Does physician gender influence the provision of medical care? An experimental study.

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UNIVERSITY OF OSLO
HEALTH ECONOMICS RESEARCH NETWORK

Working paper 2016: 6

HERO

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April 2016

Abstract

The share of female physicians in the medical workforce is increasing in many countries. An important question to consider is whether the changing gender balance in the workforce influences medical practice as a whole. This question, however, relates to whether the observed gender differences in medical practice are a result of male and female physicians having patient groups that differ systematically or whether there is indeed a difference between the providers themselves. In this paper we ask whether gender differences in provider practice are present when providers face an identical group of patients. We tested the presence of a pure gender effect by means of data from a controlled laboratory experiment. Here every provider encountered an identical patient population. We applied data from an experiment based on the design of Hennig-Schmidt, Selten, and Wiesen (2011). Medical students in the role of physicians chose the quantity of medical services to provide to their abstract patients.

We tested the null hypothesis that gender does not influence the provision of health care services. In our empirical specification we estimated both the influence of gender on the quantity of medical services and whether gender influences the maximization of patient benefits. We found that we cannot reject the null hypothesis that gender does not influence the provision of medical care.

Keywords: Gender, Physician behavior, Medical care provision, Laboratory experiment

JEL classification: C91, I11

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ISSN 1501-9071 (print version.), ISSN 1890-1735 (online), ISBN 978-82-7756-255-1

Introduction

1.1 Background

With the substantial increase of women's enrollment in medical schools and residency programs, the gender composition of medicine has changed (Levinson & Lurie, 2004). Western countries like the United Kingdom, USA, Russia, Norway, Canada, Sweden, Holland, and Australia have witnessed changes in the gender composition of the medical profession, despite the different social contexts and health care systems of these countries (Kilminster, Downes, Gough, Murdoch-Eaton, & Roberts, 2007). This increase also has been reported in China. According to *China's Health and Family Planning Statistics Yearbook* (National Health and Family Planning Commission of the People's Republic of China, 2013), the proportion of female physicians reached 70% in 2010 and 71% in 2012. Furthermore, this feminization has also been reported in specialist professions like dentistry, nursing, audiology, and pharmacy (Adams, T. L., 2010;Bottero, 1992; Knapp, Koch, Norton, & Mergener, 1992;McKay & Quiñonez, 2012; Plunkett, Kohli, & Milad, 2002). Some have argued that the increase of females in the medical profession will affect both the demand and supply of medical services, the organization of health care, the methods of physician practice (Kilminster et al., 2007; Riska, 2001;Gerber & Sasso, 2006), the earning gap, and the demand for female physicians (Baker, 1996) in the future. When it comes to the gender difference in the provision of medical services, previous researcher lies on field data, and its results are not consistent in regard to whether gender influences the length of consultation.

The inconclusive direction of gender effects might be a result of variations in patient characteristics across the different samples. We therefore propose to apply data from a laboratory experiment based on the design by Hennig-Schmidt et al. (2011) in order to assess whether female and male physicians behave differently in their provision of medical services.

1.2Related literature

Effective physician-patient communication can contribute to psychological and physical health status, patient satisfaction, physician-patient relationship, and patient health outcomes (Jefferson, Bloor, Birks, Hewitt, & Bland, 2013; Stewart, 1995). The heterogeneity in length of communication and consultation in the provision of medical services between female and male physicians has received

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ISSN 1501-9071 (print version.), ISSN 1890-1735 (online), ISBN 978-82-7756-255-1

substantial attention in previous literature. Some findings suggest that female and male physicians differ in their communication with patients: for instance, Jefferson et al. (2013) analyzed the length difference of ten previous studies and found that female physicians spent an average of 2.24 minutes longer than male physicians per consultation. They also suggested that we should pay attention to this small difference in communication length because it could contribute to larger differences in provision. Roter, Hall and Aoki (2002) systematically reviewed and quantified physician gender difference in the length of medical consultations in a meta-analysis. They found that female physicians have longer visit and communication times than male physicians.[1] Similar findings were reported by Bensing, Van Den Brink-Muinen, and De Bakker (1993); Cooke and Ronalds(1985); Meeuwesen, Schaap, and Van der Staak(1991);Roter, Lipkin, and Korsgaard (1991); and Roter and Hall (2004).

However, the opposite result is found in other studies: male physicians provide longer communication and consultation than female physicians: Hampson, McKay, and Glasgow(1996) analyzed two physicians' quarterly medical consultations with their 44 diabetes patients and found that the male physician communicated with patients longer than the female physician, but the study's deficiency is its limited sample of physicians and patients. However, when analyzing the first prenatal visit of 87 women with 21 obstetricians, Roter et al.(1999) found that male physicians engaged in longer visits than their female colleagues and that they contributed more orientation statements, which can help patients to anticipate procedures and transitions during visits. On the other hand, the study showed that females communicated more about socio-emotional functions like laughter, agreements, and disagreements.

Nevertheless, some studies found no statistically significant length difference in consultations between male and female physicians. Bertakis et al. (1995) analyzed videotapes of each initial visit to evaluate physician practice style, and they did not find any statistically significant difference between male and female physicians in consultation length. In the same study, however, female physicians were found to provide more preventative services, and their style of communication was shown to vary with their patients. This may partially explain their higher patient satisfaction scores. Jefferson et al. (2015) analyzed the data of outpatient consultations indifferent medical specialties in UK

[1] See Roter et al.(2002) for a comprehensive review.

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ISSN 1501-9071 (print version.), ISSN 1890-1735 (online), ISBN 978-82-7756-255-1

hospital settings and found little difference between male and female physicians in the mean consultation length.

Based on previous studies, we can summarize that some studies, on one hand, have recommended that future research control for potential confounding variables such as demographic characteristics(e.g., patient's and physician's gender match, ethnicity, age, and education), medical specialties, health care organization types (e.g., payment system), financial factors(e.g., insurance), therapeutic settings, and political, social and cultural backgrounds. On the other hand, they have also advised that when exploring this issue we should take into account accurate methods of time measurement, the most appropriate statistical analysis methods, and the selection and size of the sample (Carr-Hill, Jenkins-Clarke, Dixon, & Pringle, 1998; Jefferson, Bloor, & Hewitt, 2015; Roter et al., 1991; Sandhu, Adams, Singleton, Clark-Carter, & Kidd, 2009; Siu, 2015; Street, Gordon, Ward, Krupat, & Kravitz, 2005; Street, 2002).

It is worth remarking that physician-patient gender match may be endogenous, and since the gender-match may be influenced by a physician's provision of medical care. Such endogenous matching will involve reversed causality and result in difficulties in interpreting empirical results when the aim is to understand the effect of gender match on physician behavior. From the current literature, one general hypothesis has been that patients prefer physicians with similar observable characteristics and that they therefore are more likely to choose physicians of the same gender (Vick & Scott, 1998; Weyrauch, Boiko, & Alvin, 1990). Godager (2012) utilized the register data from the introduction of a regular general practitioner scheme in Norway to estimate the effect of matching gender on choice probabilities. He found that gender-match influenced male decision makers' choice of general practitioner more than it influenced females with a high education. Thus, the more general hypothesis, that general practitioner gender has a stronger influence on females' provider choice than on males' was rejected. Fennema et al. (1990) also analyzed survey data and found that 12% of male and 43% of female patients preferred a female physician, whereas 9% of females and 31% of male patients preferred a male physician. However, some studies found the opinion that patients' preference for physicians' gender varied depending on the type of health care service (Fennema,Meyer& Owen, 1990; Haar, Halitsky, & Stricker, 1975; Kerssens, Bensing, & Andela, 1997). Varadarajulu, Petruff,and Ramsey (2002) found that female patients were more likely to have a gender preference for an endoscopist than male patients were, and they were likely to wait until the preferred gender was available. Meanwhile, a hypothesis that physicians' preferences for patients may also vary by setting, gender-age group, and type of medical problem was reported by Keane,

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Woodward, Ferrier, Cohen, and Goldsmith (1991). According to the findings of Street et al. (2005), physicians provide more communication to white patients compared to nonwhite patients, and physicians offer more communication to patients who are more active during the consultation in general.

All in all, previous research studies of gender difference in the provision of medical services have compared lengths of communication or consultation. However, according to our review, it is difficult or perhaps impossible to evaluate a causal relation between physicians' gender and medical decisions using a research strategy that applies field data. Our paper addresses this challenge by using data from a controlled economic laboratory experiment[2] to identify and quantify gender differences. In our experiment, which applies the same experimental parameters as Hennig-Schmidt et al. (2011), patient population and diseases are all abstract and kept constant across the laboratory subjects, which eliminates any endogenous matching of physicians and patients.

1.3 Research questions

Our study aim to address the limitations of previous research by using data with controlled variation. We formulated two closely related research questions concerning the difference between males and females. First, we were interested in the mean difference between the quantity of medical services provided by female and male physicians at the aggregate level under two experimental conditions. Second, we were interested in whether males and females differ in their probability of choosing the quantity of services that maximize patient benefit.

Our paper proceeds as follows: Section 2 describes the experimental design and procedure. Data analysis and results are presented in Section 3, and Section 4 concludes and discusses the policy implications in the context of the feminized composition of the medical workforce.

[2]In the fields of economics and psychology, gender difference has been explored by conducting controlled laboratory experiments (see e.g.,Andreoni & Vesterlund, 2001; Brown-Kruse & Hummels, 1993; Byrnes, Miller, & Schafer, 1999; Charness & Gneezy, 2012; Croson & Gneezy, 2009; Eckel & Grossman, 2008; Hudgens & Fatkin, 1985; Powell & Ansic, 1997). Further, in the field of health economics, laboratory experiments have recently been used to explore physician behavior (see e.g., Brosig-Koch, Hennig-Schmidt, Kairies-Schwarz, & Wiesen, 2015; Brosig-Koch, Hennig-Schmidt, Kairies, & Wiesen, 2013; Godager & Wiesen, 2013; Hennig-Schmidtet al., 2011; Hennig-Schmidt & Wiesen, 2014).

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2 Experimental design and procedure

2.1Experimental design

To identify and quantify gender differences in the health care provision by males and females, we applied data from an economic experiment based on the design by Hennig-Schmidt et al.(2011). All participants were medical students preparing to become physicians in the future. They were assigned to the role of physician and took part in the experiment only once. During the experiment, each participant was to make their decisions on medical care provision under the CAP and FFS conditions of Hennig-Schmidt et al. (2011). Hence, each subject was asked to make a quantity choice for 30 abstract patient cases.

When a participant selected the preferred quantity of medical care provisions, their own profits as well as patients' benefits were determined at the same time. Subject I was required to make decisions on the quantity of medical services $q \in (1,2,3\cdots, 10)$ for three patient types (j=1,2,3 with five abstract illnesses k=A,B,C,D,E). The different patient types correspond to three different levels of health care need or health statuses—intermediate, good, and bad. By including three patient types with different benefit functions, $B_{jk}(q)$, we accounted for a heterogeneous patient population and introduced variation in the trade-offs between profit and patient benefit. Patient benefit $B_{jk}(q)$, as well as the profit $\pi_{jk}(q)$ were both measured in monetary terms. A physician's choice of medical services simultaneously determined the patient benefit and the physician's own profit ($\pi_{jk}(q)$). The patient is assumed to be fully insured and passive, accepting each level of medical service provided by the physician.

No real patients were present in our experiment. They were abstract, and the only subjects to take part were the medical students. However, the physicians' quantity choices had consequences for real patients outside of the lab. The monetary amount corresponding to the patient benefits was transferred to the inpatient accounts of real patients (see the Instructions in the Appendix). This experimental design was meant to stimulate participants to take patient benefits into consideration.

To illustrate the physicians' tasks, Figure 1 and Figure 2 provide the decision screen for patient 1C under FFS and patient 1C under CAP separately. Subjects received information on their payment, costs, profits, and patient benefits for each quantity from 0 to 10. We designated Taler as the experimental currency, and the exchange rate was 10 Taler to 1 RMB. The first two columns on the screen display the medical service and corresponding quantities. The third column indicates the

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physician's payment increasing along with the medical service quantity under condition FFS, but as a fixed amount under condition CAP. The fourth and fifth columns show the costs and profits (payment minus costs), and the final column indicates the patient benefit.

2.2 Experimental parameters

Under condition CAP, physicians received a fixed sum payment per patient, while physicians' payments increased with the increasing of q under FFS. Payment differed with illnesses $R_{jA}(q)$, $R_{jB}(q)$, ... , $R_{jE}(q)$. The lump sum of 12 Taler per patient under CAP was close to the average maximum profit per patient a subject could achieve under FFS. See Table A in Appendix A for an overview of all payment parameters.

The patient benefit $B_{jk}(q)$ is shown in Panel IV of Table A. It varies across patient type. A common characteristic of $B_{jk}(q)$ is a global optimum on the quantity interval [0, 10].There is a unique quantity q^*_{jk} that yields the highest benefit to patient of type j for illnesses k. We used the concave patient-benefit function as many theoretical papers have previously (Choné & Ma, 2011; Ellis & McGuire, 1986; Ma, 1994). The patient benefits maximum are q^*_{1k} = 5, q^*_{2k} = 3 and q^*_{3k}= 7, corresponding with patient types 1, 2, 3, and these are known to physicians. Parameters costs $c_{jk}(q)$ and profit $\pi_{jk}(q)$ relevant for physicians' decisions are shown in Panels II and III in Table 1.Costs$c_{jk}(q)$ = $1/10 \cdot q^2$are the same both under CAP and FFS, and costs are determined by subjects' decisions. Under the CAP conditions, profits decrease as q increases, and the opposite occurs under the conditions of FFS. The profit-maximizing quantity$\hat{q}$ is 0, which means that subjects would not provide any medical service for any patients in CAP. Under FFS, profits vary across illnesses because payment differs. The profit-maximizing quantity$\hat{q}$is 10 for all patients, except for those with illness A, i.e., patients 1A, 2A, and 3A, as $\hat{q}_{jA}$= 5. For patient 1A, $\hat{q}=q^*$=5.The patient-optimal quantity q^*can be interpreted as the medical treatment amount that provides the patient with the maximum health benefit.

2.3 Experimental protocol

Our computerized experiment was conducted at Center for Health Economic Experiments and Public Policy at Shandong University in Jinan, Shandong Province, PRC, and it was programmed with z-Tree (Fischbacher, 2007). By means of a posted recruitment notice we recruited 178 medical students

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who volunteered to participate in the experiment. We recruited 101 female students (56.7%), and 77 male students (43.3%), see Table 1.

The experimental procedure was as follows: after the participants arrived, they were randomly allocated to their own cubicles, where they completed their experimental tasks in complete anonymity. Then the experimenter read the instructions for the first part of the experiment, in which the physicians were to decide under either CAP or FFS conditions. All subjects were given plenty of time to clarify questions, which were asked and answered individually. In order to confirm that all participants comprehended the decision task, they had to answer three test questions. Each subject made 15 decisions on the quantity of medical services. The order of patients to be treated was predetermined and was kept constant across conditions. At the end of the first part of the experiment, they were informed of their own total profits and the total patient benefits resulting from their previous decisions. Then the experimenter read the instructions for the second part of the experiment, and subjects made their decisions under the other payment system. They were again informed of their total profits and the total patient benefits generated by their decisions at the end of the second segment of the experiment. After the subjects finished both sections, they were also required to answer questions about their gender, age, major, department, and nationality. Then they were informed of their total profits and the total patient benefits in accordance with their 30 decisions. Profits were then converted to real currency, and, after being paid in private, they left the laboratory individually.

Table1

Gender distribution in our experiment

	N	Obs.	Proportion
Female	101	3030	0.567
Male	77	2310	0.433
Total	178	5340	1.000

3 Results

Our first research question focused on data from our experiment related to the difference in the quantity of provided medical services between female physicians and male physicians. First, we

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compared the provision difference between female physicians and male physicians at the aggregate level. The results of descriptive statistical analysis (See Table 2) show that the observed difference in the average quantity is close to zero, and the difference is not statistically significant at a conventional significance level[3].

Table 2

Quantity of medical services at the aggregate level

	Mean	S.D	Min	Max	Obs	p*
Female	160.574	17.313	60	214	101	0.611
Male	159.974	12.736	130	190	77	

**p* is a two-sided Wilcoxon rank-sum(Mann-Whitney) test comparing mean quantity by gender.

Then we analyzed gender difference in the quantity of medical services within the three patient types. The results show there is little difference in the medical care offered to the three different patient types (See Figure 1), and no statistical difference between males and females were found (p_{1k}=0.947, p_{2k}=0.661,p_{3k}=0.1609,Mann-WhitneyU-Test,two-sided).

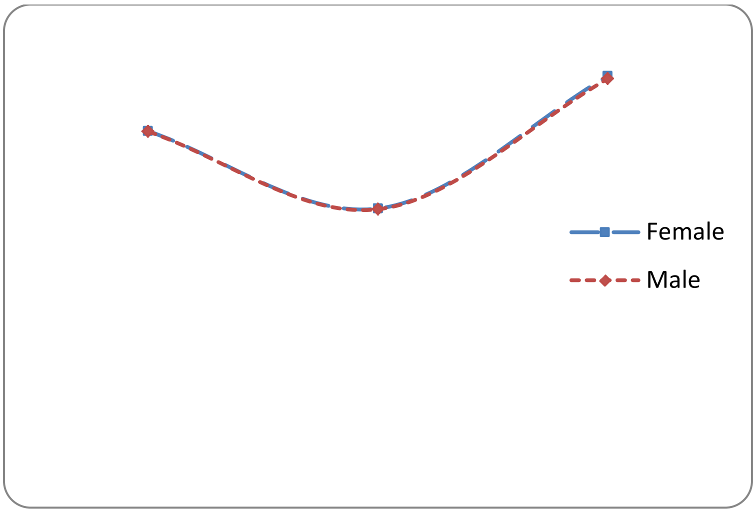

Figure1 Mean quantity choice for the three patient types by gender.

[3] A significance level of 5 % is applied in this study.

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Finally, we compared the gender difference in the average quantity for each of the 30 unique decision situations. Under both payment systems, Figure 2 shows the average medical care quantities chosen for each individual patient *jk*, and we cannot reject the null hypothesis for any of the 30 patients, Two-sample Wilcoxon rank-sum test), hence there is no significant statistical difference between female and male subjects in their provision to the particular patients.

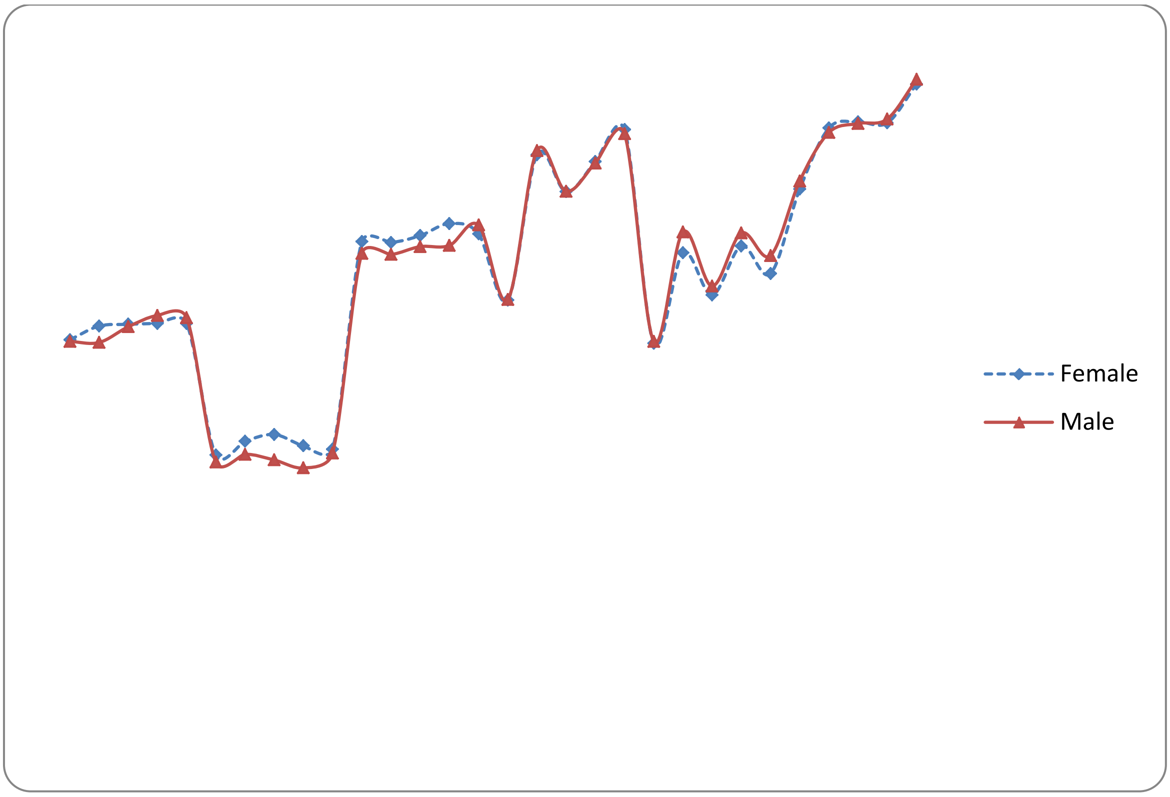

Figure2 Mean quantity chosen for the separate choice occasions by gender.

Parametric analysis

In order to utilize all of our observed data while acknowledging that repeated observations of the same subjects constitute dependent observations, we fit panel data regression models to our data. We estimated ordinal regression models to estimate the effect of the subject's gender on the chosen quantity. We also used probability models and ordinal regression models to test whether the gender of the subject influenced their probability of choosing the quantity that would maximize patient benefit. By means of random effects models we tested whether a gender difference was present. A

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two-level latent-response formulation can be written as (1), which includes the individual's gender, X_g^i, and dummy variables indicating the different choice occasions ,X_{ijk}.

$$y_{ijk}^{*} = \beta_0 + \beta_1 X_g^i + \boldsymbol{\beta}_2 X_{ijk} + \zeta_i + \varepsilon_{ijk} \qquad (1)$$

In (1), *i* indexes the individual participants; *jk* indexes the interaction expansion of the three patient types (*j*=1,2,3) with five abstract illness(*k*=A,B,C,D,E) under two experimental conditions (CAP and FFS). β_0 is a constant term,ζ_i is the random intercept at the individual participant's level. In the random effect logit model of the probability of choosing the patient benefit maxium (Table 3), ε_{ijk} are assumed to be distributed type 1 extreme value. In the random effect ordered logit model of quantity of medical care (Table 4), ε_{ijk} are assumed to follow the standard logistic distributions. The unknown parameters to be estimated, β_1 and the vector $\boldsymbol{\beta}_2$ are assigned to the dummy for gender and the indicator choice occasions respectively. The observed dependent variable is dichotomous in the probability model presented in Table 3, and ordinal in the model presented in Table 4. For the categorical variables of individual gender we let female be the reference category. For the occasion variable, 29 dummy variables were put into models with occasion 1—the decision for patient type 1 with abstract illness A under condition CAP—as the reference category.

Based on the results of the probability models shown in Table 3, we cannot reject the null hypothesis that gender does not affect the chosen quantities in the five models (Logit:p=0.214; Probit:p=0.299; Complementary log-log: p=0.803; Ologit: p=0.575; Oprobit: p=0.754, two-tailed test). Male physicians behave similar to their female colleagues when they are confronted with the task of maximizing benefits for their patients.

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Table 3

The probability of choosing the patient benefit maximizing quantity of medical services for patients. Results from probability models with random effects.

Variables \ Model	Logistic regression Coef.	Std.Err.†
Gender	-0.496	0.399
Dummies for Choice occasion	Yes	
Constant	1.952	0.285*
Log likelihood	-2318.9405	
ζ_i	2.348046	
N	5340	

*Significantly≠0 at the 5% level (two tailed test); † Standard errors are robust.

Table4

The choice of quantity of medical services for patients. Results from ordered logistic regression models with random effects.

Variables \ Model	**Ordred logisticRegression** Coef.	Std.Err.†
Gender	0.083	0.148
Dummies for choice occasion	Yes	
Constant	6.147	0.307*
Log likelihood	-8202.5142	
ζ_i	0.56541477	
N	5340	

* Significantly≠0 at the 5% level (two tailed test); † Standard errors are robust.

4 Discussion and conclusion

Knowledge of the relation between physician gender and the provision of medical care is necessary to assess the consequences of a feminized health care workforce. Gender differences have been the focus of research in health economics. However, evidence on the direction of gender effects in health care provision is not entirely clear from previous research. In particular, some studies have

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found that females provide longer consultations, while others come to the opposite conclusion, and there are also studies that do not find any gender differences. One possible explanation is that the gender effect on the provision of medical care is context-specific and influenced by the mix of patients that consult each physician. Hence, the case mix has most likely been imperfectly controlled for in previous research. We addressed this issue by conducting a fully incentivized lab experiment where we examined how gender influences provision behavior when subjects make decisions in identical scenarios. In our experimental context, we can be certain that no unobservable heterogeneity in patient characteristics was present.

When we compare the mean quantity of medical care at the aggregate level for female and male subjects, we cannot reject the hypothesis that there is no difference in choice of quantity. The conclusion remains the same when looking at more disaggregated results. Our results are consistent with the findings of Bertakis(1995) and Jefferson(2015) on the comparison of gender difference in the length of communication and consultation in studies of gender difference in the provision of medical care services.

We have also analyzed the gender difference in profit and patient benefit, and we did not find any significant differences. The results at different levels of aggregation do not indicate any difference in profit between female and male physicians. This differs from previous findings (Baker, 1996; Bobula, 1980; Kehrer, 1976; Langwell, 1982; Sasso, Richards, Chou, & Gerber, 2011; Wallace & Weeks, 2001).

Policy makers do not control the enrollment of females in medical school and residency programs. Understanding the influence of a changing gender structure is crucial for assisting local decision makers in determining appropriate strategies for organizing the medical care market.

Some researchers suggest that increasing the proportion of females entering medical profession may increase the demand for female physicians, in particular for some clinical specialties, such as obstetrics and gynecology (Gerber & Sasso, 2006). In terms of obstetrics and gynecology, the increasing demand for female physicians may result from patient preference. Some researchers have found that expecting mothers prefer female physicians (Schmittdiel, Selby, Grumbach, & Quesenberry, 1999;Ahmad, Gupta, Rawlins, & Stewart, 2002). The increasing number of female obstetricians and gynecologists may provide expecting mothers with more opportunities to choose a physician of their preferred gender. We did not address the role of gender difference in the provision of medical services between different clinical specialties in our experiment. Exploring the gender

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ISSN 1501-9071 (print version.), ISSN 1890-1735 (online), ISBN 978-82-7756-255-1

difference within or between specialties by conducting experiments in the field, whether under specific clinical settings or in the laboratory, is recommended for future research.

Acknowledgements

We are grateful to Heike Hennig-Schmidt who provided us with the zTree-program of the Hennig-Schmidt et al. (2011) experimental design, and who in several ways made possible the use of the experimental data in this paper. Funding from The Research Council of Norway is gratefully acknowledged. This study is supported from both Independent innovation fund of Shandong University (grant no. 2012JC038) and the National Natural Science Foundation of China (grant no. 71373146) "name of Chinese funding source" for funding the experiments conducted at Shandong University.

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Appendix A: Experimental parameters

Table A

Experimental parameters

	Condition	Varia	0	1	2	3	4	5	6	7	8	9	10
I	FFS	$R_{jA}(q)$	0.00	1.70	3.40	5.10	5.80	10.5	11.0	12.1	13.5	14.9	16.6
		$R_{jB}(q)$	0.00	1.00	2.40	3.50	8.00	8.40	9.40	16.0	18.0	20.0	22.5
		$R_{jC}(q)$	0.00	1.80	3.60	5.40	7.20	9.00	10.8	12.6	14.4	16.2	18.3
		$R_{jD}(q)$	0.00	2.00	4.00	6.00	8.00	8.00	15.0	16.9	18.9	21.3	23.6
		$R_{jE}(q)$	0.00	1.00	2.00	6.00	6.70	7.60	11.0	12.3	18.0	20.5	23.0
	CAP	$R(q)$	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
II	FFS,	c(q)	0.00	0.10	0.40	0.90	1.60	2.50	3.60	4.90	6.40	8.10	10.0
II	FFS	$\pi_{jA}(q)$	0.00	1.60	3.00	4.20	4.20	8.00	7.40	7.20	7.10	6.80	6.60
		$\pi_{jB}(q)$	0.00	0.90	2.00	2.60	6.40	5.90	5.80	11.1	11.6	11.9	12.5
		$\pi_{jC}(q)$	0.00	1.70	3.20	4.50	5.60	6.50	7.20	7.70	8.00	8.10	8.30
		$\pi_{jD}(q)$	0.00	1.90	3.60	5.10	6.40	5.50	11.4	12.0	12.5	13.2	13.6
		$\pi_{jE}(q)$	0.00	0.90	1.60	5.10	5.10	5.10	7.40	7.40	11.6	12.4	13.0
	CAP	$\pi(q)$	12.0	11.9	11.6	11.1	10.4	9.50	8.40	7.10	5.60	3.90	2.00
I	FFS,	$B_{1k}(q)$	0.00	0.75	1.50	2.00	7.00	10.0	9.50	9.00	8.50	8.00	7.50
		$B_{2k}(q)$	0.00	1.00	1.50	10.0	9.50	9.00	8.50	8.00	7.50	7.00	6.50
		$B_{3k}(q)$	0.00	0.75	2.20	4.05	6.00	7.75	9.00	9.45	8.80	6.75	3.00

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This table shows all experimental parameters. $R_{jk}(q)$ denotes physicians' payment for patient type j and illness k. Under FFS, $R_{jk}(q)$ varies with illnesses k and increases in q, whereas under CAP, $R_{jk}(q)$ remains constant. The costs for providing medical services $c_{jk}(q)$ increase in q and are the same under all experimental conditions. The physicians' profit $\pi_{jk}(q)$ is equal to $R_{jk}(q) - c_{jk}(q)$. $B_{jk}(q)$ denotes the patient benefit for the three patient types j=1,2,3, held constant across conditions.

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Appendix B: Instructions

General Information

In the following experiment, you will make a couple of decisions. Following the instructions and depending on your decisions, you can earn money. It is therefore very important that you read the instructions carefully.

You take your decisions anonymously in your cubicle on your computer screen. During the experiment, you are not allowed to talk to any other participant. Whenever you have a question, please raise your hand. The experimenter will answer your question in private in your cubicle. If you disregard these rules, you may/will be excluded from the experiment <u>without</u> receiving <u>any</u> payment.

All amounts of money in the experiment are stated in Taler. At the end of the experiment, your earnings will be converted into RMB at an exchange rate of 10 Taler =1RMB and paid to you in cash.

Your decisions in the experiment

During the entire experiment, you are in the role of a physician. You have to decide on the treatment of 15 patients. All participants of this experiment take their decisions in the role of physicians. You decide on the **quantity** of medical services you want to provide for a given illness of a patient.

You will decide on your computer screen where five different illnesses—A, B, C, D, and E—of three different patient types—1, 2, and 3—will be shown one after another. For each patient you can provide 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 medical services.

Your remuneration is as follows:

Treatment FFS: A <u>different</u> PAYMENT is assigned to each **quantity** of medical services. The PAYMENT increases with the **quantity** of medical services.

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Treatment CAP: For each patient you receive a lump-sum PAYMENT that is independent of the **quantity** of medical services.

While deciding on the **quantity** of medical services, in addition to your PAYMENT you determine the COSTS you will incur when providing these services. COSTS increase with the increasing **quantity** provided. Your PROFIT in Taler is calculated by subtracting your COSTS from your PAYMENT.

A certain benefit for the patient is assigned to each quantity of medical services, the PATIENT BENEFIT that the patient gains from your provision of services (treatment). Therefore, your decision on the **quantity** of medical services not only determines your own PROFIT, but also the PATIENT BENEFIT. An example of a decision situation is given on the following screen [Figures 1 and 2] （please refer to the end）.

You will decide on the quantity of medical services on your computer screen by typing an integer between 0 and 10 into the box labeled ''Your Decision.''

There are no real(only abstract) patients participating in this experiment. Yet, the PATIENT BENEFIT, which an abstract patient receives by your provision of medical services, will be beneficial for a real patient. The total amount corresponding to the sum over all 15 PATIENT BENEFITS determined by your decisions will be transferred to Shandong Province Hospital to support a patient undergoing cancer treatment.

Earnings in the experiment

After you have made your 15 decisions, your overall earnings will be calculated by adding up the PROFITS from all of your decisions. This amount will be converted from Taler into RMB at the end of the experiment.

The overall PATIENT BENEFIT resulting from your 15 quantity decisions will be converted into RMB as well and will be transferred to the Shandong Province Hospital. The transferal will be made by the experimenter and a monitor. The monitor writes a check for the amount of

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money corresponding to the aggregated PATIENT BENEFITS of this experiment. Then the experimenter and monitor will send the money to the cancer patient's account and Shandong Province Hospital will give a signed receipt. The experimenter will scan the signed receipts into electronic form and send them to all participants via e-mail in order to ensure the authenticity of the above process. The experimenter will black outthe personal information to respect the patient's privacy.

After all participants have madetheir decisions, one participant will berandomly assigned the role of monitor. The monitor receives a payment of 200 RMB in addition to the payment from the experiment. The monitor verifies by a signed statement that the procedure described above was actually carried out.

Next, please answer some questions familiarizing you with the decision situation.

After making your 15 decisions, please answer some further questions on your screen.

患者类型 1/临床症状 C

医疗服务	数量	你的诊疗费 (代币)	你的成本 (代币)	净收益 (代币)	患者效益 (代币)
不提供	0	0.00	0.00	0.00	0.00
服务 C1	1	1.80	0.10	1.70	0.75
服务 C1, 服务 C2	2	3.60	0.40	3.20	1.50
服务 C1, 服务 C2, 服务 C3	3	5.40	0.90	4.50	2.00
服务 C1, 服务 C2, 服务 C3, 服务 C4	4	7.20	1.60	5.60	7.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5	5	9.00	2.50	6.50	10.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6	6	10.80	3.60	7.20	9.50
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7	7	12.60	4.90	7.70	9.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8	8	14.40	6.40	8.00	8.50
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8, 服务 C9	9	16.20	8.10	8.10	8.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8, 服务 C9, 服务 C10	10	18.30	10.0	8.30	7.50

请填写你要提供的医疗服务的数量

你的决策

OK

Figure 1: Screen of Part 1

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患者类型 1/临床症状 C

医疗服务	数量	你的诊疗费 (代币)	你的成本 (代币)	净收益 (代币)	患者效益 (代币)
不提供	0	12.00	0.00	12.00	0.00
服务 C1	1	12.00	0.10	11.90	0.75
服务 C1, 服务 C2	2	12.00	0.40	11.60	1.50
服务 C1, 服务 C2, 服务 C3	3	12.00	0.90	11.10	2.00
服务 C1, 服务 C2, 服务 C3, 服务 C4	4	12.00	1.60	10.40	7.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5	5	12.00	2.50	9.50	10.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6	6	12.00	3.60	8.40	9.50
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7	7	12.00	4.90	7.10	9.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8	8	12.00	6.40	5.60	8.50
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8, 服务 C9	9	12.00	8.10	3.90	8.00
服务 C1, 服务 C2, 服务 C3, 服务 C4, 服务 C5 服务 C6, 服务 C7, 服务 C8, 服务 C9, 服务 C10	10	12.00	10.0	2.00	7.50

你的决策

请填写你要提供的医疗服务的数量

OK

Figure 2: Screen of Part 2

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