Effectiveness of an integrated chronic disease management model in improving patients’ health outcomes in rural South Africa

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Outline

- Background
- Statement of the problem
- Justification
- Research questions
- Methodology
- Results and discussions
- Policy implications
Background

- Chronic diseases expand beyond traditional NCDs to include HIV/AIDS

- In 2012, NCDs accounted for 38 million of the world’s 57 million deaths
  - Three-quarter of these 38 million deaths occurred in LMICs

- Mortality due to NCDs estimated to increase to 55 million by 2030
  - Africa will have the greatest increase

- In 2012, HIV accounted for 1.5 million (2.7%) global deaths
  - Ranking the 6th global cause of death
Background

- Dual disease burden in South Africa - stalled epidemiological transition
  - NCDs e.g. hypertension
  - Chronic communicable diseases (e.g. HIV and TB)

- NCDs accounted for 43% of all deaths in S/Africa in 2014

- HIV prevalence in S/Africa estimated at 10% in 2014
  - One of the highest in Africa
Background

- Evidence of integrating HIV/AIDS, hypertension and diabetes services in Cambodia:
  - Increase in median CD4 count from 53 to 316 cells/mm$^3$ after 2 years
  - 68% of hypertension patients on regular therapy had controlled BP
  - 57% of diabetes patients had glycosylated haemoglobin ≤ 9%

- UNAIDS recommends integration of HIV/AIDS and NCD services to:
  - Leverage HIV programme for NCDs
  - Improve patients’ health outcomes
  - Minimise HIV-related stigma
  - Improve the quality of chronic disease care

- The South African govt. implemented UNAIDS recommendation in 2011
  - One of the first of such efforts in Africa
Background

S/Africa’s response to the dual burden of HIV/AIDS and NCDs
- The National Department of Health introduced the ICDM model
- Pilot of the model was initiated in July 2011 in three Provinces

The ICDM model:
- Component of PHC re-engineering; nurse-led
- “One-stop-shop” for management of chronic diseases
- Expected to enhance coherent services and improve patients’ health outcomes
Components of the ICDM model

- **Facility re-organisation:**
  - Supply of critical medicines and equipment
  - Prepacking of medicines
  - Referral
  - Defaulter tracing
  - Appointment system

- **Community-oriented chronic disease care**
  - Outreach team serves a catchment population
  - Responsible for 6000 persons, 1500 households
  - Target: manage 80% of chronic diseases
  - Composition of the PHC outreach team
    - A professional nurse, three staff nurses and six CHWs

- **Health promotion and screening in the population**
Statement of the problem

- S/Africa’s health care system has yet to adapt to the long-term continuity of chronic care
- Chronic disease care is fragmented within the public health system in S/Africa
- Poor management of NCDs
- Dearth of information on the changes in the patients’ health outcomes
Study justification

- Better understand how the ICDM model works
- Provide evidence of changes, if any, in the patients’ health outcomes
Hypothesis:
Patients receiving treatment in the ICDM model pilot PHC facilities were more likely to have better health outcomes than those in the comparison facilities over the 24-time points (months) after initiation of the ICDM model.

Research question:
Is the ICDM model effective in improving key indicators of health outcomes, i.e. patients’ CD4 count and blood pressure (BP)?
Study setting

115,000 people; in 60,000 h/holds
2 health Centers, 6 fixed clinics
2 hospitals       25 – 60 km away
Methodology

Study setting

- Bushbuckridge sub-district (38 PHC facilities: 17 ICDM model pilot facilities)
  - Seven ICDM model pilot facilities in the Agincourt HDSS
  - Five comparison facilities outside Agincourt HDSS

- Study design: Controlled interrupted time series - part of the broader mixed methods study
- Study population: Patients on treatment for the markers of chronic diseases in the area
Methodology

Sample size calculation

- Diggle’s formular for repeated measures of dichotomous outcome in a longitudinal study

- Aimed to detect a 10% significant difference in the proportion of patients with controlled BP between the study groups (P1 = 68% in the Cambodian study)

- Assuming 0.9 correlations of repeated BP measurements

- 5% significance level for a one-sided hypothesis test ($Z_\alpha=1.645$)

- 90% power ($Z_\beta=1.28$)

- Minimum sample size of 435 in each study arm, after adjusting for 15% attrition
Methodology

Three-step sampling technique: Proportionate, stratified and systematic sampling

- Seven ICDM facilities
  - 3,602 patients in ICDM facilities
  - 435 Sampled patients
    - 141 HIV/AIDS patients
    - 292 Hypertension patients
    - 2 Diabetes patients
  - ICDM model facilities

- Five comparison facilities
  - 3,668 patients in comparison facilities
  - 443 Sampled patients
    - 286 HIV/AIDS patients
    - 155 Hypertension patients
    - 2 Diabetes patients
  - Comparison facilities

Patients proportionately sampled
Stratified sampling by main diseases

7,270 patients in 12 PHC facilities

ICDM facilities
Comparison facilities
**Methodology**

**Inclusion criteria**
- ≥ 18 years
- On treatment from January 2011

**Exclusion criteria**
Transferred between the study groups during data collection

**Type of data**
Secondary data

**Data points**
Specified time periods: pre-ICDM (Jan-Jun 2011) and post-ICDM (Jul 2011-June 2013)

Data retrieval commenced

![Diagram showing time periods and data points](image)

**Key:**
- Period before initiation of the ICDM model
- Period after initiation of the ICDM model

*Jan 2011  *Jun 2011  *Jun 2013

**Figure 1:** Time periods for data collection

Viral load CD4 count Blood pressure Blood glucose

{Outcomes}
Methodology

Study variables
- Controlled BP: <140/90 mmHg
- Controlled CD4 count: >350 cells/mm³

Data analysis
- Stata 12.0 used for analysis
- Controlled segmented linear regression analysis
  - Changes in trend (slope) at pre- and post-intervention periods at 5% significance level
## Results

Table 1: Socio-demographic characteristics of the patients in the ICDM pilot and comparison facilities in the Bushbuckridge sub-district.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study groups n (%)</th>
<th>p-value of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICDM pilot facilities (n = 435)</td>
<td>Comparison facilities (n = 443)</td>
</tr>
<tr>
<td>Age group (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>19 (4.4)</td>
<td>39 (8.8)</td>
</tr>
<tr>
<td>30-39</td>
<td>60 (13.8)</td>
<td>119 (26.9)</td>
</tr>
<tr>
<td>40-49</td>
<td>59 (13.6)</td>
<td>92 (20.8)</td>
</tr>
<tr>
<td>50-59</td>
<td>84 (19.2)</td>
<td>85 (19.2)</td>
</tr>
<tr>
<td>≥ 60</td>
<td>197 (45.3)</td>
<td>105 (23.7)</td>
</tr>
<tr>
<td>Missing</td>
<td>16 (3.7)</td>
<td>3 (0.6)</td>
</tr>
<tr>
<td>Gender</td>
<td>363 (83.4)</td>
<td>368 (83.1)</td>
</tr>
<tr>
<td>Male</td>
<td>72 (16.6)</td>
<td>75 (16.9)</td>
</tr>
<tr>
<td>Education (completed years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>172 (39.6)</td>
<td>167 (37.7)</td>
</tr>
<tr>
<td>1-6</td>
<td>174 (40.0)</td>
<td>169 (38.1)</td>
</tr>
<tr>
<td>&gt; 6</td>
<td>71 (16.3)</td>
<td>73 (16.5)</td>
</tr>
<tr>
<td>Missing</td>
<td>18 (4.1)</td>
<td>34 (7.7)</td>
</tr>
<tr>
<td>Chronic disease status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>210 (48.3)</td>
<td>91 (20.5)</td>
</tr>
<tr>
<td>HIV</td>
<td>141 (32.4)</td>
<td>282 (63.7)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2 (0.5)</td>
<td>2 (0.5)</td>
</tr>
<tr>
<td>Co-morbidities</td>
<td>82 (18.8)</td>
<td>68 (15.3)</td>
</tr>
</tbody>
</table>
Figure 2: Monthly percentages of HIV/AIDS patients on medication with CD4 count > 350 cells/mm³ before and after initiation of the ICDM model by study health facilities.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Pre-ICDM era</th>
<th></th>
<th>Post-ICDM era</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>p-value</td>
<td>95% CI</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Pilot</td>
<td>-3.19</td>
<td>0.457</td>
<td>-11.85 ; 5.47</td>
<td>1.76</td>
</tr>
<tr>
<td>Comparison</td>
<td>-0.84</td>
<td>0.838</td>
<td>-9.16 ; 7.48</td>
<td>0.37</td>
</tr>
</tbody>
</table>
Figure 3: Monthly percentages of hypertensive patients on medication with controlled blood pressure before and after initiation of the ICDM model by study health facilities.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Pre-ICDM periods</th>
<th>Post-ICDM periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>p-value</td>
</tr>
<tr>
<td>Pilot</td>
<td>-1.91</td>
<td>0.480</td>
</tr>
<tr>
<td>Comparison</td>
<td>3.25</td>
<td>0.401</td>
</tr>
</tbody>
</table>
Conclusions

- A novel evaluation of an ICDM model; one of the first of such efforts in Africa

- Findings do not typically conform with the pattern reported in Cambodia
  - The ICDM model appears to enhance the effect of the existing ART programme
  - However, no equivalent effect observed for the control of hypertension

- Poor BP control - unintended consequences of the ICDM model
  - Evidence from qualitative study
    - Work overload
    - Staff shortages
    - Stock-outs of antihypertensive drugs
    - Malfunctioning BP machines

- Study contributes to global debate on an integrated approach for chronic disease care
Limitations

- Incompleteness/unavailability of health facility data
  - Missing laboratory results
  - Malfunctioning equipment
  - Nurses’ errors

- Inability to achieve a minimum of eight data time points before ICDM model initiation
  - Use of household-based notebooks in the pre-ICDM model era
Policy implications

- The ICDM model has yet to achieve its purpose
  - Leveraging HIV programme for NCDs

- Large scale evaluation study needed

- Lessons learned relevant for nation-wide scale up of the ICDM model

- Shared experiences in implementing integrated chronic care
  - Uganda, Kenya, Ethiopia and Swaziland
Acknowledgments

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Thank you for listening