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Concise Communication

Improving fluoroquinolone use in the outpatient setting using a patient safety initiative

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Abstract

We analyzed the impact of a fluoroquinolone patient safety initiative on the weekly fluoroquinolone prescription rate in Veterans Affairs community-based outpatient clinics. We observed a significant initial but unsustained reduction. Such an initiative can function as an antimicrobial stewardship intervention; however, strategies to promote sustainability should be explored.

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Fluoroquinolones (FQs) are broad-spectrum antibiotics that are frequently overprescribed in the outpatient setting[1] and have been associated the development of multidrug-resistant infections,[2] *Clostridium difficile* infections,[3] and adverse drug reactions such as tendon rupture.[4] In July 2014, in response to the recommendation by the Office of Inspector General at the Department of Veterans Affairs (VA),[5] the VA Portland Healthcare System (VAPORHCS) implemented an outpatient safety initiative via a mandatory FQ order checklist in the electronic health record (EHR).

Although studies have described interventions to promote judicious outpatient antibiotic prescribing,[6,7] a paucity of data exist on how a patient safety initiative using an EHR-embedded checklist could impact antibiotic prescriptions. Using a retrospective interrupted time-series analysis, we tested the hypothesis that this FQ patient safety initiative would sustainably reduce oral FQ prescriptions in VAPORHCS community-based outpatient clinic (CBOC) settings.

Methods

The VAPORHCS includes 10 CBOCs across Oregon and southern Washington, serving ~95,000 unique veterans with ~900,000 outpatient visits annually. The FQ patient safety initiative, implemented as a new order screen embedded in the EHR, required provider documentation of (1) antibiotic indication, (2) patient education of antibiotic risks, and (3) medication reconciliation to prescribe FQs (Fig. 1). The primary-care chief educated CBOC leadership, who in turn notified providers of the new menu. Messaging focused on the fulfillment of a mandated patient safety initiative.

From January 1, 2013, to April 30, 2015, we retrospectively extracted and analyzed data for all FQ prescriptions dispensed and filled at all CBOCs in VAPORHCS including 78 weeks before and 43 weeks after implementation of the FQ safety initiative. We obtained data from 2 prescription datasets: (1) the VA pharmacy database, which contains all medications prescribed during regular business hours through the EHR, and (2) the contract pharmacy claims database (Heritage Health Solutions, Flower Mound, TX), which includes prescriptions ordered during non-business hours through alternative methods such as paper-based or phone prescription without using the EHR. We excluded prescriptions with durations <4 days (to exclude prophylactic use such as before urologic procedures) and >21 days (to exclude chronic use such as osteomyelitis treatment). We considered the prescriptions ordered through the EHR as being exposed to the FQ safety initiative directly, and we defined these as a "direct effect" group. The prescriptions ordered through the contract pharmacy (and not through the FQ order menu) were defined as the "indirect effect" group. We labeled these groups as such because all VA providers overlapped and were aware of this patient safety initiative. We obtained the number of all clinical visits (excluding vaccination-only clinic visits during influenza vaccine campaign) in CBOCs during the study period as the denominator. We defined the weekly FQ prescription rate as the

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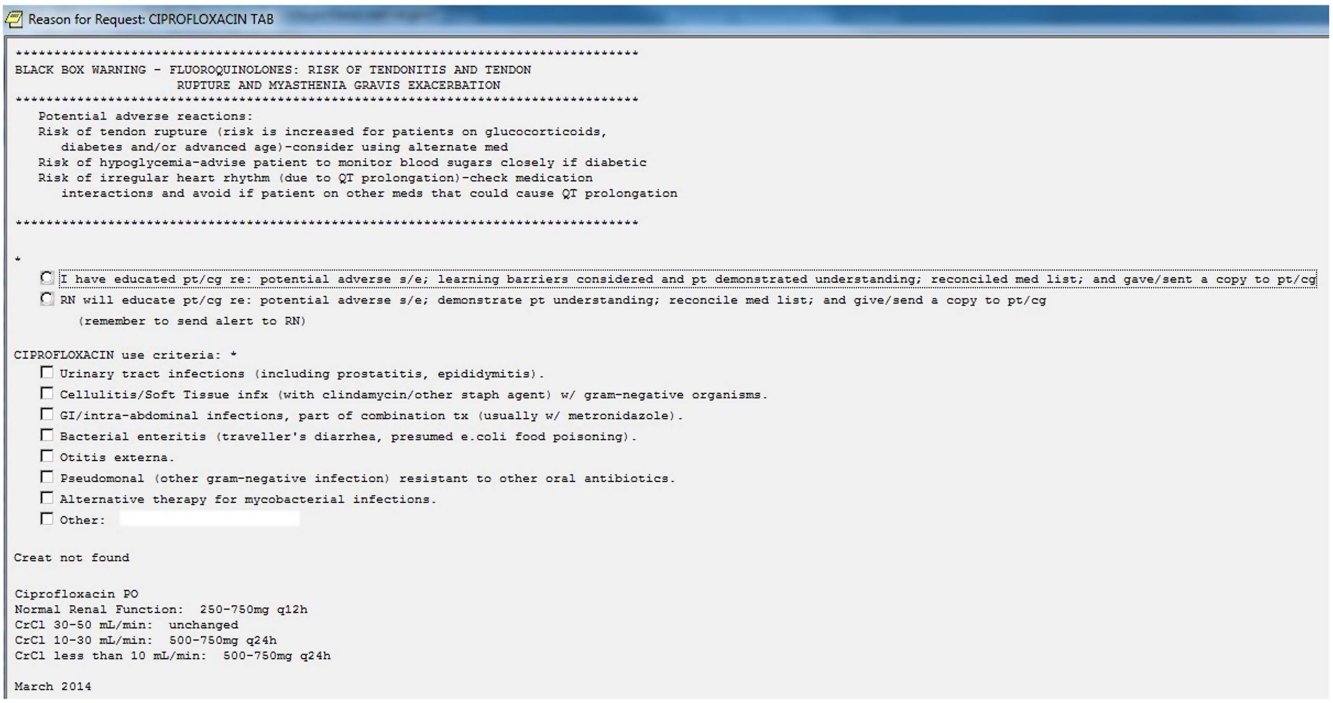

Fig. 1. The pop-up image of the EHR-embedded check list upon prescribing oral fluoroquinolones in Veterans Affairs Portland Health Care System. Note. EHR, electronic health record.

number of weekly FQ prescriptions divided by the number of weekly CBOC visits.

We analyzed the effect of the initiative via quasi-experimental interrupted time-series analysis. We used Poisson regression model (count time-series model) to account for baseline trend, intercept change, and change in trend. Month of the year was also included as a categorical variable to account for seasonality. The model's outcome variable was the number of weekly FQ prescriptions, and the number of weekly clinic visits was included as an offset variable. Impacts of included variables were expressed as incidence rate ratios (IRRs), and corresponding 95% confidence intervals (CIs) were calculated. Residuals and leverage plots were examined to assess model appropriateness. As a nonequivalent dependent control group, we also analyzed the non-FQ antibiotic prescription rate in a similar manner. The VAPORHCS Institutional Review Board approved this study.

Results

In total, 641,778 CBOC visits occurred during the study period and were included; the mean number of visits per week was 5,304 (SD ±709.9). The direct and indirect effect groups filled 1,138 and 853 FQ prescriptions, respectively, and the mean weekly numbers of filled prescriptions (± SD) were 7.0 (±3.5) and 9.4 (±4.1), respectively.

Both the direct and indirect effect groups experienced a statistically significant reduction in the weekly FQ prescription rate immediately after the initiative was implemented; however, the decreased rate trend in either group did not persist (Fig. 2, A and B). Specifically, during the preimplementation period, the weekly FQ prescription rate declined 0.4% per week (IRR, 0.996; 95% CI, 0.993–0.999; $P = .016$) in the direct-effect group and ~0.4% per week (IRR, 0.996; 95% CI, 0.993–1.000; $P = .044$) in the indirect-effect group. Immediately after the initiative was implemented, statistically significant reductions in the FQ prescriptions were observed: a ~62% per week reduction in direct-effect group (IRR, 0.383; 95% CI, 0.271–0.538; $P < .001$) and a ~62% per week reduction in the indirect-effect group (IRR, 0.377; 95% CI, 0.254–0.557; $P < .001$). However, the FQ prescription rates in both groups thereafter reverted to baseline prescription rates over time via ~1.9% per week (IRR to baseline trend, 1.023; 95% CI, 1.011–1.035; $P < .001$) and 2.1% per week (IRR to baseline trend, 1.025; 95% CI, 1.011–1.039; $P < .001$) in the direct- and indirect-effect groups, respectively. For the non-FQ prescription rate (Fig. 2, C and D), no intercept change was observed in either group immediately after the intervention, and we observed elevated trends thereafter.

Discussion

We found that the FQ patient safety initiative implemented in CBOCs via the EHR initially significantly reduced the FQ prescription rate without affecting the rate of non-FQ antibiotic prescriptions, but this early FQ prescription rate reduction was not sustained. Our study is distinct from other EHR-based interventions[6,7] because it was driven not by an antibiotic stewardship team but primarily by patient safety as part of a medication management initiative focused on FQ prescribing,[5] which required components of traditional stewardship. For instance, the provider was required to justify the FQ indication alongside additional patient safety aspects, including medication reconciliation.

An immediate FQ prescription drop was observed in both groups, and most likely indicated a spillover effect on the indirect-effect group. Therefore, some component of the intervention influenced practices in the indirect-effect group beyond the EHR checklist itself.[7]

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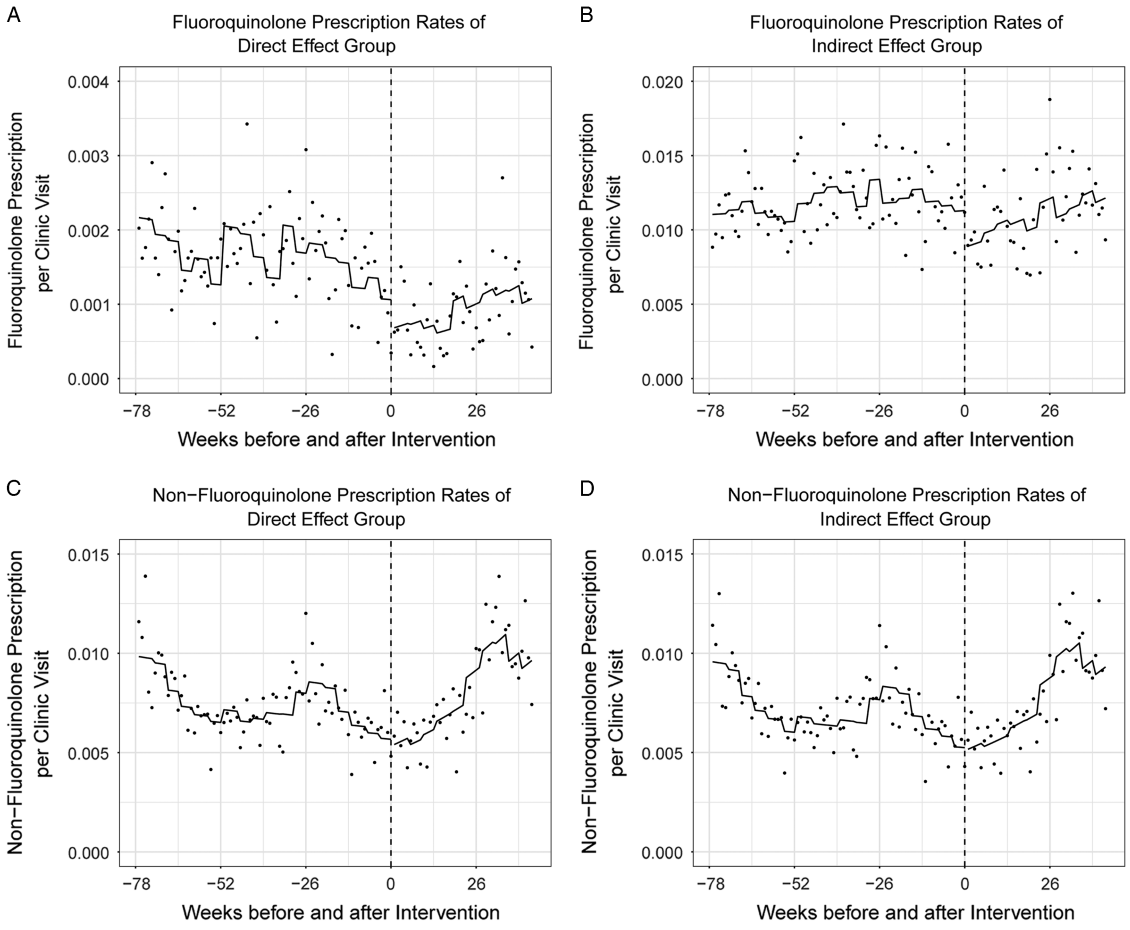

Fig. 2. Weekly FQ and non-FQ prescription rate—All CBOCs within the Veterans Affairs Portland Healthcare System, January 1, 2013, through April 30, 2015. (A) FQ prescription rate in direct effect group, (B) FQ prescription rate in indirect effect group, (C) non-FQ prescription rate in direct effect group, (D) non-FQ prescription rate in indirect effect group. Vertical dotted lines represent the week when the FQ patient safety initiative was implemented. Note. CBOC, community-based outpatient clinic; FQ, fluoroquinolone.

We suspect that the initial success was not sustained because the initiative was not coupled with ongoing training on this menu, ongoing education on rational FQ use and recommended alternatives, or performance feedback and audit. These approaches have been shown to enhance sustainability.[8] Alternatively, the postintervention trend may have been unsustained due to unmeasured external factors such as number and type of clinic visits, as we observed similar postintervention increased prescription rates in both FQ and non-FQ groups.

Our study has limitations. We only observed weekly prescriptions for 1 year after the initiative was implemented; thus, we were unable to determine whether the FQ prescription rate reverted completely to the preimplementation period. The overall study period, however, was long enough to account for relevant factors such as seasonality.[9] A qualitative study to evaluate how and why providers and patients responded to this initiative and to analyze barriers to sustainability, such as alert fatigue and EHR workaround,[10] was not performed but would be useful to inform future interventions.

In conclusion, we found that this FQ patient safety initiative was associated with a significant initial but unsustained reduction of FQ prescriptions over time, and overall, it aligned with goals of outpatient antibiotic stewardship. Further study should investigate ways to create strategies that sustain such initiatives in the outpatient setting.

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