Three Pitfalls in Workforce Planning: The Flaw of Averages, the Errors of Agglomeration, and the Miscalculations of Fractional Employment

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Defining staffing shortages for advanced practice providers (APPs) based on historical patterns of supplementary temporary worker utilization can produce inaccurate estimates. We have identified three possible sources of error: 1) relying on prior average levels of utilization without considering variance, 2) wrongly classifying individuals with different roles within a single category, and 3) assuming part-time positions of the apt size are available. Strategies, such as a 'central staffing' model in which APPs can be trained and credentialed for multiple units, offering flexible part-time positions, and defining the costs and benefits of overstaffing and understaffing to determine the correct balance between the two, can address these issues.

Among the most critical elements in maintaining high-quality health care delivery is appropriate staffing: namely, having enough skilled workers to meet all institutional needs (Needleman, 2015). Appropriate staffing directly influences the quality of patient care, worker satisfaction, and the financial health of an organization (Mensik & Nickitas, 2015). Staffing challenges are particularly acute in specialized roles, such as advanced practice providers (APPs), a role that includes nurse practitioners, physician assistants, and certified nurse anesthetists, among others.

At our institution:

> *APPs work in a variety of settings across the entire organization, including the intensive care units, inpatient medical and surgical units, operating rooms, emergency department, all out-patient subspecialty clinics in the Care Network, including primary care, urgent care, and specialty care centers.* (Children's Hospital of Philadelphia, n.d.)

Precisely because APPs provide such diverse specialized services, the problem of accurately gauging overall institutional needs based on individual unit staffing requirements is difficult.

For a particular unit, a simple method of estimating an APP staffing shortage is to examine how many work-hours were provided by supplementary temporary workers in the past year. In the base case, if a unit regularly requires one supplementary temporary worker every pay period, it indicates a deficit of one staff member. It may be tempting to generalize from that and estimate system-wide staffing shortages by examining the total annual hours worked by

supplementary temporary workers (Engelbrecht et al., 2020). The annual total number of hours divided by 2,080, the annual time contribution of a full-time equivalent (FTE) employee, can provide an overall estimate of the average FTE staffing shortage for the institution.

We propose this simple measure as described, which may be accurate for a single unit, can potentially misinform if applied system-wide. Three factors are responsible: 1) the flaw of averages, 2) the errors of agglomeration, and 3) the miscalculations of fractional employment.

The *flaw of averages* (Savage, 2009) describes the pitfalls arising when decisions are based on average situations or conditions without considering significant deviations (Ginosar et al., 2022). A notable illustration of this flaw occurred in 1997, when the Red River flooded Grand Forks, North Dakota. The town's dikes, constructed to contain average high water flows, were overrun when the river's levels surged well beyond the average (Morss, 2010).

The flaw of averages in the context of nurse staffing can be seen in an extreme yet illustrative hypothetical scenario. Imagine that an institution requires 26 supplementary temporary workers for one pay period but none for the next 25. Averaging this pattern – 26 total workers divided by 26 pay periods – would suggest hiring one additional full-time employee will suffice. However, this approach would result in overstaffing in 25 of the 26 pay periods and severe understaffing during the single period of high demand.

The *error of agglomeration* refers to the misconception that all provider vacancies can be consolidated for a singular analysis (Inman et al., 2005). Given the differences in required education, skills, and credentials, it is often impractical to presume a nursing vacancy in one unit can be compensated by a surplus worker in another (Fulton, 2005). For example, an APP from a medical service is unlikely to be interchangeable with an APP from a surgical team. Hence, by way of example, if an institution experiences a shortage of one medical APP in even-numbered months and another surgical APP in odd-numbered months, the institution would need to hire two distinct APPs to be 'fully staffed,' even though there is a deficit of only one individual in any given month. This necessity arises because medical APPs are not typically suited to fill roles in surgical settings and vice versa.

Lastly, the *miscalculations of fractional employment* concept emphasizes challenges in gauging staffing shortages when, by policy or practice, only full-time hires are available to address fractional deficits. Consider a unit that consistently requires an additional 20 hours of work in every 80-hour pay period; this leads to a calculated deficit of '0.25 FTE.' Yet this figure does not correctly represent the deficit in environments where part-time roles are not an option: it will take a full FTE hire to fill this quarter-FTE-sized gap. In addition, even when institutions offer part-time positions, the problem can persist, albeit at a smaller scale. As a result, dimensions of standard fractional roles, like half-time or quarter-time (as detailed in the U.S. Chamber of Commerce's article on fractional hiring [Heaslip, 2021]) might not match the specific measured deficits.

To examine the effects of the flaw of averages, the errors of agglomeration, and the miscalculations of fractional employment, we studied our APP staffing requirements at our institution, a large, urban Children's hospital with more than 800 APPs on staff.

Methods

We conducted a detailed analysis of the expenditures incurred in employing temporary worker staff across 27 different cost-centers that regularly utilized APPs throughout the 2022 calendar year. We examined spending on supplementary temporary workers in each 26 (two-week) pay period. We initiated this analysis by converting total dollar-expenditure into hours, using the Enterprise hourly wage rate for temporary worker staff. These hours were then converted into FTEs by dividing the total by 80 hours per pay period, reflecting a standard full-time duty assignment for the two-week pay period. We then conducted a second similar tabulation, rounding up to the

nearest whole number all FTE deficits in each unit every pay period. This up-rounding would more accurately reflect the staffing shortage if only full-time positions were offered.

To consider the issue of units being unable to lend or borrow resources from one another (the error of agglomeration), we identified each unit's 'critical deficit.' The critical deficit of a unit was defined as the number of supplementary temporary workers required during the specific period(s) of maximum usage. (In the hypothetical example above, if an institution needs 26 supplementary temporary workers for a single pay period and none for the remaining 25, the critical deficit is 26.) In essence, the critical deficit represents the number of additional APPs a unit must hire to eliminate the need for *any* supplementary temporary worker services by that unit throughout the year.

We further calculated the minimum, maximum, and average usage of supplementary temporary workers for each unit by pay period.

Finally, we estimated the savings that might result if some agglomerations were possible by cross-training APPs to work in multiple units. To do so, we regrouped all 27 cost units into three conceptual categories: 'medical,' 'procedural/surgical,' and 'intensive care' (these categories are not yet used in the hospital and were devised here strictly for analysis). The medical category included the adolescent unit, the emergency department, and the medical behavioral, neurology, general pediatrics, nursing advanced practice, oncology, and rehabilitation units. The surgical/procedural category included cardio-thoracic surgery, anesthesia, sedation, special delivery and procedures, the surgical ICU, and trauma. Lastly, the intensive care category included the cardiac care unit, the cardiac ICU, the infant transitional care unit, the neonatal and pediatric ICUs, and the progressive care unit. The individual unit's supplementary temporary worker hours were then combined within these three proposed groups, and analyses were repeated on this combined dataset.

Results

Based on total expenditures over the year, we identified 73,865 hours of temporary worker staffing across 27 units and 26 pay periods (see Table 1). As shown, the use of supplementary temporary workers varied significantly between different units and pay periods, highlighting the fluctuating nature of staffing needs. Minimum and maximum hours of supplementary temporary worker usage in given pay periods was 2,002 (pay period 5) and 3,740 (pay period 3), respectively. Minimum and maximum hours of annual supplementary temporary worker usage per unit ranged from 428 to 6,908 hours, with an average of 2,736.

Hours per pay period were converted to FTEs by dividing by 80 and then rounding to the nearest whole person. Without rounding, the minimum, maximum, and average FTEs per pay period were 25.0, 46.7, and 35.5, respectively. However, after rounding, the minimum was 38.0, the maximum was 61.0, and the average was 48.2.

Critical staffing for each unit can be identified in Table 1 as the maximal value in each row. On the assumption that each unit needs to have its complete staffing requirements met independently, the sum of these per-unit maximal values, a total of 94 newly hired APPs are required to obviate the need for any supplementary temporary workers.

Grouping our 27 units into one of the three conceptual categories devised for this analysis (namely, 'medical,' 'surgical,' and 'intensive care') markedly reduced the measured shortages (see Table 2). The pay period of maximal use was 9 in the medical group, 13 in the surgical group, and 33 in the intensive care group. As shown, the pay period of highest use required 48 supplementary temporary workers, the lowest 26, with an average of 37.

Discussion

The purpose of this study was to examine the effects of the flaw of averages, the errors of agglomeration, and the miscalculations of fractional employment with regard to APP staffing requirements at our institution. We found that traditional methods of calculating staffing shortages (namely, considering the aggregate spending on

Table 1.
Supplementary Temporary Worker Hours, By Unit and Pay Period

Unit	Pay Period																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Cardiac Care Unit	64.6 [1]	188.5 [3]	169.1 [3]	124.3 [2]	94.4 [2]	120.2 [2]	29.9 [1]	157.5 [2]	68 [1]	72.3 [1]	147.7 [2]	133.5 [2]	204.1 [3]	85.2 [2]	138.8 [2]	87.2 [2]	141.4 [2]	189.2 [3]	122.8 [2]	124.8 [2]	39.2 [1]	219.2 [3]	116.8 [2]	131.2 [2]	265.2 [4]	201.8 [3]
CICU	155 [2]	74.1 [1]	104.3 [2]	143.2 [2]	216.7 [3]	163.7 [3]	117.5 [2]	212.9 [3]	301.8 [4]	223.8 [3]	178.5 [3]	214.4 [3]	169.1 [3]	152.3 [2]	240.8 [4]	330.1 [5]	153.6 [2]	134.2 [2]	188.6 [3]	222.2 [3]	134.8 [2]	233.6 [3]	161.8 [3]	80 [1]	133.6 [2]	104.8 [2]
CSH Adolescent	0 [0]	62.4 [1]	82 [2]	75.4 [1]	46.8 [1]	54.6 [1]	72.8 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	14.7 [1]	44 [1]	49.3 [1]	84.8 [2]	234.9 [3]	28 [1]	66.1 [1]	216.8 [3]	149.6 [2]	78.5 [1]	60.8 [1]	14 [1]	89.2 [2]
Emergency Department	131.2 [2]	37.7 [1]	72.4 [1]	57.6 [1]	81.6 [2]	111.9 [2]	185.2 [3]	129.6 [2]	131.6 [2]	147 [2]	90.2 [2]	22.8 [1]	32.6 [1]	158.5 [2]	84.1 [2]	122.8 [2]	109.6 [2]	74.8 [1]	142.4 [2]	201.6 [3]	101.6 [2]	70.8 [1]	108.8 [2]	108.7 [2]	130.9 [2]	100 [2]
Infant Transitional	235.2 [3]	115.2 [2]	515 [7]	224.8 [3]	107.3 [2]	291.9 [4]	161.7 [3]	251 [4]	377.1 [5]	132.4 [2]	336.6 [5]	268.5 [4]	261.5 [4]	242.6 [4]	195 [3]	206 [3]	266.9 [4]	221.2 [3]	219.1 [3]	261.6 [4]	269.8 [4]	268.5 [4]	186.8 [3]	235.2 [3]	206.1 [3]	199.5 [3]
Medical Behavioral Unit	92.2 [2]	155.1 [2]	133.5 [2]	100.2 [2]	74.6 [1]	137.4 [2]	49.4 [1]	46.3 [1]	71.1 [1]	14.7 [1]	5.6 [1]	18.4 [1]	38.5 [1]	27.3 [1]	34 [1]	63.9 [1]	55.2 [1]	15.6 [1]	30.2 [1]	72.6 [1]	23.8 [1]	18.2 [1]	64 [1]	33.8 [1]	72.2 [1]	93.4 [2]
Neurology	38 [1]	63.4 [1]	18.3 [1]	68.6 [1]	52.6 [1]	122.2 [2]	141.8 [2]	124.3 [2]	68 [1]	36.7 [1]	21.3 [1]	131.8 [2]	64.9 [1]	29.7 [1]	16 [1]	32 [1]	83.2 [2]	25.4 [1]	78.6 [1]	55.6 [1]	113.8 [2]	41 [1]	33.8 [1]	41.6 [1]	91.8 [2]	171.4 [3]
NICU Administration	129.6 [2]	44.8 [1]	0 [0]	15.6 [1]	15.6 [1]	56 [1]	37.8 [1]	19.6 [1]	18.2 [1]	19.6 [1]	37.8 [1]	19.6 [1]	0 [0]	0 [0]	112 [2]	39.2 [1]	36.4 [1]	19.6 [1]	37.8 [1]	22.4 [1]	19.6 [1]	19.6 [1]	21 [1]	0 [0]	19.6 [1]	19.6 [1]
NICU C	61.4 [1]	93.4 [2]	76.8 [1]	33.6 [1]	16.8 [1]	14.4 [1]	94.2 [2]	140.3 [2]	68 [1]	45.5 [1]	47.4 [1]	0 [0]	39.2 [1]	28.8 [1]	56.2 [1]	73.8 [1]	48.4 [1]	48.4 [1]	39.2 [1]	53.6 [1]	22.8 [1]	0 [0]	0 [0]	0 [0]	0 [0]	34 [1]
NICU East	297.6 [4]	241.6 [4]	288 [4]	124.4 [2]	9.6 [1]	170 [3]	205.8 [3]	95.8 [2]	188.7 [3]	148.6 [2]	70.4 [1]	177.1 [3]	226 [3]	114 [2]	81.5 [2]	135.4 [2]	62.8 [1]	140.6 [2]	36.4 [1]	115.6 [2]	12 [1]	57.6 [1]	134.8 [2]	34 [1]	113.2 [2]	44.8 [1]
NICU North East	124.8 [2]	163.2 [3]	116.8 [2]	87.6 [2]	67.8 [1]	68 [1]	156.2 [2]	125.6 [2]	77.6 [1]	37.6 [1]	40.4 [1]	19.6 [1]	70.4 [1]	60 [1]	28.8 [1]	95.6 [2]	55.2 [1]	77.2 [1]	19.6 [1]	48.4 [1]	34 [1]	34 [1]	100.6 [2]	28.8 [1]	43.2 [1]	34 [1]
NICU West 1	280.3 [4]	74.2 [1]	92.5 [2]	48 [1]	69.6 [1]	145.8 [2]	103.2 [2]	100.2 [2]	131.1 [2]	115.1 [2]	158.4 [2]	85.8 [2]	176.4 [3]	57.2 [1]	75.5 [1]	27.8 [1]	114.6 [2]	33.8 [1]	162.2 [3]	65.2 [1]	93.2 [2]	109.5 [2]	64.9 [1]	139.8 [2]	77.6 [1]	74.4 [1]
NICU West 2	128.6 [2]	247.6 [4]	64.2 [1]	112.4 [2]	133.3 [2]	109.6 [2]	203.5 [3]	223.9 [3]	104.4 [2]	43.2 [1]	0 [0]	59.5 [1]	58.8 [1]	25.2 [1]	14.4 [1]	145.7 [2]	113.2 [2]	143.5 [2]	48.8 [1]	48.4 [1]	48.4 [1]	14.4 [1]	57.6 [1]	34 [1]	14.4 [1]	94 [2]
Nursing Advanced Practice	0 [0]	9 [1]	0 [0]	0 [0]	0 [0]	0 [0]	3.4 [1]	1.4 [1]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]	3.2 [1]	54.4 [1]	57.6 [1]	54.4 [1]	60.8 [1]	76.8 [1]	54.4 [1]	52.8 [1]
Oncology East	30.4 [1]	35.2 [1]	92.8 [2]	67.6 [1]	7.5 [1]	18.2 [1]	43.5 [1]	24 [1]	66.1 [1]	45.6 [1]	47.5 [1]	27.3 [1]	65.4 [1]	47.6 [1]	80.8 [2]	118.4 [2]	140.8 [2]	84.4 [2]	30 [1]	14 [1]	66.4 [1]	55.6 [1]	19.2 [1]	37.6 [1]	33.6 [1]	43.1 [1]
Oncology South	62.4 [1]	40.8 [1]	48.8 [1]	57 [1]	13.2 [1]	21.4 [1]	70.2 [1]	35 [1]	35 [1]	0 [0]	65.2 [1]	59.8 [1]	22.2 [1]	17.5 [1]	25.6 [1]	65.6 [1]	70.2 [1]	72.2 [1]	0 [0]	0 [0]	60.8 [1]	101.6 [2]	54.4 [1]	0 [0]	74 [1]	20 [1]
OR CT Surg	113.6 [2]	100.8 [2]	65.6 [1]	54.2 [1]	51 [1]	57.4 [1]	40.6 [1]	40.6 [1]	49 [1]	109.6 [2]	39.2 [1]	137.8 [2]	58.8 [1]	125 [2]	39.2 [1]	33.6 [1]	59.6 [1]	56 [1]	109.8 [2]	85.6 [2]	82.4 [2]	127 [2]	105.6 [2]	108.2 [2]	78.4 [1]	72 [1]
OR General	12.4 [1]	33.9 [1]	33.5 [1]	38.7 [1]	21.4 [1]	40 [1]	52 [1]	59.2 [1]	52.8 [1]	80 [1]	46 [1]	32.7 [1]	42 [1]	66 [1]	55.8 [1]	60.8 [1]	64 [1]	46.4 [1]	52 [1]	44 [1]	27.2 [1]	29.6 [1]	32 [1]	33.6 [1]	65.6 [1]	44 [1]
PICU Main	216.8 [3]	258.4 [4]	502.4 [7]	223.5 [3]	211.2 [3]	214.4 [3]	223.9 [3]	219.6 [3]	440 [6]	272.6 [4]	289.8 [4]	284.8 [4]	470.4 [6]	316.8 [4]	381 [5]	311.8 [4]	200 [3]	59.4 [1]	175.2 [3]	108 [2]	129.9 [2]	184.5 [3]	134.4 [2]	143.2 [2]	242.4 [4]	98.4 [2]
PICU South	140.8 [2]	83.2 [2]	245.9 [4]	50.4 [1]	136.8 [2]	146.4 [2]	96 [2]	0 [0]	152.8 [2]	68.4 [1]	181.6 [3]	209.2 [3]	92 [2]	188.4 [3]	268.8 [4]	414.1 [6]	484.2 [7]	500 [7]	499 [7]	361.6 [5]	212.8 [3]	353 [5]	381.6 [5]	234.4 [3]	321.6 [5]	174.4 [3]
PICU West	57.6 [1]	106.4 [2]	115.2 [2]	31.2 [1]	57.6 [1]	102.8 [2]	0 [0]	51.2 [1]	19.2 [1]	59.2 [1]	98.4 [2]	33.6 [1]	56 [1]	18.2 [1]	44.8 [1]	55.5 [1]	143.2 [2]	187.2 [3]	307.2 [4]	462 [6]	416 [6]	407.8 [6]	249.6 [4]	228 [3]	163.2 [3]	237.6 [3]
Progressive Care Unit	237.6 [3]	185.6 [3]	326.4 [5]	107.1 [2]	191.1 [3]	187.5 [3]	89.6 [2]	105.8 [2]	109.2 [2]	109.6 [2]	178.7 [3]	44.8 [1]	115.2 [2]	249.7 [4]	204.1 [3]	92.2 [2]	201.6 [3]	81.4 [2]	98.9 [2]	167.2 [3]	211.5 [3]	164.9 [3]	96 [2]	228 [3]	259.2 [4]	288 [4]
Rehabilitation Unit	89.2 [2]	100 [2]	18.3 [1]	0 [0]	0 [0]	0 [0]	13.7 [1]	0 [0]	34.1 [1]	74.1 [1]	16.9 [1]	0 [0]	8.4 [1]	82 [2]	8.4 [1]	57.2 [1]	31.2 [1]	66.6 [1]	1 [1]	0 [0]	8 [1]	32.8 [1]	55.2 [1]	0 [0]	8.7 [1]	44.2 [1]
Sedation Unit	18.2 [1]	25.6 [1]	38.4 [1]	40.6 [1]	31.2 [1]	27.2 [1]	9.6 [1]	19.2 [1]	9.6 [1]	30.8 [1]	19.2 [1]	19.2 [1]	19.2 [1]	32.2 [1]	19.2 [1]	41.8 [1]	6.4 [1]	0 [0]	25.6 [1]	44.8 [1]	37.6 [1]	34.4 [1]	27.2 [1]	40.8 [1]	34.4 [1]	44.8 [1]
Special Delivery	47.2 [1]	54.4 [1]	72 [1]	14.4 [1]	12 [1]	12 [1]	43.2 [1]	24 [1]	60 [1]	73.6 [1]	0 [0]	60 [1]	0 [0]	53.6 [1]	48 [1]	60 [1]	39.2 [1]	32 [1]	21.6 [1]	32.8 [1]	14.4 [1]	53.6 [1]	48.6 [1]	80 [1]	74.4 [1]	79.2 [1]
Surgical Unit South	108.5 [2]	161.6 [3]	194 [3]	94 [2]	85.2 [2]	178.5 [3]	183 [3]	206.4 [3]	143 [2]	181.8 [3]	179.6 [3]	179.4 [3]	151 [2]	46.5 [1]	143 [2]	47.6 [1]	57.2 [1]	223 [3]	182 [3]	237.4 [3]	254.2 [4]	96.6 [2]	128 [2]	137 [2]	389.2 [5]	189 [3]
Trauma Program	226.4 [3]	288 [4]	253.6 [4]	149.6 [2]	197.2 [3]	238.8 [3]	280.8 [4]	204 [3]	286.2 [4]	260.4 [4]	323.1 [5]	278.8 [4]	273 [4]	379.3 [5]	272.8 [4]	256 [4]	230.4 [3]	232.8 [3]	235.2 [3]	247.2 [4]	278.4 [4]	326.4 [5]	268.8 [4]	326.4 [5]	345.6 [5]	249.6 [4]

* Each cell represents the number supplementary temporary worker hours for the 80 hour, 2 week pay period, with the rounded FTE shown in brackets.

Table 2.
Rounded Full Time Equivalent of Supplementary Temporary Worker Used in Proposed Groups by Pay Period

Combined Services	Pay Period																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Medical	6	7	6	6	4	6	8	5	6	4	4	4	3	5	4	8	8	8	4	6	8	6	7	4	6	9
Surgical	7	9	9	5	5	7	8	7	8	10	8	9	7	9	8	6	6	8	8	9	9	9	8	10	13	8
Intensive Care	27	24	33	17	17	23	26	26	26	17	23	20	25	20	24	26	26	22	25	27	22	27	21	20	24	21

supplementary temporary worker hours without specific attention to these three issues) may produce an inaccurate assessment of the problem. In particular, at our institution in calendar year 2022, the total number of supplementary temporary worker hours (73,865) divided by the number of hours in a work-year (2,080) yields an average value of 35.5 workers, but the true shortage is far larger.

In the extreme, if there were an institutional rule banning the use of supplementary temporary workers, and each unit required unique skills such that APPs cannot 'cross-cover,' 94 new staff employees are needed, not 35.5. That is, the true staffing need was nearly 3 times as great as suggested by the pure average.

Additionally, the requirement to fill any deficit with a complete person also changes the assessment. In fact, the utilization of unrounded data to calculate the average understates the demand by almost 50% because the real requirement would be for 48.2 APPs, not 35.5. (Again, under real-world conditions, this miscalculation is less drastic because some part-time positions are typically available.)

The flaw of averages error becomes evident when considering the different demands across various pay periods and units. Using an average value to determine staffing needs can lead to overstaffing during periods of low demand and understaffing during periods of high demand. This lack of adjustment to real-time needs can have important implications for both patient care and financial stability because two types of 'staffing errors' are possible: hiring too few full time APPs, or hiring too many.

Proposed Solutions

Each of the three areas of potential error identified can be addressed by changes in policy. Theoretically, the easiest problem of the three to address is fractional employment, namely, by allowing for part-time positions that are less than one FTE. For example, at our institution, the sedation unit, as shown in Table 1, routinely required less than 40 hours of supplementary temporary worker per pay period; it could avoid overstaffing by hiring a half-time equivalent.

While part-time positions might seem like a solution to staffing issues, there are significant considerations to bear in mind. First, as noted, a fixed number of hours in the part-time position might not match variable needs. Beyond that, it is uncertain if there is a substantial pool of qualified APPs who are interested in part-time roles. In addition, maintaining skills and competencies in a part-time setting could be challenging. Continuity of care is another concern because patient management might be affected with multiple APPs sharing duties. Lastly, introducing part-time positions might disrupt existing staffing models. If many full-time employees express a desire to switch to part-time, this

could destabilize the staffing balance. It is crucial to weigh these factors before making any changes, and a more in-depth analysis is warranted.

The error of agglomeration poses a substantial real-world challenge. The assumption of interchangeable roles is rarely feasible. Given that APPs are often not interchangeable, a direct conversion of temporary worker hours into full-time staff requirements can be misleading. The solution to this problem is some variant of 'central staffing' in which APPs can be trained and credentialed for multiple units. For example, if APPs were skilled and credentialed to operate across three groups (medical, surgical and intensive care), staffing needs for the original 27 independent units are markedly reduced.

Needless to say, central staffing should be implemented only with appropriate training and rigorous credentialing. Still, if this can be accomplished, the savings can be great. As shown, pay periods with maximum usage required 9 medical APPs, 13 surgical APPs, and 33 APPS in intensive care. Thus, if three-group cross-coverage were permitted, hiring 55 APPs (the sum of 9, 13, and 33) would eliminate the need for supplementary temporary workers – approximately half of the number needed without any cross coverage.

Lastly, challenges associated with averages cannot be fully resolved. There will inevitably be times of either heightened or reduced health care demand, both leading to significant deviations from average conditions. If an institution aims to hire APPs to the extent that supplementary temporary workers are never required, periods of overstaffing are probable. Conversely, adopting a lean staffing approach could result in more frequent instances where surging demand is not met, and supplementary temporary workers become necessary. As such, staffing decisions can only be optimized, not perfected. For example, in the specific year analyzed, had our institution employed additional workers to meet the average shortfall of 48.2 APPs, we would have faced understaffing in 12 pay periods, overstaffing in 14, and none would have been perfectly balanced.

Determining which error, overstaffing or understaffing, is more harmful can be difficult because the correct balance depends on the relative costs of these errors (Griffiths et al., 2021). In simple terms, if a supplementary temporary worker's cost is twice that of a staff nurse, the ideal staffing level would be one where the error of overstaffing occurs approximately twice as often as the error of understaffing. Of course, both overstaffing and understaffing have specific costs that may extend well beyond salary considerations. Furthermore, there is the issue of uncertainty and risk aversion: hiring more staff than the minimum can help avoid competing for supplementary temporary workers in times of shortage, which can be very expensive. Any unit consistently requiring at least one FTE in every pay period, such as the infant transitional unit, can be deemed 'understaffed.' Conversely, units that infrequently utilize supplementary temporary workers, like the adolescent and rehabilitation units, might find it more efficient to employ such workers only as needed. Taken together, institutions should define its hiring needs with these relative costs in mind and not necessarily address only the average labor shortage.

Conclusion

In summary, the information we have presented underscores the intricacies involved in determining staffing shortages. While findings from a single year are instructive, they alone do not provide an adequate foundation for immediate policy shifts. However, these results have catalyzed a refinement in our measurement approach. Rather than expressing staffing shortages as a solitary figure, we are moving toward a more nuanced method that accounts for the three pitfalls identified in our study. Adopting such a methodology is paramount for ensuring both efficient resource allocation and the financial sustainability of our institution. $

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References

Children's Hospital of Philadelphia. (n.d.). *Center for advanced practice*. https://www.chop.edu/centers-programs/center-advanced-practice

Engelbrecht, M., Rau, A., Nel, P., & Wilke, M. (2020). Emotional well-being and work engagement of nurses who moonlight (dual employment) in private hospitals. *International Journal of Nursing Practice*, *26*(1), e12783. https://doi.org/10.1111/ijn.12783

Fulton, J.S. (2005). The importance of specialization. *Clinical Nurse Specialist*, *19*(3), 105-106.

Ginosar, Y., Wimpfheimer, A., & Weissman, C. (2022). Using mean anesthesia workload to plan anesthesia workforce allocations: The "flaw of averages." *Anesthesia & Analgesia*, *135*(6), 1138-1141. https://doi.org/10.1213/ane.0000000000006220

Griffiths, P., Saville, C., Ball, J.E., Jones, J., & Monks, T. (2021). Beyond ratios - flexible and resilient nurse staffing options to deliver cost-effective hospital care and address staff shortages: A simulation and economic modelling study. *International Journal of Nursing Studies*, *117*, 103901. https://doi.org/10.1016/j.ijnurstu.2021.103901

Heaslip, E. (2021). *What is fractional hiring*? https://www.uschamber.com/co/run/human-resources/fractional-hiring

Inman, R.R., Blumenfeld, D.E., & Ko, A. (2005). Cross-training hospital nurses to reduce staffing costs. *Health Care Management Review*, *30*(2), 116-125. https://doi.org/10.1097/00004010-200504000-00006

Mensik, J., & Nickitas, D.M. (2015). Why nurse staffing matters: A moral imperative. *Nursing Economic$*, *33*(3), 186-187.

Morss, R.E. (2010). Interactions among flood predictions, decisions, and outcomes: Synthesis of three cases. *Natural Hazards Review*, *11*(3), 83-96. https://doi.org/doi:10.1061/(ASCE)NH.1527-6996.0000011

Needleman, J. (2015). Nurse staffing: The knowns and unknowns. *Nursing Economic$*, *33*(1), 5-7.

Savage, S.L. (2009). *The flaw of averages: Why we underestimate risk in the face of uncertainty*. John Wiley & Sons.