Promises and Limitations of Participatory Group Model Building (GMB) for Addressing Social Determinants of Health

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Overview of talk

Overarching purpose

• Begin to develop a more rigorous theory of GMB and its value for understanding social determinants of health at community level

Outline

• Motivate focus on using group model building for understanding social determinants at the community level
• Background
  • What kinds of models and how do we build them?
  • Group model building
• The problem of increased participation detracting from the quality of the modeling
  • Tendency to reduce problem of model quality into a debate about relative merits of qualitative vs. quantitative simulation models (challenge as an issue of semantics)
  • Rigor of analytic insights declines (test a theory of modeling)
• Participation and Qualitative of Model (PQM) Model
• Closing remarks
“...Similarly the possibility of describing the world by means of Newtonian mechanics tells us nothing about the world: but what does tell us something about it is the precise way in which it is possible to describe it by these means. We are told something about the world by the fact that it can be described more simply with one system of mechanics than with another.”

Ludwig Wittgenstein (1974, , TLP 6.342, p. 68)

“...Today’s knowledge about something is not necessarily the same tomorrow. Knowledge is changed to the extent that reality also moves and changes. Then theory also does the same. It’s not something stabilized, immobilized.”

Paulo Freire (Horton and Freire 1990, p. 101)

“One way to focus on this problem is to discover that we have no conception of objectivity that enables us to distinguish the scientifically ‘best descriptions and explanations’ from those that fit most closely (intentionally or not) with the assumptions that elites in the West do not want critically examined.”

Sandra Harding (1991, p. 97)
Social determinants of at the community level is a complex system.
Need for better mathematical models of theories

Progressively stronger specifications of theory

1. Type of entity postulated (substance, structure, event, state, disposition, field)

2. Compositional, developmental, or efficient-causal connections between the entities in (1)

3. Signs of derivatives of functional dynamic laws in (2)

4. Ordering relationships among the derivatives in (2)

5. Signs of mixed partial derivatives (“interactions”) in (2)

6. Function forms (e.g., linear? logarithmic? exponential?) in (2)

7. Trans-situationality of parameters in (6)

8. Quantitative relations among parameters in (6)

9. Numerical values of parameters in (6)

Causal maps as theories about causal structure

- Fast food restaurants
  - Designed for a purpose based on population serving
  - + Planning of meals for day
- Mindset of meals (pizza, hotwings)
  - + Unhealthy eating
  - - Parents knowing how to prepare meals
  - Teaching kids to cook meals
- Social issues of parent
  - + Unhealthy eating
  - Subsidies for healthy food
  - Fruit at service
  - Unhealthy snacks
- Money
  - + Unhealthy snack food
- Seeking comfort foods
  - Social issues with kids
- Social issues with kids
  - + Becoming parents
  - - Steady supervision
- Self-esteem
  - + Weight norm
  - - Weight gap
  - - Dieting
- Weight
  - + Dieting
  - Getting sick
  - Older adults walking with children
  - Friendly environment
- Depression
  - Alcohol, drugs and guns
  - Depressant medications
- + Soda Tax Policy
- Revenue from soda tax
  - + Buying unhealthy snack food
  - - Stable parent
- Kids know each other
- <School in neighborhood>

Factors affecting weight:
- Unhealthy eating
- Unhealthy snacks
- Buying unhealthy snack food
- Seeking comfort foods
- Money
- Social issues of parent
- Social issues with kids
- Self-esteem
- Weight
- Depression
- Friendly environment

Factors affecting mental health:
- Self-esteem
- Depression
- Friendly environment

Factors affecting social issues:
- Social issues of parent
- Social issues with kids

Factors affecting physical activity:
- Gyms at church
- Ministers talking about physical health
- Teaching kids to cook meals
- School in neighborhood

Factors affecting mental health and depression:
- Self-esteem
- Depression
- Friendly environment

Factors affecting physical activity:
- Gyms at church
- Ministers talking about physical health
- Teaching kids to cook meals
- School in neighborhood
Information sources for modeling

Mental Data Base

Observation Experience

Written Data Base

Numerical Data Base

Group model building, direct observation, key informant interviews, focus groups

Literature reviews, systematic reviews, meta analyses, reports

Secondary data analysis, prospective studies and experiments

Modeling approaches

Community-driven models, i.e., group model building with communities

Literature driven models

Data driven models

Group Model Building (GMB)

• “Group model building is a process in which team members exchange their perceptions of a problem and explore such questions as: what exactly is the problem we face? How did the problematic situation originate? What might be its underlying causes? How can the problem be tackled?” (Vennix 1996, p. 3)

• “Group model building, as we intend the phrase, signals the intent to involve a relatively large client group in the business of model formulation, not just conceptualization” (Richardson and Andersen, 1995, p. 1)
Reasons for Using GMB

- Greatest insights come from modeling process
- Shared conceptual view of problem
- Building consensus
- Increased likelihood that results will be implemented
- Participation is an intervention
  - Social construction of new realities
  - Models are only artifacts of that process
- “Dignity of risk”
  - People should have the opportunity to be involved in designing the systems that are intended to benefit them
- More efficient approach to building a model/theory
Efforts to involve more direct participation

- Stave 2002; Beall and Ford 2007; Costanza and Ruth 1998:
  - Involving advisory groups as opposed to direct participation
  - Small group of experts involved in formulation of the model
  - Limit participation to the earlier stages of developing scoping models

- An inherent tension appears in this literature is between participation and formal modeling
What do we mean by participation and formal model?

<table>
<thead>
<tr>
<th>Participation</th>
<th>Formal model</th>
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<tbody>
<tr>
<td>Interviews or key informants</td>
<td>Diagram</td>
</tr>
<tr>
<td>Involved in selecting problem</td>
<td>Physical models</td>
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<tr>
<td>Helped conceptualized model</td>
<td>Causal map</td>
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<tr>
<td>Interacted with model</td>
<td>Stock and flow diagram</td>
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<tr>
<td>Helped formulate equations</td>
<td>Functional forms</td>
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<tr>
<td>Made decisions about modeling process, model formulation, data, analysis,</td>
<td>System of equations</td>
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<tr>
<td>and implementation</td>
<td>Computer simulation</td>
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<td>Software code</td>
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Modeling and participation

- Community Organizing
- Participatory Action Research
- Action Research
- Participatory Rural Appraisal
- Systems Thinking
- Soft Systems Methodology
- Human System Dynamics
- Group Model Building
- Classic SD
- Computer modeling and simulation

Formal modeling vs. Participation
Semantics of participation in modeling in single vs. multiple project perspectives

Problem selection and conceptualization

Model formulation and simulation

Testing and analysis

Implementation

Single project
Semantics of participation in modeling in single vs. multiple project perspectives

- Problem selection and conceptualization
- Model formulation and simulation
- Testing and analysis
- Implementation

Single project vs. Multiple project
Does participation increase efficiency of modeling?

• Assumptions:
  • Participation improves relevance of model
  • Participation also improves the information that can be used in developing a model
  • How information is used to improve a model is dependent on the quality of the model
  • Participation is dependent on both the relevance of the model to the problem at hand and the quality of the model

• Purpose of PQM model:
  • To articulate and test an initial dynamic theory about how participation and quality of model contribute to the quality of a model
Participation and Quality of Model (PQM1)
Final quality of model as a function of initial model quality, initial participation, and modeler skill

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<th>Modeler.skill</th>
<th>Initial.quality</th>
<th>Initial.participation</th>
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<tr>
<td>0.6</td>
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<tr>
<td>1.4</td>
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Dynamic Modeling for Health

Hovmand
Final quality of model as a function of initial model quality, initial participation, and modeler skill
Final quality of model as a function of initial model quality, initial participation, and modeler skill

1. Initial participation has a stronger effect on final quality than initial quality of the model.
2. Initial participation in the modeling also lowers the skill level of modeler required for a final high quality model.
Final quality of model as a function of initial model quality, initial participation, and modeler skill

3. Investing in high quality scoping models and building up strong community participation is both feasible and may contribute to a robust modeling process that is less sensitive to modeler expertise.
Closing remarks

• Promises
  • Participation can improve the quality of models
  • Participation can also increase the envelope of modeler skill required
    • Less skill required of simulation modelers, lower cost, more opportunities for training and development of expert modelers, increased diversity of modelers
  • Participation is likely to lead to immediate implementation of “low hanging fruit” leaving harder questions for simulation analysis

• Limitations
  • Participation introduces errors, and how these errors are aggregated into a model is likely to be very sensitive to group process
  • Group process sensitive to skilled facilitators and community participation in the design of group model building process
  • Seeking to implement “low hanging fruit” may be the root cause of some problems
  • Participation does not inherently yield better information, and failure to engage in a process of critical reflection with group can lead to false confidence in results
Next steps

- Extend theory of group model building process to include:
  - Participant error
  - Different approaches to aggregating information in groups
  - Participant learning
  - Modeler learning

- Extend approach to test theories about “ensemble modeling”
  - Consider multiple group model building projects within the same community using agent based models

- Empirically test and revise theory of GMB process:
  - Collect longitudinal data on key variables to estimate parameters
  - Conduct factorial experiments to test sensitivity of dynamics to initial conditions and skill of modelers
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