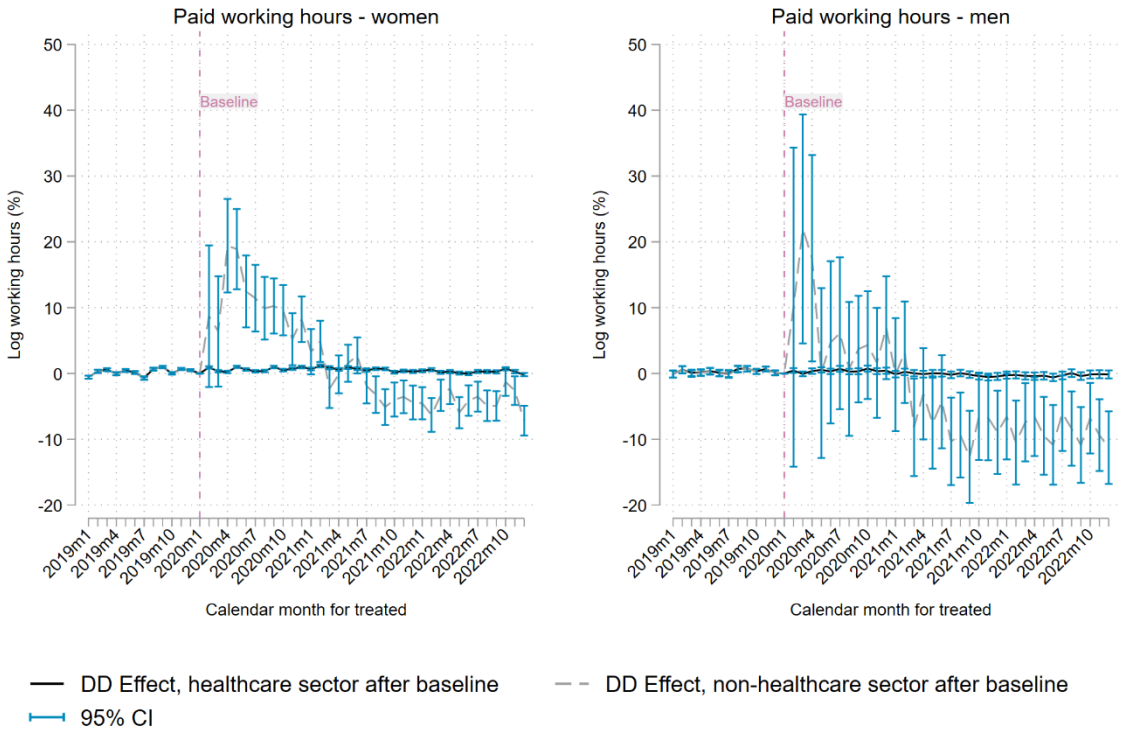


Notes: All workers were nursing-qualified and employed in the healthcare sector at baseline (January 2016 or January 2020). The employment outcome equals one for employees and self-employed, and zero for the non-employed. The employment in healthcare outcome is conditional on being employed, and is missing for non-employed persons.

Source: Administrative data covering 2015 to 2022 from the CBS, authors' own calculations.

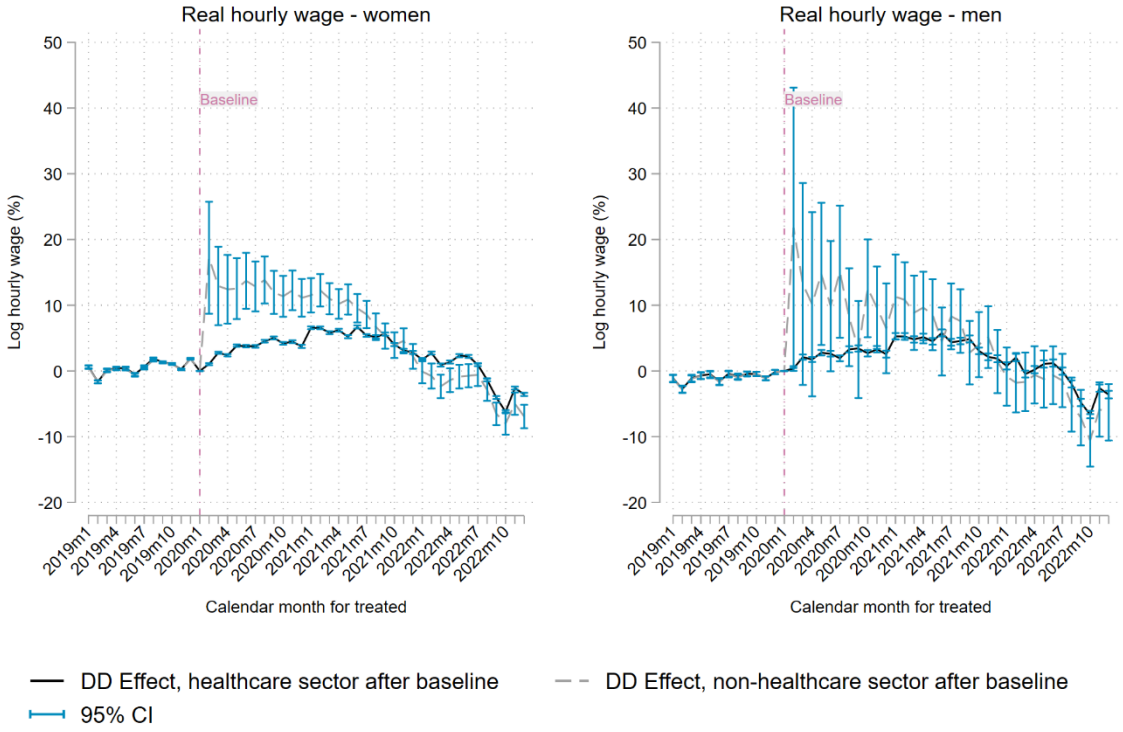
The three graphs below are stratified based on the employment outcome after baseline (January 2016 or January 2020). The graphs distinguish results for men and women employed in healthcare versus employed outside of healthcare. Figures B.3 to B.5 present results for hours worked, and real hourly wages and monthly earnings, respectively. As we do not take into account selection into other employment, these are descriptive results. All men and women were qualified as a nurse and worked in the healthcare sector at baseline.

Figure B.3 Changes in working hours for all nursing-qualified workers in the healthcare sector relative to baseline (comparison of treatment with control cohort), conditional on type of workplace after baseline (in healthcare sector or outside healthcare sector)



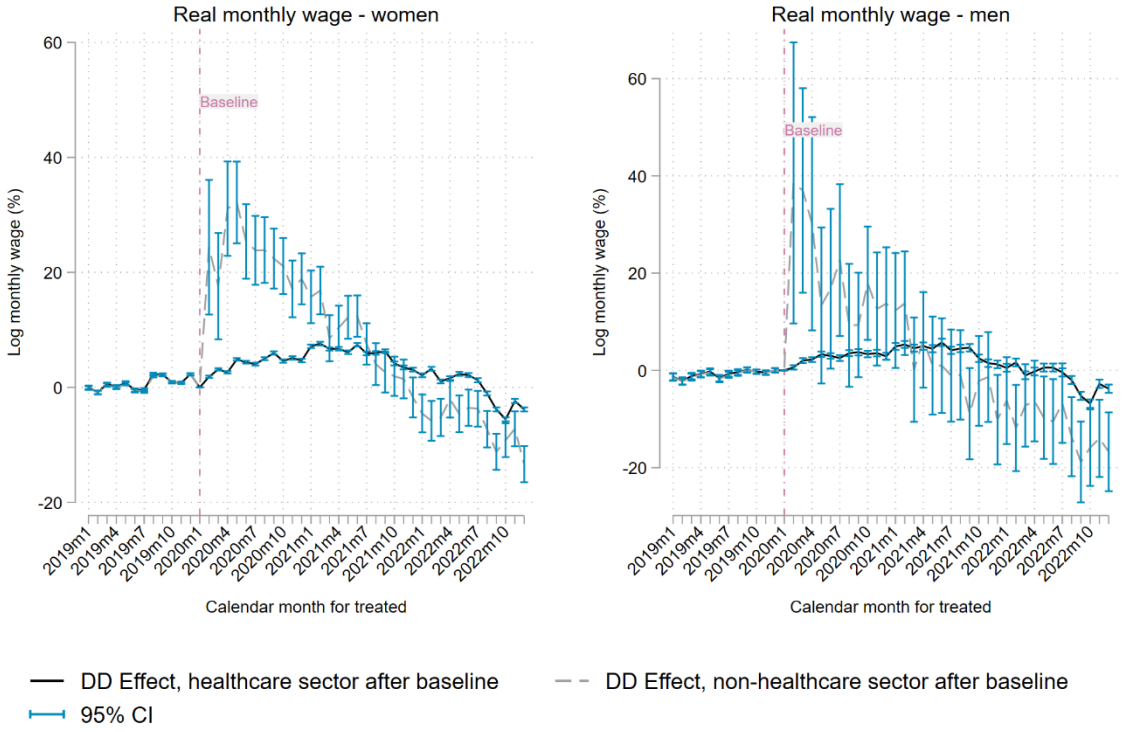
Notes: Graphs are based on results from estimating equation (1) for women and men separately. Baseline is January 2020 for the 2020 Cohort and January 2016 for the 2016 Cohort, and the period under observation is January 2019 up to December 2022 for the 2020 Cohort which is compared with January 2015 up to December 2018 for the 2016 Cohort. All workers were nursing-qualified and employed in the healthcare sector at baseline.

Figure B.4 Changes in real hourly wages for all nursing-qualified workers in the healthcare sector relative to baseline (comparison of treatment with control cohort), conditional on type of workplace after baseline (in healthcare sector or outside healthcare sector)



Notes: See notes to Figure B.3.

Figure B.5 Changes in real monthly wages for all nursing-qualified workers in the healthcare sector relative to baseline (comparison of treatment with control cohort), conditional on type of workplace after baseline (in healthcare sector, in hospital, or outside healthcare sector)



Notes: See notes to Figure B.3.