Health literacy is associated with patients’ adherence-related knowledge and motivation, but not adherence or clinical outcomes

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Acknowledgments

Conflicts of Interest: None.

Funding:

• The Diabetes Medication Adherence Study in an Underserved Racially and Ethnically diverse Sample (MeASURES) funded by NCATS UL1TR000445.

• Mr. Corcoran supported by NIDDK T35DK007383.

• Dr. Mayberry supported by NIDDK F32DK097880.

• Dr. Osborn supported by NIDDK K01DK087894.

Research Staff:

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Background

• The exact mechanisms by which health literacy influences health behaviors and clinical outcomes are unclear.\textsuperscript{1}

• Theoretical frameworks have suggested possible pathways.\textsuperscript{2,3}
  
  – Paasche-Orlow & Wolf, 2007
  
  – von Wagner et al., 2009

\textsuperscript{1}Osborn et al., 2011, \textit{Am J Health Behav}
\textsuperscript{2}Paasche-Orlow & Wolf, 2007, \textit{Am J Health Behav}
\textsuperscript{3}von Wagner et al., 2009, \textit{Health Educ Behav}
Health Outcomes

Health Literacy

Access and Utilization of Health Care

Patient Factors
Navigation Skills
Self-efficacy
Perceived Barriers

System Factors
Complexity
Acute care orientation
Tiered delivery model

Provider- Patient Interaction

Patient Factors
Knowledge
Beliefs
Participation in decision making

Provider Factors
Communication skills
Teaching ability
Time
Patient-centered care

Self Care

Patient Factors
Motivation
Problem solving
Self-efficacy
Knowledge/skills

Extrinsic Factors
Support technologies
Mass media
Health education
Resources

Adapted Health Literacy Framework from Paasche-Orlow & Wolf, 2007, Am J Health Behav
Health Literacy

Motivational phase
- Knowledge & Understanding
- Beliefs and attitudes

System Factors
- (health-care costs, accessibility of health info)

Volitional phase
- Implementation skills (e.g., planning, organizing, task-specific skills)

Health Actions
- Access and use of health care
- Patient-provider interaction
- Management of health and illness

Health Outcomes

Adapted Health Literacy Framework from von Wagner et al., 2009, *Health Educ Behav*
Background

• The exact mechanisms by which health literacy influences health behaviors and clinical outcomes are unclear.¹

• Theoretical frameworks have suggested possible pathways.²,³
  – Paasche-Orlow & Wolf, 2007
  – von Wagner et al., 2009

• However, empirical support for these frameworks has been limited.

¹Osborn et al., 2011, Am J Health Behav
²Paasche-Orlow & Wolf, 2007, Am J Health Behav
³von Wagner et al., 2009, Health Educ Behav
Background

• In diabetes, there has been mixed evidence linking limited health literacy to suboptimal self-care and glycemic control (A1c).
  
  – Limited health literacy has been inconsistently associated with less adherence to self-care behaviors.\(^1,2\)
  
  – Limited health literacy has been inconsistently associated with worse glycemic control.\(^3\)

• Health literacy may be more strongly related to factors that determine health behaviors and, in turn, clinical outcomes than to either of these endpoints.

\(^1\)Fransen, von Wagner, & Essink-Bot, 2012, J Gen Intern Med
\(^2\)Loke et al., 2012, Ann Pharmacother
\(^3\)Al Sayah et al., 2013, J Gen Intern Med
Background

• The Information-Motivation-Behavioral Skills (IMB) model predicts adherence to diabetes medications and glycemic control.\(^1\)

• Limited evidence suggests health literacy impacts self-care through behavior-related information and motivation.\(^2,3\)

1Mayberry & Osborn, under review, *Diabetes Care*
2Osborn et al., 2011, *Am J Health Behav*
3Osborn, Bains & Egede, 2010, *Diabetes Technol Ther*
Background

Adapted Path Model from Osborn et al., 2011, *Am J Health Behav*

Coefficients are standardized path coefficients. *p*<0.05, **p*<0.01, ***p*<0.001
Background

Adapted Path Model from Osborn, Baines & Egede, 2010, *Diabetes Technol Ther*

Coefficients are standardized path coefficients.
*\( p<0.05 \), **\( p<0.01 \), ***\( p<0.001 \)
Study Objective

• We examined the relationships between health literacy and each of the IMB model components as potential mechanisms by which health literacy affects health behaviors and, in turn, health outcomes.
Methods

Procedure:

• Recruited 314 consecutive patients at a Federally Qualified Health Center (FQHC) in Nashville, TN.

• Eligibility:
  – Age ≥ 18 years
  – Diagnosed with T2DM
  – Prescribed diabetes medications

• Exclusion criteria:
  – Visual, auditory, speech or cognitive impairment
  – No social security number
  – All medications administered by a caregiver

• A clinic nurse administered a point-of-care A1C test.

• A trained research assistant conducted structured in-person interviews and chart reviews.
Methods

Self-Report Measures:

• **Health Literacy** - Short Test of Functional Health Literacy in Adults (S-TOFHLA)\(^1\)
• **Information** - Diabetes Medication Knowledge Questionnaire (DMKQ)\(^2\)
• **Motivation (Personal)** - Medicines for Diabetes Questionnaire (MDQ-bb)\(^3\)
• **Motivation (Social)** - Medicines for Diabetes Questionnaire (MDQ-nb)\(^3\)
• **Behavioral Skills** - Revised Medication Adherence Self-Efficacy Scale (MASES-R)\(^4\)
• **Medication Adherence** - Adherence to Refills and Medications Scale for Diabetes (ARMS-D) reverse coded\(^5\)

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\(^1\) Baker et al., 1999, *Patient Educ Couns*
\(^2\) McPherson et al., 2008, *Res Social Adm Pharm*
\(^3\) Farmer, Kinmonth & Sutton, 2006, *Diabet Med*
\(^4\) Fernandez et al., 2008, *J Behav Med*
\(^5\) Mayberry et al., 2013, *Diabetes Res Clin Pr*
Methods

Analysis:

• Bivariate Correlations
  – Spearman’s ρ correlations

• Multivariate Regression Models
  – Conducted unadjusted and adjusted linear regression models for each IMB model component with a significant ($p \leq 0.05$) ρ with health literacy
  – A priori covariates in adjusted models:
    
    Age                      Insurance status
    Gender                   Diabetes duration
    Race                     Insulin status
    Education

### Participants' demographic characteristics

<table>
<thead>
<tr>
<th></th>
<th>N = 314</th>
<th>M ± SD or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>51.8 ± 11.7</td>
<td></td>
</tr>
<tr>
<td>Female gender</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian/White</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>African American/Black</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>Other race</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Hispanic ethnicity</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Education, years</td>
<td>11.9 ± 2.9</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;$10K</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>$10-$15K</td>
<td>26%</td>
<td></td>
</tr>
<tr>
<td>$15-$25K</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>&gt;$25K</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Insurance Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uninsured</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Publicly insured</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td>Privately insured</td>
<td>9%</td>
<td></td>
</tr>
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</table>

### Participants' clinical characteristics

<table>
<thead>
<tr>
<th></th>
<th>N = 314</th>
<th>M ± SD or n %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes duration, years</td>
<td>7.7 ± 6.7</td>
<td></td>
</tr>
<tr>
<td>Treatment Regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin only</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Oral agents only</td>
<td>54%</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Glycemic Control (A1C), %</td>
<td>8.2 ± 2.2</td>
<td></td>
</tr>
</tbody>
</table>

### Participants' health literacy scores

<table>
<thead>
<tr>
<th></th>
<th>N = 311</th>
<th>M ± SD or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-TOFHLA</td>
<td>26.0 ± 11.2</td>
<td></td>
</tr>
<tr>
<td>Inadequate (0-16)</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Marginal (17-22)</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td>Adequate (23-36)</td>
<td>72%</td>
<td></td>
</tr>
</tbody>
</table>
Results

<table>
<thead>
<tr>
<th>Construct/Outcome</th>
<th>Measure</th>
<th>Mean ± SD</th>
<th>Spearman’s ρ with Health Literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ρ</td>
</tr>
<tr>
<td>Health Literacy</td>
<td>S-TOFHLA</td>
<td>24.7 ± 12.4</td>
<td>–</td>
</tr>
<tr>
<td>Information</td>
<td>DMKQ</td>
<td>4.3 ± 1.4</td>
<td>0.33</td>
</tr>
<tr>
<td>Personal Motivation</td>
<td>MDB-bb</td>
<td>3.9 ± 0.5</td>
<td>0.12</td>
</tr>
<tr>
<td>Social Motivation</td>
<td>MDQ-nb</td>
<td>4.3 ± 0.5</td>
<td>0.34</td>
</tr>
<tr>
<td>Behavioral Skills</td>
<td>MASES-R</td>
<td>3.5 ± 0.5</td>
<td>-0.10</td>
</tr>
<tr>
<td>Medication Adherence</td>
<td>ARMS-D</td>
<td>39.1 ± 5.0</td>
<td>-0.15</td>
</tr>
<tr>
<td>Glycemic Control</td>
<td>A1C</td>
<td>8.2 ± 2.2</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Health literacy was associated with information, personal motivation, and social motivation, and marginally associated with adherence.
Results

<table>
<thead>
<tr>
<th></th>
<th>Information (DMKQ)</th>
<th>Personal Motivation (MDQ-bb)</th>
<th>Social Motivation (MDQ-nb)</th>
<th>Medication Adherence (ARMS-D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>p-value</td>
<td>β</td>
<td>p-value</td>
</tr>
<tr>
<td>Unadjusted</td>
<td>0.30</td>
<td>&lt;0.001</td>
<td>0.07</td>
<td>0.273</td>
</tr>
<tr>
<td>Adjusted*</td>
<td>0.18</td>
<td>0.009</td>
<td>0.09</td>
<td>0.250</td>
</tr>
</tbody>
</table>

* Adjusted for age, gender, race (white vs. non-white), education, insurance status, diabetes duration, & insulin status.

In adjusted models, health literacy was independently associated with adherence-related information and social motivation to adhere.
Discussion

• Health literacy was independently associated with greater adherence-related information and social motivation to adhere...

  ...but *not* with adherence-related behavioral skills (self-efficacy), actual adherence, or glycemic control.

• Health literacy may indirectly influence self-care and glycemic control through its relationships with factors that determine these outcomes.
Discussion

Health literacy predicts adherence-related information and motivation.
Discussion

Health literacy predicts adherence-related information and motivation.
Limitations

• Sampling from a single FQHC, study design, self-report measures, and not accounting for the potential influence of regimen complexity

Future Directions

• Examine indirect effects of health literacy on adherence and clinical outcomes through patients’ behavior-related information and social motivation

• Determine the efficacy of health literacy-appropriate interventions that address adherence-related information and social motivation