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Evaluation of Surgical Antibiotic Prophylaxis Compliance at a Large, Tertiary Medical Center



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Background

- Surgical site infections (SSIs) are a significant cause of morbidity, prolonged hospitalization, and mortality.
- Studies estimate SSIs contribute to nearly one million additional inpatient days per year and SSI mortality rate has been estimated to be 3%.
- Additionally, SSIs in the US alone have an annual cost of approximately \$3.5 billion.
- A prior quality improvement project performed at a large, tertiary medical center in 2018-2019 identified that consistent adherence to the system surgical antibiotic prophylaxis (SAP) guideline and institutional antibiogram for antibiotic selection was an area for improvement.
- This was particularly evident in hysterectomy and colorectal surgeries; therefore, the institutional SSI committee implemented quality improvement changes in July 2020.
- For hysterectomies, the committee recommended adding metronidazole to cefazolin.
- For colorectal surgeries, the preferred agent was changed from cefazolin plus metronidazole to ceftriaxone plus metronidazole.

Purpose

- To evaluate the overall compliance of SAP selection prior to incision based on guideline recommendations from the institutional SSI committee

Objectives

- Assess hysterectomy and colorectal surgery peri-operative antibiotic prophylaxis for compliance from previous recommendations made by the institutional SSI committee
- Measure the percent change of primary surgeon and anesthesiologist SAP selection from the pre-intervention analysis phase to post-intervention analysis phase

Methodology

- Institutional Review Board (IRB)-approved
- Electronic health record (EHR)-based retrospective and prospective analysis of hysterectomy and colorectal surgeries performed at a tertiary medical center
- Study population:
 - Patients ≥ 18 years old
 - Underwent a hysterectomy or colorectal surgery
- Study period:
 - Pre-intervention: October 2019-March 2020
 - Post intervention: July-December 2020
 - April-June 2020 was excluded due to the COVID-19 pandemic
- Exclusion criteria:
 - Underwent greater than one type of surgery
- All patients meeting inclusion criteria were included
- Primary outcomes: overall compliance of SAP and the percent change from the pre- to post-intervention analysis phase

Results

SAP Review - Regimen Selection

Figure 1. Hysterectomy SAP Regimen Percent Use

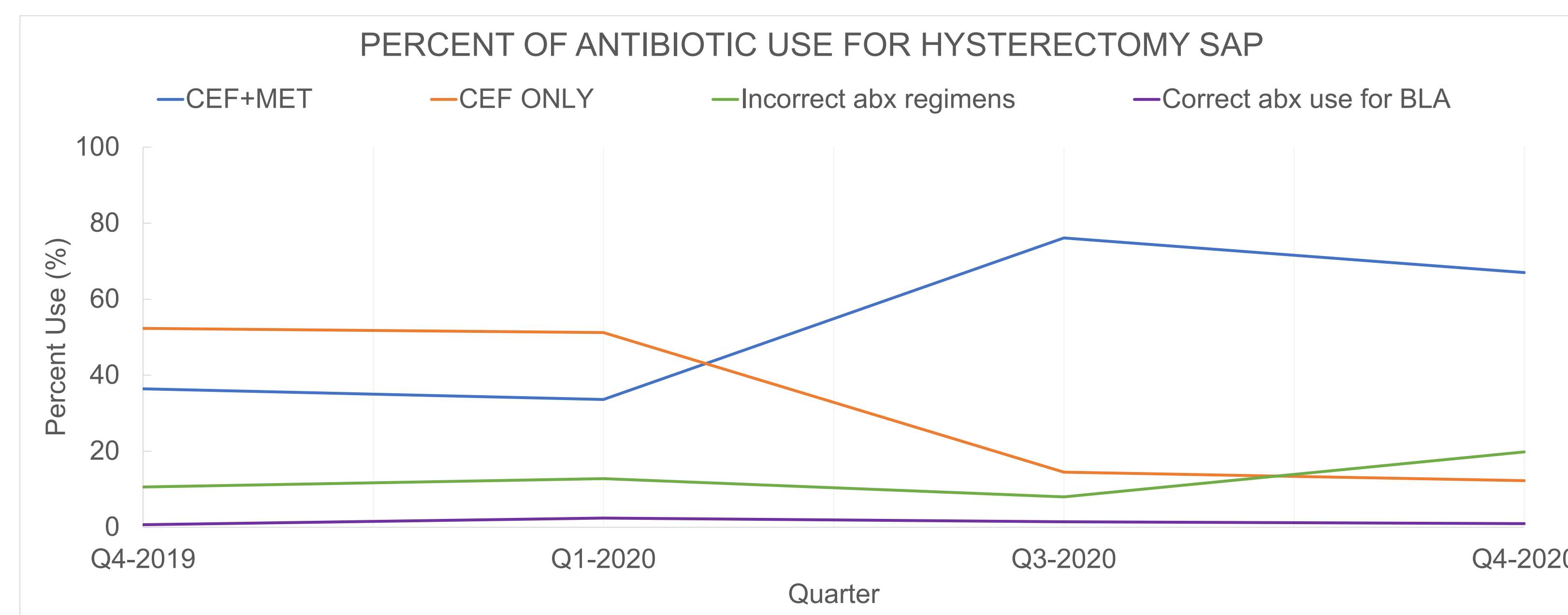
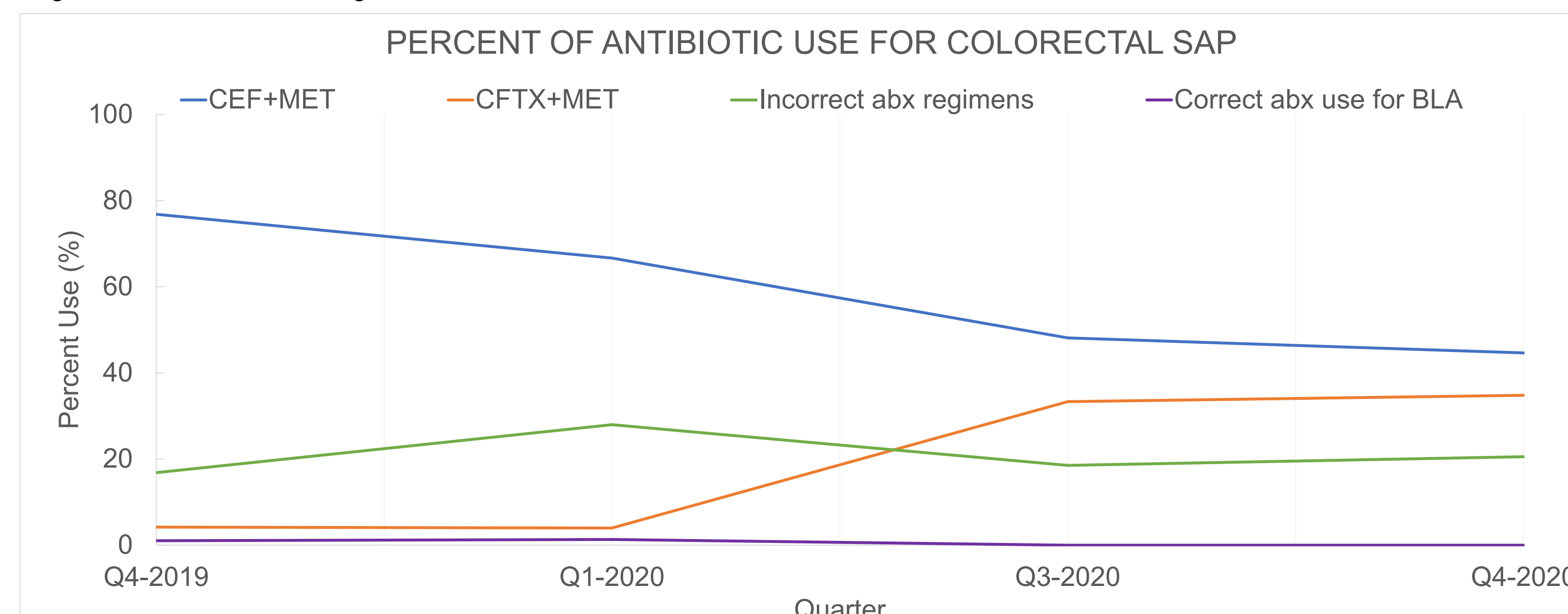


Figure 2. Colorectal SAP Regimen Percent Use



Clinical Outcomes

Table 1. Institution Recommendations for SAP in Adults

Procedure	Recommended Regimen	Severe BLA	Hx MRSA	Severe BLA & Hx MRSA
Colorectal-Anorectal	CFTX+MET	MET+ VANC+ GM	MET+ VANC+ CFTX	MET+VAN+ GM
Hysterectomy	CEF+MET	GM+ CLDM	CEF+ VANC	GM+CLDM+ VANC

Hx= history; CFTX= ceftriaxone; CEF= cefazolin; MET= metronidazole; VANC= vancomycin; GM= gentamicin; BLA= B-lactam allergy; CLDM= clindamycin; MRSA=Methicillin-resistant Staph. Aureus; abx= antibiotics

Table 2. Percent of Errors Associated with the Recommended Regimens

Regimen	Percent Error (%; n=80)
Hysterectomy with Cefazolin	
Cefazolin + metronidazole	35
Cefazolin only	7.5
Colorectal with Cefazolin or Ceftriaxone	
Cefazolin + metronidazole	53.3
Ceftriaxone + metronidazole	2.8

Table 3. Incorrect Dose of Antibiotic Given in Hysterectomy and Colorectal Surgeries

Procedure	Incorrect Dose Amount	# Instances
Hysterectomy	< 5mg/kg gentamicin	2
	>120kg received cefazolin 2gm	6
	<120kg received cefazolin 3gm	8
	<120kg received cefazolin 1gm	10
	<120kg received ceftriaxone 1gm	1
	TOTAL	
Colorectal	>120kg received cefazolin 2gm	3
	<120kg received cefazolin 1gm	11
	<120kg received clindamycin 600mg	1
	<120kg received levofloxacin 500mg	2
	<120kg received ceftriaxone 1gm	4
	TOTAL	

Clinical Outcomes (continued)

Table 4. Percent of Errors Associated with Antibiotic Use in Hysterectomy Surgeries

Summary of Error (#)	Q4-2019	Q1-2020	Q3-2020	Q4-2020	Total (n=80)	Percent Error (%)
Incorrect timing prior to surgery	3	2	1	6	7.5	
Re-dose needed	1	2	1	4	5.0	
Incorrect timing of re-dose/ re-dose not needed		1	1	2	2.5	
Incorrect dose amount given	4	7	7	9	27	33.8
No abx given	6	8	5	11	30	37.5
No true BLA	4	3	2	2	11	13.8
No true MRSA hx					0	0

n=80 (number of incidences of error); Q= quarter

Table 5. Percent of Errors Associated with Antibiotic Use in Colorectal Surgeries

Summary of Error (#)	Q4-2019	Q1-2020	Q3-2020	Q4-2020	Total (n=107)	Percent Error (%)
Incorrect timing prior to surgery	7	4	7	4	22	20.6
Re-dose needed	8	6	8	2	24	22.4
Incorrect timing of re-dose/ re-dose not needed	8	5		1	14	13.1
Incorrect dose amount given	5	8	5	3	21	19.6
No abx given	2	4	3	7	16	15.0
No true B-lactam allergy	2	2	1	3	8	7.5
No true MRSA hx			1	1	2	1.9

n=107 (number of incidences of error)

Discussion

Patient Population

- A total of 276 patients who underwent a hysterectomy were included in the pre-intervention analysis (October 2019-March 2020) and 244 patients were included in the post-intervention analysis (July-December 2020).
- For colorectal surgeries, 170 patients were included in the pre-intervention analysis and 193 patients were included in the post-intervention analysis.

Clinical Outcomes

Hysterectomy SAP

- 35% achieved the primary outcome of compliance to the system guidelines in the pre-intervention analysis.
- 71.6% achieved the primary outcome of compliance to the system guidelines in the post-intervention analysis.
- Overall, there was a 105% change in SAP selection for hysterectomy surgeries to the guideline recommended regimen (cefazolin only to cefazolin plus metronidazole).

Colorectal SAP

- 75.8% achieved the primary outcome of compliance to the institutional guidelines in the pre-intervention analysis (cefazolin or ceftriaxone plus metronidazole).
- 80.5% achieved the primary outcome of compliance to the institutional guidelines in the post-intervention analysis.
- Overall, there was a 752% change in SAP selection for colorectal surgeries to the institutional preferred regimen (cefazolin to ceftriaxone).

SSI Occurrence

- No SSIs occurred in October-December 2019 for either procedure.
- Four SSIs occurred in January-March 2020 for colorectal surgeries. All cases included cefazolin plus metronidazole.
- Two SSIs occurred in July-December 2020 for colorectal surgeries. Both cases included ceftriaxone plus metronidazole.
- One SSI occurred after a hysterectomy in August 2020 using the regimen cefazolin plus metronidazole.

Study Limitations

- Retrospective, non-randomized study
- Select data was pulled from EHR via retrospective chart evaluation by single reviewer
- Could not include April-June 2020 data due to the absence of elective surgeries during the start of the COVID-19 pandemic
- Did not assess patients with a history of MRSA who should have received vancomycin pre-operatively

Conclusions

- This study was performed to assess hysterectomy and colorectal surgery peri-operative antibiotic prophylaxis for compliance from previous recommendations made by the institutional SSI committee and measure the percent change from the pre-intervention analysis.
- The rate of change to the recommended SAP was 105% and 752% for hysterectomy and colorectal surgeries, respectively.
- There was a higher rate of error associated with the use of cefazolin in colorectal surgeries.
- The rate of incorrect use of an alternative regimen for a beta-lactam allergy in hysterectomies decreased from 2.6% to 1.6% (pre- and post-intervention, respectively).
- The rate of incorrect use of an alternative regimen for a beta-lactam allergy in colorectal surgeries decreased from 2.4% to 2% (pre- and post-intervention, respectively).
- Four SSIs occurred in the pre-intervention phase compared to two SSIs in the post-intervention phase in colorectal surgeries. However, it is difficult to assess if antibiotic selection was the main cause of infection, as there were many other variables to consider.
- Individual provider data was collected and shared internally for the purpose of quality improvement.
- Additional statistical analysis is currently being assessed.

References

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 Zimlichman, E., et al., Health Care-Associated Infections. A Meta-analysis of Costs and Financial Impact on the US Health Care System. JAMA Intern Med, 173(22): 2013; 2039-46.