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The Gender Wage Gap in Medicine

An empirical study on the gender wage gap among physicians in Norway

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Abstract

This master thesis studies the gender wage gap among physicians in Norway in 2019. Further, we explore the gender wage gap using a fixed-wage variable to isolate the effect overtime pay has on the gender wage gap. We also studied the gender wage gap among medical specialists and general practitioners. Lastly, we studied the wage gap in 2009 to see how the pay gap has evolved. Our analyses are based on cross-sectional data from 2019 and 2009 obtained from Microdata.no.

The results suggest that the unadjusted gender wage gap is 19,5% in 2019, despite the increase in the share of women in medicine. When controlling for age, sector, level of education, and counties, the adjusted gender wage gap in 2019 is still notable at 16,2%, with age used as a proxy for experience being the factor with the greatest effect. In addition, we observe that the unadjusted gender wage gap using the total wage variable is considerably larger than the fixed wage pay gap, which was 9,2%. We also find that the gender gap of fixed-wage is smaller for women working in the public sector than for women working private sector. We also observe that the unadjusted gender wage gap is 19,7% for general practitioners and 19,0% for medical specialists. The adjusted gender wage gap is 14,3% for general practitioners and 16,6% for medical specialists, suggesting that the larger gender wage gap among medical specialists might be attributed to women self-selecting into specific specializations to fulfill family duties or other preferences. Also, the results indicate that the gender wage gap is smaller for female medical specialists in the public sector than for those working in the private sector. We also found that the gender wage gap has diminished between 2009 and 2019. The main explanation for this development is that the age difference between men and women has evened out over time.

We conclude that although the medical profession has characteristics that are associated with a smaller gender wage gap, such as greater substitutability among workers and thus a more linear wage structure, a notable gender wage gap persists as the medical profession requires overtime work, and there is a gendered difference in working overtime. Also, our result suggests that women self-selecting into specific specializations also contributes to why the gender wage gap persists.

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1 Introduction

There has been a great convergence of the gender wage gap in the last few decades, yet the development has stagnated in most developed countries (Kunze, 2017). Researchers have studied why this is the case for many decades, but the problem is that many factors influence the gender wage gap. Much of the current research on the gender wage gap is based on the aggregate labor force, making it even more challenging to pinpoint the causes since the samples studied are often large and heterogeneous. When comparing individuals across different industries, sectors, and professions, many unobservable heterogeneous factors make it hard to quantify the results. Therefore, there is a need for research that focuses on the gender wage gap among smaller, more homogenous groups. Focusing the research on a specific profession is a possible way to achieve this.

We have chosen to do just this by studying the wage gap among Norwegian physicians. Both of us find topics in the intersection of gender and economics interesting, and there was no doubt that we would write our thesis about this topic. The gender wage gap is an important issue, and it feels especially pertinent given that we are both young women about to enter the workforce ourselves. So, naturally, the issue of the gender wage gap concerns us as well. The inspiration for studying the pay gap for physicians specifically came after reading a book called "This is Going to Hurt," by Adam Kay, a memoir of a junior physician in Great Britain that gives an honest account of what it is like working in a profession that many of us know so little about. We also have friends and family that are in medical school or have newly graduated and have just started their first residency, which piqued our curiosity further.

In addition, in the Norwegian media, there has been a discussion about the shortage of physicians in many areas of the country. As we learned more about the profession and theories about the gender pay gap, we realized that the medical profession is, on the one hand, characterized by factors that often would indicate a higher pay gap, namely that it is highly prestigious (Magnusson, 2010), and that the workload can be intense (Briscoe, 2006). On the other hand, some characteristics would suggest a smaller pay gap, the fact that there is greater substitutability among workers in health care (Goldin, 2014), and thus more linear earnings. In addition, the medical field is increasingly dominated by women in medical schools and the workplace. We found this juxtaposition interesting and decided to study it further.

We chose to study physicians in Norway for several reasons. Norway is often considered one of the most gender-equal countries (CORE, 2021), and more than half of the active physicians under 70 in Norway are women (Den Norske Legeforening, 2023). The country also has a generous welfare system, a high female presence in the workforce, and family policies that aim to make it easier to combine parenthood with work (Petersen, Penner, & Hogsnes, 2007). On the other hand, there are claims that the Norwegian family policies have helped maintain the gender pay gap in the country by increasing gender segregation in the labor market and contributing to the underrepresentation of women in leadership positions, especially in high-skilled professions (Gupta, Smith, & Verner, 2008; Hakim, 2000; Mandel & Semyonov, 2005). These different views on gender-egalitarian family policies make the topic even more interesting. Lastly, there is a gap in the literature regarding the wage gap for physicians in Norway. This leads us to our research questions:

1. How large is the gender wage gap in 2019 among physicians in Norway?
2. How does the wage gap change if we study fixed wages?
3. How large is the gender wage gap when we look at general practitioners and specialists separately?
4. How has the gender wage gap for physicians changed over the last ten years?

Our thesis will first present a review of relevant literature to serve as the background of our thesis. We provide information on the gender pay gap internationally and in Norway specifically. We will also provide background on the Norwegian labor market and family policies in Norway. Then we will present relevant literature about the gender pay gap, discussing theories on why it occurs. Next, we will present literature on the medical profession specifically, starting by presenting characteristics of the medical industry in Norway, then by reviewing the existing literature on the pay gap in the medical profession and discussing how it ties into the theory. The following chapter will present our source of data, the sample selection process in Microdata.no, and a presentation of the variables we will use in our analysis. Next, we will present our methodological approach. We will then present our analysis, followed by a discussion of the results.

2 Background

2.1 The gender pay gap internationally

Since 1970, there has been an increase in the number of women who have entered education and the workforce (Kunze, 2017). As a result, women are beginning to overtake men in many countries. The relative increase in women's human capital has significantly decreased the observed gender wage gap in most countries. However, although most developed countries experienced a rise in women in the labor force, a gender wage gap remains (Kunze, 2017). For example, women in OECD countries earn 18% less than men (OECD, n.d.). Also, Boye, Halldén, and Magnusson (2014) argue that there have been small changes in the wage gap between genders in high-skilled occupations between 1974 and 2010.

There is also a significant variation across countries and over time (Kunze, 2017). A study of eight sample countries documenting the raw median gender wage gaps from 1970 to 2015 suggests that the US, the UK, and Japan had a large raw median gender wage gap of 40-50% in the early 1970s, which has dropped drastically ever since. Similarly, the result of a time series done of the developed countries also reveals no increase in the gender wage gap from 1970-2015. Kunze (2017) also suggests that the wage gap in the Scandinavian countries always has been less than 20% during this period, where the changes in the gender wage gap have been relatively small. Hence, there is significant heterogeneity in the convergence rate, where the UK, the US, and Japan had the highest convergence rate with -0,58 (Kunze, 2017).

A Panel Study of Income Dynamics documented a considerable decrease in the US gender wage gap from 1980 to 2010 (Blau & Kahn, 2017). According to the Pew Research Centre, there has been little change in the U.S. wage gap in the last two decades, with women on average earning 18% less than men, which is only 2% lower than in 2002 (Kochhar, 2023). The International Labor Organization estimates that the gender wage gap is, on average 20% globally, with large variations between countries (International Labour Organization, 2019). The World Economic Forum predicts it will take another 136 years to close the gender pay gap at the current rate (World Economic Forum, 2022).

2.2 The gender pay gap in Norway

2.2.1 The size of the Norwegian gender pay gap

Norway is often regarded as one of the most gender-equal countries globally (CORE, 2021). Even though no countries have attained full gender equality yet, Norway narrowed 84,5% of the gender gap in 2022 (World Economic Forum, 2022). In the index for 2022, the country ranks third, surpassed only by Finland and Iceland. Moreover, Norway achieved the highest score on educational attainment, where it attained nearly full gender equality (World Economic Forum, 2022). Despite this, the gender wage gap persists.

Over the last 20 years, there has been a decrease in the gender wage gap in Norway (Fløtre & Tuv, 2022). For example, in 2021, women earned an average of 87,9% of men's monthly wages, measured in full-time equivalent. However, the gender wage gap is much smaller if we look at the median wage instead, as women, in this case, earned 94,1% of men's monthly wages. This could be because men are overrepresented at the top of the wage distribution, whereas there are more women than men in the middle (Fløtre & Tuv, 2022).

2.2.2 Norwegian labor market characteristics

Occupational segregation is prevalent in Norway, with almost 70% of workers in the public sector being women (Fløtre & Tuv, 2022). In contrast, more than 60% of individuals in the private sector are men. The overrepresentation of women in the public sector may explain the lower wage level among women since wages in the public sector are generally lower than in the private sector. For instance, 80% of women work in health- and social services, where women earn an average of 88,2% of men's wages (Fløtre & Tuv, 2022). While Norway has a gender-segregated labor market, there has been some progress. For instance, women are increasingly enrolling in higher education and entering professional industries previously dominated by men (CORE, 2017b). However, most jobs that comprise the upper ten percent of the wage distribution are in the private sector, where men are overrepresented (Fløtre & Tuv, 2022).

Norway introduced gender quota regulations in 2003 (CORE, 2017a). The main goal was for listed companies and public enterprises to have a board of at least 40% of each gender (CORE, 2017a). However, in 2022, Norway's subindex score on economic participation and opportunity dropped by three percentage points to the levels in 2007 (World Economic Forum, 2022). This was due to a lower share of women as legislators, senior officials, and managers. For example, 65,95% of the legislators, senior officials, and managers are men in Norway, while only 34,05% are women (World Economic Forum, 2022).

Women are also likelier to work part-time (Fløtre & Tuv, 2022). More precisely, 46% of Norwegian women reported working part-time, while 25% of men reported working part-time. Part-time jobs often pay less, even if one calculates the wage to the full-time equivalent. This contributes to reducing the average wage of women, considering that women work fewer hours in nearly every profession (Fløtre & Tuv, 2022).

In addition, women are generally younger than men in many occupational groups (Fløtre & Tuv, 2022). The exceptions include office occupations, sales and service occupations, cleaning, nursing assistants, etc. Lower age may indicate shorter experience and seniority, affecting the wage level (Fløtre & Tuv, 2022). This is significant because longer seniority in a profession generally provides a basis for a higher wage level (Gunnes, 2018).

2.2.3 Family policy in Norway

Over the last 20-30 years, there have been significant family policies in Norway to facilitate a balance between family and career (Petersen et al., 2007). This includes paid parental leave, where a certain number of weeks are reserved for fathers (Arbeidstilsynet, n.d.; Pedersen & Godal, n.d.). In Norway, there is evidence that most fathers use their father's quota but seldom take out more than that (CORE, 2020). However, fathers who work in the private sector are less likely to use the entire quota (CORE, 2020). The fact that some fathers do not use the entire father's quota may be unfortunate for women, considering that lengthy maternity leave may reduce their accumulated human capital due to loss of work experience (Petersen et al., 2007). Parents in Norway have had this right since the 1970s, with 100% pay since 1978 (CORE, 2020; Petersen et al., 2007).

The second policy in Norway is the right to low-cost and high-quality childcare facilities, which lets mothers return to work after the maternal leave (Ministry of Education and Research, n.d.). However, a problem in Scandinavia is the limited hours at childcare facilities, which makes it difficult for the parents' careers (Petersen et al., 2007). People in high-paying professional jobs have been particularly affected by these short hours. Also, tax and cash benefits for families with children are another family policy in Norway. Lastly, the employment policies that facilitate flexible hours and the availability of part-time employment facilitate labor-force attachment for mothers (Petersen et al., 2007).

Notably, Norway is one of the countries where household labor is the most equally divided (Hook, 2006). On the other hand, Hakim (2000) argued that Nordic women have not attained any considerable degree of equality with men in market work yet, especially regarding high-paying and leadership positions. She also claimed that some policies that aim to balance career and family could have unintended consequences (Hakim, 2000). This is consistent with Mandel and Semyonov (2005), who highlighted some of the problems with gender-egalitarian family policies. They argued that despite a high women's labor force participation rate, these policies might also contribute to the underrepresentation of women in top positions as well as increase the gender-segregated labor market, where women mostly will be found in traditionally female-dominated occupations (Mandel & Semyonov, 2005). Gupta et al. (2008)) also argued that these family policies lead to a growing gender wage gap, particularly in high-skilled professions. Angelov, Johansson, and Lindahl (2016) argue that while family policies can help improve labor force participation for women, they will not close the gender pay gap unless women start working as many hours as men.

2.3 Explanations for the gender pay gap

Variables such as human capital, the family division of labor, selection into the labor force, compensating differentials, and discrimination have traditionally been emphasized by economists when studying the gender wage gap (Blau & Kahn, 2017). As a result, the total gender wage gap is often decomposed into three parts: (1) human capital factors, (2) occupational segregation, and (3) discrimination (Kanazawa, 2005). This section will present these factors and relevant theories on the causes of the gender wage gap.

2.3.1 Human capital theory and workforce interruptions

Human capital theory has been the most common explanation for the gender wage gap (Blau & Kahn, 2017; Kunze, 2017). However, since women now outnumber men in higher education in many countries (American Council on Education, 2017; De Hauw, Grow,

& Bavel, 2017), it is speculated that differences in human capital are less significant in explaining the gender wage gap today (Blau & Kahn, 2017). Despite this, a human capital model that connects the acquisition of knowledge of skills with the income earned from the labor market is a common starting point for analyzing the gender pay gap (Kunze, 2017). Therefore, we will outline this theory as the basis for more recent theories on the causes of the gender wage gap.

Goode (1959) defines human capital as "knowledge, skills, attitudes, aptitudes, and other acquired traits that contribute to production." The assumption is that the more human capital a worker has, the more productive they will be, thus increasing their wages (Becker, 1962). Therefore, differences in wage rates will be due to differences in human capital stock (Mincer, 1958). Human capital is an investment since the worker must forego potential earnings to increase their stock of human capital through schooling or on-the-job training (Becker, 1962), hoping that it will result in higher wages in the future (Goode, 1959). Human capital can be separated into "general human capital," which can be easily transferred between different firms, and "firm-specific" human capital refers to skills that only provide returns in a specific firm (Blau & Kahn, 2017).

Women's labor force participation rate has traditionally been lower than men's, vary by marital status and the number of children (Mincer & Polachek, 1974). Mincer and Polachek (1974) observed that women spend less than half of their lifetime in the labor market after marriage, which disincentivizes employers from training and learning opportunities for women. This also disincentivizes women from investing in their human capital stock. Women tend to invest less in their jobs because they spend less time in the labor force, which results in lower wages (Mincer & Polachek, 1974).

Human capital theory assumes that women's investments in human capital are lower because individuals with a shorter workforce participation tend to invest less per year worked than individuals with more extensive work experience (Mincer & Polachek, 1978). Mincer and Polachek (1978) also found that interruptions in one's workforce participation, regardless of length, can cause the human capital stock to depreciate over time. Therefore, any period of nonparticipation in the labor force results in lower future wages (Mincer & Polachek, 1974).

2.3.1.1 The motherhood penalty

The motherhood penalty is a concept that can help explain why women temporarily leave the workforce. The motherhood penalty is the negative relationship between women's wages and having children (Budig & England, 2001). Researchers have found connections between lower wages and fertility-related workforce withdrawals (Gronau, 1988; Korenman & Neumark, 1992). Mincer and Polachek (1974) suggest that mothers often prioritize the human capital acquisition of their children over accumulating market-oriented human capital for themselves by staying home with children.

The motherhood penalty can cause women to leave the workforce entirely or to switch to a more "mother-friendly" job (Budig & England, 2001). Erosa, Luisa, and Restuccia (2002) found that "fertility decisions generate important gender differences in turnover rates, with long-lasting effects in employment and wages." Even when controlling for human capital, work experience, and part-time work status, the average wages of mothers are less than for women without children, with each additional child negatively affecting wages (Avellar & Smock, 2003).

Budig and England (2001) suggest four possible explanations as to why mothers earn less; (1) fertility-related workforce interruptions cause them to lose job experience, (2) they may become less productive at work, (3) they choose mother-friendly jobs over high paying jobs, and (4) they may experience discrimination from their employers.

England, Bearak, Budig, and Hodges (2016) observe that in the U.S., high-earning, highly skilled white women face the largest total motherhood penalty. The reasoning is that even short interruptions from work are costly because they have such high returns to work experience (England, Bearak, Budig, & Hodges, 2016). However, even among high earners, there are differences in motherhood penalties. Bütikofer, Jensen, and Salvanes (2018) observe that the parenthood gap is greater among professions with non-linear pay structures than those with linear pay structures.

Petersen et al. (2007) findings suggest that there has been a considerable decline in the motherhood wage penalty from 1980 to 1997 at all levels. However, by the end of the period, there was still a small motherhood penalty at the population level (Petersen et al., 2007). Also, men experience a considerable marriage premium and small fatherhood premium, which have been relatively stable over this period at all levels, but much smaller at the occupation-establishment level. Thus, the gender wage gap in Norway, by the end of the period, is no longer mainly due to the motherhood wage penalty, but instead that men are rewarded for being male, for marriage, and for fatherhood (Petersen et al., 2007).

However, recent evidence from Denmark suggests that there is a motherhood penalty. In a study from Denmark, Kleven, Landais, and Søgaard (2019) found that although the gender wage gap has converged over time, the remaining pay gap can largely be attributed to the effects of having children. Because of the reduction in the pay gap over time, the fraction of the pay gap that is caused by child penalties has increased in Denmark between 1980 and 2013. While the child penalty for women is persistent and large for Danish women, it is virtually nonexistent for men. The study also found that daughters of couples adhering to traditional gender roles would experience larger child penalties after having children themselves (Kleven et al., 2019).

Angelov et al. (2016) studied the parenthood gap within Swedish families. They compared the earning trajectory of women to the earnings of their partner before and up to 15 years after the birth of their firstborn. The results indicate that after giving birth, the wage difference between the mother and the father increased by 32%. (Angelov et al., 2016) estimate that this effect is mainly caused by interruptions from the workforce that are directly caused by childbirth, such as parental leave, in addition to the long-term effect of childcare responsibilities. The authors also found that for couples where the man earns more or has a higher degree of education, the greater the parenthood penalty is for the woman (Angelov et al., 2016).

2.3.2 Gender segregation in the labor market

Another explanation commonly used when discussing the gender wage gap is occupational segregation, which refers to the fact that women tend to have different occupations than men (Polachek, 1981).

2.3.2.1 Vertical segregation and horizontal segregation

There are two primary forms of occupational segregation: vertical and horizontal. Vertical segregation, colloquially referred to as the glass ceiling, refers to the systemic barriers to women's career progression in a firm (EurWORK, 2017). In the Nordics, women are often underrepresented at higher levels in an organization, despite having high labor force participation rates (Anker & Melkas, 1998). Women are especially underrepresented at the managerial level in the private sector. This significantly impacts the wage gap because the gap is typically greater towards the top of the income distribution (Booth & Bryan, 2007).

Horizontal segregation refers to how men and women often work in different sectors and occupations (EurWORK, 2017). Women are, for example, more likely to work in the public sector, where the wages are generally lower than in the private sector (Anker & Melkas, 1998). In addition, Anker and Melkas (1998) found that Nordic women are more willing to enter traditionally male occupations, while men generally prefer to stay in historically male fields.

Significant evidence shows that traditionally, female occupations pay less than male occupations (Levanon, England, & Allison, 2009). Kanazawa (2005) illustrates the importance of occupational segregation with the following example: "Paying the same wages to male and female truck drivers, and male and female secretaries, will not close the sex gap in pay if truck drivers make more than secretaries, and most truck drivers are male, and most secretaries are female."

2.3.2.2 Background for occupational segregation

There are several possible explanations for why occupational segregation occurs. The traditional explanation is based on human capital theory. The theory assumes that strict gender roles cause women to invest less in their on-the-job training because they anticipate shorter and more discontinuous workforce participation, thus reducing their human capital and potential earnings (Mincer & Polachek, 1974). Consequently, jobs that require a high degree of skill may not be as appealing to women since they expect they will not stay long enough to benefit from investing in the necessary human capital (Winter-Ebmer & Zweimüller, 1992). Therefore, human capital theory predicts that women will select occupations where human capital investments are less critical to reducing the consequences of human capital depreciation from temporarily leaving the workforce (Polachek, 1981). However, England et al. (2016) found women do not experience a significant difference in penalization for time spent out of the labor market between male-dominated and female-dominated occupations.

Another hypothesis is the "crowding" effect, which states that there are restrictions to male-dominated fields, limiting women's job opportunities in these fields, and forcing them to apply elsewhere (Winter-Ebmer & Zweimüller, 1992). The restrictions in the male-dominated fields increase the labor supply for these female-dominated roles, thus decreasing the wages due to supply and demand. This causes wages in female-dominated fields to be relatively low and relatively high in male-dominated fields (Winter-Ebmer & Zweimüller, 1992).

The most salient explanation for occupational segregation, however, is differences in preferences (Winter-Ebmer & Zweimüller, 1992). Differences in preferences can help explain why men and women choose different occupations, why women are more likely to work part-time, and in some cases, why women are underrepresented in the higher levels of a firm. For example, individuals who value maximizing their earnings will choose well-paying jobs. In contrast, other individuals might appreciate non-pecuniary factors more and will thus prefer jobs with lower pay (Winter-Ebmer & Zweimüller, 1992). In addition, motherhood often leads to employment interruptions or part-time employment. Therefore, it may lead women to prefer occupations with amenities such as flexible hours, on-site childcare, and low demands for work-related travel (Budig & England, 2001).

Occupational segregation relates to the theory of compensating differentials, which states that jobs with "disagreeable" qualities will demand higher compensation and that the sum of agreeable and disagreeable characteristics in positions must be near equal to ensure labor market equilibrium (Smith, 1979). Firms must attract workers to unpleasant jobs by offering them high wages, while pleasant jobs are popular, enabling employers to offer lower wages (Smith, 1979).

Therefore, workers who highly value a particular non-pecuniary amenity will prefer to work for firms that can provide that reward more cheaply (Smith, 1979). A worker who does not value said amenity as much will choose to work for a firm that does not offer said amenity but compensates for it by offering higher wages (Filer, 1985). It follows that individuals who value earnings more than other factors will necessarily have high-paying jobs, while individuals that value non-pecuniary rewards more would be willing to accept lower-paying jobs as a trade-off (Winter-Ebmer & Zweimüller, 1992). Filer (1985) findings suggest that male-dominated occupations tend to have working conditions that make it necessary to offer higher wages to attract workers to these occupations (Filer, 1985).

2.3.2.3 Preferences on work hours

Cha and Weeden (2014) found that the increasing prevalence of overwork and the returns to overwork significantly slowed down the gender pay gap convergence. Overwork is defined as working more than 50 hours a week. It is especially common in professional and managerial jobs, where men tend to work longer hours and has exacerbated the gender wage gap by approximately 10%. This effect is significant enough to counteract the progress in reducing the wage gap through educational attainment and other forms of human capital (Cha & Weeden, 2014).

These results align with Goldin (2014) findings that individuals willing to work long and particular hours are disproportionally compensated. Because women often bear the brunt of household labor, they often prioritize flexibility at work. However, flexible work hours usually come at a price since some firms want their employees to work specific hours to be "on call" for clients or meetings. Thus, firms are willing to pay more to employees willing to work such particular hours. This practice is common in the legal, financial, and corporate sectors (Goldin, 2014).

Even in occupations where individuals are not disproportionately rewarded for the number of hours worked and working particular hours, there still might be a notable gender wage gap if the work requires overtime hours (Bolotnyy & Emanuel, 2018). Due to the existence of overtime hours, otherwise, substitutable male and female workers become less substitutable with each other, as women work less overtime than men due to family responsibilities (Bolotnyy & Emanuel, 2018; Goldin, 2014). Reyes (2007) studied OB/GYNs and demonstrated that women in this high-skilled occupation selected positions with fewer working hours and where the schedules are more regular. Workplaces that require long hours exacerbate the gender wage gap due to the gender difference in choices of working hours (Reyes, 2007). Women prefer more work flexibility, take more unpaid leave and work fewer overtime hours than men to fulfill family responsibilities (Bolotnyy & Emanuel, 2018).

Furthermore, although women and men work almost the same number of hours when the overtime hours are scheduled three months in advance, this is not the case when they are offered the day before as men, in this case, are twice as more likely to work overtime than women (Bolotnyy & Emanuel, 2018). These gender differences in working overtime contribute to the gender wage gap. Moreover, since women are more likely to take unpaid leave than men, this also results in men earning more than their scheduled wage while women earn less. Offers for scheduled and unscheduled overtime are often given to those with the highest seniority first, which lets them get the first pick for the most attractive overtime schedules. There might be occurrences of favoritism, as the supervisor can decide who to offer the shift first (Bolotnyy & Emanuel, 2018).

2.3.3 Discrimination in the labor market

Since human capital differences and occupational segregation cannot explain the total gender pay gap, gender-based discrimination in the labor market is another factor often considered when analyzing the gender wage gap (Blau & Kahn, 2017). Discrimination's effect on the gender pay gap is often studied because it is assumed that it makes up most of the unexplained wage gap. Therefore, the unexplained component of the gender wage gap is usually measured as an estimate of discrimination (Blau & Kahn, 2017).

Statistical discrimination models prescribe that when there is asymmetrical information in the labor market, a profit-maximizing employer might discriminate against an individual based on assumptions about their group to minimize the perceived probability of them quitting or expected productivity (Phelps, 1972). An example is that an employer may expect that all women will have children at some point, which will cause them to leave the workforce, and based on this assumption, offer women less pay and fewer possibilities (Budig & England, 2001). This assumption is consistent with the findings of Correll et al. (2007) that mothers were discriminated against based on perceived competence and recommended starting wages. At the same time, fathers were not penalized and, in some cases, even benefitted from their parental status. The fact that men seemingly prioritize money and high earnings more so than women could result in women anticipating the lower wages they will receive due to labor market discrimination and adapting to this expectation by deprioritizing high earnings (Blau & Kahn, 2017).

2.4 The gender pay gap in the medical profession

2.4.1 The characteristics of the medical industry in Norway

To be an authorized physician in Norway, you have to complete a rotational "LIS1" service, be under the age of 80 years old, be fit for the medical profession, as well as having completed the Norwegian medical official exam or foreign exam equivalent to the Norwegian exam (Helsedirektoratet, n.d-b). A physician can work in hospitals, clinics, doctors' offices, private practices, humanitarian organizations, defense, and in medical research (Helsedirektoratet, n.d-b).

Specialist training for doctors was established in 1955 (Helsedirektoratet, n.d-a). The specialization includes practical service, theoretical teaching, and other learning activities for at least six and a half years after authorization or license. The specialization is now divided into three phases: LIS1, LIS2, and LIS3, where the LIS1 component is common for all doctors (Braut, n.d.). The clinical practice consists of twelve months in the hospital and six months in the municipal health service. The hospital year is usually divided in two between the surgical department and the medical department. During the practice period, the doctor works independently but under the guidance and supervision of qualified doctors (Lovdata, 2016). To specialize in surgery or internal medicine, one must go on to LIS2 before proceeding to LIS3. All other specialists go directly from LIS1 to LIS3 (Braut, n.d.; Helsedirektoratet, n.d-a; Lovdata, 2016).

The Norwegian Medical Association reported that there were nearly 30,940 active physicians under age 70 in Norway, where 17,000 were specialists (Den Norske Legeforening, 2023). Although around 16,800 physicians received their education in Norway, almost half of the active physicians received their education in foreign countries and this proportion continues to increase (Den Norske Legeforening, 2023; Hermansen, 2020). In fact, Norway imports almost 30% of its specialists from foreign countries (Hermansen, 2020). It takes a minimum of five years to become a specialist after completing the LIS1 service, yet physicians spend an average of 8 years after being authorized to specialize (Den Norske Legeforeningen, n.d.; Enden, 2023).

According to Statistics Norway, there were 4,930 general practitioners (GPs) as of December 31, 2020 (SSB, 2022). Most GPs are self-employed and organized as sole proprietorships.

However, some GPs are employed as GPs in the contracting municipality, others are employed in their own (GP) limited liability company and many GPs have several different jobs for which they receive a salary (SSB, 2022). GP scheme was introduced in 2001 and gave everyone who lives in a Norwegian municipality the right to have a GP (Helse- og omsorgsdepartementet, 2022). The GP scheme also introduced an arrangement for the purchase and sale of existing GP practices, where the doctor who takes over the patient list of an outgoing doctor is forced to buy the entire medical practice (Den Norske Legeforeningen, 2015). Young doctors who want to become GPs are often expected to pay approximately one million NOK to the outgoing doctor for this package (Mykletun & Østby, 2023).

Female GPs had an average gross income of NOK 1,500,000; the men earned almost NOK 380,000 more (SSB, 2022). GPs younger than 30 had an average gross income of just under NOK 1,250,000, and GPs aged 67 and over made well over NOK 2,000,000. GPs with fewer than 750 patients on the list had an average gross income of NOK 1,400,000; those with 1,500 or more patients earned approximately NOK 870,000 more (SSB, 2022).

According to the Norwegian Medical Association, 4.87% of doctors work part-time in their registered primary position, respectively 4.9% among men and 4.8% among women, among working medical members under 70 in Norway (Den Norske Legeforening, 2023). The proportion of part-time workers is lowest among hospital doctors and lower among subordinates than superiors. On the other hand, the proportion of part-time workers is highest among specialists in private practice (13.1%), company doctors (13.1%), in scientific positions (12.7%), and general practitioners (11.3%), in this order. The proportion of part-time workers increases with age across the entire age spectrum up to 70 years (Den Norske Legeforening, 2023).

Even though all Norwegian citizens have a right to be assigned a GP, the Association of General Practitioners states that over 235,000 citizens did not have an assigned GP as of September 2022 (Allmenlegeforeningen, 2023). The GP shortage in Norway is a countrywide problem, but the situation is exacerbated in rural and remote areas (Humstad, Kræmer, & Moen, 2021). The northernmost county of Finnmark was also the most sparsely populated county before the municipality merger of 2020, with a population of just over 75,000 as of January 2020 (Statsforvalteren i Troms og Finnmark, 2021). These factors have caused the GP shortage to be especially dire in this county, with many municipalities in Finnmark struggling to attract and retain GPs (Dimmen, 2021).

The county is also struggling when it comes to medical specialists. The Finnmark Hospital Trust has provided signing bonuses to newly employed doctors over several years to attract and retain specialists in the region (Onsøien, 2022). The bonus is as follows: NOK 100,000 upon entering into an employment agreement in a permanent 100 percent position against a 12-month commitment period. An additional NOK 150,000 for a fixed period of 2 years in a permanent full-time position (paid after a trial period). The challenge of recruiting qualified health personnel is greatest at the smaller hospitals in the region (Onsøien, 2022). The shortage of specialists and general practitioners in the north has also caused wages to increase drastically in some municipalities in Finnmark and Troms (NRK, 2022; Tierno, 2003). As a result, some municipalities have resorted to hiring substitute GPs from staffing agencies, some reporting spending upwards of 300 000 NOK a week for a single substitute (Nyhus, 2022).

2.4.2 Human capital and the medical profession

In Norway, the first female physician graduated in 1893 (Aasland, 2022). In the 1970s, changes in attitudes toward women's role in society and gender equality occurred, and women began to expect equal career opportunities (Gjerberg, 2001). There was also an expansion of the Norwegian healthcare service, which increased job opportunities while facilitating women's entry into the medical profession. Since then, there has been an increase in the number of women in medicine as more women may have realized they would receive a high return on their investment in education, which is consistent with the human capital theory (Gjerberg, 2001).

Although the medical profession was male-dominated in the past, this has changed drastically in the last ten years (Gillebo-Blom, 2008). Approximately 54,7% of the active physicians under age 70 in Norway are women (Den Norske Legeforening, 2023). Also, 71,7% of students enrolling in medical school in 2022 were women (Onsøien, 2022). Women are also overrepresented in Ph.D. programs in medicine and are starting to overtake men in professor roles (Aasland, 2022). Thus, women's human capital is arguably greater or at least at the same level as men today, as both genders must invest many years in education to finish their medical degree (Aisenbrey & Brückner, 2008).

Among the medical specialists, who generally have higher wages than general practitioners, the majority are women (Fløtre & Tuv, 2022). However, since women are, on average, four years younger than male specialists, men still get to enjoy a higher wage on average than women. Thus, the few high-earning men contribute to the growing gender wage gap (Fløtre & Tuv, 2022).

2.4.3 Occupational segregation in the medical profession

Although the human capital between men and women is converging, women's returns in the labor market, in general, are lower partly due to within-occupational gender segregation (Aisenbrey & Brückner, 2008). Gjerberg (2001) found a within-occupational gender segregation in the medical profession in Norway. When Gjerberg (2001) studied the specialty choices made by the 1970 and 1980 cohorts of Norwegian female physicians, she discovered that both the 1970 and 1980 cohorts specialized to a high degree like male physicians. One possible reason is the changes in the attitudes toward equal opportunities. However, occupational segregation has historically been an issue in medicine. For instance, female physicians have been underrepresented in top positions and several highly-compensated medical specialties (Gjerberg, 2001). This also applies in Scandinavia (Arnesen, Myraker, Steinsholt, Thesen, & Ørbeck, 1974; Flottorp, 1993; Hovig, 1993; Korremann, 1994; Kvarner, Aasland, & Botten, 1999).

The underrepresentation of women in several specialties can result from their uncertainty of whether they can combine family and career in medicine or not (Gjerberg & Hofoss, 1995; Martin, Arnold, & Parker, 1988; Uhlenberg & Cooney, 1990). Thus, preferences affect occupational segregation. For instance, some women prefer favorable working hours and may choose a particular specialty, for example, pathology (Arnesen et al., 1974; Flottorp, 1993; Steinsholt, e Rygh, & Thesen, 1990).

On the other hand, some women prioritize professional challenges or choose specialties involving a specific patient group (Gjerberg, 2001). Female physicians were also more likely to select gynecology, obstetrics, or pediatrics (Brooks, 1998), despite these fields being primarily hospital-based specialties, which can involve challenging and unpredictable work (Gjerberg, 2001). Women also choose to sub-specialize to a lesser degree than men, which can be explained by the fact that subspecializing requires training for several years, in addition to it happening late in their careers (Gjerberg, 2001).

Although both men and women are present in general practice, women tend to work in the public sector, associated with fixed wages and regular working hours that can easily be combined with family life (Gjerberg, 2001). In contrast, private practice is dominated by men, where the wages are generally higher than in the public sector, thus contributing to the gender wage gap. This is interesting because physicians working in private practice tend to earn more than in the public sector, thus contributing to the gender wage gap (Gjerberg, 2001).

Some argue that the underrepresentation of female physicians in higher positions and certain specialties is due to male exclusionary practices (Crompton, Feuvre, & Birkelund, 1999; Gjerberg & Hofoss, 1998; Kvarner et al., 1999; Lorber, 1984; Riska & Wegar, 1993). For instance, women may have been prevented from choosing certain specialties like surgical specialties through lack of opportunity to gain relevant and enough experience, not being contemplated for appointments, etc. (Gjerberg, 2001). 30% of the Norwegian physicians believed that this was the case (Gjerberg & Hofoss, 1995).

Moreover, Magnusson (2016) suggests that male and female physicians choosing different specializations only have a modest effect in explaining the gender wage gap. In addition, women earned lower than men in every specialty. However, her findings suggested no clear pattern between the share of female physicians in medical specialization and wages. The results indicate that even when gender differences in specialization are considered, a gender wage gap persists. Despite this, the differences in the gender wage gap between specializations were relatively small (Magnusson, 2016). However, vertical segregation is important in explaining the gender wage gap, considering that female physicians are underrepresented in top positions (Gaiaschi, 2019).

2.4.4 Flexibility in the medical profession

In the health sector, the number of working hours is essential in explaining the gender wage gap. Still, the individuals here are not disproportionately rewarded for the number of hours worked and working particular hours (Goldin, 2014). Also, flexibility in the healthcare sector is less costly as the workers can be viewed as more substitutable with each other. This is because the transaction cost is lower than for other occupations when transferring information about the patient to another employee (Goldin, 2014). Similar to other health care professions, physicians can easily hand off work to their colleagues, and patients have less preference for a specific physician, which may decrease the penalty to working part-time and thus reduce the gender wage gap (Goldin, 2014; Goldin & Katz, 2016).

This is consistent with the findings of Briscoe (2006). Although a widely accepted theory has revealed that physicians in large bureaucratic medical organizations lack workplace control, Briscoe (2006) found that large organizations have potential substitute physicians, which also lessen patient burdens on individual physicians, thus reducing their on-call schedules and enabling them to pursue other career activities or fulfill family duties. Also, larger organizations have a systematic patient record system to a greater extent that enables the safe transfer of clients between physicians (Gans, Kralewski, Hammons, & Dowd, 2005). Larger medical organizations may also improve the handover of patients between physicians by having more standardized work processes, which in turn mitigate the risk of disagreements and misunderstandings (Gittell, 2002). In addition, ownership was significantly related to an increase in on-call schedules (Briscoe, 2006).

As a result of physicians being viewed as more substitutable with each other, their earnings have a linear relationship in relation to time worked, which in turn might indicate a low gender wage gap (Goldin, 2014). Occupations with linear earnings do not experience significant reductions in earnings related to working fewer hours and parental leave compared to other occupations. Hence, women in high-skilled professional occupations where the wage structure is more linear are less disadvantaged (Goldin, 2014).

Moreover, Goldin (2014) argues that occupations with less competition may have more linear earnings in proportion to working hours and thus lower the gender wage gap. Some specializations may be more competitive than others (McNally, 2008). Specialties that are considered more competitive have more limited positions in specialties compared to other specialties (Lefebvre, Hartman, Tooze, & Manthey, 2020). They also illustrated a strong connection between competitive specialties and high earning potential (Lefebvre et al., 2020). Also, field experiments reveal that women tend to avoid competition (Andersen, Ertac, Gneezy, List, & Maximiano, 2013). This also applies to women in medicine as they are not selected or discouraged to apply to certain specialties that are considered highly competitive, even if they are competent (McNally, 2008; Richardson & Redfern, 2000). Moreover, there might be some positions, like the top manager in a hospital or permanent medical professor at a university, where competition does matter. In these positions, the number of hours worked may increase the likelihood of attaining the reward, and hours themselves may be rewarded (Goldin, 2014).

Greater flexibility offered by larger organizations might be attractive for physicians as the medical profession has long working hours, complex schedules, and inflexible careers (Briscoe, 2006). In addition, patients' urgent timing might make it challenging to achieve flexible schedules and careers. However, if physicians can easily hand off work to each other, this may fix the flexibility problem (Briscoe, 2006). But, if the work is complex in a way where a service depends on knowledge from a previous service, it is more difficult to hand off between physicians (Crowston, 1997).

Greater flexibility provided in larger organizations should be especially attractive to female workers and dual-income families based on research on work-family role conflict (Lundgren, Fleischer-Cooperman, Schneider, & Fitzgerald, 2001; Moen & Dempster-McClain, 1987; Wharton & Blair-Loy, 2002). Furthermore, the number of physicians marrying someone in the same medical profession is growing (Sobecks et al., 1999). For example, every third physician in Norway has a partner in the same medical profession (Aasland, 1999). Hence, more and more individuals may prefer greater flexibility (Briscoe, 2006).

2.5 The Motherhood Penalty in the medical profession

Goldin and Katz (2008) illustrated that among Harvard graduates, physicians took the shortest time out of the workforce after childbirth. This result might suggest that the medical profession facilitates the balance between family and career for female physicians. Moreover, the time taken off from the workforce for each child declined across the three cohorts. In addition, among those with professional degrees or a doctorate, the penalty on earnings due to workforce interruptions was the smallest for physicians and other medical professionals. Despite mothers having lower full-time participation 15 years after graduating from Harvard, their findings suggest that female physicians with children may be far more attached to the workforce, regardless of how many children they have (Goldin

& Katz, 2008).

Magnusson (2016) found a positive association between parenthood and wages among Swedish female and male physicians. Both genders experienced a considerable wage premium for having children living in the household, although this effect is more positive for men. Also, the number of children was positively related to wages for both men and women. Thus, women did not have a wage penalty associated with having children but rather gained from having children. Then she studied the two groups, single men and women without children and married/cohabiting female and male parents. It also seems that cohabiting/married mothers earn less than cohabiting/married fathers, but cohabiting mothers earn more than single women without children (Magnusson, 2016).

There is a lack of research on the motherhood penalty for physicians in Norway specifically. However, in Norway, young men are increasingly taking out paternal leave (Aasland, 2022). In addition, male physicians take longer parental leave compared to other occupations and usually more than the allotted father quota (Pettersen & Engvik, 2021).

2.5.1 Unexplained factors

Magnusson (2016) studied the gender wage gap among physicians in Sweden and observed that most of the gender wage gap is unexplained even after controlling for parenthood and specialty. Jones and Kaya (2021) found that the average gender wage gap among physicians working in the public sector is mostly unexplained by work-related and personal attributes. This especially applies at the top of the wage distribution, where their result suggests that the gender wage gap among these physicians shows a glass ceiling. It is unknown whether the vertical segregation is due to discrimination or individual preferences to balance family and work (Jones & Kaya, 2021).

3 Data

This thesis aims to study the gender wage gap among physicians in Norway. This section will present the data we will use in our analysis, how we selected and refined the sample, and the explained and explanatory variables we will utilize.

We will use a cross-sectional dataset for the years 2009 and 2019. The year 2019 is chosen as the measurement year because it was the last year before the covid-19 pandemic, which we want to exclude to prevent this event from affecting our results. We included the year 2009 to study how the wage gap has developed over ten years.

3.1 Data source

We use Microdata.no to access data and perform our analyses. Microdata.no is an analysis system that provides access to large amounts of mergeable data and contains more than 11 million people, with time series dating back to 1964 (Microdata, n.d.-a). The microdata base has a wide range of register data, accessible without lengthy application processes (Microdata, n.d.-b). The advantage of using microdata.no is that it gives access to high-quality register data with a high level of validity. The data is also anonymized, meaning confidentiality is built into the platform. There are also some limits to which functions microdata.no can run, and the platform adds random noise to the descriptive statistics tables and hides extreme values to maintain confidentiality (Microdata, n.d.-b).

3.2 Sample selection

Our sample includes residents in Norway per 01.01.2019, i.e., removing people that have deceased or emigrated. We further limit our sample based on education. The educational variable we have chosen is based on the Norwegian standard for educational grouping (NUS), meaning that an individual's highest level of education receives an NUS code. If several educational activities are registered for an individual, the education with the highest level is selected (SSB, 2019). Since our analysis studies physicians, we keep individuals with the candidate medicinae (hereafter cand.med.) degree, the official Norwegian title for the medical degree. In addition to the cand.med degree, we have included three other educations to keep individuals with additional education beyond the standard medical degree in our sample. Since more than half of all physicians in Norway obtained their degrees from other countries, we have also decided to include individuals with the "additional course for international medical graduates." We also keep those with a dr.med.-degree, the title previously given to physicians with doctorates (Madssen & Tufte, 2016) and PhDs in medical subjects, since many specialists in our sample also have an advanced degree in addition to the standard medical degree. We keep The NUS codes '763101', '763102', '863101', and '863105'.

We keep medical graduates that obtained their degrees as of 01.01.2019 to ensure that individuals have graduated before 2019, the year we are studying. We want to ensure that all individuals in our sample have their degrees before the start of 2019. Since we are studying yearly wages, we do not want to include individuals that receive their degrees in June, as then we would likely observe annual wages that are only valid for half a year or wages earned from working a different job before completing their studies.

Further, we are interested in studying the wage gap for physicians. Therefore, we limit our sample by keeping physicians that work as general practitioners (GPs) or medical specialists, hereby referred to as specialists, per 01.01.2019. Limiting our sample to this profession is interesting because it has specific job characteristics that are especially interesting regarding the gender wage gap, such as higher levels of work flexibility, substitutability between individual physicians, and a more linear wage structure. Therefore, these factors are assumed to be associated with a smaller gender wage gap.

In addition, by exclusively analyzing physicians, a group assumed to be relatively homogenous in terms of human capital, we can more easily isolate the effect gender has on wages. Medical training is a long process, and it can take up to 14 years to complete a medical degree and specialist training. The dedication required of aspiring physicians can, therefore, also reduce heterogeneity in unobserved characteristics and work commitment among the group (Kralj, O'Toole, Vanstone, & Sweetman, 2022). However, a medical degree provides many career opportunities, and candidates are sought after in other sectors and industries, but our analysis aims to be more specific. Therefore, it is necessary to limit the sample to individuals who work as physicians to study the gender wage gap in this profession in isolation.

We use the variable 'REGSYS_ARB_YRKE_STYRK08', which indicates an individual's main occupation, and occupations are based on Statistics Norway's standard for occupational classification (SSB, n.d.). According to the standard, GPs and specialists are assigned the codes '2211' and '2212' respectively. We limit the analysis to these two occupational classification codes.

It is important to note that for the 2009 dataset, we use the variable REGSYS_YRKE_PUBL where there is no distinction between GPs and specialists, these two professions are lumped together into one professional category, given by the code 'P221X'. Also, for an additional analysis, we study the gender wage gap in 2019 for general practitioners and medical specialists separately. For that analysis, the sample will be split into two samples, one with GPs and one with specialists. Aside from that, there will be no difference from the main sample. Descriptive statistics on both of these professions can be found in Table 3.1.

Table 3.1: Descriptive statistics of General practitioners and Medical specialists in 2019 by gender

Characteristic	**General practitioners**		**Medical specialists**	
	Female (n=2 408)	**Male (n=1 755)**	**Female (n=6 944)**	**Male (n=5 347)**
Gender ratio	57,8%	42,1%	56,5%	43,5%
Mean age	37,62	40,73	40,61	42,42
PhDs %	2,0%	2,1%	7,0%	6,4%
International Medical Graduates%	1,8%	2,1%	2,6%	2,4%
Public sector %	60,4%	39,5%	57,1%	43,0%
Private sector %	48,9%	50,2%	49,1%	50%
Children under 10	0,43	0,39	0,51	0,49
Average annual wages	819.258,99	1.007.157,34	1.023.332,37	1.234.944,83

Notes: The table shows descriptive statistics of GPs and specialists in 2019. The former group is characterized by the profession code '2211', and the latter group by '2212'. Note that there is no equivalent table for 2009, since the data for 2009 did not distinguish between these two professions.

Next, we focus on individuals with reported income in 2019 since we are interested in studying the gender wage gap. Then we kept individuals over the age of 25 and under 61. According to the Norwegian Health Personnel Act, the age limit for medical authorization is 80, and after the authorization expires, the individual can apply for a license to continue their practice (Helsedirektoratet, n.d-b). Although the authorization expires at 80, physicians will likely reduce their commitment to full-time work or retire before they reach this age limit. Since the standard age of retirement in Norway is 67, and the earliest age for normal retirement is 62 years, which is possible one month after reaching that age, we decided to use 61 years as a cut-off point for age to avoid individuals who retired early to avoid including pension payments in our income variable.

We chose 25 years as the lower age restriction because, with few exceptions, most Norwegian high schoolers graduate the year they turn 19, and if they manage to get into medical school directly after high school and finish their degree in the standard six years, they will graduate the year they turn 25. Although many individuals complete medical school at a later age, 25 is generally the youngest a newly educated physician in Norway can be.

After we have completed the sample selection process for the year 2019, we do the same for the year 2009. Some of the codes differ from the 2019 sample, but the logic behind the process is the same. Tables 3.2 and 3.3 illustrate the sample selection process for both years.

Table 3.2: Sample selection process for 2019

Sample selection for 2019	**Observations**	**Removed**
(1) Total population	11.089.163	
(2) Keep just individuals living in Norway per 2019.01.01	5.325.830	5.763.333
(3) Keep only individuals with the chosen degrees per 2019.01.01	33.721	5.292.109
(4) Keep only GPs and specialists working as of 2019.11.16	18.170	15.551
(5) Remove all individuals without a reported income in 2019	18.167	3
(6) Keep only individuals between 25-61	16.458	1.709
Final sample	**16.458**	

Notes: The table shows the selection process for the sample used in the 2019 analysis. The chosen degrees are given by the NUS codes '763101', '763102', '863101', and '863105', and only include those that finished their degrees prior to 2019. The physicians have the profession codes '2211' and '2212'.

Table 3.3: Sample selection process for 2009

Sample selection for 2009	**Observations**	**Removed**
(1) Total population	11.089.163	
(2) Keep just individuals living in Norway per 2009.01.01	4.798.335	6.290.828
(3) Keep only individuals with the chosen degrees per 2009.01.01	22.991	4.775.344
(4) Keep only GPs and specialists working as of 2009.11.16	11.899	11.092
(5) Remove all individuals without a reported income in 2009	11.896	3
(6) Keep only individuals between 25-61	10.825	1.071
Final sample	**10.825**	

Notes: The table shows the selection process for the sample used in the 2009 analysis. The chosen degrees are given by the NUS codes '763101', '763102', '863101', and '863105', and only include those that finished their degrees prior to 2009. The physicians have the profession code 'P221X'.

3.3 Variable description

3.3.1 Dependent variable: Yearly wages

The main explained variable in our analysis is the logarithm of individual yearly wages. We have used a yearly wage variable, 'INNTEKT_WLONN,' that includes all taxable income during the calendar year, comprised of cash wages, benefits in kind, and sickness and maternity benefits. For simplicity's sake, we will hereby refer to this variable as the "total wage". The year of measurement is 2019 and 2009, since we will later compare these two years. We use the logarithm of wages, so the function is log-linear. A log-linear model is common when studying strictly positive variables such as wages because it normalizes the distribution and makes interpreting the results more intuitive.

We have also chosen to include a variable for fixed yearly wages, to compare the wage gap between fixed wages and total wages. The variable we chose, 'ARBLONN_LONN_FAST', shows the agreed fixed salary paid in the statistical month, fees, piecework, and commission are also included in the variable. Since the variable shows monthly wages, we summed each month in 2019 to create a yearly fixed wage variable so that it can be compared to the total yearly wage variable. It is worth mentioning that some enterprises, particularly in the state, municipalities and some large private companies, normally pay out wages for sickness and maternity benefits and later ask for a refund from NAV. In those cases, the fixed yearly wage variable includes sickness and maternity benefits. However, if NAV is in charge of the sickness and maternity benefits, these benefits will not be included in the fixed yearly variable. Microdata does not have information on which enterprises are in charge of sickness and maternity benefits, and which are not. It is also important to note that both wage variables are not calculated to the full-time equivalent wage.

The data for both wage variables are collected through the "a-ordning", which is a coordinated service employers use to rapport information about employees and their income to SSB, NAV and the Tax Administration (The Norwegian Tax Administration, n.d.). Table 3.4 shows the descriptive statistics of wages.

Table 3.4: Descriptive statistics of yearly wages in 2019 and 2009

	Men			**Women**		
	Mean	Median	Std.dev	Mean	Median	Std.dev
2019 Wages	1 178 590,93	1 157 708	387 504,89	970 860,45	950 874	316 366,64
2009 Wages	891 369,09	888 000	283 955,19	703 732,86	686 000	235 513,88

Notes: The table displays descriptive statistics of male and female physicians in 2019 and 2009. In 2019 the physicians have the profession codes '2211' and '2212', while in 2009 the code is 'P221X'.

3.3.2 Independent variables

In this subchapter, we present the explanatory variables we utilize in the analysis, what they include, and why they are relevant. In addition, we present descriptive statistics for the variables, which are summarized in tables 3.6 and 3.7.

3.3.2.1 Gender indicator

Since our research question is the gender pay gap among physicians in Norway, the primary independent variable in this analysis is an indicator variable for gender. The reference category is men, meaning the gender variable equals 1 when the individual is female and 0 when male. For the simplicity of our analysis, we view gender as a binary and exogenous factor.

3.3.2.2 Age

Work experience is assumed to be an essential factor in explaining the gender wage gap. From the literature study, we know that women are overtaking men both in medical school and the medical profession, thus causing an overrepresentation of young female physicians. Since this shift happened recently, female physicians are on average younger than male physicians. This suggests that the difference in experience between male and female physicians could be a significant contributing factor to why the gender gap persists. Therefore, we have opted to use an age variable as a proxy for experience, meaning that we assume that work experience will increase as an individual ages and that there is no significant difference in the age of men and women when they enroll in medical school, graduate, and start working. Therefore, we include a variable *age*. We also assume that the return to experience is diminishing over time, meaning that the relationship between income and experience is not linear and that for each year of work experience, the increase in income will be less than in the previous year. To capture this effect, we have included age^2 as an explanatory variable as well. The drawback of using age as a proxy for experience is that the assumption that experience increases with age may not hold if an individual leaves the workforce for an extended period. For example, we know that women, on average, take longer parental leave than men; therefore, the age proxy will not register such a break from the workforce and its subsequent effect on work experience.

3.3.2.3 Sector

The literature review shows that men and women work in different sectors. Women tend to work in the public sector, and men in the private sector. This also tends to be the case in the medical profession, with male physicians overrepresented in private practice. Since the private sector usually offers higher wages, the gender imbalance in sectors can help explain the gender wage gap. Our sector variable, 'REGSYS_FRTK_SEKTOR_2014' for the 2019 dataset and 'REGSYS_SEKTOR' for the 2009 dataset, indicates the institutional sector of the company where the person has their main employment. According to Statistics Norway, the public sector is normally defined by grouping public financial enterprises and public non-financial enterprises together with the public administration sector (SSB, 2009). Each of these sub-sectors can in turn be divided into publicly owned enterprises and public business operations, which in turn can be divided into state and municipally owned enterprises or business operations.

We therefore combine the sectors of state administration, municipal administration, state-owned joint stock companies, and municipally owned joint stock companies to create the public sector category. We merge the remaining sectors to create the private sector category. Table 3.5 shows how we created the public and private sector categories. The process was similar for 2009, see appendix A0.2 for further details.

Table 3.5: Sector grouping

Public sector
1120 - State-owned joint stock companies
1520 - Municipally owned joint stock companies
6100 - The state administration
6500 - The municipal administration
Private sector
2100 - Private limited companies
2300 - Personal enterprises
2500 – Private producer-oriented non-profit organizations
5500 – Life insurance companies and pension funds
5700 - Non-life insurance companies
7000 – Nonprofits
8200 - Self-employed

Notes: The table displays how we created the 'Public' and 'Private' sectors for the control variables, based on SSB's standard for sector grouping.

3.3.2.4 Additional degrees

As mentioned in the sample selection subchapter, cand.med. is the primary education we wish to study, but we decided to include three other educations as it was common in our sample to have these educations in addition to cand.med. In addition, human capital theory states that increased human capital will result in an increase in wages, which is consistent with what we observe in our sample; physicians with the course for international medical graduates, dr.med. or PhDs in addition to cand.med also have higher wages on average than physicians who only have cand.med. Therefore, we have chosen to include a PhD indicator and an international graduate indicator, where the variable *PhD* or *foreign* will equal one if the individual has the degree in question or 0 if they do not.

3.3.2.5 County

In 2019, Norway was divided into 18 counties, and 19 in 2009. Evidence from Canada shows that physicians' wages can vary depending on where they work (Kralj et al., 2022). Since some specialties might be scarcer in rural communities, the local government might offer higher wages to attract the necessary specialists (Kralj et al., 2022). In Norway we can see this trend, where the wages historically have been quite high in the Northernmost counties in order to attract physicians to these regions Onsøien (2022); Tierno (2003).

GPs in small Norwegian municipalities earned more than GPs in other municipalities; in municipalities with up to 5,000 inhabitants, GPs earned an average of NOK 2.05 million, while those in other municipalities earned NOK 1.89 million (KS, n.d.). In order to create the county variable, we imported 'BOSATTEFDT_BOSTED' which indicates the municipality an individual lives in and transformed it into a variable indicating the county of residence.

3.3.2.6 Children under 10

As mentioned in the literature review, the motherhood penalty is an important factor in the gender wage gap. However, the impact of children is believed to be the most significant when the children are young and require adult supervision, we decided to include an indicator variable that shows whether an individual has children under the age of ten or not. This age is chosen as the upper age limit because we assume that children over this age become more independent of their parents. Therefore, the effect of having children above this age is expected to have less of an impact on the parents' income in the measurement year.

We created a dummy to indicate whether an individual has children under the age of ten or not, using the variables 'BEFOLKNING_YNGST_I_REGSTAT_FAMNR' and 'BEFOLKNING_BARN_I_REGSTAT_FAMNR' which indicate the age of the youngest person in the family and the number of children under the age of eighteen in the family respectively. If the first variable is ten or under ten and the second variable is greater than zero, our dummy equals one.

However, the choice to have children is endogenous. The desire to have children might influence an individual's career choices, opting for a more highly paid job to afford having kids. Conversely, individuals with lower paying occupations might decide not to have children, because child rearing is costly. Therefore, we cannot make any causal interpretations based on this control variable. We have chosen to include it solely to control for the motherhood gap and to avoid omitted variable bias in our analysis.

Tables 3.6 and 3.7 show the descriptive statistics of all variables.

Table 3.6: Descriptive statistics of physicians in 2019 by gender

Characteristic	**Male (n = 7108)**	**Female (n = 9346)**
Gender ratio	43,2%	56,8%
Mean age	42,01	39,85
GPs %	42,2%	57,9%
Specialists %	43,5%	56,4%
PhDs %	5,29%	5,81%
International Medical Graduates%	2,31%	1,81%
Public sector %	42,2%	57,7%
Private sector %	50,7%	49,7%
Children under 10	0,46	0,49
Average annual wages	1.178.590,93	970.860,45

Notes: This table displays the descriptive statistics for male and female physicians in 2019.

Table 3.7: Descriptive statistics of physicians in 2009 by gender

Characteristic	**Male (n = 5 649)**	**Female (n = 5 177)**
Gender ratio	52,2%	47,8%
Mean age	43,56	39,08
PhDs %	5,9%	3,2%
International Medical Graduates%	5,1%	5,0%
Public sector %	51,0%	49,1%
Private sector %	61,8%	38,6%
Children under 10	0,42	0,47
Average annual wages	891.369,09	703.732,86

Notes: This table displays the descriptive statistics for male and female physicians in 2009.

3.4 Empirical Approach

3.4.1 Estimating the unadjusted gender wage gap

To estimate the unadjusted gender wage gap among physicians, we will perform a simple regression. Our model studies the wages of individual i in 2019 and 2009, which gives us our primary regression equation (3.1):

$$lnW_i = \beta_0 + \delta_0 Female_i + \epsilon_i \tag{3.1}$$

The dependent variable is the logarithm of the yearly wage. The independent variable is an indicator variable, $Female_i$ that captures whether the physician is a male or female. An indicator variable is binary and takes the value 0 or 1.

β_0 and δ_0 are unknown parameters that will be estimated in the model. β_0 is the constant term, which in this case, indicates the average wage of male physicians. δ_0 is the indicator variable for gender. ϵ_i is the error term in the regression model. It contains everything the model fails to explain or the unobserved factors that influence the dependent variable.

Further, we use ordinary least squares (OLS) to estimate the coefficients. OLS aims to select OLS-estimates that minimize the sum of squared residuals (SSR) (Woolridge, 2018). In other words, to minimize how inaccurate our model is. The estimated OLS-model can be expressed as the following:

$$ln\hat{W}_i = \hat{\beta_0} + \hat{\delta_0}Female_i \tag{3.2}$$

Where $\hat{\beta_0}$ is the estimate of the constant and $\hat{\delta_0}$ is the estimated unadjusted wage gap.

3.4.2 Estimating the wage gap controlled for other factors

After estimating the unadjusted wage gap, we will study the size of the gender wage gap when we control for other independent variables that might be affecting the dependent variable. Doing so will also reduce the omitted variable bias (Woolridge, 2018). We will gradually add one variable after another. First, we will investigate the gender wage gap after controlling for age and age^2, which serve as proxies for experience. We include age^2 because we assume that there are diminishing returns to experience. In this case, β_1 can be interpreted as the percentage with which wages will increase each year, and β_2 will capture the nonlinear effect age has on wages. This gives us the following equation:

$$lnW_i = \beta_0 + \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \epsilon_i \tag{3.3}$$

Next, we control for sector. We have included an indicator variable that captures whether the individual works in the private or public sector. The indicator is equal to 1 if the individual works in the public sector and 0 if they work in the private sector. In this case, the private sector is the reference category. The indicator δ_1 shows how many percent the average wage will change if the physician works in the public sector instead of the private sector. The resulting equation is as follows:

$$lnW_i = \beta_0 + \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \delta_1 Public_i + \epsilon_i \tag{3.4}$$

We will also control for additional education beyond the cand.med.-degree because this may influence wages. Therefore, we have created indicators for PhDs and for the additional course for international medical graduates, *PhD* and *IntGrad*, respectively. In this case, the reference category is physicians with “only” the cand.med. degree. The indicators δ_2 and δ_3 can be interpreted as how many percent having an additional degree increases the yearly wages.

$$lnW_i = \beta_0 + \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \delta_1 Public_i + \delta_2 PhD + \delta_3 IntGrad_i + \epsilon_i \tag{3.5}$$

We also want to control for the county and have included an indicator with 17 counties in 2019. Oslo is the reference category. The aim is to capture whether there are any wage differences in counties. For the 2009 model, we use δ_{20} SørTrøndelag and δ_{21} NordTrøndelag instead of δ_{20} because in 2009, Trøndelag was split into two different counties. The indicators δ_4 until δ_{20} show the percentage by which living in a particular county affects the yearly wage relative to living in Oslo.

$$\begin{aligned} lnW_i = \beta_0 &+ \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \delta_1 Public_i + \delta_2 PhD + \delta_3 IntGrad_i \\ &+ \delta_4 Ostfold_i + \delta_5 Akershus_i + \delta_6 Hedmark_i + \delta_7 Oppland_i + \delta_8 Buskerud_i \\ &+ \delta_9 Vestfold_i + \delta_{10} Telemark_i + \delta_{11} AustAgder_i + \delta_{12} VestAgder_i \\ &+ \delta_{13} Rogaland_i + \delta_{14} Hordaland_i + \delta_{15} Sognogfjordane_i \\ &+ \delta_{16} MoreogRomsdal_i \delta_{17} Nordland_i + \delta_{18} Troms_i \\ &+ \delta_{19} Finnmark_i + \delta_{20} Trondelag_i + \epsilon_i \end{aligned} \tag{3.6}$$

Next, we add an indicator variable for children under 10. We have that δ_{21}=1 for individuals with children below ten and δ_{21}=0 for individuals without children below 10. The indicator δ_{21} can be interpreted as the percentage change having a child under the age of 10 has on the yearly wage.

$$\begin{aligned} lnW_i = {} & \beta_0 + \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \delta_1 Public_i + \delta_2 PhD_i + \delta_3 IntGrad_i \\ & + \delta_4 Ostfold_i + \delta_5 Akershus_i + \delta_6 Hedmark_i + \delta_7 Oppland_i + \delta_8 Buskerud_i \\ & + \delta_9 Vestfold_i + \delta_{10} Telemark_i + \delta_{11} AustAgder_i + \delta_{12} VestAgder_i \\ & + \delta_{13} Rogaland_i + \delta_{14} Hordaland_i + \delta_{15} Sognogfjordane_i \\ & + \delta_{16} MoreogRomsdal_i + \delta_{17} Nordland_i + \delta_{18} Troms_i \\ & + \delta_{19} Finnmark_i + \delta_{20} Trondelag_i + \delta_{21} Child10_i + \epsilon_i \end{aligned} \tag{3.7}$$

Lastly, we add the interaction term of female and public sector. An interaction term allows us to take into consideration that the partial effect an independent variable has on the dependent variable might vary based on the magnitude of another independent variable (Woolridge, 2018). Therefore, we take the product of the female indicator and the sector indicator to create an interaction term, to see if there is an interaction effect present. This is to study if working in the public sector reduces the gender wage gap for female physicians. A positive β coefficient can be interpreted as public sector having a lower gender wage gap for female physicians than the private sector, while a negative β implies the opposite.

$$
\begin{aligned}
lnW_i = {} & \beta_0 + \delta_0 + Female_i + \beta_1 Age_i + \beta_2 Age_i^2 + \delta_1 Public_i + \delta_2 PhD_i + \delta_3 IntGrad_i \\
& + \delta_4 Ostfold_i + \delta_5 Akershus_i + \delta_6 Hedmark_i + \delta_7 Oppland_i + \delta_8 Buskerud_i \\
& + \delta_9 Vestfold_i + \delta_{10} Telemark_i + \delta_{11} AustAgder_i + \delta_{12} VestAgder_i \\
& + \delta_{13} Rogaland_i + \delta_{14} Hordaland_i + \delta_{15} Sognogfjordane_i \\
& + \delta_{16} MoreogRomsdal_i + \delta_{17} Nordland_i + \delta_{18} Troms_i \\
& + \delta_{19} Finnmark_i + \delta_{20} Trondelag_i + \delta_{21} Child10_i \\
& + \delta_{22} Female * Public + \epsilon_i
\end{aligned} \tag{3.8}
$$

4 Analysis

In this section, we will provide the results of our analysis. We will begin by presenting the findings from the main specification. The main specification studies the unadjusted and adjusted size of the gender wage gap among physicians in 2019, using the total wage variable. As mentioned earlier, the total wage variable includes all yearly taxable income, such as cash wages, benefits in kind, and sickness and maternity benefits. Hence, overtime is also included in this variable.

For additional analysis, we will explore the size of the gender wage gap using the fixed wage variable. Fixed yearly wages variable consists of agreed yearly fixed salary paid, fees, piecework, and commission. As mentioned earlier, the fixed yearly wage variable may include sickness and maternity benefits for some enterprises, particularly in the state, municipalities, and some large private companies, and not for others. We have included this fixed yearly wage variable as we are interested in comparing the size of the gender wage gap between fixed wages and total wages. This is an important comparison, as we know from the literature review that gender differences in working hours can play an important role in explaining the gender wage gap. However, we excluded working hours from our main specification to avoid bias because the choice of working time may be endogenous as it depends on people's choices.

We will then study the size of the gender wage gap among general practitioners and medical specialists. We are interested in whether there is a problem in our sample regarding people's self-selection into different jobs. By splitting the sample into general practitioners and medical specialists, we still cannot make any conclusions when comparing the size of the gender gap in wages between these two occupations, but we make the self-selection problem more visible.

Lastly, we want to explore whether the gender wage gap among physicians has changed over time using cross-sectional data from 2009 and 2019. This is interesting as Boye et al. (2014) suggest that there have been few changes in the gender wage gap in high-skilled occupations between 1974 and 2010.

4.1 The gender wage gap in 2019

Table 4.1: OLS regression of log yearly total wage in 2019

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.19494***	-0.16046***	-0.16193***	-0.1616***	-0.16188***	-0.16399***
	(0.00625)	(0.00578)	(0.00577)	(0.00576)	(0.00573)	(0.01669)
Age		0.07449***	0.07467***	0.07263***	0.07374***	0.0843***
		(0.0029)	(0.00289)	(0.00291)	(0.0029)	(0.00331)
Age^2		-0.00068***	-0.00067***	-0.00066***	-0.00067***	-0.00079***
		(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Public			0.07456***	0.06999***	0.05878***	0.057***
			(0.00911)	(0.00912)	(0.00917)	(0.01282)
PhD				0.06598***	0.07159***	0.07125***
				(0.00943)	(0.00958)	(0.00957)
IntGrad				0.02811**	0.03959***	0.03846***
				(0.01376)	(0.0137)	(0.01369)
Nordland					0.09178***	0.09504***
					(0.01488)	(0.01487)
Troms					0.10657***	0.10662***
					(0.01473)	(0.01472)
Finnmark					0.15965***	0.15538***
					(0.0263)	(0.02627)
Child10						-0.04318***
						(0.00658)
Female*Public						0.00296
						(0.01774)
Observations	16 458	16 458	16 458	16 458	16 458	16 458
Adjusted R^2	0.05567	0.20335	0.20653	0.20885	0.21996	0.2219

Standard errors are in parentheses
***p <0.01; **p <0.05; *p <0.1

Notes: The table shows the results from the main specification of the gender pay gap among physicians in Norway as of 2019. The dependent variable is the logarithm of yearly total wage variable 'INNTEKT_WLONN' from Microdata. The physician sample are those that are between the age of 25 and 61 and have the cand.med.-degree, including individuals that might have a PhD or completed an additional course for international graduates. These educations are given by the NUS codes '763101', '763102', '863101', and '863105'. The occupations we are keeping are GPs and medical specialists, given the by the codes '2211' and '2212'. The reference categories are Male, Private, Cand.Med., and Oslo. We control for all counties.

Column (1) of table 4.1 shows the unadjusted gender gap of total wage among physicians between the ages of 25 and 61 in Norway. The unadjusted wage gap shows the difference in average annual wage when we only control for gender. We observe that the estimated coefficient of the female dummy is -0,195. Thus, the unadjusted gender wage gap among all physicians is 19,5%, suggesting that female physicians, on average, earn 19,5% less than male physicians. Hence, female physicians earn an average of 80,5% of male physicians' wages. The coefficient of the female dummy is negative and significant at a 1% percent significance level.

Furthermore, the adjusted R^2 is low, which implies that gender only explains 5,6% of the variation in wage. Omitting a relevant variable from the regression may cause biased and inconsistency in the estimator of all the parameters (Woolridge, 2018). We, therefore, find it reasonable to estimate the gender wage gap after controlling for other factors that may explain the variation in wage and correlates with the female indicator. This is to avoid that the coefficient of the female indicator captures both the true effect female has on wage and parts of the effect the omitted explanatory variables have on wage. The omitted variable bias may thus lead to the female dummy being over or underestimated.

Column (2) suggests that the gender wage gap is reduced from 19,5% to 16,0% when controlling for *age* and age^2(which are proxies for experience), suggesting that the unadjusted estimate contained omitted variable bias. This is an expected result, as women, on average, are younger than men. The interpretation is that female physicians earn 16.0% of their male coworkers given the same age. The positive coefficients of *age* and the negative coefficient of age^2 suggest that experience proxied by age is positive, but as they age, the effect age has on wages shrinks. In other words, there is a nonlinear relationship between wage and age. Our results suggest that wages will increase for each additional year to the turning point, age*= 0,07449/[2(0.00068)] = 54,77206, approximately 55 years of age (Woolridge, 2018). This implies that at approximately 55 years, an additional year would reduce the wage, which is not quite consistent with reality. That is one of the issues with including the age^2 variable, which aims to capture the diminishing return to age (Woolridge, 2018).

Although there is no reverse causality between age and wage, whereby that wage does not affect age, the estimation of the age coefficient may be biased and inconsistent due to omitted variables. Omitting a relevant variable may cause biased and inconsistent estimators of all parameters. Thus, this may result in either an overestimation or underestimation of the estimator of the female dummy, *age*, and age^2. This implies that we cannot correctly study the true effect gender has on wages unless we include all the relevant variables. Nevertheless, the coefficient of the female dummy is still negative and significant at a 1% percent significance level.

When we include *age* and age^2 as explanatory variables, the adjusted R^2 has dramatically increased to 20,3%. This indicates that gender, *age*, and age^2 explain 20,3% of the variation in wage. This may suggest that gender differences in age, could be an essential contributing factor to why the gender wage gap still persists among physicians, as female physicians are on average younger than male physicians.

Column (3) shows the gender pay gap increasing slightly from 16,0% to 16.2% when controlling for *age*, and age^2 and *sector*. The coefficient of the female dummy is still negative and significant at a 1% significance level. Our result from our analysis implies that female physicians earn 83,8% of their male colleagues, given they are the same age and work in the same sector. The coefficient of the public sector suggests that physicians working in the public sector earn 7,5% more than those that work in the private sector, all else equal. This was unexpected, as wages in the public sector are generally lower than in the private sector. In addition, most jobs that comprise the upper ten percent of the wage distribution are found in the private sector, based on the literature review.

However, we must be cautious when interpreting the coefficient of the public sector. This is because the sector one works in may be an endogenous factor, since it depends on an individual's choice (Beblo, Beninger, Heinze, & Laisney, 2003). Based on existing literature, it is fair to assume that the choice of sector can affect wages. Nevertheless, wages might also likely affect the choice of sector. The issue with reverse causality is that the OLS estimators of all the parameters can be biased and inconsistent. Hence, this may result in either an overestimation or underestimation of the female dummy, *age* and age^2 and sector, and we can no longer know the effect gender has on wages. Furthermore, we see that the adjusted R^2 has increased to 20,7%, which implies that this is a relevant explanatory variable that influences the wage variable.

Column (4) displays the gender wage gap after controlling for age, sector, and level of education. The gender wage gap is 16,2%. The coefficient of the female dummy is negative and is significant at a 1% significance level. Our findings imply that female physicians earn 83,8% of the male physicians, given that they are the same age, work in the same sector, and have the same education level. The coefficients *PhD* and *IntGrad* suggest a positive association between wage relative to cand.med, all else equal. However, the coefficient might be biased because education may be an endogenous factor as it depends on an individual's choice (Beblo et al., 2003). The level of education will likely affect wage, but it is also likely that wage will affect the level of education an individual chooses. Thus, the estimates of all parameters may be over or underestimated, and we cannot make causal interpretations. Furthermore, adjusted R^2 has also increased, which suggests that the independent variables explain the variation in wage by 20,9%.

Column (5) shows that the gender wage gap after controlling for age, sector, level of education, and counties is 16,2%. Thus, female physicians earn 83,8% of male physicians with the same experience (proxied by age), the same level of education, and who work in the same sector and county. After controlling for counties, the female dummy is still negative and significant at a 1% significance level. Since we have used Oslo as a reference category, the coefficient of the Finnmark dummy suggests that physicians working in Finnmark earn 16,0% more than those who work in Oslo, all things equal. These results are consistent with the literature review that Finnmark offers higher wages to attract and retain physicians. However, since which county one lives in may be endogenous as it depends on an individual's choice, the estimation of the dummy coefficient might be biased. Based on the literature review, Which county an individual chooses to work in will likely affect wage, however wage may also affect the choice of county. Thus, this may lead to an over or underestimation of all the parameters, can be biased and inconsistent, and we cannot make a causal interpretation. Nevertheless, adjusted R^2 has also increased after adjusting for county and implies that this is a relevant variable that explains the variation in wage.

Column (6) presents the gender wage gap after including a dummy indicating whether the individual has a child under ten years and an interaction of female and public sector, and is 16,4%. This suggests that female physicians earn 16,4% less than male physicians given the same experience, sector, level of education, county, and children under 10.

As mentioned earlier, we cannot make any causal interpretations between the dummy indicating whether the individual has a child under ten years and wages, as this might lead to reverse causality. However, we still decided to control for this because of omitted variable bias. The female dummy is negative and remains significant at a 1% significance level after adjusting for the dummy indicating whether the individual has a child under ten years and the interaction term. In addition, we have included an interaction of female and public sector to examine if the public sector reduces the gender wage gap for female physicians. Based on the literature review, we would expect a lesser gender wage gap in the public sector compared to the private sector as public sector are associated with larger organizations, thus providing greater flexibility. This may suggest that fewer women are working part-time in public compared to the private sector, and thus smaller gender wage gap.

Moreover, we also suspect that the gender wage gap is larger in the private sector because men are overrepresented at the top of the wage distribution, and most jobs comprising the upper ten percent are private (Fløtre & Tuv, 2022). We observe that the interaction term of female and public sector is insignificant, which implies that there is no significant difference in the wage gap for women working in the public than women working in the private sector. Moreover, adjusted R^2 displays that the explanatory variables explain 22,2% of the variation in the wage variable.

4.2 The gender wage gap using a fixed-wage variable

Based on the literature review, the number of hours worked can contribute to explaining the gender wage gap. Our main specification uses the total wage variable, however, we decided to exclude working hours from our main specification as the choice of working hours may be endogenous as it depends on people's choices. That might lead to a reverse causal relationship between working hours and wages, and we cannot interpret the coefficient causally. Hence, we will be studying the gender wage gap using the fixed wage variable and compare the size of the gender wage gap between fixed wages and total wages, which includes overtime. Since overtime is not included in the fixed-wage variable, gender differences in working overtime do not affect the fixed-wage dependent variable. Table 4.2 compares the regressions with the total wage variable and fixed wage variable.

Table 4.2: Comparing our main specification with the fixed wage specification

	Total wage			**Fixed Wage**		
	Unadjusted	Controls	Interaction	Unadjusted	Controls	Interaction
Female	-0.19494***	-0.16188***	-0.16399***	-0.09222***	-0.05652***	-0.11764***
	(0.00625)	(0.00573)	(0.01669)	(0.00597)	(0.00547)	(0.01598)
Age		0.07374***	0.0843***		0.06983***	0.07007***
		(0.0029)	(0.00331)		(0.00276)	(0.00316)
Age^2		-0.00067***	-0.00079***		-0.00064***	-0.00064***
		(0.00003)	(0.00003)		(0.00003)	(0.00003)
Public		0.5878***	0.057***		-0.08797***	-0.12283***
		(0.00917)	(0.1282)		(0.00877)	(0.01226)
PhD		0.7159***	0.07125***		0.07517***	0.07593***
		(0.00958)	(0.00957)		(0.00912)	(0.00912)
IntGrad		0.03959***	0.03846***		0.01926	0.02042
		(0.0137)	(0.01369)		(0.01308)	(0.01308)
Nordland		0.09178***	0.09504***		0.07313***	0.07298***
		(0.01488)	(0.01487)		(0.01418)	(0.01418)
Troms		0.10657***	0.10662***		0.07034***	0.0694***
		(0.01473)	(0.01472)		(0.01403)	(0.01403)
Finnmark		0.15965***	0.15538***		0.09312***	0.09321***
		(0.0263)	(0.02627)		(0.02503)	(0.02503)
Child10			-0.04318***			0.00036
			(0.00658)			(0.00629)
Female*Public			0.0296			0.06909***
			(0.01774)			(0.01698)
Observations	16 458	16 458	16 458	16 378	16 378	16 378
Adjusted R^2	0.05567	0.21996	0.2219	0.01427	0.18777	0.18885

Standard errors are in parentheses
***p <0.01; **p <0.05; *p <0.1

Notes: The table shows the results from the main specification found in the previous section, and the 'Fixed Wage' variable that includes the agreed upon fixed wage, fees, commission and piecework. The total wage variable comes from the 'INNTEKT_WLONN' variable from Microdata.no, while the fixed wage variable comes from the 'ARBLONN_LONN_FAST', which is a monthly variable, that we summed to obtain the yearly wage form. We use the same sample of physician as in the previous section to find the gender wage gap using different wage variables. We control for all counties.

It is worth mentioning that there are fewer observations when we use the fixed-wage variable since around 77 observations had no valid value for the fixed-wage variable, which is just about 0,5% of our sample. Hence, these were excluded when we ran the regression because of missing information on fixed wages.

The regression model shows that the unadjusted gender wage gap when looking at fixed wages is 9,2%. On the other hand, the unadjusted gender wage gap when using the total wage variable is 19,5%. Hence, the gender wage gap is lower when the wage only includes fixed elements. Based on the results of Bolotnyy and Emanuel (2018), this is expected as there is a gender difference in working overtime, where women work fewer overtime hours than men to fulfill family responsibilities. Thus, the differences between men and women in overtime hours will affect the total wage variable that includes overtime but not the fixed wage variable.

Regarding the gender wage gap controlling for age, age^2, sector, the level of education, and counties, this is also larger using the total wage variable at 16,2%, whereas the gap is "only" 5,7% for fixed wage. The female dummy is negative and significant on a 1% level. Without making any causal interpretation, the adjusted gender wage gap being considerably larger using the total wage suggests that gender differences in overtime hours might be essential in explaining the gender wage gap among physicians.

Moreover, when we look at the fixed wage, the interaction term of the female dummy and public sector is both positive and significant at a 1% significance level, which suggests that the gender wage gap is smaller for women working in the public sector than for women working private sector. However, when we look at the total wage, which includes overtime, we observe that this interaction term is insignificant.

4.3 The gender wage gap among GPs and specialists

We are also interested in investigating the size of the gender gap between general practitioners and medical specialists, as the literature review indicates that the gender wage gap among specialists might be more prominent. Individuals self-selecting into different professions is a reason we might have reverse causality, and we could not make any causal interpretations of the coefficient had we included a dummy indicating whether the individual is a medical specialist. Thus, we study the gender gap in total wage among GPs and specialists separately. It is important to note that by splitting the sample into GPs and specialists, we can still not make any causal interpretations about the differences in the size of the gender wage gap between the two samples, but we can make the self-selection problem more visible. Table 4.3 shows the size of the gender gap between general practitioners and medical specialists.

Table 4.3: Gender wage gap among General practitioners and Medical specialists

	General practitioners			**Medical specialists**		
	Unadjusted	Controls	Interaction	Unadjusted	Controls	Interaction
Female	-0.19691***	-0.14301***	-0.13297***	-0.19048***	-0.16569***	-0.1983***
	(0.01608)	(0.01524)	(0.03102)	(0.00587)	(0.00535)	(0.01933)
Age		0.04101***	0.05148***		0.05974***	0.07047***
		(0.00686)	(0.00804)		(0.00298)	(0.00334)
Age^2		-0.0003***	-0.00043***		-0.00052***	-0.00065***
		(0.00008)	(0.00009)		(0.00003)	(0.00003)
Public		-0.01794	-0.01341		-0.02699***	-0.04454***
		(0.01911)	(0.02655)		(0.01041)	(0.0145)
PhD		0.22937***	0.22804***		0.02752***	0.02744***
		(0.03868)	(0.03867)		(0.0083)	(0.00828)
IntGrad		0.03902	0.0392		0.03961***	0.03876***
		(0.03894)	(0.03892)		(0.01255)	(0.01253)
Nordland		0.21443***	0.21966***		0.07854***	0.08107***
		(0.03595)	(0.03599)		(0.01458)	(0.01456)
Troms		0.15414***	0.15554***		0.11186***	0.11148***
		(0.04076)	(0.04076)		(0.01361)	(0.01358)
Finnmark		0.30892***	0.3052***		0.14914***	0.14434***
		(0.05434)	(0.05433)		(0.0282)	(0.02815)
Children under 10			-0.04512**			-0.04244***
			(0.0179)			(0.00611)
Female*Public			-0.01077			0.03536*
			(0.0355)			(0.0201)
Observations	4 168	4 168	4 168	12 289	12 289	12 289
Adjusted R^2	0.03452	0.15962	0.16053	0.07883	0.24431	0.2473

Standard errors are in parentheses
***p <0.01; **p <0.05; *p <0.1

Notes: The table presents the results from the regression of the gender pay gap among GPs and specialists as of 2019. The two professions are characterized by the profession codes '2211' and '2212' respectively in Microdata. The dependent variable is the logarithm of yearly total wage variable 'INNTEKT_WLONN' from Microdata.

Table 4.3 displays a considerable unadjusted gender gap in total wages among general practitioners at 19,7%. Among specialists, the unadjusted gender wage gap is, however, 19,0%. The female dummy is also significant at a 1% significance level. Our results suggest that the unadjusted gender wage gap is slightly larger among general practitioners than specialists. However, we have to be careful when we compare the size of the gender wage gap between GPs and medical specialists due to people self-selecting into different jobs based on preferences. Nonetheless, this result was unexpected as we would assume that the gender wage gap is greater among specialists based on the literature review.

Since our results may suggest that the unadjusted gap is larger for general practitioners than for medical specialists, we decided to study the gender wage gap after controlling for age, sector, level of education, and county. As a result, we observed a notable adjusted gender wage gap at 14,3% for general practitioners, while this is 16,6% for medical specialists. Thus, our result might indicate that the adjusted gender wage gap is greater among specialists than general practitioners, but again we have to be careful when comparing these two due to the issue of individuals self-selecting into different jobs.

When we include the interaction term of the female dummy and the public sector, we observe that the interaction term is positive and significant at 10% for specialists, while it is insignificant for general practitioners. This implies that the gender wage gap is smaller for female specialists working in the public sector than for specialists working in the private sector.

4.4 The gender wage gap in 2009

We are also interested in whether the gender wage gap among all physicians has increased or decreased over time using cross-sectional data from 2009 and 2019. Some studies have shown that there has been little change in the gender wage gap in high-skilled occupations between 1974 and 2010 (Boye et al., 2014). Moreover, our data show that the proportion of female physicians increased from 43,2% in 2009 to 56,8% in 2019. Therefore, we find it interesting to see if this is true for physicians, which is considered a highly skilled profession.

Table 4.4: OLS regression of log yearly wage in 2009

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.24262***	-0.18624***	-0.18657***	-0.18401***	-0.18441***	-0.18407***
	(0.00787)	(0.00755)	(0.00755)	(0.0075)	(0.0075)	(0.00752)
Age		0.08652***	0.08607***	0.08289***	0.08344***	0.09264***
		(0.00371)	(0.00371)	(0.00372)	(0.00372)	(0.00405)
Age^2		-0.00084***	-0.00083***	-0.00081***	-0.00081***	-0.00093***
		(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)
Public			-0.00062***	-0.00058***	-0.00056**	-0.000047*
			(0.00016)	(0.00016)	(0.00016)	(0.00017)
PhD				0.15446***	0.15752***	0.15794***
				(0.01318)	(0.01337)	(0.01335)
IntGrad				0.03369***	0.03726***	0.03898***
				(0.01231)	(0.01232)	(0.01231)
Nordland					0.06491***	0.0661***
					(0.01886)	(0.01883)
Troms					0.07041***	0.07443***
					(0.01773)	(0.01771)
Finnmark					0.11482***	0.11473***
					(0.0319)	(0.03185)
Child10						-0.04818***
						(0.00831)
Female*Public						-0.00056
						(0.00031)
Observations	10 825	10 825	10 825	10 825	10 825	10 825
Adjusted R^2	0.08063	0.19883	0.19986	0.2099	0.21397	0.21639

Standard errors are in parentheses
***p <0.01; **p <0.05; *p <0.1

Notes: The table shows the results from the regression of the gender pay gap among physicians as of 2009. The dependent variable is the yearly wage variable 'INNTEKT_WLONN' from Microdata. The physician sample are those that are between the age of 25 and 61 and have the cand.med.-degree, including individuals that might have a PhD or completed an additional course for international graduates. These educations are given by the NUS codes '763101', '763102', '863101', and '863105'. The occupations we are keeping are physicians, given the by the codes 'P221X'. The reference categories are Male, Private, Cand.Med., and Oslo.

In 2009 the unadjusted gender gap was 24,3%, whereas this gap was reduced to 19,5% in 2019. Without making any causal interpretations, our results suggest that the gender wage gap among physicians was larger in 2009 than in 2019, implying that the gender wage gap may have reduced over time. Moreover, our findings suggest that female physicians in 2009 earned 75,7% of male physicians' wages. Further, we want to explore why there might have been a decrease in the gender wage gap, and we do that by adding control variables other than gender.

In column (2) of Table 4.4, we see a notable gender wage gap after adjusting for *age* and age^2 at 18,6%. We observe that the gender wage gap went from 24,3% to 18,6% after adjusting for *age* and age^2 in 2009. In comparison, the gender wage gap after controlling for *age* and age^2 went from 19,5% to 16,0% in 2019. The considerable reduction in the wage gap in 2009 compared to 2019 after controlling for age is expected. This is because the differences in the average age between men and women is larger in 2009 than in 2019. Based on our data, the mean age of women increased from 39,08 in 2009 to 39,85 in 2019. In comparison, the mean age of men decreased from 43,56 in 2009 to 42,2 in 2019. Moreover, adjusted R^2 has increased to 19,9%, which indicates that age is a relevant variable that explains wage in 2009.

Column (3) shows that the gender wage gap in 2009, after adjusting for *age* and age^2 and sector, increased slightly to 18,7%. It is also worth mentioning that the coefficient of the public dummy was negative in 2009, whereas it was positive in 2019. The coefficient of the public sector dummy suggests that physicians in 2009 who worked in the public sector earned 0,1% less than physicians who worked in the private sector, all things equal. This makes sense as wages in private sector are typically higher compared to public sector. However, we must be cautious when interpreting the coefficient of the public sector because the choice of working in the public sector depends on an individual's preferences (Beblo et al., 2013). The choice of sector will likely influence the wage one can expect to receive, and wage levels might affect which sector an individual chooses to work in. Such an instance of reverse causality means that the OLS estimators of all the parameters can be biased and inconsistent, so we cannot interpret the causal effect sector has on wages. The coefficient of female dummy is still negative and significant on a 1% significance level.

Column (4) presents that the gender wage gap in 2009 after controlling for age, sector, and level of education is 18,4%. This indicates that female physicians earn 81,6% of the male physician with the same experience, sector, and education level. The female dummy is still negative and is significant at a 1% significance level. Moreover, having a PhD had a greater effect on wages relative to those with only a cand.med.-degree in 2009 than in 2019. Since 5,9% of men had PhD in 2009 while this number was 3,2% for female physicians, based on our sample. The fact that more men have PhDs compared to women may have contributed to a larger gender wage gap in 2009 than in 2019.

However, the coefficient might be biased because the choice of education may be endogenous as it depends on an individual's choice (Beblo et al., 2003). The level of education will most likely influence the wage, but it is also possible that wage will affect the level of education an individual chooses. Thus, the estimates may be over- or underestimated, and we cannot make any causal interpretations.

Column (5) shows that the gender wage gap is 18,4% after adding the county as a control variable. The coefficient of the female dummy is negative and significant at a 1% significance level. Our result implies that women earn 81,6% of what male physicians earn, given that they have the same experience, work in the same sector, have the same level of education, and work in the same county. In addition, adjusted R^2 has increased, indicating that county is a relevant variable.

We also see that some control variables experience a noticeable increase or decrease compared to the 2019 regression in Table 4.4 column (5). The control variables that change the most are the PhD dummy, the Public dummy, and the Finnmark dummy. The coefficient of PhD dummy went from 15,8% in 2009 to 7,2% in 2019, suggesting that these had a greater effect on wages in 2009 compared to 2019. Considering that more men in 2009 had PhD than women, based on our data, and there was a larger effect of having PhD, this may have contributed to a larger gender wage gap in 2009.

In addition, the public dummy went from –0,1% in 2009 to 5,9% in 2019, suggesting that individuals who worked in the public sector earned lesser than individuals working in the private sector in 2009. In comparison, people working in the public sector earned more compared to those who worked in the private sector in 2019. Considering that 61,8% of the individuals working in the private sector were male in 2009, based on our data, this may have contributed to an even larger gender wage gap in 2009. Moreover, the Finnmark – dummy coefficient went from 11,5% in 2009 to almost 16,0% in 2019, suggesting that the county had a smaller impact on wages in 2009 compared to 2019. This is reasonable since the lack of GPs countrywide has been increasing steadily over the last ten years, and Finnmark's population is decreasing, further exacerbating the problem in this county.

Without making any causal interpretations, the decrease in the gender wage gap overall in ten years could be due to the age difference between male and female physicians evening more out over time, thus reducing the relative impact of age in 2019. Also, the fact that people working in the public sector earned less compared to those working in the private sector in 2009, while we observe the reverse in 2019, may have contributed to narrowing the gender wage gap over time, considering that women are overrepresented in the public sector.

After controlling for age, sector, level of education and county, and child under ten and including the interaction term for the female dummy and the public dummy, column (6) suggests that the gender wage gap was 18,4% in 2009. The interaction term is insignificant. Since the adjusted gender wage gap was 16,4% in 2019, our result may suggest that the gender wage gap in a high-skilled occupation like medicine has diminished over time. This contrasts with the finding that the gender wage gap has been stable in skilled occupations (Boye et al., 2014).

5 Discussion

5.1 The gender wage gap in 2019

Our findings suggest a significant unadjusted wage gap between men and women at 19,5% in 2019 when using the total wage variable that includes all taxable income, consisting of cash wages, benefits in kind, and sickness and maternity benefits. Thus, overtime is also included in this variable. When we control for age, sector, level of education, and counties, the gender wage gap remains significant and is 16,2%. Our result aligns with international literature that there is a noticeable gender wage gap even after controlling for different factors. This implies that even among a homogenous group such as physicians and in one of the most gender-equal countries, there is still a notable gender wage gap.

It is worth noting that the coefficient of the public sector was positive in 2019, which was unexpected. The coefficient indicates that physicians working in the public sector earn, to a certain extent, more than physicians who work in the private sector. This finding contrasts with the assumption that wages are generally lower in the public than in the private sector. We, therefore, speculate that there might be more medical specialists working in the public sector, considering that most GPs are self-employed (SSB, 2022). Since medical specialists generally earn more than general practitioners, this would result in a positive coefficient for the public sector.

Another possible explanation for why the coefficient of the *Public* dummy is positive might be because it partly captures some of the effect firm size has on wages, as a larger organizational size is common in the public sector. Based on the findings of Briscoe (2006), we speculate that the effect firm size has on wages is positive as larger organizations have more potential substitute physicians. This will, in turn, reduce patient demands on individual physicians, thus reducing their on-call schedules and enabling physicians to fulfill family responsibilities and offer greater work flexibilityBriscoe (2006).

In addition, larger organizations are more likely than smaller organizations to have a systematic patient record system and more standardized work processes for all physicians, which enables safe hand-offs of patients between physicians (Gans et al., 2005; Gittell, 2002). We speculate that this effect positively affects wages as a larger firm size enables greater flexibility for physicians. Since women often are responsible for household labor, they usually prefer work flexibility (Goldin, 2014). Since larger organizations provide greater flexibility that women often value, this may explain why the share of part-time workers is the lowest among physicians at hospitals and highest among company doctors in Norway (Den Norske Legeforening, 2023). With greater flexibility, we can assume that women work less part-time, diminishing the wage gap.

It is also worth mentioning that the age coefficient increases after we control for different factors. We speculate this might be the case because the age variable might correlate with some other independent variables. One might hypothesize that age could be correlated with the sector. Part of the LIS1 service, which all graduates must partake in, is serving one year in the specialist health service and half a year in the municipal health service (Helsedirektoratet, 2023). The specialist health service portion usually takes place at a hospital. Since most large hospitals in Norway are publicly owned, it is reasonable to assume that most young physicians are in the public sector. It is also reasonable to assume that private hospitals and offices prefer to hire experienced physicians, and there is a high upfront cost for becoming a private practice GP, which could also prevent young physicians from entering this field. These factors could cause age to be correlated with the sector.

It is also worth noting that the gender wage gap increases by 0,147% after controlling for sector. Although this increase in the gender wage gap is minimal, it is reasonable as this might be due to omitted variable bias or that the female dummy is also catching part of the effect of organizational size because women are more likely to work in the public sector, and larger organizations are common in the public sector.

Our result also suggests that physicians working in Finnmark earn more on average than those working in Oslo. This is consistent with the literature review, where we found a systematic shortage of specialists and GPs in the region, where some municipalities have resorted to offering higher wages to attract physicians (Dimmen, 2021; NRK, 2022; Nyhus, 2022; Onsøien, 2022).

Moreover, the interaction term of the female and the public sector is statistically insignificant. This implies that we cannot conclude that the gender wage gap is smaller or larger for women working in the public sector than in the private sector. There is no significant difference between women working in the public sector and private in terms of wages when we look at the total wage variable where overtime is included.

5.2 The gender wage gap using a fixed-wage variable

Our results suggest that the unadjusted wage gap when studying the fixed-wage is 9,2%. In comparison, the unadjusted gender wage gap is 19,5% when studying the total wage variable, where overtime is included. This result was expected since gender differences in overtime work will necessarily affect the overtime wage variable but not the fixed wage variable. It suggests that the gender wage gap can be primarily explained by men working more overtime than women. Cha and Weeden (2014) support this demonstrating that the increasing presence of overwork and the returns to overwork notably slowed down the convergence of female and male wages. Based on the literature review, women tend to prioritize workplace flexibility and work fewer overtime hours than men, an important reason being to fulfill family responsibilities (Bolotnyy & Emanuel, 2018). Men and women work nearly the same hours of overtime when planned three months in advance, but men are almost twice as likely to work overtime hours when offered the day before (Bolotnyy & Emanuel, 2018). This suggests that women are less spontaneous when accepting overtime, as they might have to fulfill family responsibilities, and it is reasonable to assume that many instances where overtime is necessary for a medical environment occur in emergencies, which are spontaneous and unpredictable. Thus, gender differences in working overtime contribute to the gender wage gap.

Even though the number of working hours may explain the gender wage gap in the health sector, people working in the health sector are not disproportionately compensated for working long hours and particular hours, as in other industries (Goldin, 2014). Moreover, work flexibility in the health sector is less costly as there is a comparatively lower transaction cost when transferring client information to another employee, facilitating greater substitutability among individuals. This suggests that earnings have a linear relationship with the number of working hours, indicating a low gender wage gap and fewer penalties for working fewer hours and parental leave (Goldin, 2014). (Bolotnyy & Emanuel, 2018) support this finding, adding that a considerable gender wage gap may occur if the work demands working overtime. This reduces the substitutability between male and female physicians as family responsibilities limit women from working overtime more than men. Therefore, it is reasonable that by excluding overtime compensation, the gender wage gap is smaller.

Another possible explanation for the smaller gender wage gap when studying the fixed wage might be due to less discrimination or favoritism (Bolotnyy & Emanuel, 2018). Since supervisors decide whom to call for the shift among those who have stated interest, this can open up for favoritism(Bolotnyy & Emanuel, 2018).

One possible explanation for a larger unadjusted gender gap in total wages where overtime is included might be because the female dummy captures part of the effect age has on wages. Based on the literature review, we hypothesize that the effect seniority has on wages is positive, as individuals with more experience, in general, earn more. Based on the results of Bolotnyy and Emanuel (2018), more senior individuals are offered the most desirable scheduled overtime shifts and unplanned overtime opportunities. Since men are, on average older than women, based on our data, we speculate that these are offered the most attractive overtime shifts first. We, therefore, speculate that the female dummy using the total wage captures the age difference between male and female physicians more so than in the fixed-wage regression because, in addition to capturing the effect of the gender differences in experiences, it also captures the effect of overtime being offered to more senior physicians first. Thus the gender wage gap is larger when overtime is included.

To summarize, the fact that the gender wage gap is larger when studying the total wage variable where overtime is included may either be due to preference, i.e., that women prefer to work less overtime or that men are more likely to be offered overtime opportunities and the more desirable schedules considering that they are on average older than women, or favoritism– that men are offered it first.

When we control for age, sector, level of education, and county, the gender wage gap remains significant and is 16,2% using total wage, while this is 5,7% using fixed wage variable. It is worth noting that even when we control for different factors, the gender gap of fixed wages remains. This suggests that although taking overtime into account might reduce the wage gap, other factors still contribute to the wage gap. Moreover, the coefficient of the public sector dummy is negative when studying the fixed wage. This might be because the public sector is associated with fixed wages and is overrepresented by women. On the contrary, men are overrepresented in the private sector, which is associated with higher wages than the public sector, thus explaining the gender wage gap.

We also observe that the coefficient of the county dummy is greater when we use total wages, including overtime, than when we look at fixed wages. One possible reason is a shortage of physicians in the northernmost counties (Onsøien, 2022). Thus, it is reasonable to assume that physicians in this county face a heavy workload and many overtime hours compared to those working in Oslo. There are also fewer colleagues to change shifts, indicating less flexibility. It, therefore, makes sense that the coefficient of the Finnmark dummy is greater when we look at total wages, including overtime.

The interaction term of the female dummy and the public sector dummy is significant at a 1% significance level when we study the fixed wage. This implies that the gender gap in fixed wages is smaller for women in the public sector. However, despite wages tending to be higher in the private sector, this might not necessarily be the case for women because most of those working in the private sector are men, increasing the average wage in the sector. In addition, we can speculate that the public sector is often larger regarding the number of employees, enabling more work flexibility, consistent with Briscoe (2006). For example, we assume that one can swap shifts easier, whereas, in the private sector, the ability to do so might be limited, especially if there are few employees. As a result, women in the private sector might have to work part-time to fulfill their family responsibilities, contributing to a larger gender wage gap in the private sector. Conversely, since there are more employees in the public sector, there may be less need for women to work part-time as there is more work flexibility, which narrows the gender wage gap.

Another possible reason why fixed wages are higher for women in the public sector could be because the wages of public employees are strictly regulated by the state, which reduces the possibility of wage discrimination significantly. The state "A-table" defines how much a public employee will earn based on their competence and position, and this information is publicly available, thus resulting in a high degree of pay transparency (The Norwegian Tax Administration, n.d.). In the private sector, owners are not bound by this and can choose more freely what to pay their employees. Of course, one can assume that the pay must be competitive enough to attract employees. Still, there is much less transparency around pay, and one can assume that they are free to offer different pay schemes to different employees without being penalized. Therefore, these private actors might offer a lower fixed wage but higher overtime compensation than the public sector.

5.3 The gender wage gap among GPs and specialists

The unadjusted gender wage gap among general practitioners was 19,7%, whereas this was 19,0% for medical specialists. As mentioned earlier, we must be cautious when comparing the size of the gender wage gap between GPs and medical specialists as people self-select into different professions. Due to this self-selection problem, we cannot make any claims from the differences between the two samples. However, we still decide to split the sample into GPs and medical specialists as this may make the self-selection problem more visible. Also, the specialists might be very heterogenous, which further restricts the claims we can make when comparing the differences between GPs and medical specialists.

Without making any causal interpretations, our results may suggest that the unadjusted gender wage gap is slightly larger among general practitioners than specialists. This was unexpected as Magnusson (2016) suggests that the gender difference in specialization choices can explain the gender wage gap to a modest degree. In addition, her findings suggest that women earned lower than men in every specialty (Magnusson, 2016). Gjerberg (2001) also found that Norwegian female physicians are underrepresented in specific highly compensated medical specialties. One possible reason might have to do with women self-selecting into certain specialties as they are uncertain about whether they can combine family and career in medicine (Gjerberg & Hofoss, 1995; Martin et al., 1988; Uhlenberg & Cooney, 1990). Another possibility might be that mothers self-select into family-friendly jobs over high-paying jobs Budig and England (2001). Based on these arguments, this would have suggested that there would be a larger gender wage gap among specialists due to women self-selecting into certain specializations that may not be so highly compensated so they can balance family and career.

One possible explanation as to why the unadjusted gender wage gap might be larger among GP than specialists might be because of the share of part-time workers being high among general practitioners in Norway (Den Norske Legeforening, 2023). Although the share of part-time workers is highest among specialists in private practice (13,1%), we speculate that fewer specialists work in the private sector. Thus, there might be a possibility that the coefficient of the female dummy captures some female general practitioners who choose to work part-time, considering that women often work part-time (Fløtre & Tuv, 2022). Women often prioritize other responsibilities over their careers and will likely self-select into part-time positions or positions with more flexible working hours. Since part-time jobs often pay less, and our wage variable is not calculated to the full-time equivalent, this reduces the average wage of women (Fløtre & Tuv, 2022).

Another reason why the unadjusted gender wage gap might have been larger among general practitioners might be because the female dummy might have captured part of the effect sector has on wages. More male general practitioners are working in the private sector than women. In contrast, women general practitioners work in the public sector to a greater extent than men, based on our data. The literature review found that the highest-paid GPs have over 1500 patients on their patient lists, increasing the hours worked. We speculate that men are more likely than women to choose to have more patients on their patient list, given that they are more likely than women to work overtime. Conversely, we speculate that women may choose to have fewer patients on their patient list than men, as they work less overtime than men to fulfill family duties. These differences in choices contribute to the unadjusted gender wage gap.

We also speculate that this coefficient of a female dummy may capture some of the effect county has on wages. When we control for the county, we can see that they have a greater effect on wages among general practitioners than specialists. We speculate that this is the case considering that there are more GP offices than hospitals in this region, and there is a shortage of GPs all over Norway that is further exacerbated in Finnmark because of the less attractive qualities of the county. However, we assume that there might be more men who choose to work in this county, considering that women tend to value non-pecuniary aspects of work more highly (Budig & England, 2001). Moreover, the fact that men prefer and self-select into high-paying jobs more than women indicates that they might be more likely to work in this county (Blau & Kahn, 2017). Thus, this may indicate a larger gender wage gap among GPs than specialists.

We also see that PhDs have a greater effect on wages among general practitioners than specialists. We assume this is the case as there might be more specialists who select into PhD degrees than general practitioners because a PhD degree might be a requirement or at least an advantage for certain competitive specialties. We assume that having a PhD is more common among medical specialists, which causes the positive effect of having a PhD on wages to be more substantial for GPs. This is because having a PhD is relatively rarer among GPs.

Without making any causal interpretation, our findings may suggest that the adjusted gender wage gap is larger among specialists than GPs. In addition to women self-selecting into certain specializations to combine family and career, which may contribute to the gender wage gap, we also speculate that the gender wage gap might have been larger among specialists due to competition. Goldin (2014) claims that professions, where competition does not matter, may have a more linear wage structure regarding working hours and, therefore smaller gender wage gap. There are certain specializations where there is more competition than others (McNally, 2008). Lefebvre et al. (2020) adds that competitive specialties are greatly associated with high earning potential. Since women in medicine are self-selecting into specialists that are not so highly competitive and therefore not so highly compensated, even if they are competent enough (McNally, 2008; Richardson & Redfern, 2000), this may explain the larger gender wage gap among specialists compared to GPs.

In addition to women self-selecting into certain specializations due to preferences, some believe that male exclusionary practices can also explain the gender differences in specialty (Crompton et al., 1999; Gjerberg & Hofoss, 1998; Kvarner et al., 1999; Lorber, 1984; Riska & Wegar, 1993), which may further exacerbate the gender wage gap. For instance, women may have been restricted from selecting certain specialties because they do not receive the opportunity to gain adequate experience (Gjerberg, 2001).

We can also see that the interaction term is positive and significant for medical specialists at 10%. This indicates that female medical specialists in the public sector earn more than female medical specialists in the private sector, thus contributing to a smaller gender wage gap in the public than in the private sector. One possible reason might be that the share of part-time workers is highest among specialists in the private sector (Den Norske Legeforening, 2023). We can assume that a private practice with few employees provides less work flexibility. Greater work flexibility offered in larger organizations is likely attractive to female workers and dual-income families (Lundgren et al., 2001; Moen

& Dempster-McClain, 1987; Wharton & Blair-Loy, 2002). As a result, when there is less flexibility in the private sector, more female specialists might decide to work part-time. Since the wage variable is not calculated to the full-time equivalent, women who choose to work part-time contribute to an even larger wage gap. It also makes sense that the gender wage gap among medical specialists is smaller in the public sector, considering that the organization size is likely larger, which enables more work flexibility and thus narrows the gender wage gap (Briscoe, 2006).

5.4 The gender wage gap in 2009

To explore the gender wage gap over time, we have used cross-sectional data from 2009 and 2019. However, it is worth mentioning that one cannot make a causal interpretation as we cannot be sure whether the change in the gender wage gap results from the individuals' unique characteristics or the independent variables we are including. Therefore, it would be more appropriate to use panel data to control for individual fixed effects and thus reduce the omitted variable bias. However, this was impossible as some of the explanatory variables we wanted to use had different validity periods. Thus we could not import them at the same time.

The unadjusted gender wage gap in 2009 was 24,3%. In comparison, the unadjusted gender wage gap in 2019 was 19,5%. When we control for age, sector, level of education, and county, there is a considerable gender wage gap at 18,4%, while the gap was 16,4% in 2019. Without making any causal interpretations, these results may contrast with the findings of (Boye et al., 2014), which suggest that the gender wage gap in skilled occupations has remained stable.

It is also worth mentioning that the gender wage gap in 2009 went from 24,3% to 18,4% after controlling for age, sector, level of education, and county. This might imply that some of the explanatory factors, like age and the level of education, may have had a greater effect on wages in 2009 than in 2019. For instance, the age coefficient was larger in 2009 than in 2019. That indicates that an increase in age had a larger effect on wages in 2009 compared to 2019. An explanation for this may be that the age variable captures part of the effect of being a medical specialist because we assume it might have taken longer to become a medical specialist in 2009 than in 2019. Therefore it is reasonable to assume that an increase in age might have had a greater effect on wages in 2009 than in 2019.

In addition, we can also see that the coefficient of PhD was much larger in 2009 than in 2019. We speculate that the PhD coefficient in 2019 captured relatively more of the effects of being a medical specialist, as we assume that there might be more specialists who obtained PhD degrees than general practitioners as this might be a requirement or advantage for certain competitive specialties in 2009. However, we assume that there is less of a difference in the relative number of general practitioners and medical specialists who obtained a PhD in 2019.

Also, our sample showed that most of those with PhD were men in 2009, while in 2019, women were overrepresented in PhD programs in medicine. Since a PhD had a greater effect on wages in 2009 compared to 2019, and more men completed PhD degrees in 2009, this might indicate a larger gender wage gap in 2009 compared to 2019.

Another thing worth noting is that the coefficient of the public sector was negative in 2009, while it was positive in 2019. This makes sense, considering that people working in the private sector earn more than those working in the public sector. We speculate that people working in public, on average, earn less because women were working part-time regardless of sector. There might not have been a significant difference in women working part-time in the public and private sectors, but we believe that more female physicians worked part-time in the private sector in 2019. Perhaps it was harder to combine a career in medicine with family responsibilities in 2009 compared to 2019. This could be the case considering that young men increasingly take paternal leave, which facilitates women to return to work faster (Aasland, 2022). Another possibility might have been that there was less work flexibility in 2009 than in 2019, that the journal system and possibilities for changing shifts were improved in 2019, which could have contributed to narrowing the gender wage gap considering that these enable women to work more hours.

We also observe that Finnmark had a larger effect on wages in 2019 than in 2009. One possible explanation could be that there might be a larger shortage of physicians increased between 2009 and 2019, which in turn could have increased the willingness to pay to acquire the competence necessary in hospitals and doctors' offices. The increase in the average of the control variables public in 2019 could also suggest that the demand for specific specializations in public hospitals in the region was especially strong, driving the wages in the public sector up even further. We speculate that men may be more likely to work in this county as they are more likely than women to work overtime and prioritize monetary compensation, based on what we found in the literature review, which may explain why the gender wage gap persists in 2019.

We wanted to study if there has been an increase in the share of female specialists from 2009 to 2019, as this would explain why the gender wage gap might have diminished over time. In 2019, most medical specialists were women (Fløtre & Tuv, 2022). This could be why the gender wage gap has diminished over time because medical specialists usually have higher wages than general practitioners (Fløtre & Tuv, 2022). However, it was impossible to see the share of female physicians in 2009 because Microdata.no does not distinguish between GPs and specialists in the variable for profession for 2009.

In conclusion, although the share of women in medicine has increased, the gender wage gap may not have disappeared completely, which is in line with existing literature. However, our results may suggest that the gender wage gap among highly skilled occupations such as physicians has decreased over time, which contrasts with Boye et al. (2014). Furthermore, our findings suggest that the gender wage gap in 2019 diminished further after controlling for factors other than gender. This could be due to the averages of the control variables changing over time. We observe that there has been a slight decrease in the average age from 2009 to 2019, while there has been an increase in the average of the public sector variable. These changes suggest that the age difference has decreased relatively over time, which may have reduced the gender wage gap between 2009 and 2019. Moreover, the increase in the average of the public sector may also have contributed to reducing the gender wage gap, considering that women are overrepresented in the public sector. However, an increase in the averages of Finnmark country may contribute to explaining why the gender wage gap persists as Finnmark demands overtime work, and men are more likely to work overtime than women as well as they prioritize monetary compensation, based on the literature review. Moreover, we observe that the gender difference in working overtime might play an important role in explaining the gender wage gap by comparing the size of the gender wage gap using total wage and fixed wage. Without making any causal interpretations, our results suggest that the unadjusted gender wage gap may be higher among general practitioners than medical specialists but becomes smaller when studying the adjusted gender wage gap.

5.5 Limitations

This section will discuss the limitations of our study and their implications for the results. We will also provide suggestions for future research on this topic.

Microdata has been an invaluable platform that has given us access to high-quality data that we would not have been able to access otherwise. However, there are restrictions regarding the data available in Microdata and the functions we can use to analyze them. For instance, in our analysis, we have compared GPs with specialists. This is quite a simplistic operation because there are many diverse specialties; therefore, lumping them into one "specialist" category is misrepresentative. For example, there is a vast difference in compensation and the work tasks of a neurosurgeon and a psychiatrist. The group of specialists we have lumped together in our analysis will be highly heterogeneous, with a large gap regarding wages between the upper and lower end of the spectrum. This limits the conclusions we can draw when comparing the GPs with the specialists. Ideally, we would have the data on the specific specializations of our sample so we could control for the higher and lower-paid specialties. Unfortunately, this data was not available to us through Microdata.no.

Regarding our chosen methodological approach, we used OLS regression to analyze our data. The problem with OLS is that it only provides the average values of the coefficients. This means that when we perform a regression analysis, the coefficient that signifies the gender wage gap only shows the average gender wage gap. Based on what we know from previous literature, it is very likely that the pay gap will be greater in the upper percentiles of the wage distribution and lower towards the bottom. We cannot confirm this using OLS regression; we would have had to use quantile regression instead.

For future research on this topic, we would suggest obtaining data on different specializations to compare them with each other and to be able to perform better comparisons between specialists and general practitioners. We would also recommend using a more detailed sector grouping since many different forms of employment are available to a physician, which goes beyond the typical public/private dichotomy. Separating the sample into more detailed sector grouping could also create more homogenous subsamples, decreasing the degree of unobservable heterogeneity. We also suggest studying the parenthood gap in the medical profession, we only included children as a control variable, and it was a bad control that cannot be interpreted causally. It is also important to note that this variable only measures children living with the family and is not precise. Suppose one compares male and female physicians with children to each other. In that case, one can more easily analyze the different wage profiles after parenthood for mothers and fathers since the endogeneity problem is thus reduced to only the omitted variable bias.

6 Conclusion

In this master's thesis, we examined the gender wage gap among physicians in Norway. More specifically, we had four research questions we aimed to study: (1) How large is the gender wage gap in 2019 among physicians in Norway, (2) How does the wage gap change if we study fixed wages, (3) How large is the gender wage gap when we look at general practitioners and specialists separately, and (4) How has the gender wage gap for physicians changed over the last ten years?

To answer these research questions, we have studied the gender wage gap among physicians aged 25 and 61 in 2019 using the logarithm of total yearly wage as the dependent variable includes overtime. Then we studied the gender wage gap using the logarithm of the fixed-wage variable as the dependent variable to compare the size of the wage gap between fixed and total wages to isolate the effect overtime pay has on wages. Then we examined the size of the gender wage gap among general practitioners and medical specialists. Lastly, we studied the pay gap in 2009 to investigate how the gender wage gap has developed over the last ten years. We used cross-sectional data from Microdata.no for 2009 and 2019 for these analyses. This grants us access to high-quality data with a high level of validity.

Our results suggest that the unadjusted gender gap in total wage among physicians in Norway was 19,5% in 2019. The gender wage gap decreases when controlling for certain factors like age, age^2 sector, level of education, and counties to 16,2%, with age as a proxy for experience being the factor with the greatest effect. When we include a dummy indicating whether the individual has a child under ten years and the interaction term of the female and public sector dummy, the gender wage gap is 16,4%. The interaction term is insignificant, which implies that there is no significant difference in the wage gap for women working in the public sector than women working in the private sector.

In comparison, when we conduct the same analysis, the only difference being using the fixed-wage variable instead of the total-wage variable, we find that the unadjusted gender wage gap was 9,2% in 2019. This is quite the reduction to the 19,5% gender gap we found when the total-wage variable is used, which includes overtime pay. Moreover, the fixed-wage pay gap decreases to 5,7% when controlling for age, age^2, sector, level of education, and counties, whereas this is 16,2% using the total-wage variable. Based on our findings and existing literature, the gender wage gap can largely be explained by men working more overtime than women. Also, the interaction term of the female dummy and the public sector dummy is positive and significant at 1% when we study the fixed wage, suggesting that the gender wage gap is smaller for women working in the public sector than for women working in the private sector. Even after controlling for different factors, the gender gap of fixed wages persists, indicating that even after overtime is considered, other factors maintain the gender wage gap.

When studying the gender wage gap separately for general practitioners and specialists, we discovered that the unadjusted gender wage gap among general practitioners was 19,7%, whereas this was 19,0% for medical specialists. However, after adjusting for other factors such as age, age^2, sector, level of education, and counties, the gender wage gap is 14,3% for general practitioners and 16,6% for medical specialists, indicating that the larger gender wage gap among medical specialists might be that men and women self select into different specializations. We also observe that the interaction term of female indicator and public sector indicator is positive and significant for medical specialists at the 10% significance level, indicating that female medical specialists in the public sector earn more than female medical specialists in the private sector, hence a smaller gender wage gap in the public compared to the private sector.

When studying the wage gap in 2009, we observe that the unadjusted gender wage gap was 24,3%, while this was 19,5% in 2019. After controlling for age, age^2, sector, level of education, and country, the gender wage gap was 18,4% in 2009. Since the adjusted gender wage gap in 2019 was 16,4%, our result suggests that the gender wage gap has diminished over time. The interaction term of female and public sector indicators is insignificant, implying no significant difference in the wage gap for women working in the public sector than women working in the private sector in 2009. We also see that the average age gap between male and female physicians was higher in 2009, suggesting a larger gap in experience in seniority, which might help explain why the wage gap was higher in 2009 compared to 2019. Also, the fact that working in the public sector earned less compared to working in the private sector in 2009, while we observe the reverse in 2019, may have contributed to narrowing the gender wage gap over time, considering that women are overrepresented in the public sector.

Even if the medical profession can be characterized by greater substitutability among workers and work flexibility, indicating a linear pay structure and, therefore lower gender wage gap, our thesis suggests that a notable gender wage gap persists even after controlling for different factors. When we compare the size of the gender wage gap between the total wage and fixed wage variables, we observe that the gender wage gap is considerably larger when using total wage. This implies that even if physicians might have a more linear pay structure compared to other professions, the gendered difference in the number of overtime hours worked contributes to why the gender wage gap among physicians persists. The medical profession often requires long working hours, where overtime occurs frequently. Depending on the field of medicine a physician works in or if they work in a large hospital or a small private practice can likely influence the amount of autonomy a physician has over the number of hours they work. For example, general practitioners can choose to take on more patients in their lists, resulting in more working hours and higher pay.

Our master's thesis suggests that the gender wage gap persists in 2019 as there is still a gender difference in age and working and overtime hours. Another reason why the gender wage gap remains might be attributed to women self-selecting into specific specializations so they can combine family and career or based on other preferences. In comparison, men self-select into specializations that are more competitive and thus highly compensated. Therefore, to reduce the gender wage gap for physicians, measures that help even out the burden of domestic labor and childcare responsibilities between men and women are necessary. One policy that could help in this regard is, for example, expanding the opening hours of childcare facilities, which would make it easier for both parents to accept offers of overtime work. In addition, public awareness campaigns aimed at changing the expectation that women, by default, should reduce their labor force participation once family responsibilities arise might also be helpful, however even after controlling for factors such as age, sector, level of education, and counties as well as taking overtime into account, the gender wage gap in 2019 remains, which indicate that there are other factors which contributes to why the gender wage gap persists.

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Appendix

Table A0.1: Overview of all variables used with explanation

Variable	Microdata code	Explanation
Gender	BEFOLKNING_KJOENN	The first variable we import, describes the gender of all individuals in Microdata. Used to create indicator variable for gender.
Age	BEFOLKNING_FOEDSELS_AAR_MND	The variable shows the year and month of birth. Used to create age variables for each individual. Age = Year - Birthdate
Status	BEFOLKNING_STATUSKODE	Code that tells whether the person is a resident, emigrated or dead. Used to limit sample to individuals still residing in Norway.
Education	NUDB_BU	NUS-code showing the highest completed degree, used to limit the sample to four educations and create education indicator variables.
Profession	REGSYS_ARB_YRKE_STYRK08	Shows an individual's main employment, essentially the employment with the highest agreed working hours. Used to limit the sample to GPs and specialists
Profession	REGSYS_YRKE_PUBL	Shows an individual's main employment, essentially the employment with the highest agreed working hours. Used to limit the sample to physicians for the 2009 dataset
Yearly wages	INNTEKT_WLONN	Wage income includes all taxable income, i.e. cash wages, taxable benefits in kind and sickness and maternity benefits.
Fixed yearly wages	ARBLONN_LONN_FAST	Fixed agreed wages, also includes fees, piecework, and commission. Used as an alternate dependent variable for comparison purposes taxable benefits in kind and sickness and maternity benefits.
Sector	REGSYS_FRTK_SEKTOR_2014	Used to make an indicator for sector
Sector	REGSYS_SEKTOR	Used to make an indicator for sector for the 2009 dataset
County	BOSATTEFDT_BOSTED	Address according to the national register. Used to make indicators for counties
Children under 10	BEFOLKNING_YNGST_I_REGSTAT_FAMNR	The variable describes the family using the age of the youngest person in the family.
	BEFOLKNING_BARN_I_REGSTAT_FAMNR	Number of children (0-17 years) in the family. Used to make the children under 10 indicator variable

Notes: The table displays all of the variables imported into Microdata to select our sample and to create the dependent and independent variables.

Table A0.2: Sector grouping 2009

Public sector
110 - The state and social security administration
550 - Municipalities
630 - State-owned companies
Private sector
410 – Life insurance companies etc.
710 - Private limited companies
717 - Private limited companies, foreign-owned
740 – Private producer-oriented non-profit organizations
760 - Personal enterprises etc.
770 – Private consumer-oriented non-profit organizations

Notes: The table displays how we created the 'Public' and 'Private' sectors for the control variables for 2009, based on SSB's standard for sector grouping.