Guidelines for screening for high risk infectious diseases, specifically human immunodeficiency virus (HIV) and hepatitis C virus (HCV), are of particular importance in relatively high-risk patient populations like those seen within the MetroHealth System (MHS). The recommendations have evolved: In January 2005, the US Preventive Services Task Force (USPSTF) recommended once-lifetime screening for HIV among “high risk” adolescents and adults ages 15-64 (where the CDC defined a population as “high risk” based on its baseline prevalence for HIV within all patients of the healthcare system). As a whole, the MHS patient population met the definition. In June 2013, the USPSTF recommended once-lifetime screening for HCV among adults born 1945-1965.

The MHS implemented electronic health record (EHR) health maintenance reminders for HIV and HCV in July 2010 and July 2013 respectively. For HIV, these reminders caused an increase in screening of more than 225% and an increase in disease detection of 11%. For HCV, these reminders caused an increase in screening of over 2500% and an increase in disease detection of 560%.

Although these examples show the effectiveness of EHR health maintenance reminders important insights came from comparing and contrasting the effectiveness of the health maintenance reminders for HIV and HCV. In both cases, point-of-care health maintenance reminders significantly increased screening. However, screening rates among all eligible patients within the healthcare system remained below 50%. This relatively low screening rate argues for adding an active population management approach to the point-of-care health maintenance reminders. Additionally, the yield of the screening (number needed to screen for a positive test) went down for both HIV and HCV as screening became more universal. This points to the idea that prior to the implementation of the health maintenance reminders, providers were screening disproportionately more high-risk patients.

The MHS infectious disease staff were interested in implementing USPSTF recommended universal screening of patients for HIV and HCV. The staff recognized that this screening would need to occur primarily in the primary care clinics within the MHS. They wanted a way to “notify” primary care providers that the screening for HIV and/or HCV needed to be done. In addition, they thought it would be easier for primary care providers if they were provided an easy way to order the recommended screening. The infectious disease staff approached the MHS clinical informatics team for help.

Together, the infectious disease staff and clinical informatics team formed a “mini-task force” to implement the EHR health maintenance reminders for HIV and then HCV screening. The HIV...
and then HCV health maintenance reminders were designed, built, tested, implemented and monitored by a combination of infectious disease and clinical informatics staff.

Primary care providers and other MetroHealth staff learned about the new reminders via EHR staff messages and by seeing the reminders for their patients. Any patients “due” for a health maintenance reminder has an indicator in the patient’s EHR header (“HM Due” shows up in red when a patient is due (Figure 1) and extinguishes if all health maintenance reminders are up to date). Because other health maintenance rules were already active in the MHS EHR, primary care providers were already accustomed to looking at the patient header for the indicator flag. In addition, for the HIV health maintenance reminder, infectious disease staff provided “in-services” for clinic staff over a several month period.

Despite the USPSTF grade “A” recommendation (The USPSTF recommends the service and there is high certainty that the net benefit is substantial) for HIV screening and grade “B” recommendation (The USPSTF recommends the service and there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial) for the HCV screening, there was local disagreement among providers who were called upon to implement the screening. The dissenting provider argued that, while the CDC definition of “high risk” might apply to the entire MHS population (based on HIV prevalence in our healthcare system population), they felt that their own patients were not at high risk. Some publicly stated that they were not going to follow the recommendation (in 2013 the USPSTF revised their HIV screening recommendation again, this time dropping the “high risk” qualifier and therefore indicating that everyone ages 15-64 should have once in a lifetime HIV screening – grade A recommendation).

How Health IT Was Utilized
The infectious disease and clinical informatics used standard health maintenance rule/reminder functionality within the Epic EHR to build HIV and then HCV health maintenance reminders. These reminders are shown to providers, if any are due, when they click on the HM: Due link in the patient header. Specific topics due, date due, and most recent date completed (if applicable) are all shown (Figure 2).

In the last several years, as MHS has deployed the Epic personal health record, health maintenance reminders are also shown to patients through the personal health record (Figure 3).
Value Derived

The value of the health maintenance reminders (HIV and then HCV) can be measured in terms of increased screening (process measure) and increase in disease detection (outcome measure). For the HIV health maintenance reminders, screening per month increasing by over 225%, while the increase in positive tests was only 11%. The “effectiveness” of the testing decreased by more than 50% (i.e. more than double the number of people needed to be screened for each positive test) (Figure 4 and Table 1).

The EHR HIV health maintenance reminder has led to an additional average 2-3 HIV cases being diagnosed per year since implementation. Early diagnosis can save up to $75,000 in healthcare costs for the person being diagnosed.\(^1\) Also, it can decrease the chance that the HIV+ person will infect others with HIV, at an estimated lifetime costs of almost $400,000 per HIV case.\(^2\) Therefore, the EHR HIV health maintenance reminder saves at least an estimated $150,000 per year in lifetime healthcare costs through at least two cases being diagnosed earlier.
MetroHealth Davies Case Study: Infectious Diseases (HIV and HCV)  Screening

Figure 4 – Trends in HIV screening total and positive test (2000-2015) (Month 0 is 7/2010 when EHR HIV health maintenance reminder implemented)

<table>
<thead>
<tr>
<th>HIV</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Tests</td>
<td>10,350</td>
<td>34,628</td>
</tr>
<tr>
<td>Tests per month</td>
<td>172.5</td>
<td>577.1</td>
</tr>
<tr>
<td>Total positive tests</td>
<td>79</td>
<td>88</td>
</tr>
<tr>
<td>Positive tests per month</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Proportion of tests positive for HIV</td>
<td>0.8</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 1 – Pre-Post implementation evaluation of EHR HIV health maintenance reminder

For the HCV health maintenance reminders, screening per month increasing by over 2500%, and positive tests increased by 560%. The proportion of tests positive for HCV decreased by approximately 60% (Figure 5 and Table 2).

Figure 5 – Trends in HCV screening total and positive test (2000-2015) (Month 0 is 7/2013 when EHR HCV health maintenance reminder implemented)
The HCV reminders were more effective in increasing screening than the HIV reminders. This is somewhat surprising given that the education surrounding the roll-out of the HIV screening included “in services” by the infectious disease staff. The HCV health maintenance reminders were more effective in increasing screening probably because providers had a stronger “belief” that the HCV recommendations were more applicable to their patients. In addition, the baseline rate of screening for HIV was higher than for HCV prior to implementation of the health maintenance reminders. Finally, the difference in disease detection rates is almost certainly related to the fact that the prevalence of HIV in the MHS population is lower than the prevalence of HCV.

The EHR HCV health maintenance reminder has led to an additional average 335 HCV cases being diagnosed per year since implementation. Early diagnosis, depending on the stage of liver cirrhosis, can save on the order of $10,000 of lifetime expenses.

**Lessons Learned**

The infectious diseases (HIV and HCV) example demonstrates both the power and limitations of health maintenance reminders to improve clinical care and compliance with guidelines.

Key lessons learned include:

1. Inter-disciplinary team is critical (in this case infectious disease and clinical informatics)
2. Point of care health maintenance reminders improve compliance with recommendations, but still leave many patients without recommended care because:
   a. They do not come to a face-to-face visit
   b. At the face-to-face visit the recommendations are not followed
3. Point of care reminders should probably be coupled with population health strategies outside of the point of care to increase compliance (and the same rules used for the point of care reminders to be leveraged for the population health strategies)
4. Showing patients health maintenance reminders through their personal health records does not significantly improve compliance
5. If providers (the group being shown the clinical decision support) do not believe the science behind the underlying recommendation, compliance with the clinical decision support will suffer
Financial Considerations
All of the tools implemented as part of this effort relied on existing functionality of the EHR infrastructure already in place with MHS. The cost to implement these features was only the MHS staff time need to design, build, test, and implement, estimated at a several tens of hours.

Since 2010, based on comparison to historical trends, MHS has diagnosed an additional at least 12 patients with HIV because of the EHR HIV health maintenance alert. These 12 earlier diagnosed cases because of screening, represent almost $1 million (~$180,000/year) in healthcare costs avoided in these patients. These 12 cases also represent potentially 1-2 cases of stopped HIV transmission from these cases resulting in a healthcare cost avoidance of approximately $400,000 per new case avoided. The estimated cost per additional HIV screening test is about $10 per test. MetroHealth screens approximately 7,000 patients per year, which produces a cost of approximately $70,000. This cost is typically covered by third-party payers.

Since 2013, based on comparison to historical trends, MHS has diagnosed an additional 670 patients with HCV because of the EHR HCV health maintenance alert. These 670 earlier diagnosed cases because of screening, represent approximately $6.7 million ($3.4 million/yr) in healthcare costs avoided in these patients.

The estimated initial and ongoing EHR technology and implementation cost of the EHR HIV and HCV health maintenance reminders were low, as standard health maintenance reminder building blocks already existing in the EHR were used and other health maintenance reminders were already deployed in our healthcare system, which providers were familiar with. Therefore, there were no additional hardware, software, licensing or consulting costs. The only costs were associated with infectious disease physicians, physician informaticists and information services analysts designing, building, testing and maintaining the reminder over time, with some initial training for providers to understand the details and evidence behind the HIV screening recommendations. These costs, per alert, are estimated to be about $10,000 for the initial build (about 50 hours of analyst time at about $50 per hour with benefits and ~60 hours of physician time at about $125 per hour with benefits) and about $1,000 for annual ongoing maintenance (about 5 hours of analyst time at about $50 per hour with benefits and about 6 hours of physician time at about $125 per hour with benefits). Approximately $20,000 was utilized for the initial build and about $2,000 per year is budgeted for ongoing maintenance.

Together, the HIV and HCV health maintenance reminders have saved over almost $8 million in healthcare expenses and are expected to continue to save $3.5-$4.0 million annually.

References