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Factors Influencing Female Registered Nurses' Work Behavior

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Objective. To analyze factors that are related to whether registered nurses (RNs) work (WK) or do not work (NW) in nursing; and if the RN works, whether she works full- (FT) or part-time (PT).

Data Sources. Secondary data from National Sample Survey of Registered Nurses 2000 (NSSRN), the InterStudy Competitive Edge Part III Regional Market Analysis (2001), and the Area Resource File (2002).

Study Design. Using a cross-sectional design we tested the relationship between WK or NW and FT or PT; and demographic, job-related, and metropolitan statistical area (MSA)-level variables.

Data Collection/Extraction Methods. We combined the data sources noted above to produce the analytic sample of 25,471 female RNs.

Principal Findings. Working in nursing is not independent of working FT or PT. Age (55 and older), other family income, and prior other work experience in health care are negatively related to working as an RN. The wage is not related to working as an RN, but negatively influences FT work. Age, children, minority status, student status, employment status, other income, and some job settings have a negative impact on working FT. Previous health care work has a positive effect on whether married RNs worked. Married RNs who are more dissatisfied are less likely to work FT. A greater number of market-level factors influence FT/PT than WK/NW behavior.

Conclusions. An important contribution of this study is demonstrating that MSA-level variables influence RN work behavior. The market environment seems to have little effect on whether a nurse works, but is influential on how much the nurse works, and has differential effects on married versus single nurses.

Key Words. Nursing supply and demand, salaries and wages, health workforce: distribution/incomes/training, nursing, organization theory, health care organizations and systems, labor economics

Understanding registered nurses' (RNs') work behavior could lead to interventions to modify workforce participation and hours and help to abate the cycles of RN shortages and surpluses. In 2000, about 81.7 percent of RNs were

employed in nursing, down from 82.7 percent in 1996. Of those RNs not employed in nursing, about 7.7 percent were seeking nursing employment, 27.2 percent had another occupation, and 65.1 percent were not in the labor force (Spratley et al. 2001). A change in the workforce participation rate from 82 to 83 percent and switching 10 percent of the nurses who worked part-time (PT) in 2000 to full-time (FT) would be equivalent to adding over 58,000 FT RNs to the workforce (Brewer and Kovner 2000; Spratley et al. 2001). Better utilization of already licensed and experienced RNs is more cost effective than adding newly licensed RNs to the supply (Buerhaus, Staiger, and Auerbach 2000; Spetz and Given 2003). Unfortunately, little is known about why RNs change their workforce participation in the short run. The purpose of this paper is to increase our understanding of this behavior.

Workforce participation behavior is a complex phenomenon. This paper will focus on the following research questions: (1) is working/not working (WK/NW) as an RN related to working FT/PT, and (2) do market-level factors (managed care, physician-related demand, and unemployment rate) influence work participation? Specific hypotheses are: (1) the wage is not related to work participation, (2) age is negatively related to participation, and (3) satisfaction with work is positively related to participation.

According to economic theory, observed participation in the work force, hours worked, and wages depend on both supply- and demand-side factors (Ehrenberg and Smith 2000; Blau, Ferber, and Winkler 2001); that is, characteristics of the RNs themselves and characteristics of the local health care market such as working conditions. There is a voluminous literature on the constructs of nurse satisfaction, organizational commitment, and turnover (Antonazzo et al. 2003; Price 2004). Much of this research has been focused on RNs employed in hospitals (Skatun et al. 2005). Most of the existing research is not relevant to RNs leaving the workforce or changing participation.

In addition to their working conditions and work satisfaction, the short-run supply of RNs depends on personal preferences, the wage they could earn, and factors affecting the value of their time in other activities, such

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as the household's income from other sources, the number and ages of children in the home, and whether the RN is a PT or FT student (Phillips 1995; Brewer 1996; Antonazzo et al. 2003; Skatun et al. 2005). Increases in the value of RNs' time in other activities reduce their likelihood of working, and of working FT rather than PT. Research on nurses (Antonazzo et al. 2003; Shields 2004) is consistent with research on women's labor, particularly in terms of the negative effects of age (Brewer 1996; Buerhaus, Staiger, and Auerbach 2000; Chiha and Link 2003), young children (Phillips 1995; Brewer 1996; Chiha and Link 2003), and other household income (Blau, Ferber, and Winkler 2001). Generally minority RNs and PT students work more (Link 1992; Brewer 1996; Brewer and Kovner 2000; Ehrenberg and Smith 2000; Blau, Ferber, and Winkler 2001), as do male RNs (Chiha and Link 2003). The aging of the nursing workforce, and increasing diversity and the potential effects on participation levels for RNs are major policy concerns.

The role of the wage in nursing labor supply studies was recently reviewed by Antonazzo et al. (2003) and Shields (2004); evidence for a backward-bending supply response was mixed (as wages increase, RNs work less because they can earn the same amount of money for less work). Chiha and Link (2003) argue that wages have a minor effect on decisions to work and hours worked given participation. If wages are not an incentive to RNs, it is important to understand factors other than wages in order to design appropriate policy.

RNs' observed work behavior and hours are affected by the demand for RNs as well as by these supply-side factors. Increases in demand open up more job opportunities for RNs, and more attractive ones (that is, wage increases and/or improvements in other working conditions), thereby increasing their participation and hours worked in nursing. The job opportunities, wages, and working conditions offered by employers of RNs depend on the RN's level of education and experience in nursing, the work setting and position, and local health care market conditions. These local market conditions encompass factors affecting (1) the overall supply and demand for health care, and (2) the substitution or complementarity of RNs with other occupations.

In this paper, we estimate a reduced-form bivariate probit model of whether an RN works in nursing and, conditional on working, whether she works FT or PT. Each equation includes as independent variables both supply- and demand-side factors (characteristics of the RNs and of the local health care labor market) including the predicted value of the wage. The FT/PT equation also includes characteristics of the RN's job. The parameters are

allowed to differ between the two equations, and the parameters of the FT/PT equation are corrected for selectivity bias.

The relationship of market-level economic factors to RNs' workforce participation has received very little attention in the research literature. This paper attempts to fill in this gap. First, we control for regional variations in wages which may influence participation and hours worked. Previous analyses by Brewer and Kovner (2000) and the New York State Department of Education (2003) demonstrate regional wage variations.

Second, we consider the effects of the local unemployment rate and percentage uninsured. A low unemployment rate may affect RN labor supply because it indicates employment opportunities for RN spouses, as well as RNs (Lake 1998). The unemployment and uninsurance rates may also affect the demand for RNs because the population's health may be worse in communities with high levels of unemployment and uninsurance. However, some disagree about the effect of unemployment on health (Ruhm 2003). In any case, the unemployed have a harder time paying for health care, so that high unemployment and numbers of uninsured may not translate into more jobs for RNs. The empirical evidence is mixed. Buerhaus (1995) reported that hospital nurse vacancy rates are inversely related to the area unemployment rate. Others (Seago et al. 2001) found the opposite. Dusansky et al. (1985) found the unemployment rate had no effect on participation. The relationship of the proportion uninsured to RN employment has not been studied.

Third, we investigate physician-related demand for RNs. Providers can create a demand for their own supply of services that would create a variety of RN job opportunities. Most nurses can be considered complements to physicians, so that as demand for physicians rises, demand for RNs also rises, thus affecting the job opportunities for RNs. However, high physician/population ratios may also represent alternative working conditions or PT opportunities that influence the supply of nurses. Link (1992) found a positive relationship of physicians per 100 population with the female RN wage, but not with work behavior per se. In addition, more physicians have been associated with higher health care utilization by patients, which could result in a similar increased demand for RNs (Rice 1998).

Fourth, we analyze the effect of methods of payment for health services. Little is known about the effects of payment methods on the nursing workforce, and these variables could represent both supply and demand effects. Public payment, particularly fee for service, may be related to greater demand for RNs because of increased utilization. On the other hand, Medicaid could also represent a less desirable patient population that nurses want to avoid.

Seago et al. (2001) reported that the percent of Medicaid and Medicare discharges were positively related to hospitals' self-report of shortages. Buerhaus and Staiger (1996, 1999), using the Current Population Survey (CPS), found that from 1989 to 1997, RNs' wage and employment growth slowed the most in states with high managed-care enrollment. Competition among health maintenance organizations (HMOs) may be based on quality, which may cause employers to try to improve working conditions to attract nurses; or it may involve price competition and workforce reductions that create unpleasant working conditions for nurses.

Lastly, the behavior of the 18.3 percent of RNs who are currently out of the RN workforce (Spratley et al. 2001) must be examined. Not all can be expected to work as RNs (Pierce et al. 1991). Nevertheless, we included all nonworking RNs, because RNs at the margin may not be looking for work but could be attracted given changes in the wage, other income, or other circumstances.

METHODS

Datasets

Variables from three datasets were used to examine factors that influence RNs' work behavior: the county-version, individual-level National Sample Survey of Registered Nurses (NSSRN) (Spratley et al. 2001), the metropolitan statistical area (MSA)-level InterStudy Competitive Edge Part III Regional Market Analysis (InterStudy 2001), and the county-level Area Resource File (ARF) (Quality Resource Systems 2002).

NSSRN Data. The target population for this survey was all RNs with active licenses as of March 22, 2000 in the 50 States and the District of Columbia. The public use data file contains data on 35,579 RNs (Spratley et al. 2001). To preserve confidentiality, the Division of Nursing omitted some data from the public use dataset, such as minority subgroup identifiers and specific ages. The NSSRN contains data on the RN's annual salary from the primary and any secondary job, a categorical total income variable that includes the RN's salary, and annual hours. The logarithm of other (non-RN) income was estimated by subtracting the RNs' total salaries from the midpoint of the total income categorical variable, converting negative values to one, and taking the natural logarithm of the result.

The sample of working RNs in the dataset was used to estimate a regression model of the market wage. First, RN wages were calculated by

adding salaries from the primary and secondary jobs, then dividing by the number of annual hours worked for both jobs. The natural logarithm of the wage was used to make the distribution approximately normal. Variables used in the wage equation were: minority, region, years since graduation, highest education, and ratios of specialists and of primary care doctors per 1,000 population in the MSA (Chiha and Link 2003). The estimated coefficients were used to predict the market wage for both working and nonworking RNs, which was then included in the bivariate probit regression model for all RNs (results of the wage regression are in an appendix that is available at the publishers website).

InterStudy Competitive Edge Part III Regional Market Analysis Data. InterStudy's National HMOs Census Survey 12.1 includes data for full-service HMOs as of July 2001. This report contains a variety of MSA-level data, including variables related to metropolitan market structure, physicians, and population statistics. We created three dummy variables for MSA size, based on the definitions used by InterStudy (small, $<$250,000; medium, 250,000–999,999; and large, 1,000,000+), and selected the following variables: medical, surgical, and other specialists per 1,000 population, primary care practitioners per 1,000 population, index of HMO competition (defined as 1 minus the sum of squared HMO market shares of all HMOs operating in a market area; it ranges from zero [a monopoly] to one [competition among numerous HMOs with similar market shares]), percent of HMO hospital services paid through fee schedules, non-HMO Medicaid beneficiaries as percent of total MSA population, and percent of population that is uninsured. These factors represent various avenues by which demand or supply for RNs may be affected, as discussed above.

ARF Data. We used the MSA unemployment rate from the Bureau of Labor Statistics and the percent of people below the poverty level in 2000 from the Area Resource File. To merge the three datasets into one, we transformed the ARF data from county-specific into MSA-specific (U.S. Census Bureau 2000), or primary MSAs (PMSAs) where appropriate. MSAs are county-based and therefore single counties or groups of counties can be mapped into MSAs. Following a convention used in the NSSRN data, for working RNs in the NSSRN we used the data from the MSA in which they worked, and for nonworking RNs we used the data from the MSA where they lived. Rural RNs were excluded as MSA-level data are not available.

Sample

From the NSSRN public use data file of 35,579 actively licensed RNs, we removed all cases in which the RN neither worked in nursing in an MSA nor lived in an MSA ($n = 8{,}416$), was deceased ($n = 97$), was not in the USA ($n = 9$), or was male ($n = 1{,}586$). Preliminary likelihood ratio tests of models for all male versus female RNs showed that male and female RNs had different explanatory models, and are not reported in this paper. The remaining sample included 21,007 female RNs working in nursing and 4,464 female RNs not working in nursing.

Table 1 shows that most subjects were 40–49 years old, white, and had no children at home. Those who were not working were older and more likely to be white. A majority of RNs are FT staff nurses in hospitals, and many hold more than one position in nursing for pay. Table 2 shows that compared with how they felt in 1999 nurses are less than moderately satisfied with their job (1 = extremely satisfied; 2 = moderately satisfied; 3 = neither satisfied not dissatisfied; 4 = moderating dissatisfied; 5 = extremely dissatisfied). The table also shows that MSA characteristics are similar for working and nonworking RNs.

Model Specification

A bivariate probit model with selection bias correction (Greene 2003) was used to estimate the effects of all variables simultaneously on RN workforce behavior: working in nursing or not (WK/NW), and if the RN works, whether part-time (PT) or full-time (FT). Bivariate probit is designed to model two different but potentially conditional outcomes (such as WK/NW and FT/PT) and to determine whether the FT/PT outcome is conditional on the WK/NW outcome (Maddala 1983; Greene 2003). This model incorporates all the variables available only for working RNs (such as position and job satisfaction) and for both working and nonworking RNs in one model (Killingsworth 1983; Brown and Pagan 1998). If the estimated disturbance correlation, ρ, is significant, the outcomes are related. NLOGIT v 3.0, an add-on module to LIMDEP (Greene 2003), was used to estimate the model. All data were weighted to reflect the female RN population in MSAs.

The variables in the model include the following demographic and MSA characteristics: age, race, ages of children, marital status, highest nursing degree, years since graduation, current student status, whether previously an LPN or other health worker, predicted log wage, total other family income, MSA size, unemployment rate, percent of population uninsured, primary care

Table 1: Demographic and Work Characteristics of Female RNs by Marital Status: Working in Nursing or Not Working in Nursing but Living in MSAs, 2000 (Weighted)

	Single Female		*Married Female*	
	Working in Nursing in MSAs, n = 505,834 (%)*	*Not Working in Nursing but Living in MSAs, n = 101,978* (%)*	*Working in Nursing in MSAs, n = 1,191,536* (%)*	*Not Working in Nursing but Living in MSAs, n = 288,680* (%)*
Age				
<25	5.9	0.7	1.6	0.3
25–29	8.4	1.8	7.3	2.3
30–34	8.1	2.4	11.0	5.8
35–39	11.6	4.4	15.4	11.0
40–44	15.6	7.8	20.0	12.7
45–49	16.8	7.9	19.1	13.1
50–54	14.4	10.7	12.7	11.2
55–59	9.5	10.3	8.3	12.3
60–64	5.8	15.6	3.4	13.7
≥65	3.5	38.3	1.2	17.6
Race				
White	83.0	85.3	86.5	91.0
Other	17.0	14.7	13.5	9.0
Ages of children who live at home				
No children at home	64.7	78.9	33.6	52.8
All <6 years old	3.1	1.1	11.7	8.0
All 6 years or older	28.9	18.7	44.0	29.0
Some <6, some >6	3.4	1.3	10.4	10.2
Metropolitan statistical areas				
Small	11.3	9.1	12.6	10.7
Medium	25.4	22.7	27.6	27.0

continued

Table 1: *Continued*

	Single Female		*Married Female*	
	Working in Nursing in MSAs, n = 505,834 (%)*	*Not Working in Nursing but Living in MSAs, n = 101,978* (%)*	*Working in Nursing in MSAs, n = 1,191,536* (%)*	*Not Working in Nursing but Living in MSAs, n = 288,680* (%)*
Large	63.3	68.2	59.7	62.3
Region of employment				
New England	6.7	7.5	7.1	7.0
Middle Atlantic	18.4	25.4	17.5	21.0
South Atlantic	19.0	17.1	18.4	18.4
East South Central	4.8	3.8	5.4	4.0
West South Central	9.2	6.1	9.4	7.5
East North Central	15.5	17.1	18.0	18.6
West North Central	6.6	4.1	7.0	4.4
Mountain	5.3	6.3	4.9	5.9
Pacific	14.7	12.8	12.3	13.1
Highest nursing education				
Diploma	18.9	40.5	20.7	36.5
Associate degree	34.1	19.3	33.5	21.4
Baccalaureate	35.0	29.9	34.9	32.4
Masters	11.9	10.4	10.9	9.7
Years since graduation				
<5	24.5	5.6	17.5	4.9
6–10	13.6	5.6	14.7	6.9
11–15	12.3	6.1	14.5	12.4
16–25	24.6	18.9	30.2	27.6
>26	25.0	63.9	23.2	48.3
Full/part-time student				
Not student	91.1	97.8	93.2	97.6
Full-time student	2.1	0.8	1.4	1.1
Part-time student	6.8	1.5	5.4	1.4

Previous position in health care				
No previous health care job	61.7	72.7	63.7	74.3
Nurse aide	19.3	13.9	19.3	16.4
Licensed practical/vocational nurse	10.9	7.9	8.8	4.2
Other	2.5	2.3	2.5	1.9
Allied health	4.0	2.0	3.8	2.0
Other health	0.1	0.1	0.1	0.2
Managerial	1.6	1.1	1.9	1.1
Work status				
Full-time	75.8	N/A	57.2	N/A
Part-time	24.2		42.8	
Principal employment status				
An employee of facility	95.4		96.9	
Temporary employment	3.0		1.4	
Agency	1.6	N/A	1.7	N/A
Self-employed				
Hold >1 position in nursing for pay				
Yes	16.4		13.9	
No	83.6	N/A	86.1	N/A
Work setting				
Hospital	61.0		59.2	
Nursing home/extended care	7.4		5.6	
Nursing education	1.7		2.3	
Public health/community health	12.8		12.0	
Student health	2.9		4.5	
Occupational health	1.7		1.8	
Ambulatory care/not owned	8.1		11.1	
Insurance claims/benefits	2.9	N/A	2.6	N/A
Planning/licensing agency	0.6		0.5	
Other	0.9		0.4	

continued

Table 1: *Continued*

	Single Female		*Married Female*	
	Working in Nursing in MSAs, n = 505,834 (%)*	*Not Working in Nursing but Living in MSAs, n = 101,978* (%)*	*Working in Nursing in MSAs, n = 1,191,536* (%)*	*Not Working in Nursing but Living in MSAs, n = 288,680* (%)*
Position				
Admin/asst. admin	5.5		5.1	
Consultant	1.2		1.3	
Supervisor	3.7		3.3	
Instructor	2.3		3.1	
Head nurse or assistant	5.2		4.6	
Staff or general duty	62.1		62.5	
Practitioner/midwife	2.8		3.3	
Clinical special	1.7		2.0	
Nurse clinician	1.4	N/A	1.6	N/A
Certified nurse anesthetist	0.9		0.7	
Research	0.8		0.9	
Private duty	0.6		0.5	
Informatics nurse	0.5		0.4	
Other	10.7		10.3	
Home health	0.1		0.1	
Surveys/auditors/regulator	0.3		0.2	

*Each sample size is weighted based on its observed numbers: 6,282 for single working females; 1,160 for single nonworking females; 14,725 for married working females; and 3,304 for married nonworking females.

Table 2: Means and Standard Deviation for Satisfaction and Market-Level Variables (Weighted)

	Single Female		*Married Female*	
	*Working in Nursing; Mean (SD), n = 505,834**	*Not Working in Nursing; Mean (SD), n = 101,978**	*Working in Nursing; Mean (SD), n = 1,191,536**	*Not Working in Nursing; Mean (SD), n = 288,680**
Feeling about job compared with last year (1 = extremely satisfied, 5 = extremely dissatisfied)	2.40 (1.14)	N/A	2.31 (1.10)	N/A
Log hourly wage rate in primary and secondary position	3.15 (0.32)	N/A	3.14 (0.33)	N/A
Predicted log market wage†	3.15 (0.14)	3.18 (0.11)	3.15 (0.14)	3.17 (0.11)
Log other income	5.45 (4.34)	10.22 (0.83)	10.22 (2.04)	11.20 (0.68)
Medical, surgical and other specialists per 1,000 population	1.78 (0.75)	1.77 (0.61)	1.74 (0.70)	1.72 (0.64)
Primary care practitioners per 1,000 population	0.23 (0.09)	0.22 (0.08)	0.23 (0.08)	0.23 (0.08)
Percent of population uninsured	13.83 (3.90)	13.60 (3.71)	13.49 (3.89)	13.47 (3.85)
Unemployment rate in 2000	3.68 (1.52)	3.58 (1.09)	3.66 (1.38)	3.63 (1.39)
Index of competition among HMOs	0.70 (0.18)	0.72 (0.14)	0.69 (0.18)	0.70 (0.16)
Percent of HMO hospital services paid through fee schedules	14.78 (13.10)	13.07 (12.29)	15.55 (13.54)	14.24 (12.86)
Percent of population non-HMO Medicaid beneficiaries	7.79 (4.94)	7.47 (4.68)	7.66 (4.77)	7.27 (4.62)

*Each sample size is weighted based on its observed numbers: 6,282 for single working females; 1,160 for single nonworking females; 14,725 for married working females; and 3,304 for married nonworking females.

†Log predicted market wage was calculated based on the results of the OLS regression on log RN hourly wage controlling for sex, race, highest nursing education, years since graduation, region of employment, specialists per 1,000 population, and primary care practitioners per 1,000 population.

HMO, health maintenance organization.

practitioners per 1,000 population, specialists per 1,000 population, non-HMO Medicaid beneficiaries as percent of total MSA population, and two variables intended to capture HMO effects: index of competition (IOC) among HMOs, and percent of HMO hospital services paid through a fee schedule. This fee schedule could be percentages of billed charges, flat rates, or maximum allowable amounts (Interstudy 2001). The IOC and HMO fee schedule variables do not include the non-HMO market sector. Job-related variables that are available only for working nurses and are included only in the FT/PT equation are: type of work setting; type of position; whether employee of institution, temporary agency, or self-employed; job satisfaction; and has more than one job. The variables, their means, and standard deviations of continuous variables are listed in Tables 1 and 2. Preliminary likelihood ratio tests of models for all female RNs combined against married and single female RNs showed that married and single females had different explanatory models and should be reported separately.

A predicted wage squared term was tested because of the discussion about a backward-bending supply curve for nurses. The wage squared term was not significant in any of the equations except FT/PT for married females, where it was positive. We dropped the variable. Chiha and Link (2003) had counterintuitive results when testing this variable and also did not report it. They also tested wage categories and showed they also were not consistent with a backward-bending slope, although at higher wage rates labor supply was inelastic.

RESULTS

Results are shown in Tables 3 and 4 (complete results, including nonsignificant variables, are in an appendix available at the publishers website). We report the marginal effect at the mean for continuous variables, and the effect for categorical variables when they change from 0 to 1. In Table 3 we report the coefficients and marginal effects for the WK/NW equation. The marginal effects are the effects of the variables on Prob[WK = 1]. The coefficients and marginal effects for the FT/PT equation, shown in Table 4, account for the conditioning on the WK/NW variable in the bivariate regression. The marginal effects shown are the effects of these variables on Prob[FT = 1] and Prob[WK = 1]. We also report the (unconditional) coefficients and marginal effects for the WK/NW equation. The marginal effects are the effects of the variables on Prob[WK = 1].

Table 3: Bivariate Probit Regression Results for Single and Married Female RNs: Dependent Variable Working (versus Not Working) (ρ Is Significant)

	Single Female (n = 5,018†), Log likelihood Function = − 3,773.65, 83.2% Work				*Married Female (n = 11,613†), Log Likelihood Function = − 11,977.95, 80.5% Work*			
Explanatory Variable (Reference Category in Parentheses)*	*Coefficient*	*p[|Z|> z]*	*Marginal Effects*	*Mean*	*Coefficient*	*p[|Z|> z]*	*Marginal Effects*	*Mean*
Constant	8.149	.000	0.002		11.693	.000	1.642	—
Log other income	− 0.851	.000	− 0.2E − 03	6.181	− 0.915	.000	− 0.123	10.398
Medical, surgical and other specialists per 1,000 population	0.068	.262	0.2E − 04	1.772	0.094	.000	0.013	1.734
Percent of HMO hospital services paid through fee schedule	0.003	.317	0.1E − 05	14.581	0.005	.000	0.001	15.512
Age 50–54 (< 25)	− 0.705	.004	− 0.001	0.141	− 0.301	.054	− 0.036	0.123
Age 55–59 (< 25)	− 0.724	.004	− 0.001	0.094	− 0.693	.000	− 0.120	0.089
Age 60–64 (< 25)	− 1.327	.000	− 0.004	0.070	− 1.453	.000	− 0.383	0.051
Age ≥ 65 (< 25)	− 1.893	.000	− 0.017	0.082	− 2.325	.000	− 0.699	0.038
Education—diploma (associate degree)	− 0.037	.669	− 0.2E − 04	0.219	− 0.101	.013	− 0.015	0.229
Education—masters (associate degree)	0.525	.001	0.7E − 04	0.116	0.339	.000	0.040	0.111
Part-time student (full-time student)	1.010	.000	0.9E − 04	0.060	0.683	.000	0.060	0.046
Not student (full-time student)	0.458	.035	0.3E − 03	0.921	0.261	.024	0.048	0.939
Children at home—all < 6 years (no children at home)	− 0.120	.576	− 0.4E − 04	0.027	− 0.241	.000	− 0.045	0.115
Children at home—all > 6 years (no children at home)	0.241	.001	0.6E − 04	0.276	0.141	.000	0.017	0.410
Children at home—some < 6, some > 6 (no children at home)	0.344	.060	0.6E − 04	0.029	− 0.301	.000	− 0.056	0.109
Prior employment—licensed practice/vocational nurse (nurse aide)	− 0.123	.323	− 0.4E − 04	0.103	0.162	.013	0.021	0.079
Prior employment—allied health (nurse aide)	0.101	.543	0.2E − 04	0.038	0.224	.009	0.029	0.036
Prior employment—other health (nurse aide)	0.025	.902	− 0.1E − 04	0.023	− 0.870	.012	− 0.242	0.001
ρ	− 0.564	.000			− 0.820	.000		

*Excluded from this table are insignificant variable categories: log RN hourly wage, primary care practitioners per 1,000 population, percent uninsured population, index of competition, % non-HMO Medicaid beneficiaries as % of total MSA population; unemployment rate; small MSA; large MSA; age groups of 25–29, 30–34, 35–39, 40–44, and 45–49; race; baccalaureate degree as highest nursing education; prior employment as managerial and other; and not having previous health job.

†Each sample size is shown is the observed number, not the weighted number.

RN, registered nurse; HMO, health maintenance organization.

Table 4: Bivariate Probit Regression Results for Single and Married Female RNs: Dependent Variable Working FT (versus PT)

	Single Female (n = 5,018) Log Likelihood Function = −3,773.65 FT 75.8%, PT 24.2%				*Married Female (n = 11,613†) Log Likelihood Function = −11,977.95 FT 57.2%, PT = 42.8%*			
Explanatory Variable (Reference Category in Parentheses)*	*Coefficient*	*P[|Z|> z]*	*Marginal Effects*	*Mean*	*Coefficient*	*P[|Z|> z]*	*Marginal Effects*	*Mean*
Constant	4.431	.000			5.509	.000		
Predicted log market wage	−1.558	.000	−0.404	3.147	−1.546	.000	−0.628	3.147
Log other income	−0.001	.888	−0.3E-03	5.439	−0.051	.000	−0.071	10.215
Medical, surgical, and other specialists per 1,000 population	0.038	.238	0.010	1.777	0.044	.024	0.023	1.737
Primary care practitioners per 1,000 population	−1.578	.000	−0.409	0.226	−0.979	.000	−0.406	0.231
Percent of population uninsured	0.008	.172	0.002	13.772	0.019	.00	0.008	13.483
Index of competition among HMOs	0.571	.001	0.148	0.710	0.294	.001	0.115	0.700
Percent of HMO hospital services paid through fee schedule	−0.002	.230	−0.001	14.867	−0.003	.006	−0.001	15.772
Percent of population non-HMO Medicaid beneficiaries as percent of total MSA population	0.005	.296	0.001	7.665	0.010	.001	0.004	7.563
MSA size small (large)	0.274	.003	0.064	0.099	0.118	.020	0.041	0.110
MSA size medium (large)	0.080	.189	0.020	0.249	0.130	.000	0.048	0.271
Feeling about job compared with last year [1 = extremely satisfied, 5 = extremely dissatisfied]	−0.011	.554	−0.003	2.414	−0.032	.002	−0.012	2.308
Age ≥ 65 (< 25)	−0.734	.000	−0.251	0.033	−0.203	.153	−0.551	0.012
Race other (white)	0.193	.001	0.047	0.167	0.458	.000	0.167	0.133
Education—masters (associate degree)	0.287	.007	0.067	0.118	0.359	.000	0.143	0.112
PT student (FT student)	0.834	.000	0.148	0.068	0.058	.604	0.045	0.054
Not student (FT student)	0.884	.000	0.294	0.911	−0.002	.984	0.017	0.932

Children at home—all < 6 years old (no children at home)	− 0.503	.000	− 0.157	0.030	− 0.613	.000	− 0.278	0.121
Children at home—all > 6 years (no children at home)	− 0.055	.279	− 0.015	0.290	− 0.265	.000	− 0.097	0.437
Children at home—some < 6, some > 6 (no children at home)	− 0.417	.000	− 0.127	0.032	− 0.533	.000	− 0.251	0.109
Prior employment—no previous health care job (nurse aide)	− 0.016	.763	− 0.004	0.617	− 0.089	.004	− 0.034	0.636
Employment—employment agency (employee of facility)	− 0.773	.000	− 0.259	0.030	− 0.414	.000	− 0.173	0.014
Employment—self-employed (employee of facility)	− 0.903	.000	− 0.311	0.015	− 0.691	.000	− 0.290	0.016
One position in nursing for pay (hold >1position)	0.190	.001	0.046	0.159	0.072	.028	0.028	0.140
Work setting — nursing education (hospital)	− 0.482	.025	− 0.150	0.016	− 0.628	.000	− 0.264	0.022
Work setting — student health (hospital)	− 0.801	.000	− 0.270	0.027	− 0.763	.000	− 0.319	0.043
Work setting — ambulatory care/ not owned (hospital)	− 0.242	.002	− 0.069	0.078	− 0.186	.000	− 0.075	0.112
Work setting — insurance claims/ benefits (hospital)	0.197	.299	0.047	0.030	0.276	.001	0.102	0.026
Work position — administrator/ assistant administrator (staff or general duty)	0.983	.000	0.159	0.053	1.378	.000	0.348	0.051
Work position — consultant (staff or general duty)	0.693	.001	0.126	0.012	0.270	.030	0.100	0.012
Work position — supervisor (staff or general duty)	0.322	.004	0.072	0.037	0.438	.000	0.155	0.033
Work position — instructor (staff or general duty)	0.021	.912	0.005	0.021	0.236	.004	0.088	0.030
Work position — head nurse or asst. (staff or general duty)	1.102	.000	0.168	0.052	1.061	.000	0.303	0.048
Work position — NP/midwife (staff or general duty)	0.423	.003	0.090	0.026	0.470	.000	0.164	0.034
Work position — clinical specialist (staff or general duty)	0.374	.019	0.081	0.017	0.425	.000	0.150	0.020

continued

Table 4: *Continued*

Explanatory Variable (Reference Category in Parentheses)*	*Single Female (n = 5,018) Log Likelihood Function = − 3,773.65 FT 75.8%, PT 24.2%*				*Married Female (n = 11,613†) Log Likelihood Function = − 11,977.95 FT 57.2%, PT = 42.8%*			
	Coefficient	*P[|Z|> z]*	*Marginal Effects*	*Mean*	*Coefficient*	*P[|Z|> z]*	*Marginal Effects*	*Mean*
Work position — nurse clinician (staff or general duty)	0.806	.000	0.137	0.014	0.239	.005	0.089	0.016
Work position — certified nursing anesthetist (staff or general duty)	0.686	.004	0.124	0.008	0.667	.000	0.216	0.007
Work position — research (staff or general duty)	1.451	.000	0.171	0.009	0.509	.000	0.175	0.009
Work position — informatics nurse (staff or general duty)	0.573	.087	0.110	0.005	0.539	.002	0.183	0.004
Work position — other (staff or general duty)	0.674	.000	0.133	0.107	0.648	.000	0.220	0.103
Work position — surveys/auditors/regulators (staff or general duty)	15.250	1.000	0.190	0.003	0.662	.022	0.214	0.002

*Excluded from this table are insignificant variable categories: unemployment rate; age groups of 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, and 60–64; highest nursing education of diploma and baccalaureate degree; prior employment as LPN/VN, allied health, other health, managerial, and other; work settings of nursing home, public/community health, occupational health, plan/licensing agency, and other; and position titles of private duty and home health.

†Each sample size shows the observed number, not the weighted number.

RN, registered nurse; FT, full time; PT, part time; HMO, health maintenance organization.

The marginal effect is interpreted as the raw change in the probability of WK (versus NW) or working FT (versus PT). If, for example, the marginal effect is $-.25$, this means that when the variable in question increases by 1 unit (from 0 to 1), the probability decreases by 25 percentage points. Thus, the probability of a single RN older than 65 working FT is .25 less than for one under age 25 (Table 4). If the initial probability is .6, it drops to .35 (a change of 42 percent); if it is .4, it drops to .15 (a change of 62.5 percent).

To answer our first research question, whether RNs' WK/NW and FT/PT behaviors are related, we examine the disturbance correlation (ρ) in Table 3. This assumption is supported (i.e., ρ is significant) for both married and single females. Our second research question asked whether market-level factors are also significant predictors of work behavior. The answer is yes, and individual factors will be discussed below (results for insignificant variables will not be discussed).

Significant Variables in WK/NW Regression (Table 3)

Market-Level Variables. The marginal effects of percent of HMO hospital services paid through fee schedules and specialists per 1,000 population are positive for married (but not single) RNs, but other market-level variables are not significant in the WK/NW equation.

Demographic Variables. The effect of age on whether an RN works in nursing is negative, confirming our hypothesis, but only for older nurses. The effect is small but significant for single RNs older than 50, whereas it is large for married RNs older than 55. Other income has a small negative effect on single RNs, and decreases the probability of working in nursing even more for married RNs, but the predicted wage rate has no significant effect on whether an RN works in nursing (as hypothesized). Children, particularly those under 6, have negative effects on married RNs; older children have no effect. Compared with an associate degree, there is a small but positive effect on the probability of working in nursing if the highest degree is a master's degree, and a small negative effect for married RNs if the RN is only diploma prepared. The probability of working in nursing increases for married and single RNs if they are not FT students. For married RNs, relative to experience as a nurse aide, experience as an LPN or in allied health occupations has a positive effect on the probability of working, whereas experience in other health occupations has a negative effect.

Significant Variables in FT/PT Regression (Table 4)

Market-Level Variables. Except for the unemployment rate, all the market-level variables have significant effects on working FT rather than PT for married RNs. Several are also significant for single RNs; however, the effect is not always in the expected direction. For both married and single female RNs, an increase in primary care physicians reduces the probability of working FT. On the other hand, an increase in specialists increases the likelihood that married RNs work FT, but has no significant effect on single RNs. Larger shares of the population being non-HMO Medicaid beneficiaries and being uninsured have positive effects on the probability of working FT for married RNs, but have no significant effects for single RNs. More competition among HMOs increases the probability of FT work for both married and single RNs, as does a small MSA. On the other hand, in MSAs where a larger percentage of HMO hospital services are paid through fee schedules, married (but not single) RNs are less likely to work FT.

Demographic Variables. Although the results regarding WK/NW as an RN support the hypothesis that the wage is not related to work participation, this hypothesis is not supported by the results regarding working FT/PT. The likelihood of working FT decreases as the wage rate increases, suggesting a backward-bending labor supply curve, and (for married RNs only) as other income increases. The hypothesis that age is negatively related to working FT/PT is only marginally supported. Conditional on working in nursing, the probability of working FT is significantly lower only for single female RNs older than 65 compared to RNs under age 25.

Nonwhite RNs are more likely to work FT than white RNs. Compared with RNs without children, both single and married RNs who have any children under age 6 are less likely to work FT. Married RNs whose children are all over age 6 are also less likely to work FT than those without children at home, but the effect is much weaker than for children under age 6. Single RNs are more likely to work FT if they are not full-time students, but student status is not significant for married RNs.

Work-Related Variables. The hypothesis that job satisfaction with work is positively related to participation is supported only for married RNs. Decreased job satisfaction compared with a year ago has a small negative effect on the probability that a married RN works FT. This negative effect

may reflect "reverse causation" if PT jobs are less satisfying, rather than indicating that RNs who are less satisfied choose to work fewer hours. Compared with those who had a previous job as a nurse aide, those married RNs who had no previous health care job are less likely to work FT. The probability of FT work decreases for both married and single RNs if the RN is a temporary or self-employed worker rather than an employee. Those who have more than one position in nursing are more likely to work FT. Relative to a hospital setting, student health, ambulatory care, and education settings reduce the probability of working FT, whereas those married RNs who work in insurance settings are more likely to work FT. The probability of working FT is higher for most other positions than for staff RNs.

DISCUSSION

An important contribution of this study is demonstrating that MSA-level variables influence RN work behavior. The market environment seems to have little effect on *whether* a nurse works (only two of the nine variables were significant in Table 3), but is influential on *how much* the nurse works. Some of the marginal effects are small. For example, for percent of HMO hospital services, a one unit increase at the mean of 14.9 percent is a 6.34 percent increase. To find the marginal effect of a 10 percent increase at the mean, we have to divide the marginal effect in the table (-0.001) by 6.34 and then multiply the result by 10. The result is -0.16 percentage point decrease in the probability of working FT, a small result. However, an increase of one unit in the percent of population uninsured at its mean of 13.5 percent results in a 1.1 percentage point increase in the probability of working FT for married RNs. The 57.2 percent of married FT RNs would increase to 58.3 percent. There were 1,563,033 working married RNs in 2000 (Spratley et al. 2001); 17,193 more married RNs would work FT, a nontrivial number.

Some of the MSA-level effects also have unexpected signs. For example, the results do not support the idea that RNs and primary care doctors are complements. Perhaps primary care physicians increase demand by creating more opportunities for PT office work and fewer FT hospital opportunities because of less hospital utilization.

Like Dusansky et al. (1985) and Lake (1998), we found no relationship between MSA unemployment rates and nurses' work behavior. Buerhaus (1995) reported an inverse relationship between regional unemployment rates

and nurse vacancy rates. Our results could differ because we compared unemployment rates across MSAs, whereas Buerhaus compared unemployment within regions over time. Also, we use different sources of data and our data were collected in a later time period.

At present it is unknown whether the effects of the MSA-level variables are the result of changes in demand or in the willingness of the RNs to work. Buerhaus and Staiger (1996) found that nurses in high managed care areas were less likely to work FT; they speculated that this reflected the employer economies that reduce employment costs and gain flexibility in staffing. We found a positive relationship between the IOC and FT work. Although these measures of managed care are not identical, higher managed care levels are considered to create competitive environments. When the IOC is higher, hospitals and other employers compete for HMO business. Thus competition may result in improving quality by attracting RNs through improved work conditions or staffing quality, or may result in contraction of services or beds and reduced demand. To the extent that government policies can influence these variables, this may suggest new avenues for developing workforce policies.

Under the current shortage conditions, changes in societal work expectations for women mean that the typical labor behavior is how much, where, and under what conditions rather than whether to work. RNs may "job hop" among employers to find desirable working conditions, and/or reduce work effort which contributes to employer-level shortages and underscores the importance of employer-led efforts to retain nurses. Married women have an income cushion, so their labor supply can be more responsive to working conditions or spousal work factors, or they may be less geographically mobile (being "tied" to their husbands' job location), so they are more at the mercy of demand-side relations between FT/PT and other factors. Married RNs differ in a number of respects from single RNs. For example, age has a stronger effect on married women older than 60 suggesting that a supply-side income effect may be at work. A Master's degree is more influential on single RNs; this suggests the desirability of the Master's degree to employers, but also the career orientation single nurses may have due to life circumstances. The percent of hospital services paid through fee schedules is significant and positive for married RNs in the decision to work, suggesting perhaps an increase in demand for RNs. If single RNs are already participating fully, only married RNs have enough slack in the supply to respond. However the percent of hospital services is significant and negative for married RNs for FT/PT behavior (Table 4); while perhaps they are more willing to work, the working

conditions under possible cost control pressures and price competition may create poor conditions, to which married RNs can afford to respond.

Married RNs have a positive work and FT response to the physician specialist ratio. More specialist physicians may create more demand for higher level nursing skills that primary care physicians do not, and have the slack in supply that allows a response. The working environments may also be more attractive.

One of the single most consistent findings across this and other female labor studies (Blau, Ferber, and Winkler 2001; Shields 2004) is that young children lower workforce participation, particularly if the worker is married. On the demand side, employers interested in young workers need to assure accessible, reliable, and inexpensive child care, and other working conditions conducive to family life.

Theoretically, a higher wage rate should induce more RNs to want to work as RNs, but should also reduce the number of jobs offered by employers and/or increase PT at the expense of FT jobs. The wage rate affects the RNs' FT/PT behavior in two ways, and the outcome depends on how the RN values alternative uses of time. When the income effect (a higher income enables the RN to "buy" more time for other activities) outweighs the substitution effect (the increase in labor supply because of the increased "cost" of time used in other activities), workers want to work fewer hours. Nursing supply studies have shown inconsistent evidence of the response to wage increases; some have shown a backward-bending supply curve (Antonazzo et al. 2003; Shields 2004). We find that the predicted market wage rate does not influence whether nurses work in nursing, but is negatively related to working FT. In our reduced form, cross-sectional model, this result could indicate that wage effects on demand (employers are reluctant to hire higher wage RNs and hire them FT) offset effects on supply (higher wage nurses want to work, and want to work FT rather than PT), or that the supply curve is backward bending. In either case, wages clearly are not the most effective policy instrument to influence work participation of current RNs in the short run (Shields 2004). Employers cannot ignore rising wages however, or they will lose the RNs who do want to work FT at higher wages. Wages may be more useful as a policy instrument to attract people into nursing, relative to other career options, in the long run (Spetz and Given 2003).

Consistent with Antonazzo et al. (2003) and Chiha and Link (2003), we find that other income (e.g., partner's earnings and other income) negatively affects the decision to work for both single and married RNs, but affects the decision to work FT only for married RNs.

This study includes both staff and other types of RNs (Brewer 1996, 1998; Chiha and Link 2003) rather than only staff or direct care RNs (Buerhaus 1991). RNs who obtain graduate degrees or promotions may be more committed to work, and thus more likely to work FT. This is suggestive that FT work status is closely tied to career orientation, although causality cannot be determined without longitudinal studies and direct measures of career orientation. Also, employers who provide more career opportunities and have higher career expectations may attract those who want to work FT.

Studies of turnover consistently cite satisfaction as an important factor in an RN's intention to leave a job. We find that married RNs who are less satisfied compared with the previous year are less likely to be working FT, but this does not demonstrate causality. However, especially if wages are not a useful short run policy tool, the factors that influence satisfaction and thus behavior, over and above the demographic proxies, must be determined.

Another possible short-run strategy is for employers to court RNs who are more likely to work FT, such as minority RNs (including males). However, minority RNs who are currently working may not have any slack left in their supply, making rapid growth in this segment difficult. In the long run, efforts by nursing schools to recruit minority students and government policy directed at recruiting minority RNs through scholarships and other financial incentives such as those used by the military (both for students and schools) would increase the overall productivity of the RN workforce, just as the increase in women in the physician workforce has decreased the productivity of the physician workforce (Cooper et al. 2002). Increased diversity of the workforce has benefits as well for patients cared for by someone who speaks their language or shares a cultural background.

LIMITATIONS

Rural and male nurses were excluded, although the results still apply to the majority of nurses. One disadvantage of using job-related variables to predict work status is the potential endogeneity of these variables. Ideally, this problem would be addressed with instrumental variables; but unfortunately, good instruments are not available. Another limitation of this study is the satisfaction variable. According to organizational theory, this variable is potentially important in explaining nurse participation. Unfortunately, the question asks nurses about their satisfaction compared with a year ago, and the direction of causation between satisfaction and FT/PT work may go either way. Finally,

the MSA-level HMO variables are difficult to interpret because they do not account for the overall size of the HMO sector, which may be a large or small share of the local market for RNs.

Conclusions and Implications

Managing the cyclical shortages of RNs is of interest to government, employers, and RNs. Employers have primarily focused on decreasing the demand for nurses through reorganization and on increasing RN work satisfaction. This study suggests that employer strategies also could be successful if they provide working conditions that influence satisfaction, childcare, and development of career opportunities and if they attract nurses who are more likely to work FT. In this study, the wage effect was negative when job settings and position are included in the FT/PT analysis, but the wage had no effect on the decision to work as an RN. Of particular significance in an evidence-driven world, policy makers need research findings to determine whether market-driven or regulatory approaches, or both, will be most effective. Although government intervention in RN labor demand and supply is subject to politics, government has intervened in the past at both the state and federal levels. Government initiatives have focused on increasing the long-run supply through funding of training programs and aid to students to increase the supply of new graduates. This study has shown that there are some market-level factors, such as physician ratios, related to the nursing workforce that need to be better understood both as potential policy instruments and as factors that may influence the nursing workforce through either supply or demand. It is important for government to have information on which to make sound policy decisions. Organizations such as HRSA, Medical Payment Advisory Committee (MedPAC), and the Congressional Budget Office (CBO) review studies such as this one. Findings from this study will be useful to employers and policy makers as they attempt to reduce the fluctuations in shortages and surpluses.

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SUPPLEMENTARY MATERIAL

The following supplementary material is available for this article online:

Table S1. Bivariate probit regression results for single and married female RNs: dependent variable working (versus not working) (ρ is significant).

Table S2. Bivariate probit regression results for single and married female RNs: dependent variable working full time (versus part time).

Table S3. Market wage regression results.