Evaluating the Effects of an Interdisciplinary Practice Model with Pharmacist Collaboration on HIV Patient Co-morbidities

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To determine if the addition of a clinical pharmacist to the treatment model improves outcomes for management of chronic disease states in addition to HIV outcomes.
HIV and Co-morbidities

- Non-infectious co-morbidities correlate to a higher burden of disease in HIV+ patients
- HIV can accelerate inflammatory processes
  - Increased risk of cardiovascular disease
- AGEhIV cohort showed higher rates of hypertension, myocardial infarction (MI), peripheral arterial disease (PAD), and renal disease
- Most common co-morbidities in the Bronx:
  - Hypertension (26%)
  - Hyperlipidemia (48%)
  - Diabetes (13%)

Pharmacist Role in HIV+ Patient Care

• **American Academy of HIV Medicine** began offering specialist certification to pharmacists (AAHIVP) in 2011

• **DHHS AIDS Info Guidelines** recommend use of multidisciplinary teams, including pharmacists

• Literature shows pharmacist involvement to improve antiretroviral therapy (ART) adherence, CD4, viral load (VL), and decrease drug-related toxicities

Collaborative Drug Therapy Management (CDTM)

- CDTM allows qualified pharmacists to expand their role in patient care
  - NYS became 47th state to sign CDTM into law Sep. 2011
- Pharmacists may perform patient assessments, order drug-related labs, administer drugs, and select, initiate, monitor, continue, or adjust regimens under pharmacist-physician agreement
- CDTM improved patient outcomes in chronic diseases
- Impact of CDTM on HIV treatment outcomes
  - However lack of data on both chronic disease states and HIV

Odum L, Whaley-Connell A. Cardiorenal Me 2012;2:243
Murphy P, et al. AIDS Patient Care STDs 2012;26:526-31

Crisholm-Bumes MA, et al. Med Care 2010;48:923-33
PATH Center Interdisciplinary Model

- Vitals taken by nurses

- Patient examined and interviewed by medical & pharmacy residents

- Preliminary plan of care presented to ID attending and HIV clinical pharmacist

- Medical and pharmacy teams collaborate to decide final plan of care

- Counseling by pharmacy team as needed; e-Rx completed

- Labs drawn and vaccinations administered by nurses
Methodology

• Retrospective chart review of HIV+ patient visits from June 2012-December 2013

• Study Groups:
  – Interdisciplinary group
    • Patients with known pharmacy interventions 2011-2012
  – Solo provider group
    • Patients seen privately by separate NP, PA, or MD
  – All patients have access to social workers, dieticians, psychiatrist, etc.
Inclusion Criteria

- **Inclusion Criteria:**
  - HIV(+) status
  - ≥18 years old
  - Consistent follow up at PATH Center between June 2012 and December 2013
    - Defined as at least one visit every 6 months
  - Diagnosis with hypertension, hyperlipidemia, OR diabetes

- **Exclusion Criteria:**
  - Lost to follow-up
## Outcomes

### Primary Outcomes
- Change from patient’s own baseline
  - A1c
  - Systolic BP
  - Diastolic BP
  - LDL cholesterol

### Secondary Outcomes
- CD4
- VL
- No. of drug-drug interactions
- Appropriate use of aspirin
- % change in smoking status
- % treated to guidelines recommendations
Data Collection

• Minimal required sample size for 80% power at two-tailed alpha of 0.05
  • 96:48 = interdisciplinary:solo

• Electronic Medial Record (EMR) retrospectively reviewed and 18-month follow-up data collected
  • Data collected at 6 month intervals

• Charlson Co-morbidity Index (CCI) Scoring System applied
Statistical Analysis

• Statistical analysis (SPSS version 21)
  • Independent $t$-test, Mann-Whitney U, Fisher-exact, Chi-square
• Characteristics with $p<0.10$ treated as potential confounding factors and included as independent variables in regression models
• Linear regression analyses to identify potential covariates
• General linear model used to adjust for covariates in final primary outcomes
Cohort Population

Solo Provider (n=50)
- Hypertension (n=39)
- Diabetes (n=17)
- Hyperlipidemia (n=39)

Interdisciplinary (n=96)
- Hypertension (n=59)
- Diabetes (n=27)
- Hyperlipidemia (n=70)

Mean age = 54.5 years
46% Female

Mean age = 54 years
48% Female
## Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Solo</th>
<th>Interdisciplinary</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systolic BP, mmHg [median]</strong></td>
<td>132</td>
<td>140</td>
<td>0.042*</td>
</tr>
<tr>
<td><strong>Diastolic BP, mmHg [median]</strong></td>
<td>82</td>
<td>89</td>
<td>0.005*</td>
</tr>
<tr>
<td><strong>LDL, mg/dL [mean]</strong></td>
<td>97</td>
<td>120</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>A1c [mean]</strong></td>
<td>7.99%</td>
<td>8.27%</td>
<td>0.726</td>
</tr>
<tr>
<td><strong>No. of medications [mean]</strong></td>
<td>8.8</td>
<td>10.6</td>
<td>0.014</td>
</tr>
<tr>
<td><strong>No. of drug-drug interactions [mean]</strong></td>
<td>0.38</td>
<td>0.14</td>
<td>0.008</td>
</tr>
<tr>
<td><strong>CD4 ≥ 500 cells/mm³, %n</strong></td>
<td>58%</td>
<td>50%</td>
<td>0.358</td>
</tr>
<tr>
<td><strong>HIV VL &gt;500 copies/mL, %n</strong></td>
<td>18%</td>
<td>19%</td>
<td>0.380</td>
</tr>
<tr>
<td><strong>CCI [mean]</strong></td>
<td>1.78</td>
<td>2.23</td>
<td>0.185</td>
</tr>
<tr>
<td><strong>Smoking, %n</strong></td>
<td>34%</td>
<td>51%</td>
<td>0.050</td>
</tr>
</tbody>
</table>

* = Mann-Whitney U-test used for non-parametric data
Independent t-test used for all others
Primary Outcome: Blood Pressure

Change in BP

<table>
<thead>
<tr>
<th></th>
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<th>Interdisciplinary</th>
<th>Solo Provider</th>
<th>Interdisciplinary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Systolic BP</td>
<td>Systolic BP</td>
<td>Diastolic BP</td>
<td>Diastolic BP</td>
</tr>
<tr>
<td>Baseline</td>
<td>132</td>
<td>140</td>
<td>82</td>
<td>89</td>
</tr>
<tr>
<td>Final</td>
<td>130.5</td>
<td>134</td>
<td>80</td>
<td>82</td>
</tr>
</tbody>
</table>

Change from baseline
Systolic: $p = 0.619$
Diastolic: $p=0.366$
Primary Outcome: LDL cholesterol

Change from baseline
\[ p = 0.014 \]

### Change in LDL

<table>
<thead>
<tr>
<th></th>
<th>Solo Provider [mean]</th>
<th>Interdisciplinary [mean]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>97</td>
<td>120</td>
</tr>
<tr>
<td>Final</td>
<td>103</td>
<td>111</td>
</tr>
</tbody>
</table>
Primary Outcome: A1c

Change in A1c

<table>
<thead>
<tr>
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<th>Interdisciplinary [mean]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>7.99%</td>
<td>8.27%</td>
</tr>
<tr>
<td>Final</td>
<td>7.33%</td>
<td>6.97%</td>
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</table>

Change from baseline
p = 0.190
### Secondary Outcome: Therapy Goals Achieved?

<table>
<thead>
<tr>
<th></th>
<th>Solo Provider</th>
<th>Interdisciplinary</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Systolic BP</td>
<td>61.5%</td>
<td>53.5%</td>
<td>0.421</td>
</tr>
<tr>
<td>Appropriate Cardiovascular Therapy Prescribed</td>
<td>60%</td>
<td>71.6%</td>
<td>0.242</td>
</tr>
<tr>
<td>Final LDL</td>
<td>66.7%</td>
<td>71.2%</td>
<td>0.626</td>
</tr>
<tr>
<td>Final A1c</td>
<td>64.7%</td>
<td>72.4%</td>
<td>0.583</td>
</tr>
</tbody>
</table>

**BP**: JNC 7 and ACC/AHA Joint Guidelines  
**LDL**: ATP3 Guidelines  
**A1c**: ADA 2014 Guidelines
Secondary Endpoint: Aspirin Therapy

Aspirin prescribed when indicated
\[ p = 0.014 \]

![Bar chart showing comparison of ASA indicated and prescribed between Solo Provider and Interdisciplinary settings.]

- **Solo Provider**
  - ASA Indicated: 19%
  - ASA Prescribed: 5.00%

- **Interdisciplinary**
  - ASA Indicated: 5.00%
  - ASA Prescribed: 5.00%
Secondary Endpoint: Smoking Status

# Smoking (Baseline)  # Smoking (Final)  Cessation Rate

Solo Provider  17  15  11.7%

Interdisciplinary  49  39  20.5%

p=0.714
### Other Secondary Endpoints

<table>
<thead>
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<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>**No. of drug-drug</td>
<td>0.24</td>
<td>0.07</td>
<td>0.023</td>
</tr>
<tr>
<td>interactions (mean)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CD4 ≥ 500 cells/mm³</strong></td>
<td>66%</td>
<td>60.4%</td>
<td>0.648</td>
</tr>
<tr>
<td><strong>HIV RNA &gt;500 copies/mL</strong></td>
<td>12%</td>
<td>13.5%</td>
<td>0.793</td>
</tr>
</tbody>
</table>
## Estimation of Cost Savings (2015 US Dollars)

### Estimates of Benefits

<table>
<thead>
<tr>
<th></th>
<th>Solo Provider</th>
<th>Interdisciplinary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systolic BP</strong></td>
<td>+ 2 mmHg</td>
<td>-4 mmHg</td>
</tr>
<tr>
<td></td>
<td>-$548</td>
<td>$1096</td>
</tr>
<tr>
<td><strong>Diastolic BP</strong></td>
<td>-3.5 mmHg</td>
<td>-7 mmHg</td>
</tr>
<tr>
<td></td>
<td>$592</td>
<td>$1183</td>
</tr>
<tr>
<td><strong>LDL cholesterol</strong></td>
<td>+ 8.7 mg/dL</td>
<td>-7.3 mg/dL</td>
</tr>
<tr>
<td></td>
<td>-$409</td>
<td>$343</td>
</tr>
<tr>
<td><strong>A1c</strong></td>
<td>-0.44%</td>
<td>-1.30%</td>
</tr>
<tr>
<td></td>
<td>$565</td>
<td>$1668</td>
</tr>
<tr>
<td><strong>Smoking Cessation Rate</strong></td>
<td>2/17</td>
<td>10/49</td>
</tr>
<tr>
<td></td>
<td>$365</td>
<td>$634</td>
</tr>
<tr>
<td><strong>No. Drug-Drug Interactions</strong></td>
<td>7/50</td>
<td>6/96</td>
</tr>
<tr>
<td></td>
<td>$133</td>
<td>$60</td>
</tr>
</tbody>
</table>

### Sensitivity Analysis

- **Total Cost Savings**: $1655
- **Total Cost Savings**: $4984

**Total Savings = $3329/patient**

**Cost of Clinical Pharmacist = $55/hr**
Limitations

• Retrospective in nature

• Small sample size for each specific disease state

• More “difficult” patients in interdisciplinary group
  – Does not account for psychiatric or socioeconomic differences

• Patient self-selection into treatment group

• Interdisciplinary group also involves medical residents

• Based on previous disease state guidelines
• Reduction in LDL reflective of pharmacist recommendations of using appropriate intensity statins
• A1c reduction 1.3% still clinically significant
  – Patients referred to pharmacist for one-on-one visit for closer monitoring and adjustment of meds
• 99% patients living below federal poverty level
  – May not achieve therapy goals due to issues with access and adherence rather than inappropriate prescribing
  – ie. Only 53.3% patients achieved BP control despite 71.6% being prescribed appropriate therapy
• Smoking cessation interventions by pharmacists
• Decreased drug-drug interactions at baseline as expected
• No difference in CD4 and HIV RNA as expected
Conclusion

Pharmacist involvement in an HIV Primary Care clinic appears to lead to more appropriate management of chronic co-morbidities in a cost-effective manner, although positive long-term outcomes may be difficult to establish in a complicated, urban patient population.

Supports the expansion of clinical pharmacist involvement in HIV primary care centers to establish interdisciplinary team models as the standard for best practice.
Acknowledgements

- Leonard Berkowitz, MD, FIDSA, AAHIVS; Chief of the Division of Infectious Diseases
- Rebecca Arcebido, PharmD, BCACP
- Jun-Yen Yeh, BSPharm, MS, PhD
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