



# **Statewide Vacancies and Job Growth Expectations in Nursing-Intensive Healthcare Settings**

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**Addressing Nurse Workforce Issues for the Health of Florida**

## **Statewide Vacancies and Job Growth Expectations in Nursing-Intensive Healthcare Settings Estimates Based on Data from the 2007 Nurse Employer Survey**

### Background

In July 2007, the Florida Center for Nursing (Center) fielded a survey of nurse employers in five health care settings, or industry groups, known to employ a significant proportion of our state's nursing workforce. The study design called for a survey of all facilities (rather than a random sample) to ensure adequate representation at regional levels. All hospitals, skilled nursing facilities, home health agencies, public health departments, and hospices in Florida were asked to participate. Complete details of the study design and statewide survey results for each industry are presented in our report titled "[2007 Nurse Employer Survey: Methods and Statewide Results](#)".

As is true of all voluntary surveys, not all included facilities opted to complete our survey. Of 1,818 surveys distributed, 678 were returned for an overall response rate of 37.3 percent. Response rates were highest for public health departments (77.3%), hospices (47.5%) and hospitals (40.5%). Lower response rates were achieved for home health agencies (35.2%) and skilled nursing facilities (34.1%).

Among the chief purposes of the study was assessment of current and future demand for nursing personnel, measured by vacancies and anticipated growth in the number of nursing positions. If the total number of current nursing vacancies and anticipated new jobs in Florida were known, it would improve our ability to plan for nurse demand – we would know how many nurses are needed to fill new and vacant positions. Unfortunately, vacancies and anticipated job growth are unknown for facilities that did not complete our survey (non-respondents) or facilities that did participate (respondents) but could not provide information about vacancies or job growth. This research brief describes the statistical methods used to generate estimated values for these facilities and presents estimates of total vacancies and expected job growth when the reported values of respondents are combined with estimated values for non-respondents.

### Methods

Four distinct statistical methods of imputing missing data – or making an educated guess about the values for non-respondents – were used to derive the industry-wide estimates reported here. Three of these methods use information we have about the non-respondents, such as number of licensed beds, location in metropolitan or rural area, and geographic region of the state, to inform our imputations. All four of the methods assume that non-respondents would have reported similarly to respondents in actual number of vacancies or expected position growth. In the three methods that utilize additional information, it is assumed that non-respondents would have reported similarly to respondents with the same number of licensed beds or regional location.

The four methods – simple mean imputation, conditional mean imputation, regression-based imputation, and multiple imputation – are described in more detail in the appendix to this research brief. In addition, tables describing results for each method and industry group are

presented. Since all methods of imputing missing data introduce uncertainty – we cannot know the true values for non-respondents – the four different estimates were averaged so that high and low estimates both contributed to the point estimate reported here.

### Estimated Vacancies

**Table 1 shows the number of vacant full and part-time positions on 06/30/2007 that were reported by respondents to the survey.** The 678 facilities and agencies responding to the survey reported almost 3,900 vacancies for Registered Nurses (RNs) and just over 1,000 vacancies for Licensed Practical Nurses (LPNs). An additional 2,218 vacancies were reported for Certified Nursing Assistants (CNAs). The distribution of vacancies across the five industry groups reflects the skill mix of those industry groups. While hospitals reported about 2,900 of the 3,900 vacancies for RNs, the majority of LPN vacancies were reported by skilled nursing facilities and home health agencies – industry groups providing elder care. Similarly, about half of CNA vacancies were reported by skilled nursing facilities.

**Table 1. Vacant Positions as of June 30, 2007 for Respondents Only**

	<b>RN Vacancies</b>	<b>LPN Vacancies</b>	<b>CNA Vacancies</b>
Hospitals	2,889	194	591
Skilled Nsg. Facilities	299	544	1,104
Home Health	352	206	418
Public Health	155	36	19
Hospice	196	73	86
<b>Total (all groups)</b>	<b>3,891</b>	<b>1,053</b>	<b>2,218</b>

**Table 2 shows the total number of vacancies when missing data for non-respondents have been estimated and added to the reported vacancies of respondents.** We estimate that the five industries included in our study had almost 10,500 vacancies for RNs on 06/30/2007. Nearly 3,000 LPN vacancies and 5,800 CNA vacancies – more than half in skilled nursing facilities – may have existed on that date. These figures reflect a substantial need for nursing personnel in Florida, and they are likely underestimates of the true number of nursing vacancies because not all nurse employers (such as physicians’ offices or prisons) were included in the study. Note that vacancies and growth for Advanced Registered Nurse Practitioners (ARNPs) could not be imputed for non-respondents because the number of ARNPs employed within these industries was too small. See our [main report](#) of study findings for information on vacancy rates for respondents; the rates would be similar using estimated values for non-respondents because it is assumed that the two groups are similar.

**Table 2. Vacant Positions as of June 30, 2007 with Missing Data Imputed**

	<b>RN Vacancies</b>	<b>LPN Vacancies</b>	<b>CNA Vacancies</b>
Hospitals	7,649.3	482.2	1,422.9
Skilled Nsg. Facilities	960.2	1,739.9	3,534.7
Home Health	1,151.7	518.6	601.5
Public Health	185.2	47.4	26.5
Hospice	490.7	184.0	205.6
<b>Total (all groups)</b>	<b>10,436.9</b>	<b>2,972.3</b>	<b>5,791.0</b>

Estimates of vacant nursing positions in the state have not been published since 2005, when Florida’s Agency for Workforce Innovation (FAWI) reported there were 5,969 RN vacancies, 1,587 LPN vacancies, and 2,450 CNA vacancies as estimated by a 2005 survey of employers<sup>1</sup>. Also in 2005, Florida Hospital Association (FHA) estimated there were 5,342 vacant RN full-time equivalent (FTE) positions in hospitals based on a February 2004 survey<sup>2</sup>. Our estimates are not directly comparable with the estimate of vacant FTEs reported by FHA for hospitals, since our estimates are based on nursing jobs (not FTEs) and they include multiple industry groups.

However, our estimates *can* be compared with those reported by FAWI, since their count of vacancies is intended to be statewide and reflect all vacant jobs. Our estimates are nearly double those of FAWI, which raises the question of whether vacancies have increased in the past few years. The raw number of vacancies has likely grown to some extent because the healthcare workforce itself has expanded. Even if vacancy rates remained stable, the number of vacant positions would increase proportionate to the size of the workforce. A growing shortage of nurses may account for the increased number of vacancies, and it is also possible that differences in survey methodology or imputation methods play a role in the differences between these estimates. The Center plans to conduct its nurse employer survey again in 2009 so that trends in the number (and proportion) of positions that are vacant can be observed.

Estimated New Job Growth

**Table 3 shows the number of new full and part-time positions that *responding employers* expected to create during calendar year 2008.** More than 2,500 new jobs for licensed nurses were anticipated by respondents, and nearly 900 positions were anticipated for CNAs. The majority of the new RN positions were identified by hospitals, although substantial growth was also expected within home health agencies. The largest proportion of new LPN and CNA positions were expected within home health agencies and skilled nursing facilities.

**Table 3. Expected Growth in Positions in 2008 for Respondents Only**

	<b>New RN Positions</b>	<b>New LPN Positions</b>	<b>New CNA Positions</b>
Hospitals	1,323	76	202
Skilled Nsg. Facilities	81	109	270
Home Health	436	203	285
Public Health	30	15	12
Hospice	153	85	104
<b>Total (all groups)</b>	<b>2,023</b>	<b>488</b>	<b>873</b>

**Table 4 shows the expected growth in nursing jobs during 2008 when survey results from respondents are added to imputed values for non-respondents.** Note that it was not possible to generate estimates for RNs in skilled nursing facilities because the vast majority did not plan to grow their RN staffs. Since all cases of reported anticipated growth were statistical outliers, no imputation methods were appropriate. If in the remaining industries non-respondents expect similar growth as their respondent counterparts, almost 6,500 RN jobs and more than 1,800 LPN jobs may be generated by the five industry groups included in our study.

**Table 4. Expected Growth in Positions in 2008 with Missing Data Imputed**

	<b>New RN Positions</b>	<b>New LPN Positions</b>	<b>New CNA Positions</b>
Hospitals	4,536.6	324.7	769.7
Skilled Nsg. Facilities	NA (81 reported)	351.6	738.5
Home Health	1,407.1	915.8	887.2
Public Health	54.6	27.9	24.8
Hospice	379.8	219.8	295.9
<b>Total (all groups)</b>	<b>6,459.1</b>	<b>1,839.7</b>	<b>2,716.1</b>

Estimating industry-wide growth expectations was more difficult than estimating vacancies, especially for RNs. The different imputation methods yielded results that varied more widely, and the models used to predict growth generally explained less variation than was true for vacancies. FAWI estimates for new RN job growth are substantially smaller than ours. They project average annual job openings of 5,063 for RNs between 2007 and 2015<sup>3</sup>. However, their projections for LPNs (1,369 new jobs) and CNAs (2,430) are more similar to ours. FAWI projections are based on projected trends in industry growth and the assumed influence on job growth for each occupation in the industry, while our projections are based on the reported job growth expectations of employers. It is not unreasonable to assume that our higher estimates may be a more accurate reflection of employer expectations. However, it is also unknown whether the growth expectations of employers will be realized in the face of financial constraints and worker shortages.

### Conclusions

If our estimates of nursing personnel vacancies and anticipated growth are accurate, Florida faces a current shortfall of nurses that is likely to increase in magnitude during calendar year 2008. A recent Center analysis of licensure data showed that the potential RN workforce increased by only 6,000 nurses during calendar year 2007, and the potential LPN workforce actually shrank by around 1,800 nurses. These figures may overestimate gains for RNs and losses for LPNs because of biennial license renewal cycles for nurses; more detail about this analysis is available in our report analyzing licensure data.<sup>4</sup> Although our picture of changes in the nurse supply will not be complete until the close of the 2008 renewal cycle, interim results suggest that the growth of our nurse supply is not keeping pace with current need and projected growth in nursing jobs.

We estimate that more than 10,000 vacancies for RNs existed in 2007 and that nearly 6,500 new RN positions will be created in 2008. Clearly, the supply of RNs must increase more rapidly to fill existing vacancies and keep pace with new job growth. The Center plans to conduct licensure data analysis and a nurse employer survey every two years to stay apprised of the developing shortage and recommend data-driven, strategic actions to resolve the shortage.

## References

1. Florida Agency for Workforce Innovation vacancy statistics were produced by request for the Florida Center for Nursing in September 2006 and October 2007.
2. Florida Hospital Association. (2005). *Nurse Staffing in Florida: The Challenges Continue*. Retrieved April 10<sup>th</sup>, 2008 from: <http://www.fha.org/nursing2005.pdf>
3. Florida Agency for Workforce Innovation employment projections were produced by request for the Florida Center for Nursing in October 2007.
4. Florida Center for Nursing. (2008). *Licensed Nurses in Florida: 2007-2008 Trends and Longitudinal Analysis*. Available at: [http://www.flcenterfornursing.org/files/Licensure\\_Trends\\_2007-2008.pdf](http://www.flcenterfornursing.org/files/Licensure_Trends_2007-2008.pdf)



## **Appendix A: Technical Information on Imputation Methods and Detailed Results by Industry Group**

### Representativeness of the Survey Respondents

All methods of imputing missing data work from the assumption that non-respondents would have provided similar information as did respondents to a survey. Thus, imputation accuracy tends to increase when response rates are higher because it is more likely that respondents represent the total population well. It is generally accepted by survey researchers that response rates near or above 50 percent are needed to make confident inferences about the population. The 2007 Nurse Employer Survey did meet this mark for public health departments and hospices. However, only 40 percent of hospitals and around 35 percent of home health agencies and skilled nursing facilities responded.

In view of these lower response rates, a bias analysis was conducted to determine whether respondents were similar to non-respondents in bed size and regional location. We determined that non-responding hospitals and skilled nursing facilities were very similar to respondents in terms of average bed size, and all three industry groups with response rates less than 50 percent had adequate representation across the six regions of Florida. A more detailed discussion of representativeness can be found in the [main report](#) of study results. For the purposes of the present analysis, we judged the representativeness to be adequate for imputation of missing data.

### Imputation #1: Simple Mean Imputation

Simple mean imputation attributes the average for respondents in an industry group to each of the non-respondents in that group using no other additional information. Averages for respondents in each industry were computed excluding statistical outliers, defined as plus or minus three times the interquartile range of the variable. Estimates for each industry are computed as the sum of observed values for respondents and the imputed values for non-respondents. In general, this method produced the most conservative estimates of vacancies and growth. Although this is the least sophisticated method used, its results are included so that reported point estimates are more conservative.

### Imputation #2: Conditional Mean Imputation

Conditional mean imputation incorporates information from a second variable under the assumption that facilities and agencies that share a characteristic also have similar numbers of vacancies or similar growth expectations. For hospitals and skilled nursing facilities, the number of licensed beds – a proxy for facility size – was used as the conditioning variable. Averages excluding outliers were produced (separately for each industry) for facilities within each of three bed size categories. Non-respondents were assigned the average of facilities within their bed size category.

For home health agencies, public health departments, and hospices, address information was used to place each facility within counties and regions of the state. As well, each facility was assigned a Beale code reflecting the urban or rural status of the county in which the facility is

located. Beale codes range from 1 to 9 where lower values indicate a more metropolitan county. In public health departments and hospices, Beale codes were strong predictors of vacancies and growth, with more growth expected in more metropolitan areas. This variable was used to condition the average imputation in health departments and hospices. In home health agencies, neither Beale code nor region of the state was a particularly strong predictor of vacancies or growth. Since larger differences were found by region, this variable was used to produce conditional imputations for home health agencies.

In general, estimates produced with conditional mean imputation were similar to those produced using simple mean imputation.

### Imputation #3: Regression-Based Imputation

Regression analysis can incorporate several variables at once to predict the observed value of vacancies and growth among respondents to a survey. The resulting parameter estimates for each variable can then be applied to the variable values for non-respondents to generate a prediction for vacancies and growth. Regression-based imputation is similar to conditional mean imputation but is capable of efficiently incorporating multiple explanatory variables.

Ordinary Least Squares (OLS) regression with a stepwise variable selection method was used to generate the most efficient prediction of vacancies and growth. Available variables for non-respondents included number of beds (for hospitals and skilled nursing facilities only, treated as a continuous variable), region of the state, and Beale code.

Models were estimated separately for each variable and industry group. They were judged as useful for imputation when at least 10 percent of variation in the dependent variable could be explained and when the model reached a .05 level of statistical significance. When one or both of these conditions were not met, regression-based imputation was not performed for a variable. In general, regression models were more efficient within hospitals for all variables and across industry groups for current vacancies. Commonly, 20 to 50 percent of variation in vacancy rates could be explained by the variables we had available for non-respondents. Predictions for home health agencies were generally least efficient, as were predictions of growth across all industry groups.

### Imputation #4: Multiple Imputation

Multiple imputation is a more recently developed technique of imputing missing data that acknowledges the uncertainty of any single imputed value by generating multiple imputed values for each missing case and combining them statistically to arrive at a point estimate. The analysis was performed using SAS statistical software's PROC MI and PROC MIANALYZE to generate and then analyze the multiply imputed datasets.

Multiple imputation (indeed, all methods of imputing missing data) is less accurate when the proportion of cases missing data increases. This technique also depends on the efficient predictive power of other variables in the dataset, so the multiply imputed point estimate was not generated in cases where regression models failed to explain variation in the dependent variable.



In addition, estimates were not reported when the technique failed to produce an estimate significant at the .05 level.

The two more sophisticated methods of imputation – regression and multiple imputation – typically produced larger estimates of current vacancies and anticipated growth. To guard against overestimates for these variables in the face of uncertainty and large amounts of missing data, the less sophisticated and more conservative estimates were averaged with them to generate the values reported here.

### Detailed Results by Industry, Variable, and Imputation Method

The tables below show results for each industry and imputation method for each of the six variables representing vacancies and anticipated growth. Where “NA” appears, the technique was not applicable for that industry or variable. Averages are based on the imputation techniques that were possible for each industry and variable. Sums for each imputation method are based on observed imputations or the average for an industry if the method could not be used.

**Table 1. Full and Part-Time RN Vacancies**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	2,889	7,657.2	7,402.5	7,629.8	7,907.5	7,649.3
Skilled Nsg	299	906.8	904.4	1,039.2	990.3	960.2
Home Health	352	1,177.1	1,126.2	NA	NA	1,151.7
Public Health	155	188.6	192.4	180.5	179.3	185.2
Hospice	196	435.6	510.5	525.9	NA	490.7
<b>Total (all groups)</b>	<b>3,891</b>	<b>10,365.3</b>	<b>10,136.0</b>	<b>10,527.1</b>	<b>10,719.4</b>	<b>10,436.9</b>

**Table 2. Full and Part-Time LPN Vacancies**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	194	438.5	425.7	557.6	507.6	482.2
Skilled Nsg	544	1,643.8	1,668.7	1,866.0	1,781.1	1,739.9
Home Health	206	523.9	513.3	NA	NA	518.6
Public Health	36	47.5	43.0	50.5	48.6	47.4
Hospice	73	135.0	206.3	210.8	NA	184.0
<b>Total (all groups)</b>	<b>1,053</b>	<b>2,788.2</b>	<b>2,857.0</b>	<b>3,203.5</b>	<b>3,039.9</b>	<b>2,972.3</b>

**Table 3. Full and Part-Time CNA Vacancies**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	591	1,255.0	1,278.2	1,508.0	1,650.2	1,422.9
Skilled Nsg	1,104	3,416.8	3,356.2	3,598.6	3,767.0	3,534.7
Home Health	418	610.1	592.8	NA	NA	601.5
Public Health	19	28.5	22.8	29.3	25.4	26.5
Hospice	86	153.4	257.7	NA	NA	205.6
<b>Total (all groups)</b>	<b>2,218</b>	<b>5,463.8</b>	<b>5,507.7</b>	<b>5,942.9</b>	<b>6,249.6</b>	<b>5,791.0</b>

**Table 4. Projected Growth in 2008 for RN Full and Part-Time Positions**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	1,323	3,876.6	3,913.9	5,362.3	4,993.7	4,536.6
Skilled Nsg	81	NA	NA	NA	NA	NA
Home Health	436	1,414.9	1,399.3	NA	NA	1,407.1
Public Health	30	49.0	52.2	59.8	57.4	54.6
Hospice	153	340.0	419.5	NA	NA	379.8
<b>Total (all groups)</b>	<b>2,023</b>	<b>5,761.5</b>	<b>5,865.9</b>	<b>7,263.0</b>	<b>6,919.0</b>	<b>6,459.1</b>

**Table 5. Projected Growth in 2008 for LPN Full and Part-Time Positions**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	76	253.3	266.6	354.7	424.2	324.7
Skilled Nsg	109	341.7	361.5	NA	NA	351.6
Home Health	203	871.8	959.7	NA	NA	915.8
Public Health	15	22.8	27.0	29.6	32.1	27.9
Hospice	85	188.8	250.7	NA	NA	219.8
<b>Total (all groups)</b>	<b>488</b>	<b>1,678.4</b>	<b>1,865.5</b>	<b>1,871.4</b>	<b>1,933.3</b>	<b>1,839.7</b>

**Table 6. Projected Growth in 2008 for CNA Full and Part-Time Positions**

	<b>Respondents</b>	<b>Imp 1</b>	<b>Imp 2</b>	<b>Imp 3</b>	<b>Imp 4</b>	<b>Average</b>
Hospitals	202	689.5	687.2	857.7	844.3	769.7
Skilled Nsg	270	726.7	750.2	NA	NA	738.5
Home Health	285	851.9	922.4	NA	NA	887.2
Public Health	12	26.4	24.9	26.4	21.5	24.8
Hospice	104	244.8	360.3	282.6	NA	295.9
<b>Total (all groups)</b>	<b>873</b>	<b>2,539.3</b>	<b>2,745.0</b>	<b>2,792.4</b>	<b>2,787.4</b>	<b>2,716.1</b>