Interrupted Time Series Analysis of the Impact of Fluoroquinolone Cascade Reporting

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Background

Cascade reporting involves revealing microbial drug susceptibly in a sequential order in order to optimize antimicrobial prescribing.

On May 1, 2019, VCU Health began cascade reporting for ciprofloxacin and levofloxacin for *E. coli* from urine cultures (Figure 1). Fluoroquinolones (FQs) were targeted due to their suboptimal empiric UTI coverage and numerous FDA warnings.

Figure 1: VCU Fluoroquinolone Susceptibility Cascade Reporting Implementation

Always Report

- Ampicillin
- Cefazolin
- Ceftriaxone
- Gentamicin
- Nitrofurantoin
- Piperacillin - Tazobactam
- TMP - SMX

If resistant to cefazolin / ceftriaxone

Or intermediate/resistant to ciprofloxacin / levofloxacin

Then Report

- Ciprofloxacin
- Levofloxacin

We hypothesize that suppressing fluoroquinolone results using cascade reporting led to a decrease in the overall rate of inpatient fluoroquinolone use.

Methods

Interrupted Time Series (ITS) with ordinary least squares regression was used to analyze changes in inpatient FQ usage pre and post the intervention of cascade reporting

FQ usage = Total ciprofloxacin + levofloxacin usage per month in normalized days of therapy (DOT) / 1,000 patient days (PD)
Pre- Intervention Period = May 2018 – April 2019
Post- Intervention Period = May 2019 – April 2020

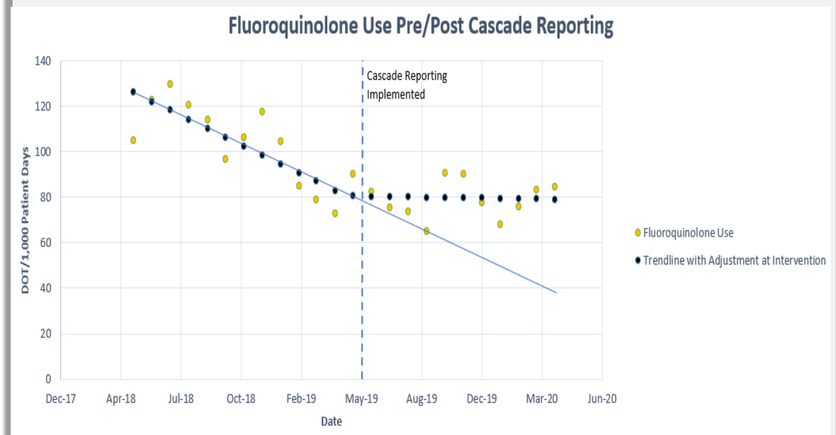
Regression Model Form

$$y = b_0 + b_1 t + b_2 x + b_3 z$$

y = FQ usage in DOT/1,000 PD
$b_{1,2,3}$ = independent coefficients
t = time in months
x = cascade reporting in binary digit (1 or 0)
z = time since intervention in months

Results

Figure 2: ITS Regression Analysis of Fluoroquinolone Usage



Statistics	
Multiple R	0.85
R Square	0.73
Adjusted R Square	0.69
Standard Error	10.48
Observations	24.00

	Coefficients	*p-value*
Intercept (b_0)	129.95	0.00
Pre-Intervention (b_1)	-3.92	0.00
Intervention (b_2)	-2.32	0.79
Post-Intervention (b_3)	3.80	0.01

Discussion

Results show no significant change in FQ usage on the intervention implementation date of May 2019 ($p = 0.79$). Possible factors impacting this are:

- Empiric prescribing of FQs in inpatient setting
- Consistent decrease in FQ use from May 2018-April 2019

Interestingly there was a significant increase in the slope of FQ usage over time when isolating the post-intervention period ($p < 0.01$).

Our hospital has had a decrease in FQ use over the past 8 years so this may be due to a 'floor' effect where the true minimum of necessary FQ use was reached.

Further investigation into this is warranted and could include a breakdown of FQ usage by individual unit and by *E. coli* specific treatment.

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