Combining Health Literacy Tools & Computer Programming Tools to Create Accessible, Individualized Report-Backs

Authors: Kathryn S. Tomsho (MPH), Erin Polka (MPH), Chad Milando (PhD), Marty Alvarez (MS), Madeleine K. Scammell (PhD), Gary Adamkiewicz (PhD)

Kathryn S. Tomsho, PhD Candidate, HSPH
Erin N. Polka, Data Coordinator, BUSPH
HOME Study

“How do housing characteristics and resident behavior affect indoor air quality, noise, and thermal comfort?”

- Winter and Summer season monitoring
  - 1 week each

- Questionnaire
- Visual Assessment
- Indoor Measurements
  - NO
  - NO$_2$
  - CO
  - PM$_{2.5}$
  - Temp/ relative humidity
  - CO2
  - Noise
  - VOCs
Background

Approach

● Streamline the process of report back for research teams
● Improve the accessibility of report back materials for readers

Presentation Goals

● Actionable tools for data communication
  ○ Part 1: Data compilation
  ○ Part 2: Reader accessibility
Part 1: Data Compilation
Macro Data Compilation Tool

Part 2: Reader Accessibility
Health Literacy Tools to Template
Part 1: Data Compilation
Macro Data Compilation Tool

Part 2: Reader Accessibility
Health Literacy Tools to Template
Challenges of Reporting Back Data to Participants

Generating Reports

- Time and resource intensive. Prone to human error.
- Presenting individualized results is limited by logistical burden of tailoring report backs.
- Tailored communication becomes increasingly time-intensive in proportion to a study’s complexity.

User Accessibility

- Participants prefer tailored messaging
- Environmental health literacy (EHL) concepts and tools still under development
  - How do we ensure material accessibility using validated tools or research-driven evidence?
MCR: Macro for the Compilation of Report-backs

- Flexible and scalable method for compiling individual reports
- Macro-enabled Excel workbook containing Microsoft Visual Basic for Applications (VBA) script
- Generalizable and open-source (available soon on GitHub)
MCR: How does it work?

1. Create template (Word or Powerpoint)
2. Generate participant text and graphic outputs
3. Compile data into a single master Excel file
4. Run MCR

Polka et al., 2021 (in preparation)
MCR: What does it do?

- Insert participant data into templates and compile individualized reports

- Participant data can be **numerical**, text, or graphics
MCR: What does it do?

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Template

Question to think about:

{NO2_seasonal_text}
- We cook with our stove or oven
- We rely on natural gas heating
- We smoke inside
- We open the windows less

Finished Product

Question to think about:

Results for NO2 in your home were higher in the Cold season than the Warm season. Your Cold season had a seasonal average of 42 ug/m3, which is higher than the WHO indoor guideline. Check any of the below activities that you do more in the Cold season that could increase your indoor air NO2 levels:
- We cook with our stove or oven
- We rely on natural gas heating
- We smoke inside
- We open the windows less
MCR: What does it do?

- Insert participant data into templates and compile individualized reports

- Participant data can be numerical, text, and/or graphics
MCR In Practice

- MCR was piloted in two environmental exposure studies in MA

- Interviewed 7 team members

- Summarized the challenges and benefits of using MCR in compiling reports back to study participants
Findings

- Efficient - speeds up the compilation process of report-backs
- Increased individualization
- Promotes design creativity
- Reduces potential for human error
- Increased confidence in report-back control
MCR Applications

- Improved engagement opportunities
- Facilitates easier communication of strengths and uncertainties
- Increased engagement opportunities among participants and community partners
- Increased accessibility of environmental health materials
- Generalizable with opportunities for scaling up
Accessing MCR

- **Publication:** Polka et al., MCR: Open-source Software to Automate Compilation of Health Study Report-back. 2021. [in preparation]

- **Upcoming:** Access online at GitHub

- **Contact for questions or to be added to our distribution list:**
  - Chad Milano, PhD: cmilando@bu.edu
Part 1:
Data Compilation
Macro Data Compilation Tool

Part 2:
Reader Accessibility
Health Literacy Tools to Template
Challenges of Reporting Back Data to Participants

**Generating Reports**

- Time and resource intensive. Prone to human error.
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**User Accessibility**

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Creating an Accessible Template

Informed by:

1. Formative research with study participants via semi-structured interviews (n=20)
2. State of the literature for research including data report-back
3. Evidence-based health literacy tools

Rigorous Assessment:

4. Overall accessibility and suitability review (CDC Index)
   a. Reviewed by multiple members of research team
Report Back Material Goals

1. Provide individual household data back to participants in a way that is accessible for our audience

1. Provide recommendations to participants for ways to improve their indoor air quality that is actionable, and builds self-efficacy
Goal 1: Accessibility
**Gist-Level**

Summary of Your Particulate Matter Results

- **What is Particulate Matter?**
  Particulate matter (PM$_{2.5}$) is tiny particles that float in the air. The particles are 30 times smaller than the width of a hair. They can be hard to see, but if there are enough of them they can be seen.

- **What are the health impacts?**
  PM$_{2.5}$ can increase the risk of heart disease, asthma, heart conditions, and eye or ear irritation. There are steps you can take in your home to lower your PM$_{2.5}$ and health risks.

- **Where does Particulate Matter come from in the home?**
  PM$_{2.5}$ comes from burning things. Smoking, cooking, burning candles, or room sprays can create PM$_{2.5}$.

Your Home’s Average Indoor PM$_{2.5}$ Results (concentration in µg/m$^3$)

- If your results are within this range, you can still lower your levels or avoid future high levels by trying ideas on page 17.

- **Your Summer Average:** 7
  - Health Guideline: 10
  - Less Indoor PM$_{2.5}$ In Your Home & Least Health Risk

  ![Image of PM$_{2.5}$ levels]

- **Your Winter Average:** 23
  - More Indoor PM$_{2.5}$ In Your Home & More Health Risk

  ![Image of PM$_{2.5}$ levels]

* Red dots represent indoor PM$_{2.5}$.

- Your home's average indoor PM$_{2.5}$ concentration in the warm season was 7 µg/m$^3$.
- Your home's average indoor PM$_{2.5}$ concentration in the cold season was 23 µg/m$^3$.
- Your home was above the World Health Organization’s indoor guideline for PM$_{2.5}$ in one season. Try some of the ideas to lower your PM$_{2.5}$ on page 17.

**Verbatim-Level**

Your Home’s Seasonal Particulate Matter Results

- **Seasonal Indoor Particulate Matter (µg/m$^3$)**

<table>
<thead>
<tr>
<th>WHO Indoor Guideline</th>
<th>Your Home</th>
<th>All homes in Dorchester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Season</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Cold Season</td>
<td>23</td>
<td>11</td>
</tr>
</tbody>
</table>

- **Question to think about:**
  Results for PM$_{2.5}$ in your home were higher in the cold season than the warm season. Your cold season had a seasonal average of 23 µg/m$^3$, which is higher than the WHO indoor guideline. There may be things that you do in your home during the cold season more often than in the warm season that could increase your indoor air PM$_{2.5}$ levels. Check any of the below activities that you do more in the cold season that could increase your indoor air PM$_{2.5}$ levels:

- We cook with our stove or oven
- We use air fresheners
- We burn candles
- We smoke inside
- Not sure
- Other (please list): ____________________
Tool 1: SMOG (Literacy Demand)

Focus: word & sentence length

- Calculation based on number of polysyllabic words, sentence length

Output: numerical score/reading grade level of text

Pros:

- Well-suited to health materials
  - More recent validation criteria for grade level estimate
  - High consistency in results
- Correlates with tests of reading comprehension
- Low input to assess readability
Tool 1: SMOG (Literacy Demand)

Application:
1. Identify 30 sentences
2. Highlight all polysyllabic words
3. Use formula to calculate reading level

Outcome:
- Reduced reports’ literacy demand
  - 13th → 7th grade level
Tool 2: PMOSE/IKIRSC (Document Complexity)

Focus: format & structure of documents
- Structure
- Density
- Dependency

Outputs:
- Score for structure
- Associated grade-level range for suitability match
Tool 2: PMOSE/IKIRSCHE

Application:
1. Determine **structure** (type of document) and score
2. Determine **density** of document and score
3. Determine **dependence** and score.
4. **Sum** all scores
5. Determine complexity using chart

Outcome:
- Reduced reports’ structure/layout complexity
  - 8th → 4th grade level
Tool 2: PMOSE/IKIRSCHER

Application:
1. Determine **structure** (type of document) and score
2. Determine **density** of document and score
3. Determine **dependence** and score.
4. **Sum** all scores
5. Determine complexity using chart

Outcome:
- Reduced reports’ structure/layout complexity
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## Tool 2: PMOSE/IKIRSCHE (Document Complexity)

<table>
<thead>
<tr>
<th>Scores</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complexity level</strong></td>
<td>Very low</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
<td>Very High</td>
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<tr>
<td><strong>Proficiency Level</strong></td>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
<td>Level 4</td>
<td>Level 5</td>
<td></td>
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<tr>
<td><strong>Grade / Schooling</strong></td>
<td>Range includes Grade 4 or less than 8 years of schooling</td>
<td>Range includes grade 8 or high school degree</td>
<td>Range includes grade 12 or some education after high school</td>
<td>Range includes 15 years of schooling or college degree</td>
<td>Range includes 16 years of schooling or post college</td>
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</tbody>
</table>
Goal 2: Actionability
Goal 2: Self-Efficacy & Actionability

- Range of solutions/actions
- Individualized report text & graphics, with direct actions suggested based on exposure concentrations
Goal 2: Self-Efficacy & Actionability

- Report focused on building self-efficacy & engagement
  - Workbook style with small, manageable steps

- Guidance from participant interviews
Assessment of Template
Assessment of Final Template

CDC Clear Communication Index

1. Main message and call to action
2. Language
3. Information design
4. State of the science
5. Behavioral recommendations
6. Numbers
7. Risk

Scores of 90/100 or above are ‘passing’

3 team members applied CDC Index
Benefits of Macro Tool in Concert with Health Literacy Tools

● Reallocate researcher time and effort from report back compilation to health literacy, accessibility, and design improvements
  ○ Facilitates easier adjustments

● Can adjust for participant variation in graphics and text
  ○ Increased tailoring of content can help link information on exposure, behaviors, and suggested actions
Accessing Health Literacy Tools

To access the health literacy tools:


PMOSE/IKIRSCCH:
https://www.jstor.org/stable/40016961?seq=1

CDC Clear Communication Index:
Acknowledgements

Many Thanks to...

- Dave Queeley (Codman Square Neighborhood Development Corp.)
- Stacey Chacker (HRiA)
- GreenRoots
- Dr. Karen Emmons
- Dr. Rima Rudd
- Liam O’Fallon - PEPH, NIEHS
- Dr. Birgit Claus Henn
- Alexa Friedman

The Center for Research on Environmental and Social Stressors in Housing across the Life Course (CRESSH)

- Dr. Francine Laden, Dr. Jon Levy, Dr. Gary Adamkiewicz, Dr. Madeleine Scammell, Marty Alvarez, Claire Schollaert, Dr. Chad Milando, Dr. MyDzung Chu, Sarah Gillooly, Andrew Shapero, Jose Vallarino, Melissa Miller

Funders

- National Institute on Minority Health and Health Disparities (P50MD010428) and the U.S. Environmental Protection Agency (RD-836156)
- We also received funding from a BU SPH Early Career Catalyst Award, and an NIEHS T32 (ES014562).
Thank you