An algorithm using electronic medical record data accurately identifies patients with unknown HIV status in a large urban healthcare system

Uriel Felsen, MD MPH

Fellow in Infectious Diseases

Albert Einstein College of Medicine/Montefiore Medical Center
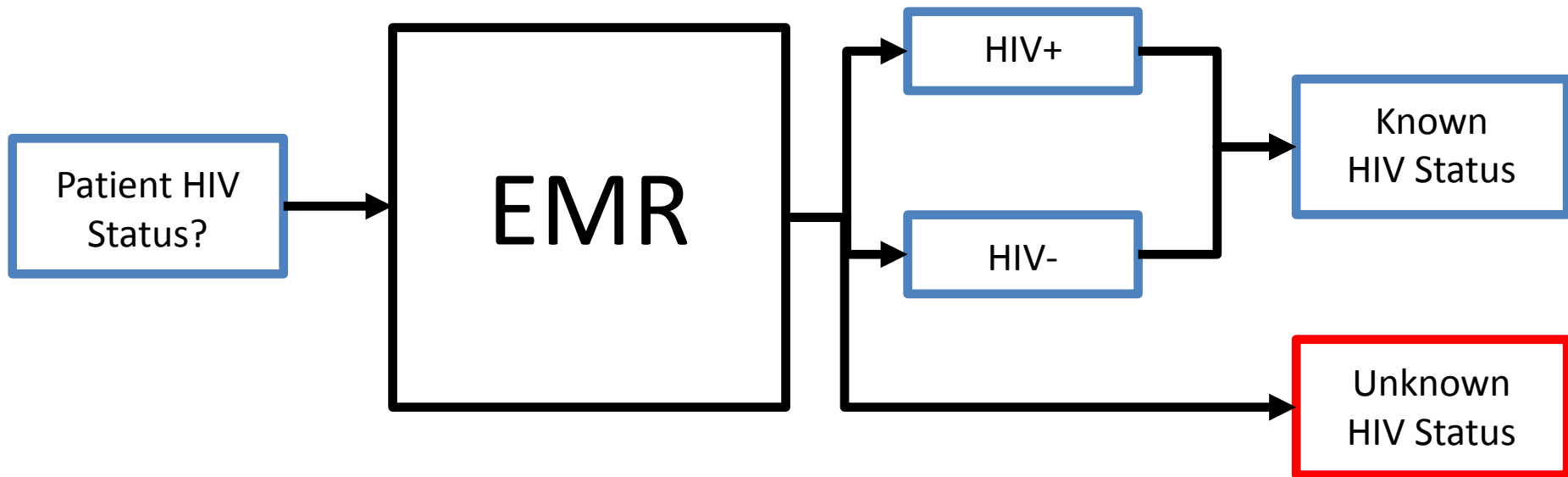
Bronx, NY

Background

- Patients with unknown HIV status are at risk for undiagnosed HIV

- Effective testing strategies must be capable of identifying patients with unknown status

- Electronic medical records (EMR) may be useful for identifying these patients

Unknown HIV Status

Undiagnosed HIV
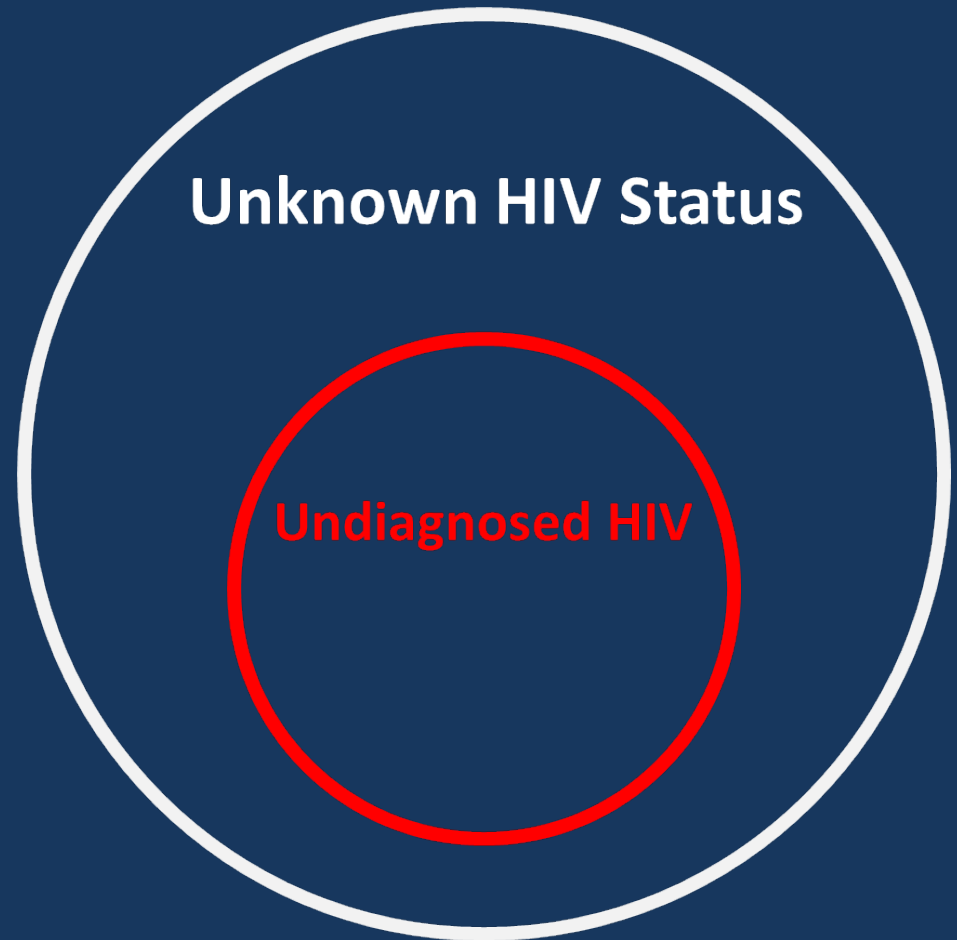
Objective

Identify patients with unknown HIV status using electronic medical record (EMR) data :

1) Population: monitor trends in prevalence of unknown status

2) Individual: strategically "test the untested"

Setting

- The Bronx, NY
  - HIV prevalence ≈ 1.8%
  - Highest HIV/AIDS related mortality rate in NYC
- Montefiore Medical Center
  - Single largest healthcare provider in the Bronx
    - >300,000 annual ED visits
    - >90,000 annual inpatient admissions
    - >2.5 million annual outpatient visits
  - Integrated EMR, data capture since 1997

Algorithm Development

#1

Identification of lab, billing, and problem list candidate criteria

#2

EMR queried for patients fulfilling each criterion

#3

Random samples of patients from each criterion reviewed for concordance with gold-standard (chart review)

#4

Criteria with greatest concordance included in final algorithm

Candidate Criteria for Algorithm

Lab	Billing (ICD9)	Problem List
HIV Ab (rapid)	Inpatient event	AIDS
HIV Ab (ELISA)	Outpatient event	AIDS due to HIV-1
HIV viral load	Outpatient x 2 events	AIDS due to HIV-II
HIV western blot	042 HIV Disease	AIDS related dementia
CD4 count (concurrent w/ VL)	042.0 HIV & Specific Infection	Asymptomatic HIV infection
CD4 count (alone)	042.1 HIV Causing Other Infection	Cryptosporidiosis related to HIV
HIV Genotype	042.2 HIV with Neoplasm	HIV counseling
HIV Phenotype	042.9 Unspecified AIDS	HIV exposure
HIV tropism	043 HIV Causing Condition NEC	HIV infection
	043.0 HIV Lymphadenopathy	HIV infection in mother
	043.1 HIV causing CNS disease	HIV positive
	043.2 HIV Cause Immune disease	HIV complicating pregnancy
	043.3 HIV causing disease NEC	HIV-1 aids
	043.9 AIDS Related Complex NOS	HIV-1 infection
	044 Other HIV Infection	HIV-2 aids
	044.0 HIV with Acute Infection	HIV-2 infection
	044.9 HIV infection NOS	Kaposi's sarcoma
	079.53 HIV, Type 2	HIV
	795.71 Nonspecific evidence of HIV	
	795.78 Positive Serologic Findings; HIV	
	V08 Asymptomatic HIV Infection	

Algorithm Development

#1

Identification of lab, billing, and problem list candidate criteria

#2

EMR queried for patients fulfilling each criterion

#3

Random samples of patients from each criterion reviewed for concordance with gold-standard (chart review)

#4

Criteria with greatest concordance included in final algorithm

Criteria for Final Algorithm

Lab	Billing (ICD9)	Problem List
HIV Ab (rapid)	Inpatient event	AIDS
HIV Ab (ELISA)	Outpatient event	AIDS due to HIV-1
HIV viral load	Outpatient x 2 events	AIDS due to HIV-II
HIV western blot	042 HIV Disease	AIDS related dementia
CD4 count (concurrent w/ VL)	042.0 HIV & Specific Infection	Asymptomatic HIV infection
CD4 count (alone)	042.1 HIV Causing Other Infection	Cryptosporidiosis related to HIV
HIV Genotype	042.2 HIV with Neoplasm	HIV counseling
HIV Phenotype	042.9 Unspecified AIDS	HIV exposure
HIV tropism	043 HIV Causing Condition NEC	HIV infection
	043.0 HIV Lymphadenopathy	HIV infection in mother
	043.1 HIV causing CNS disease	HIV positive
	043.2 HIV Cause Immune disease	HIV complicating pregnancy
	043.3 HIV causing disease NEC	HIV-1 aids
	043.9 AIDS Related Complex NOS	HIV-1 infection
	044 Other HIV Infection	HIV-2 aids
	044.0 HIV with Acute Infection	HIV-2 infection
	044.9 HIV infection NOS	Kaposi's sarcoma
	079.53 HIV, Type 2	HIV
	795.71 Nonspecific evidence of HIV	
	795.78 Positive Serologic Findings; HIV	
	V08 Asymptomatic HIV Infection	

Algorithm Validation

Table 2. Concordance of algorithm with chart review and performance characteristics		
	Chart Review	
	Unknown HIV Status	**Known HIV Status**
Algorithm — **Unknown HIV Status**	**50** ("True Unknown")	**0** ("False Unknown")
Algorithm — **Known HIV Status**	**15** ("False Known")	**418** ("True Known")

Montefiore
THE UNIVERSITY HOSPITAL

EINSTEIN
Albert Einstein College of Medicine
OF YESHIVA UNIVERSITY

Conclusions

- An algorithm using commonly available data from the EMR can accurately identify patients with unknown HIV status

- Process should be reproducible in other healthcare systems

- Potential application in diverse clinical and research settings:
    - Calculate baseline rates of unknown HIV status
    - Support planning of expanded HIV testing strategies
    - Monitor impact of new testing strategies over time
    - Integrate into EMR-based clinical decision support