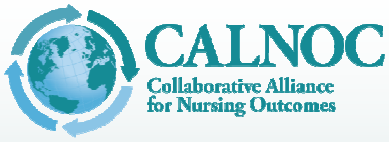

Determining "Like" Hospitals for Benchmarking

Paper #2778

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Learner Objectives:

1. Understand the value of selecting like-hospitals for benchmarking of nursing-sensitive indicators.
2. Describe the limitations of using hospital size as a characteristic to define like-hospitals

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Hospital Environment

Challenged to balance efficiency goals which assure patients receive exactly the care they need in systems without waste, with highly reliable care that is consistently safe and clinically effective (high quality).

- Greatly impacted by the economic downturn
- Facing escalating health care costs and changing reimbursement models
- Growing lists of payers who will no longer reimburse hospitals for preventable hospital-acquired conditions
- Growing scrutiny over issues that erode public trust which are highlighted in the media
- Public demands for transparency in both cost and quality data have increased

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Benchmarking Importance

- Leaders are challenged to identify appropriate benchmarks for comparative data.
- Benchmarking is an indispensable tool to gauge progress with strategic priorities.
- Benchmarking with other similar hospitals in a confidential context is an important component of improving performance on public report cards.

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Purpose:

To challenge the conventional use of arbitrary administrative comparison groups to define "like" hospitals by using a gross Average Daily Census (ADC) measure.

- ADC includes all hospital services, including Maternal Child, Rehabilitation, Psychiatric, etc.
- CALNOC has the ability to examine statistically appropriate values to determine comparison groups for benchmarking hospital performance using nursing-sensitive outcome indicators.
- **Staffing "held constant" across hospitals after California ratio implementation provided a "natural laboratory" with reliable unit-based concurrent data.**

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10 Years of CALNOC Data: Small Hospitals Are Statistically Different

- Unit-based data demonstrates significant differences in falls and hospital acquired pressure ulcers (HAPU) performance.
- Small hospitals have been administratively defined as ADC of 100 or less.
- Historical trends that follow demonstrate data from 49 hospitals (318 nursing units) in 2001, and growing to 156 hospitals (951 units) in 2007.

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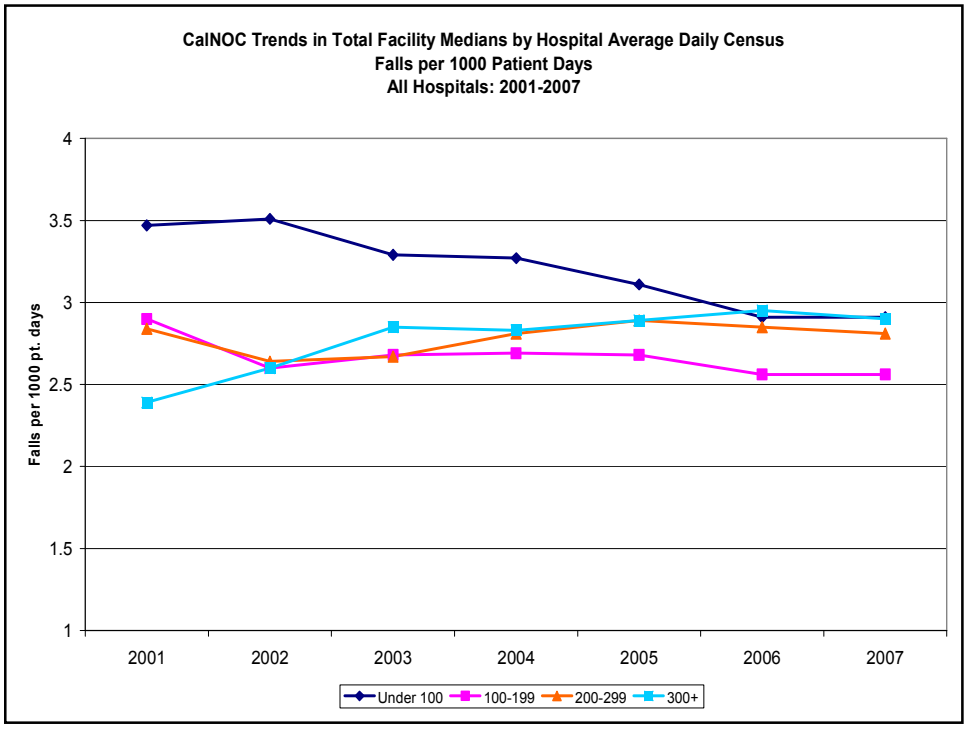

Small Hospitals: Higher Fall Rates

- Identified prior to the implementation of mandated nurse-patient ratios in 2004.
- Using hierarchical models for identification of factors associated with falls:
  - Data from 1998 – 2003
  - Most falls were in the small hospitals
  - Correlations found with patient age and higher percentages of medical diagnoses *(two variables which described the small hospitals in this sample).*

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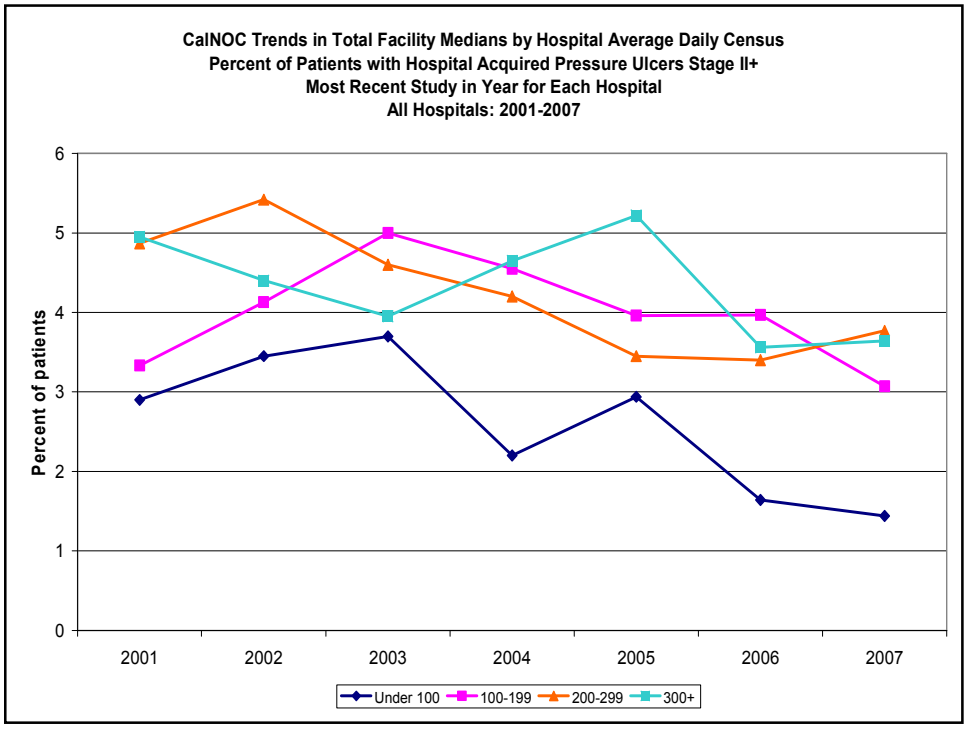

Small Hospitals: Fewer HAPU Stage 2+

- Fewer HAPU Stage 2+ than larger hospitals has continued after the implementation of staffing ratios in 2004 (staffing held constant after ratios).
- Investigation into these differences held when looking at benchmark data for best and worst performing hospitals.
- Analysis of 151 hospitals in 2006
  - Placed into benchmarking quartiles as best performers and worst performers
  - Small hospitals consistently performed the best when looking at rates for any pressure ulcers (any stage, hospital or community acquired), and various stages of hospital acquired.

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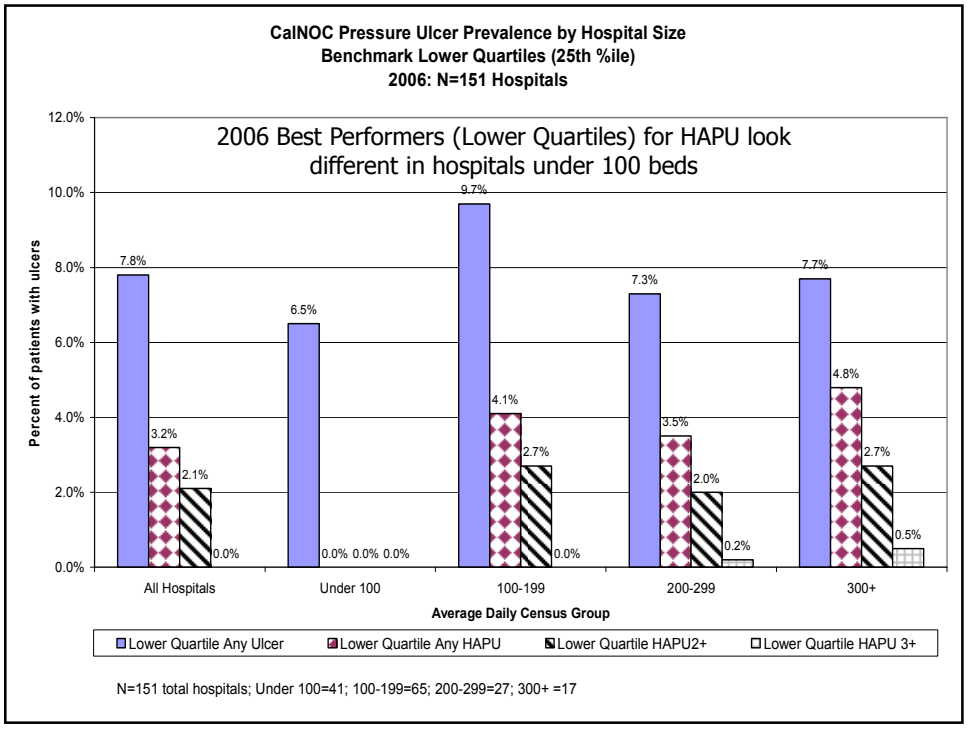

Analytical Questions

1. What is the statistically appropriate ADC cut-points that define comparison groups for small and large hospitals to benchmark performance?
2. Are there statistical differences in outcomes between small and large hospitals when using empirically defined categories?

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Methods:

Data from 6 quarters/18 months CALNOC participating hospitals reported during 2007 and the first two quarters of 2008.

- 196 Hospitals: 196 with medical/surgical nursing units (MS), 195 with critical care (CC), and 120 with step-down (SD).
- Analyses were completed at the unit-type level (CC, MS, SD) from 1264 nursing units.

Unit Level	Number of Units Contributing Data	% of Total Data
CC	308	24
MS	743	59
SD	224	17

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Table 1: CalNOC Hospital Demographics for 2007 - 2008 Analyses

Average Daily Census (ADC)	Under 100	100-199	200-299	300+	Total Number	Total Percent
Total Hospitals	**62**	**81**	**33**	**20**	**196**	100.0%
Percent by Census Category	**31.6%**	**41.3%**	**16.8%**	**10.2%**		
Ownership Category						
Not-for-profit	46	66	27	16	**155**	79.1%
For-profit	9	8	3	0	**20**	10.2%
Federal Government	2	3	0	1	**6**	3.1%
Non-federal Government	5	4	3	3	**15**	7.6%
Total	**62**	**81**	**33**	**20**	**196**	**100.0%**
Urban/Rural						
Rural	18	2	0	0	**20**	10.2%
Urban	44	79	33	20	**176**	89.8%
Total	**62**	**81**	**33**	**20**	**196**	**100.0%**
Multi-Hospital System						
No	4	7	3	6	**20**	10.2%
Yes	58	74	30	14	**176**	89.8%
Total	**62**	**81**	**33**	**20**	**196**	**100.0%**

Variables

- Three outcomes: Falls (per 1000 patient days) , Falls with Injury (excludes no injury or minor injury without loss of function), and HAPU stage 2 or greater.
- Structure indicators that are controllable by the hospital: Nurse staffing—direct care hours, skill mix, patient days, nurse/patient ratios, and contracted staffing utilization, workload intensity (admissions, discharges, transfers), staff voluntary turnover, and use of sitters.
- Patient population descriptors: patient diagnosis (% medical), age, and gender.

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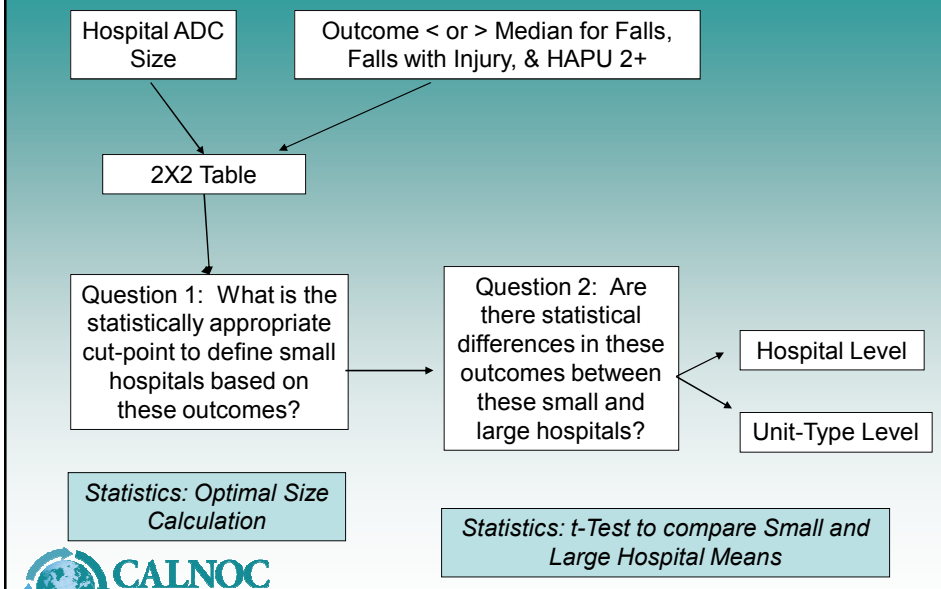

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Analysis:

Define optimal dichotomous classifications of hospitals into "small" and "large" hospital size so that the resulting groups were the best predictors of outcome.

- Varied hospital size cutoff from 30 to 310 in increments of 10.
- Calculated the overall sample median rate of outcome (for each specific outcome and unit type) and classified facility rates as "low" (below median) or "high" (above median) *(cut-points that are robust to extreme outcome values).*
  - Injury falls per 1000 patient days greater than 0.001 were considered 'high' to keep all facilities with no injury falls in the 'low' rate category (median was zero).
- This process created a two-by-two table of hospital size by outcome level (contiguous size and homogeneous hospital groups relative to the outcome).

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Statistical Procedures:

- Accuracy of prediction measured by the logistic regression c-statistic that approximately measures the proportion of accurate classification of units into 'high' and 'low' outcome rate using small or large hospital size as a predictor.
- The optimal size cut-point was the one that resulted in the highest accuracy of outcome prediction based on the largest c-statistic.
- The c-statistic value is equal to the area under the sensitivity by (1-specificity) curve, thus an alternative interpretation of the process of maximization of the c-statistic is that we seek the hospital size cutoff that results in the highest sensitivity and specificity for predicting the outcome level.
- Outcomes, as well as descriptive patient characteristics, and hospital structural variables were compared across 'small' and 'large' hospitals using t-tests for differences in means.

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Facility Level Analysis: What is a Small Hospital ?

Cut–points were not consistent by outcome.

- For HAPU 2+, small hospitals were identified as ADC < 120.
- For Falls, small hospitals were identified as ADC < 150.
- For Injury Falls small hospitals were identified as ADC < 230.

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Facility Level Analysis: Are Small Hospitals Different?

- HAPU was statistically different between hospital sizes however Falls/Falls with Injury rates were not.
- For all analyses, in small hospitals the **age of patients was significantly higher.**
- For Falls/Falls with Injury, patient turnover was higher in small hospitals.
- Hours of care and staffing variables were not significantly different between small and large hospitals for these outcomes.

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Table 3: Overall Analysis At the Facility Level (MS, SD, CC Combined)

HAPU 2+ < and >=120 ADC		Falls < and >=150 ADC		Falls w/Injury < and >=230 ADC	
Variable	**P-value; Direction**	**Variable**	**P-value; Direction**	**Variable**	**P-value; Direction**
HAPU 2+	0.007; SL	Falls	0.08* Not Significant	Falls w/Injury	0.57; SL Not Significant
Age	0.0001; SH	Workload Intensity	0.0002; SH	Workload Intensity	0.003; SH
		Age	0.0005; SH	Age	0.0006; SH
				% medical diagnosis	0.02; SH

Reference for comparison of medians between hospital groups: SH= Small Hospitals Higher; SL= Small Hospitals Lower;
* Smaller hospitals had lower median but higher mean due to outliers

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Unit-Type Level Analysis: Are Small Hospitals Different?

- For CC, cut-points were not stable (multi-modal) for Falls/Falls with Injury outcomes.
- Consistent with the facility-level data, the **only outcome that was statistically different was HAPU 2+** -- **only in critical care** with smaller hospitals below the median.
- One descriptive variable was significantly different for each unit type and for all outcomes – **patients in smaller hospitals were older**.
- Small hospitals had fewer patient sitter hours and more patient turnover in Med/Surg and SD units, but Falls/Falls with Injury outcomes were not different.
- Hours of care and skill mix were not significantly different between small and large hospitals for these outcomes with the exception of licensed hours for the Falls outcome in Med/Surg.

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Table 4: Analysis by Unit Type

	HAPU 2+ < and >=120 ADC		Falls < and >=150 ADC		Falls w/Injury < and >=230 ADC	
	Variable	P-value; Direction	Variable	P-value; Direction	Variable	P-value; Direction
Med/Surg	HAPU 2+	0.37; SL Not Significant	Falls	0.24 * Not Significant	Falls w/Injury	0.62; SE Not Significant
	Age	0.0001; SH	Lic Hrs	0.04; SH	Workload Intensity	0.0008; SH
			Sitter Hrs	0.02; SL	Age	0.0002; SH
			Workload Intensity	0.002; SH		
			Age	0.0001; SH		
Stepdown	HAPU 2+	0.15; SL Not Significant	Falls	0.17; SL Not Significant	Falls w/Injury	0.42; SL Not Significant
	%medical	0.02; SH	Sitter Hrs	0.05; SL	RN Turnover	0.05 *
	Age	0.003; SH	Workload Intensity	0.02; SH	%male	0.03; SH
			Age	0.04; SH	Age	0.04; SH
CCU	HAPU 2+	0.006; SL				
	%Other	0.01; SL				
	%medical	0.001; SH				
	Age	0.02; SH				

Reference for comparison of medians between hospital groups: SH= Small Hospitals Higher; SL= Small Hospitals Lower; SE= Small Hospitals Equal; * Smaller hospitals had lower median but higher mean due to outliers.

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Table 5: Outcomes Data By Small Hospital Cut Points and All Average Daily Census (ADC)

	ADC	Mean	SD	Median	P
All Unit Types Combined					
HAPU 2+	<120	3.31	2.0	3.10	.007
	120 or >	4.18	2.3	3.97	
	ALL ADC	3.84	2.2	3.62	
Falls per 1000 patient days	<150	3.05	1.0	2.81	.08
	150 or >	2.81	0.7	2.89	
	ALL ADC	2.94	0.9	2.87	
Injury Falls per 1000 patient days	<230	0.10	0.2	0.07	0.57
	230 or >	0.09	0.1	0.08	
	ALL ADC	0.10	0.2	0.07	

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Table 5: Outcomes Data By Small Hospital Cut Points and All Average Daily Census (ADC)

	ADC	Mean	SD	Median	P
Medical/Surgical Units					
HAPU 2+	<120	2.97	2.3	2.53	0.37
	120 or >	3.27	2.1	3.17	
	ALL ADC	3.16	2.2	2.87	
Falls per 1000 patient days	<150	3.37	1.2	3.10	0.24
	150 or >	3.18	0.9	3.32	
	ALL ADC	3.28	1.06	3.20	
Injury Falls per 1000 patient days	<230	0.12	0.2	0.08	0.62
	230 or >	0.11	0.1	0.08	
	ALL ADC	0.12	0.18	0.08	
Step Down Units					
HAPU 2+	<120	3.52	3.2	3.28	0.15
	120 or >	4.55	3.5	4.02	
	ALL ADC	4.30	3.4	3.95	
Falls per 1000 patient days	<150	2.78	1.4	2.58	0.17
	150 or >	3.11	1.1	2.95	
	ALL ADC	2.98	1.22	2.80	
Injury Falls per 1000 patient days	<230	0.10	0.2	0	0.42
	230 or >	0.13	0.2	0.07	
	ALL ADC	0.11	0.20	0.02	
Critical Care Units					
HAPU 2+	<120	6.11	5.8	4.92	0.006
	120 or >	8.83	7.0	8.32	
	ALL ADC	7.79	6.7	7.11	

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Discussion

There seems to be a direct relationship between the magnitude of the cut-point and the frequency of the outcome.

- Most frequent outcome was HAPU stage 2+ with a rate of about 3-8% and a cut-point of 120;
- Followed by falls with a rate of about 3 per 1000 patient days and a cut-point of 150;
- The rarest outcome was falls with injury with an approximate rate of 1 in 10000 patient days and a cut-point of 230 ADC.

From a statistical point of view, this makes sense:

- As outcomes rates become smaller, a larger hospital size threshold is required to be able to observe more stable rates that facilitate comparison of rates
- Small hospitals under that threshold would experience no events most of the time.

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Discussion

- Median Versus Mean: for the Falls outcome, in both the facility-level and unit-type level for medical/surgical units
  - Small hospitals were higher than the mean
  - Small hospitals were lower than the median
- Implications for using means for benchmarking – averages can be skewed by outliers.

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Implications:

- For benchmarking performance comparison of "like-sized" hospitals had limited value.
- Comparison against all hospitals may provide better data for front line staff, managers and leaders, and hospitals boards of directors to better understand their own performance.
- Leaders may be best advised to seek comparison groups that are more descriptive of "like" hospitals by criteria other than hospital size
  - rural or critical-access designations
  - population driven descriptors such as Veterans Affairs Hospitals or specialty hospitals
  - types of facilities such as county hospitals or university hospitals.
- Further research is needed to continue to explore data-based ADC size comparisons.

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Implications:

- The science of evidence-based comparison groups and risk adjustment for hospital performance indicators must continue as a priority for large datasets.
- This is an important step to refine hospital benchmarks for the future as the quest for transparency and public reporting continues to take shape.
- These findings suggest that those using comparative benchmark data to manage, monitor, accredit, acknowledge or reimburse hospitals, need to become increasingly discriminating in viewing and interpreting size-based comparisons.

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