Disclosures

• Grant funding:
  o Massachusetts Department of Public Health
  o Centers for Disease Control and Prevention
Outline

• Strengths and limitations of traditional surveillance
• The ESP public health surveillance platform
• Case identification using EHR-data
• Tracking changes in care patterns
• Summarizing and visualizing population-level data
• Predictive analytics for clinical decision support
“No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring”
### CONFIDENTIAL REPORT FOR SEXUALLY TRANSMITTED DISEASES

**Facility Name:** Harvard Vanguard Medical Associates

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First (Last name)</th>
<th>Facility Address</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.O.B.</td>
<td>Social Security #</td>
<td>Facility Name</td>
<td>Facility contact person</td>
<td>Phone</td>
<td>Fax</td>
</tr>
</tbody>
</table>

**Race:**
- American Indian
- Asian
- Black
- Other
- White

**Ethnicity:**
- Hispanic
- Non-Hispanic

**Martial Status:**
- Single
- Married

**City** | **State** | **Zip Code**
--- | --- | ---

**Street** | **Apt#** | **Phone** | **Number & area code**
--- | --- | --- | ---

**Language Spoken** | **Medical Record #** | **Is this Pt. Pregnant?** | **Y/N** | **Weeks Preg:** | **Did the patient receive treatment?** | **Yes** | **No** | **Mother’s Name**
--- | --- | --- | --- | --- | --- | --- | --- | ---

**Date of Diagnosis** | **若是症状** | **If yes, when?** | **Date** | **Did the patient have symptoms?** | **Yes** | **No** | **Mother’s Name**
--- | --- | --- | --- | --- | --- | --- | --- | ---

**105 CMR 340.100 REPORT ALL CASES:** Report immediately to the Department on the forms provided for this purpose the name of the patient, the complete address or the community of residence, the age, sex, race, and marital status, stating also the name of the disease and its form or stage.

### SYphilis (700)

- Primary (chancre) (710)
- Early latent (asymptomatic, less than 1 year) (720)
- Late latent (asymptomatic, over 1 year) (715)

**Recommended Regimen:**
- Benzathine penicillin G 2.4 million units IM, 2 doses, 1 week apart
- Doxycycline 100 mg po bid x 14 days or
- Erythromycin 500 mg po qid x 14 days or
- Azithromycin 1000 mg po single dose

**Questions about treatment for any STD?**
Call the Division of STD Prevention at (617) 983-6940.

### Gonorrhea (300)

**Recommended Regimen:**
- Ceftriaxone 250 mg IM 1 dose

**Questions about treatment for any STD?**
Call the Division of STD Prevention at (617) 983-6940.

### Chlamydia (200)

- Cervical
- Urethral
- Rectal
- Pharyngeal

**Recommended Regimen for Uncomplicated Infections:**
- Azithromycin 1 gm po single dose
- Erythromycin base 500 mg po qid x 7 days

**Questions about treatment for any STD?**
Call the Division of STD Prevention at (617) 983-6940.

### Other reportable sexually transmitted diseases

- Pharyngitis
- Genital warts
- Genital herpes
- Herpes genitalis
- Gonorrhea
- Syphilis
- Chancroid
- Granuloma inguinale
- Human papillomavirus
- HIV

**Questions about treatment for any STD?**
Call the Division of STD Prevention at (617) 983-6940.
## Paper-based reporting

<table>
<thead>
<tr>
<th>Condition</th>
<th>Completeness of Reporting</th>
<th>Time from Diagnosis to Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pertussis</td>
<td>32%</td>
<td>23 days</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>33%</td>
<td>12 days</td>
</tr>
<tr>
<td>Salmonella</td>
<td>50%</td>
<td>16 days</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>60-80%</td>
<td>7-38 days</td>
</tr>
</tbody>
</table>

*BMC Public Health* 2004;4:29  
*Am J Epidemiol* 2002;155:866
Electronic Laboratory versus Paper Reporting

Total Number of Reports

- **4.4 Fold Increase in Total Number of Reports**
  - Paper reports
  - Electronic lab reports

Time from Diagnosis to Report

- **7.9 Day Decrease in Mean Time from Diagnosis to Report**
  - Paper reports
  - Electronic lab reports

*Am J Public Health 2008;98:344*
Limitations of Labs

• Blind to purely clinical diagnoses
  – e.g. culture negative TB, early Lyme, PID

• Multiple reports for same episode
  – e.g. HIV, hepatitis B & C, syphilis

• Poor discriminator between active & resolved, acute & chronic disease
  – e.g. acute vs chronic HIV or hep B & C, current vs remote Lyme, new versus old syphilis
Our goal

- Clinician initiated manual reporting
- Electronic laboratory reporting

Automated disease detection and reporting from electronic medical records

Combine the best of traditional clinician-initiated reporting and electronic laboratory reporting systems:

- Fast, accurate, clinically detailed, digital reports
- Generalizable model
**Electronic Support for Public Health (ESP)**

- Software and architecture to extract, analyze, and transmit electronic health information from providers to public health.
  - Surveys codified electronic health record data for patients with conditions of public health interest
  - Generates secure electronic reports for the state health department
  - Designed to be compatible with any EHR system

*JAMIA* 2009;16:18-24
*MMWR* 2008;57:372-375
*Am J Pub Health* 2012;102:S325–S332
ESP: Automated disease detection and reporting for public health

Practice EMR’s → ESP Server → Health Department

diagnoses  lab results  meds  vital signs  demographics

electronic case reports or aggregate summaries

JAMIA 2009;16:18-24
Am J Pub Health 2012;102:S325–S332
Report to Health Department

• Patient demographics
• Responsible clinician, site, contact info
• Specimen source (oral, rectal, genital)
• Treatment given
• Symptoms (ICD codes & temperature)
• Pregnancy status (if pertinent)
Current ESP Installations

- Mass League of Community Health Centers:
  - 18 sites • 300,000 patients
- MetroHealth
  - Cleveland, OH
- Cambridge Health Alliance
  - 20 sites • 400,000 patients
- Planned Parenthood
  - 4 Sites • 50,000 pts
- Fenway Health
  - 4 Sites • 50,000 pts
- Atrius Health
  - 27 Sites • 800,000 pts
- Tarrant County, TX
- Planned Parenthood
  - 4 Sites • 50,000 pts

© Google Maps
Current Modules

• Notifiable diseases

• Influenza-like illness

• Chronic diseases

• Vaccine adverse events
Case Identification
ICD's
meds
lab results
orders
vital signs
ICD’s

ESP

HIV
Acute Hepatitis B
Chlamydia
Syphilis
## Limitations of Diagnosis Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Sensitivity</th>
<th>Positive Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td>75%</td>
<td>80%</td>
</tr>
<tr>
<td>Acute hepatitis C</td>
<td>63%</td>
<td>22%</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>100%</td>
<td>17%</td>
</tr>
<tr>
<td>Syphilis</td>
<td>93%</td>
<td>47%</td>
</tr>
<tr>
<td>HIV</td>
<td>96%</td>
<td>96%</td>
</tr>
</tbody>
</table>
Solution

• Integrate multiple streams of data from the EMR to increase sensitivity and specificity
  – Lab orders
  – Lab results (present and past)
  – Diagnosis codes (present and past)
  – Medication prescriptions
  – Vital signs
Case Identification Logic: Chlamydia

Any of the following:

- Positive culture for *Chlamydia trachomatis*
- Positive NAAT for *Chlamydia trachomatis*
Case Identification Logic: Syphilis

Any of the following:

- ICD9 for syphilis and prescription for (penicillin G or doxycycline or ceftriaxone)
  OR
- Serum RPR ≥ 1:8 and (TP-IGG or TPPA or FTA-ABS positive)
  OR
- Positive CSF test (VDRL≥1:1, TPPA, or FTA-ABS)
Potential Approaches to HIV Detection

Diagnosis codes for HIV
  • Not perfectly sensitive
  • Sometimes (inappropriately) used for HIV exposure or testing

Positive lab tests
  • Positive ELISA / WB / Ab-Ag may be remote or done elsewhere
  • Viral load on meds may be undetectable

Medications
  • False positives: PEP, PrEP, Hepatitis B
Accuracy of Potential HIV Surveillance Criteria

Atrius Health, 2006-2015

- Positive WB
- Detectable VL
- Rx for ARVs
- Rx for 3 ARVs
- HIV ICD Code

Sensitivity
Positive Predictive Value
Notifiable Disease Reporting
## ESP Case Reporting

*Atrius, CHA, MetroHealth, Fenway, Planned Parenthood of MA 2006-2016*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td>34,725</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>8,028</td>
</tr>
<tr>
<td>Pelvic inflammatory disease</td>
<td>359</td>
</tr>
<tr>
<td>Acute hepatitis A</td>
<td>40</td>
</tr>
<tr>
<td>Acute hepatitis B</td>
<td>131</td>
</tr>
<tr>
<td>Acute hepatitis C</td>
<td>316</td>
</tr>
<tr>
<td>Syphilis</td>
<td>1973</td>
</tr>
</tbody>
</table>
Sexually Transmitted Diseases Treatment Guidelines, 2015

Men and women who have been treated for chlamydia should be retested approximately 3 months after treatment, regardless of whether they believe that their sex partners were treated (480,481).
Chlamydia Test of Reinfection
Repeat Testing within 29-120 Days of Infection
Atrius Health, Cambridge Health Alliance, Mass League of Community Health Centers
~1.5 million patients under surveillance

Pregnant women
N=699

Non-pregnant women
N=10,605

Men
N=4,961

Percent of Cases

Year
2010 2011 2012 2013 2014 2015
Clinical Alerts to Spur EPT
Atrius Health, Boston

Patients with chlamydia infection are at HIGH RISK FOR REINFECTION after treatment if their sex partners are not also treated.

EXPEDITED PARTNER THERAPY (EPT) allows for the treatment of sex partners of patients diagnosed with chlamydia without examining/testing the partner, and increases the likelihood that partners are treated. Massachusetts law specifically permits this for Chlamydia only.

* Select line 1 to order Zithromax for your PATIENT (if you have not ALREADY entered an order for Zithromax).
* Select line 2 to print a prescription to be given to PARTNER via your patient or by faxing directly to patient or partner’s pharmacy.
* Select line 3 to dispense meds from floor stock to be given to PARTNER via your patient.
* Select line 4 to decline EPT

- Place order: PATIENT Zithromax 1 gram order [SELECT ONLY IF NOT ALREADY ORDERED]
- Place order: EPT Treatment for PARTNER: Print Rx Manual Fax
- Place order: EPT Treatment for PARTNER: Floor Meds Dispensed
- Place order: EPT Treatment for PARTNER: Declined

Accept  Cancel
Impact of EPT on Chlamydia Reinfection

1,887 Incident Positive Cases of Chlamydia

EPT Not Provided 77%

EPT Provided 23%
Reinfection Testing & Positivity Rates by EPT Status

<table>
<thead>
<tr>
<th>Repeat Testing</th>
<th>EPT Provided</th>
<th>EPT Not Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55%</td>
<td>47%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Repeat Test Positive</th>
<th>EPT Provided</th>
<th>EPT Not Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Real-time Monitoring
Chlamydia Testing Rates by Zip Code

Outcome(s) of Interest:
Chlamydia Test

Inclusion Criteria:
Age Group: ≥15 / Lifetime Encounters: ≥1 / Recent Encounters: ≥1 in the past 2 years

Overall Prevalence: 104095/1273147 (8.2%)
Chlamydia Testing Rates Stratified by Race in Newton vs Boston

Newton

Prevalence of the Selected Outcome by Race

Boston

Prevalence of the Selected Outcome by Race

Race of Patients with the Selected Outcome

Race of Patients with the Selected Outcome

Caucasian  Asian  Black  Hispanic  Other  Unspecified

Caucasian  Asian  Black  Hispanic  Other  Unspecified
Changes in Chlamydia Testing Rates Over Time

Stratified by Sex

Outcome(s) of Interest: Chlamydia Test

Inclusion Criteria:
- Age Group: ≥15
- Lifetime Encounters: ≥1
- Recent Encounters: ≥1 in the past 2 years

Graph Stratifiers and Parameters:
- By: Sex
- In: Massachusetts
- From: Oct '13 To: Mar '17

The graph shows the trend in chlamydia testing rates stratified by sex over time in Massachusetts, from October 2013 to March 2017. The rates are indicated by percentage points on the y-axis and the months on the x-axis. The graph includes trendlines for both female and male testing rates.
### Massachusetts Female

**GLS Regression Results**

- **Dep. Variable:** Reference
- **Model:** GLS
- **Method:** Least Squares
- **Date:** Mon, 08 May 2017
- **Time:** 15:56:44
- **No. Observations:** 42
- **Df Residuals:** 40
- **Df Model:** 1
- **Covariance Type:** nonrobust

| Variable | coef  | std err | t      | P>|t|  | [95.0% Conf. Int.] |
|----------|-------|---------|--------|------|-------------------|
| Intercept | 10.9253 | 0.334  | 32.668 | 0.000 | 10.249 to 11.601 |
| time     | -0.0113 | 0.011  | -0.955 | 0.326 | -0.034 to 0.012  |

### Massachusetts Male

**GLS Regression Results**

- **Dep. Variable:** Reference
- **Model:** GLS
- **Method:** Least Squares
- **Date:** Mon, 08 May 2017
- **Time:** 15:56:44
- **No. Observations:** 42
- **Df Residuals:** 40
- **Df Model:** 1
- **Covariance Type:** nonrobust

| Variable | coef  | std err | t      | P>|t|  | [95.0% Conf. Int.] |
|----------|-------|---------|--------|------|-------------------|
| Intercept | 3.9432 | 0.192  | 20.511 | 0.000 | 3.555 to 4.332   |
| time     | 0.0269 | 0.006  | 4.364  | 0.000 | 0.014 to 0.039   |
Changes in Chlamydia Testing Rates in Men Over Time
Stratified by Race-Ethnicity

Outcome(s) of Interest: Chlamydia Test

Inclusion Criteria:
Age Group: ≥15 / Sex: Male / Lifetime Encounters: ≥1 / Recent Encounters: ≥1 in the past 2 years

Graph Stratifiers and Parameters:
By: Race / In: Massachusetts / From: Oct '13 To: Mar '17

Show Trendlines
Click on Graph to select Inflection Point
Changes in Chlamydia Testing Rates in Men Over Time
Stratified by Race-Ethnicity

- Black: +26% (P=.001)
- Hispanic: +24% (P<.001)
- Asian: +52% (P<.001)
- White: +24% (P<.001)
Changes in Gonorrhea Testing Rates in Men over Time

Outcome(s) of Interest:
Gonorrhea Test

Inclusion Criteria:
Age Group: ≥15 / Sex: Male / Lifetime Encounters: ≥1 / Recent Encounters: ≥1 in the past 2 years

Graph Stratifiers and Parameters:
By: Race / in: Massachusetts / From: Sep ‘14 To: Mar ‘17

- Black: ↑42% (P<.001)
- Hispanic: ↑35% (P<.001)
- Asian: ↑73% (P<.001)
- White: ↑38% (P=.003)
Hepatitis C Testing in the 1945-1965 Birth Cohort by Zip Code

Outcome(s) of interest: HCV Elisa or RNA Test

Inclusion Criteria:
- Birth Cohort: 1945-1965
- Lifetime Encounters: ≥1
- Recent Encounters: ≥1 in the past 2 years

Overall Prevalence: 93544/362106 (25.8%)
**Prevalence of Hepatitis C Testing in the 1945-1965 Birth Cohort over Time**

**Outcome(s) of Interest**
- HCV Elisa or RNA Test

**Inclusion Criteria**
- Birth Cohort: 1945-1965
- Lifetime Encounters: ≥ 1
- Recent Encounters: ≥ 1 in the past 2 years

**Graph Stratifiers and Parameters**
- In: Massachusetts
- From: Jan '12 To: Mar '17

---

### GLS Regression Results

- **Dep. Variable:** Reference
- **Model:** GLS
- **Adj. R-squared:** 0.838
- **Method:** Least Squares
- **F-statistic:** 107.8
- **Date:** Mon, 08 May 2017
- **Prob (F-statistic):** 6.54e-24
- **Time:** 11:41:55
- **Log-Likelihood:** -1.5358
- **No. Observations:** 63
- **AIC:** 11.07
- **Df Residuals:** 59
- **BIC:** 19.64
- **Df Model:** 3
- **Covariance Type:** nonrobust

|          | coeff | std err | t     | P>|t|   | [95.0% Conf. Int.] |
|----------|-------|---------|-------|-------|-------------------|
| Intercept| 2.6408| 1.447   | 1.825 | 0.073 | -0.255 to 5.537  |
| time     | 0.1513| 0.059   | 2.558 | 0.013 | 0.033 to 0.270   |
| lvchrg   | -0.4752| 0.253   | -1.875| 0.066 | -0.982 to 0.032  |
| trchrg   | 0.2939| 0.072   | 4.108 | 0.000 | 0.151 to 0.437   |

**Omnibus:** 4.661
- **Durbin-Watson:** 0.331
- **Prob(Omnibus):** 0.097
- **Jarque-Bera (JB):** 3.966
- **Skew:** -0.517
- **Prob(JB):** 0.138
- **Kurtosis:** 2.336
- **Cond. No.:** 84.4
Prevalence of Hepatitis C Testing in the 1945-1965 Birth Cohort over Time

Stratified by Practice Group

**Outcome(s) of Interest**
- HCV Elisa or RNA Test

**Inclusion Criteria**
- Birth Cohort: 1945-1965
- Lifetime Encounters: ≥1
- Recent Encounters: ≥1 in the past 2 years

**Graph Stratifiers and Parameters**
- By: Practice Group
- In: Massachusetts
- From: Jan ’12 To: Mar ’17
Predictive Analytics
Can we leverage the ESP platform to provide advanced clinical decision support?
ESP to Identify Potential Candidates for PrEP

1. Identify patients with newly diagnosed HIV
2. Use machine learning to characterize their electronic footprint
   - Age, sex, race/ethnicity, frequency of encounters, frequency of STD testing, results of STD testing, anatomical sites of STD testing, etc.
3. Create an HIV risk prediction score using these data and machine learning
4. Identify patients with high risk scores who have not been diagnosed with HIV
5. Share this information with the patient’s PCP
Variables Assessed (Partial List)

- Demographics
- Laboratory Results
- Diagnoses
- Prescriptions

- Age
- Race
- Sex
- Home language
- No. of Encounters per Year
- No. of Gonorrhea tests per year
- Positive Gonorrhea tests per year
- Rectal Gonorrhea tests per year
- Positive rectal Gonorrhea tests per year
- Pharyngeal Gonorrhea tests per year
- Positive pharyngeal Gonorrhea tests per year
- No. of Chlamydia tests per year
- Positive Chlamydia tests per year
- Rectal Chlamydia tests per year
- Positive rectal Chlamydia tests per year
- Pharyngeal Chlamydia tests per year
- Positive pharyngeal Chlamydia tests per year
- No. of syphilis tests per year
- Syphilis diagnosis per ESP
- LGV testing
- Anal cytology testing
- No. of HCV antibody tests
- No. of HCV RNA tests
- HCV antibody or RNA tests positive
- Acute Hepatitis C per ESP
- No. of HBV DNA tests per year
- HBSAg or HBV DNA positive
- Acute Hepatitis B per ESP
- No. of HIV ELISA tests per year
- No. of HIV Western Blots per year
- No. of HIV RNA tests per year
- HIV status per ESP
- HIV new diagnosis
- History of HIV meds
- HIV negative with HIV RNA tests
- History of tenofovir-emtricitabine Rx
- Count of tenofovir-emtricitabine Rx
- Abnormal anal cytology
- Dx for Syphilis
- Dx for Anal syphilis
- Dx for Gonococcal infection of anus or rectum
- Dx for Gonococcal pharyngitis
- Dx for Chlamydia infection of anus or rectum
- Dx for Chlamydia pharyngitis
- Dx for LGV
- Dx for Chancroid
- Dx for Granuloma inguinale
- Dx for non-gonococcal urethritis
- Dx for HSV with complications
- Dx for Genital Herpes
- Dx for Anogenital warts
- Dx for Anorectal ulcers
- Dx for PID
- Dx for Contact/exposure to STD
- Dx for High risk sexual behavior
- Dx for HIV counseling
- Dx for Anorexia nervosa
- Dx for Bulimia nervosa
- Dx for Eating disorders
- Dx for Counseling for childhood sex abuse
- Dx for Alcohol dependence
- Dx for Opioid dependence
- Dx for Sedative, hypnotic, or anxiolytic dependence
- Dx for Cocaine dependence
- Dx for Amphetamine dependence
- Rx for bicillin
- Rx for azithromycin 1g
- Rx for ceftriaxone 125mg or 250mg
- Rx for methadone
- Rx for Suboxone
- Rx for sildanefil or tadalafil or vardenafil
Selected Predictors of HIV Risk

Incident HIV [Cases] (n=138)

- Anal cytology procedure code: 6.5%
- Bicillin Rx, prior year: 3.6%
- Positive Gonorrhea test, ever: 5.8%

No incident HIV [Matched Controls] (n=13,800)

- <0.1%
- <0.1%
- 0.1%

Slide courtesy of Doug Krakower MD
Distribution of Risk Scores for Acquiring HIV

Atrius Health
800,000 patients
1,000 already diagnosed with HIV
~250 currently receiving PrEP

8,414 Potential New Candidates for PrEP
Automated analysis of EHR data can facilitate timely, accurate public health surveillance

- Notifiable diseases
- Patterns and trends in disease and care
- Rates of adherence to recommended practices
- Geographic clusters of disease
- Continuum of care monitoring
- Predictive analytics for clinical decision support

Could automated EHR monitoring facilitate more pragmatic clinical trials?
Thank You!

Harvard Medical School/
Harvard Pilgrim Health Care Institute
– Micaela Coady
– Noelle Cocoros
– Libby Dee
– JT Menchaca
– Aileen Ochoa

Massachusetts Department of Public Health
– Heather Elder
– Gillian Haney
– Katherine Hsu
– Liisa Randall
– Hannah Rettler
– Kathleen Roosevelt
– Sita Smith

Commonwealth Informatics
– Karen Eberhardt
– Chaim Kirby
– Catherine Rocchio
– Bob Zambarano

Massachusetts League of Community Health Centers
– Diane Erani
– Ellen Hafer
– Mark Josephson

Cambridge Health Alliance
– Brian Herrick
– James Watt
– Michelle Weiss

Atrius Health
– Benjamin Kruskal

Beth Israel Deaconness / Fenway Health
– Doug Krakower

Contact: mklompas@bwh.harvard.edu
Changes in Chlamydia Testing Rates Over Time

Stratified by Race-Ethnicity

Outcome(s) of Interest: Chlamydia Test

Inclusion Criteria:
- Age Group: ≥15
- Lifetime Encounters: ≥1
- Recent Encounters: ≥1 in the past 2 years

Graph Stratifiers and Parameters:
- By: Race
- In: Massachusetts
- From: Oct '13 To: Mar '17

Click on Graph to select Inflection Point

Show Trendlines

<table>
<thead>
<tr>
<th>Race</th>
<th>Asian</th>
<th>Black</th>
<th>Caucasian</th>
<th>Hispanic</th>
<th>Other</th>
<th>Unspecified</th>
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<tbody>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Changes in Chlamydia Testing Rates Over Time

Stratified by Race-Ethnicity

GLS Regression Results

Dep. Variable: Reference  R-squared: 0.916
Model: GLS  Adj. R-squared: 0.914
Method: Least Squares  F-statistic: 436.4
Date: Mon, 08 May 2017  Prob (F-statistic): 3.96e-23
No. Observations: 42  AIC: -36.66
Df Residuals: 40  BIC: -33.19
Df Model: 1
Covariance Type: nonrobust

|            | coef   | std err |  t     | P>|t|   | [95.0% Conf. Int.] |
|------------|--------|---------|--------|-------|-------------------|
| Intercept  | 14.2858| 0.569   | 25.112 | 0.000 | 13.136 15.436     |
| time       | -0.0106| 0.017   | -0.614 | 0.543 | -0.046 0.024     |

Omnibus: Durbin-Watson: 0.788 1.128
Prob(Omnibus): -0.674 Jarque-Bera (JB): 0.173
Skew: -0.002 Prob(JB): 0.917
Kurtosis: 3.314 Cond. No. 42.1