

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Calculation of RTM

We explain here how the expected regression to the mean (RTM) effect is calculated as given in Linden (2013)¹. For normally distributed data, the classic formula to estimate RTM requires four inputs: the population mean at baseline (μ), the population variance at baseline (σ^2), the correlation coefficient between the baseline and the post period (ρ), and the cut-off for selection of group at baseline (κ). Given this information the expected RTM effect is: $= \frac{\gamma^2}{\sqrt{\gamma^2 + \delta^2}} C(z)$ where γ^2 is the within-subject variance (i.e. $\sigma^2 - \delta^2$), δ^2 is the between-subject variance (i.e. $\rho\sigma^2$). The denominator is the square root of total variance (i.e. σ). $C(z) = \frac{\phi(z)}{1 - \Phi(z)}$, where $\phi(z)$ is the probability density function and $\Phi(z)$ is the cumulative distribution function of the standard normal distribution. The z-score is given by: $z = \frac{\kappa - \mu}{\sigma}$ if the selection is done when baseline measurement are greater than κ and $z = \frac{\mu - \kappa}{\sigma}$ if the selection is done when the baseline measurement are less than κ .

Given the above setup, the expected mean values for both baseline and post-period for the selected group based on a cut-off is given as follows:

$$\text{Expected pre-test mean} = \mu \pm C\sigma$$

$$\text{Expected post-test mean} = \mu \pm C\rho\sigma$$

The difference in expected mean, i.e. $C(1 - \rho)\sigma$, is the expected RTM effect and is identical to formula given earlier. If there is high a correlation between the baseline and post-period, the expected mean will be similar across periods. Also, if the population standard errors are small, the mean of the baseline and post-period will not deviate further away from the population mean and RTM effect will be muted. Linden (2013), using simulation, shows that the “actual” and “calculated” RTM effects are similar when data is normally distributed. “Actual” is the effect derived directly from data and the “calculated” is the effect derived using above formula.

We used a statistical package, *rtmci* in Stata, to estimate the expected RTM effect.² This package not only provides expected RTM effects but also confidence interval using bootstrap simulation.

eTable 1. Change in Excess Readmissions Rates (ERRs) Explained by Regression to the Mean (RTM) for Hospitals in Right Tail of ERR Distribution.

	Heart Failure		Acute Myocardial Infarction		Pneumonia	
	Change in ERR	% due to RTM	Change in ERR	% due to RTM	Change in ERR	% due to RTM
a) Change in ERR (3-years Post-Measurement minus FY2013) on FY2013						
ERR > 1.07	-0.0710*** (-0.0779 - -0.0640)	90.66 (85.59-95.73)	-0.0955*** (-0.104 - -0.0868)	83.67 (78.13-89.2)	-0.101*** (-0.108 - -0.0933)	75.18 (71.03-79.33)
ERR > 1	-0.0482*** (-0.0530 - -0.0434)	85.8 (80.57-91.02)	-0.0632*** (-0.0699 - -0.0565)	86.45 (80.25-92.65)	-0.0712*** (-0.0766 - -0.0657)	74.34 (70.12-78.55)
Number of Hospitals	2965		2064		3013	

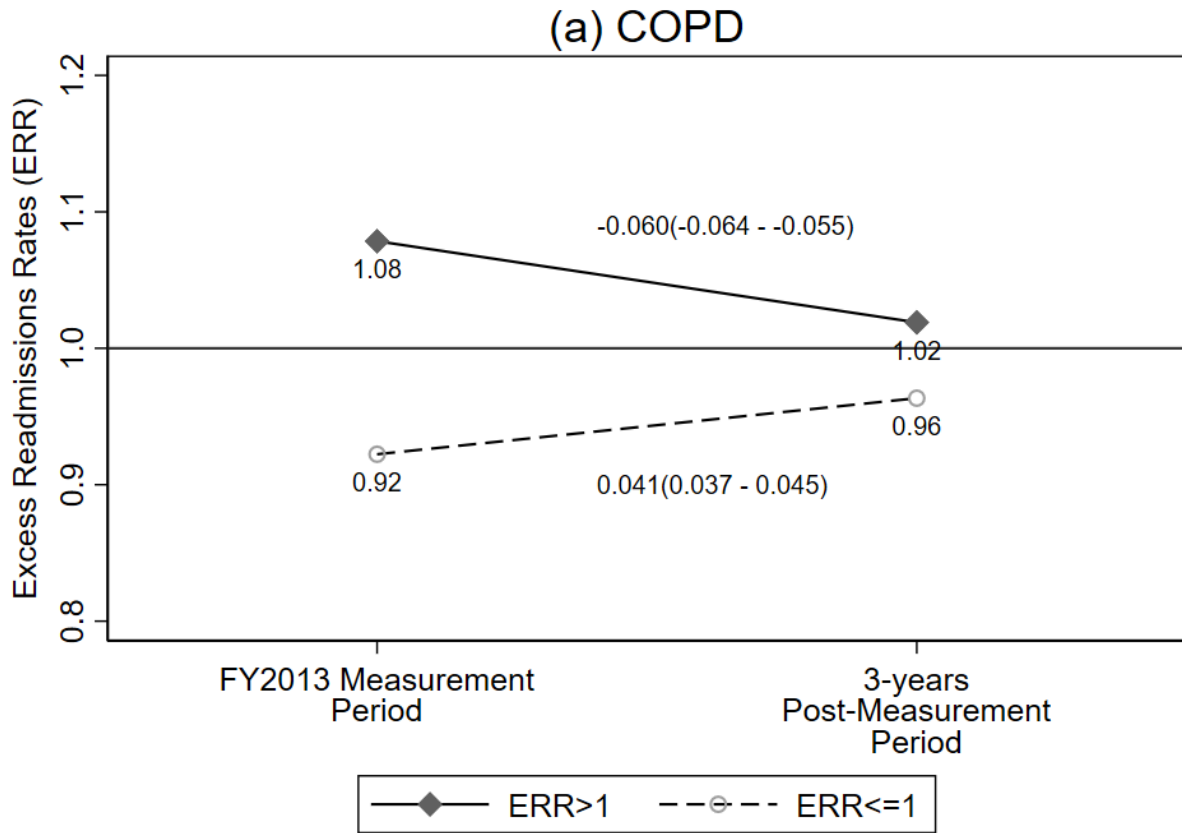
Note: The % due to RTM is calculated by dividing the RTM effect by the actual change in ERR multiplied by 100. RTM effects were calculated using *rtmci* command in Stata with cutoff of 1.07 (Linden (2013)). The cutoff of 1.07 is around the 75th percentile. Confidence interval in parentheses *** p<0.001, ** p<0.01, * p<0.05

eTable 2. Change in Excess Readmissions Rates (ERRs) Explained by Regression to the Mean (RTM) for COPD

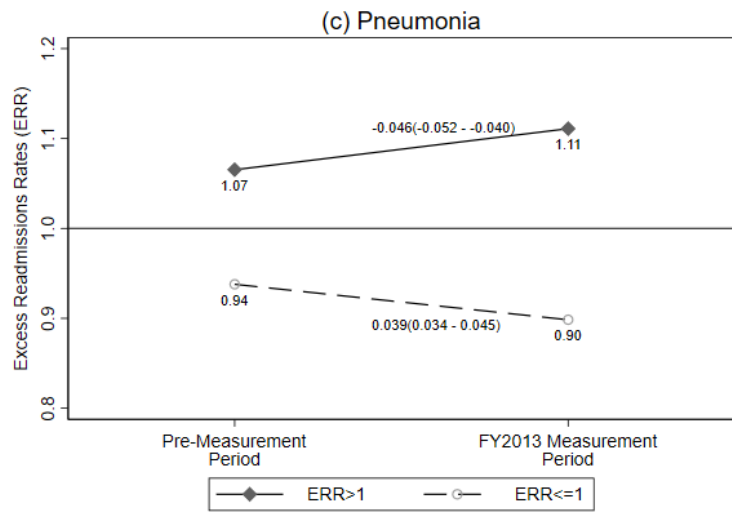
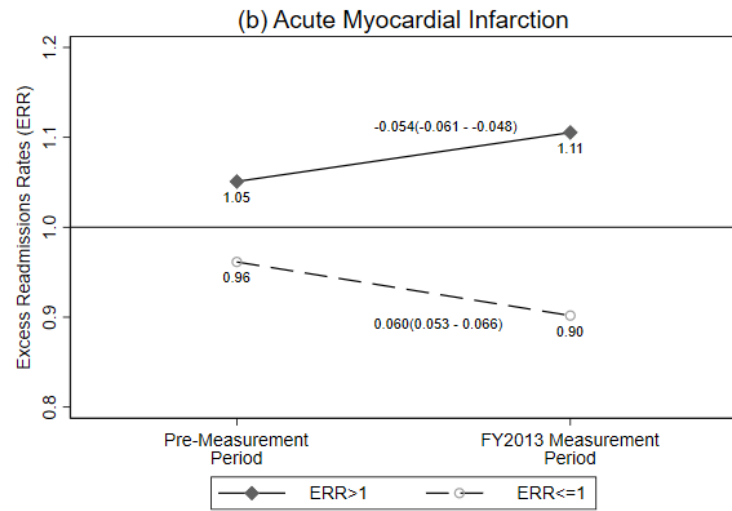
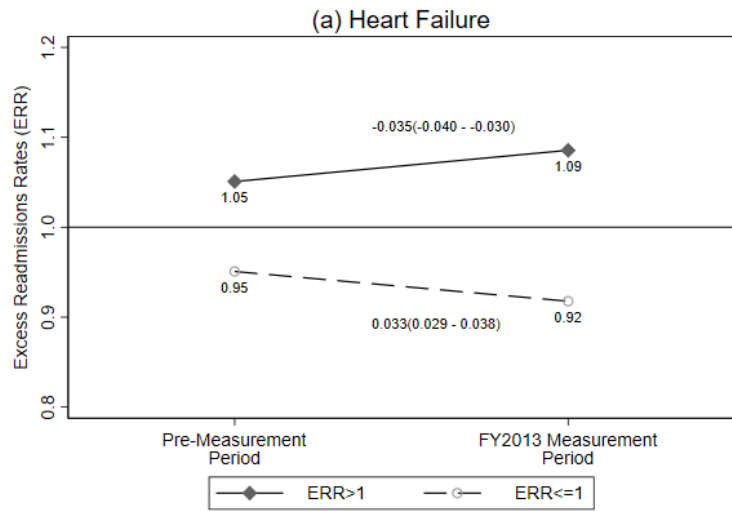
	COPD	
	Change in ERR	% due to RTM
a) Change in ERR (3-years Post-Measurement minus FY2013) on FY2013		
ERR > 1	-0.0595*** (-0.0641 - -0.0550)	80.93 (76.03-85.82)
ERR <= 1	0.0411*** (0.0373 - 0.0448)	92.98 (87.31-98.65)
Number of Hospitals	2926	

Note: The % due to RTM is calculated by dividing the RTM effect by the actual change in ERR multiplied by 100. RTM effects were calculated using *rtmci* command in Stata with cutoff of 1 (Linden (2013)). Confidence interval in parentheses *** p<0.001, ** p<0.01, * p<0.05

eFigure 1. Changes in Excess Readmissions Rate (ERRs) for COPD Before Inclusion of COPD in the HRRP



eFigure 2. Changes in Excess Readmissions Rates (ERRs) From FY2013 Measurement Period to Premeasurement Period



eReferences

1. Linden A. Assessing regression to the mean effects in health care initiatives. *BMC Medical Research Methodology*. 2013;13(1):1-7.
2. Linden A. RTMCI: Stata module to estimate regression to the mean effects with confidence intervals. *Statistical Software Components*. 2013.