A Logic Model for Understanding and Reducing Preventable Hospitalizations

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ABSTRACT

Identifying and understanding the root causes of preventable hospitalization (PH) is important for improving health outcomes and reducing unnecessary healthcare costs. Thus far, however, the desire to address this issue has been impeded by a general lack of research on factors associated with PH. To begin to address this gap, we propose an evidence-based logic model of individual, environmental, and systemic factors related to PH. We aim to use this logic model to design public health interventions to reduce PH in the State of Rhode Island and to stimulate an industry-wide discussion of the problem and its possible solutions.

INTRODUCTION

Preventable hospitalization (PH) burdens the healthcare system. In 2008, nearly ten percent of all U.S. hospitalizations (over four million in total) were deemed to have been preventable, or to have been replaceable with lower cost preventative health management options such as primary care services (1). PH costs in the U.S. exceed $31 billion (2) annually. PH may be indicative of inadequate preventative care infrastructure, and may also be a forerunner of poor population health outcomes (3-8).

PH may have many determinants, including the root causes of disparities in patients' societal, behavioral, mental, and cultural wellbeing (9). These root causes are not only complex in themselves, but also interact in complex ways. For example, social discrimination and environmental inequality may contribute *directly* to poor health, but they also may contribute *indirectly* to poor health by undermining community infrastructure (10). Evidence suggests that a focus on social determinants is needed in order to improve population health (11). Rhode Island is a case in point. According to the 2013 annual report of *America's Health Rankings*, Rhode Island has a high rate of PH among 65-99 year-old Medicare enrollees without HMO coverage, and therefore, might be expected to have a correspondingly low primary care supply (12). However, estimates show that Rhode Island has a *high* primary care supply, defined as the number of general practitioners, family practitioners, and OB-GYN, pediatrics, and internal medicine physicians per 100,000 population (12). This discrepancy illustrates the need to assess and to address *multiple* factors in hopes of reducing PH.

We assert that PH is the result of many (and inter-related) demographic, social, and behavioral factors, which together influence public health outcomes in complex ways. We recognize this complexity by proposing a "logic model" for PH which incorporates factors well beyond physical illness and its management in the healthcare system.

Logic Models

"A logic model describes the sequence of events for bringing about change by synthesizing the main program elements into a picture of how the program is supposed to work. Often, this model is displayed in a flow chart, map, or table to portray the sequence of steps leading to program results. One of the virtues of a logic model is its ability to summarize the program's overall mechanism of change by linking processes (e.g., laboratory diagnosis of disease) to eventual effects (e.g., reduced tuberculosis incidence). The logic model can also display the infrastructure needed to support program operations. […] Creating a logic model allows stakeholders to clarify the program's strategies; therefore, the logic model improves and focuses program direction. It also reveals assumptions concerning conditions for program effectiveness and provides a frame of reference for one or more evaluations of the program." (25)

THE LOGIC MODEL

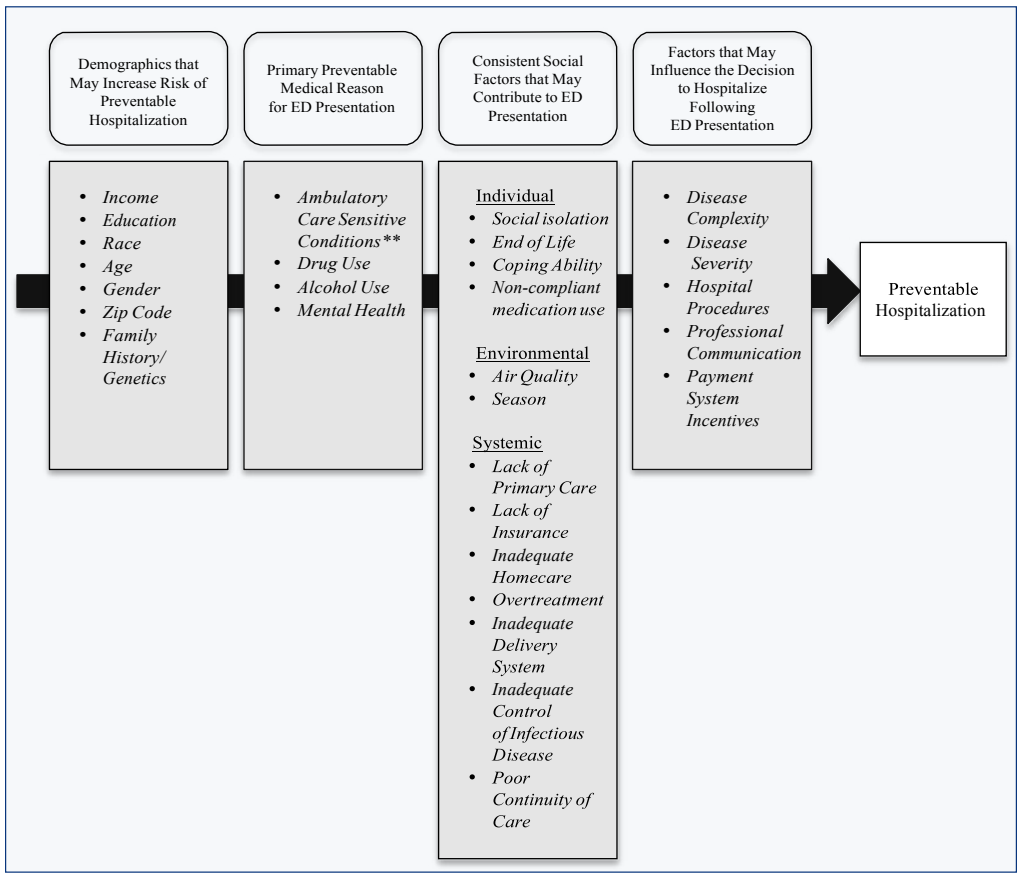
In response to the high rate of PH in Rhode Island, a committee at the Rhode Island Department of Health brainstormed to build a list of factors putatively associated with PH (along with ways to address them). Factors thus identified included medical diagnosis, mental illness, end of life complications, healthcare payment models, admission/discharge policies, individual propensity for behavioral change, and training models for emergency responders.

Upon searching the literature, we found many studies that explored the relation between PH and *demographic factors*, and a few that explored the relation between PH and more difficult-to-measure variables, such as *individual, environmental, and systemic factors* (3, 13-17). To develop a useful logic model, the various factors were articulated, differentiated, and organized (in part, to reflect their progressive nature). The model shown in **Figure 1** resulted, incorporating four groupings of PH determinants in relation to one another.

The first grouping includes the demographic, socioeconomic, and genetic elements that predispose individuals or specific populations to developing ambulatory care-sensitive conditions. Evidence of health disparities in communities of low socioeconomic status (S.E.S.) is well documented (4, 18). Likewise, wealth, race, age, gender, and S.E.S. have been shown to affect rates of PH (2, 3, 16, 19-21). For example, higher rates of PH occur in communities of lower average income (3, 4, 19, 21), and it has been suggested that persistently high rates of PH in these areas may be the product of underlying access barriers and environmental concerns (16), in conformity with our logic model.

The second grouping lists those clinical conditions which are frequently associated with PH. These include "ambulatory sensitive conditions," such as angina, asthma, chronic obstructive pulmonary disease, diabetes, grand mal status and other epileptic convulsions, heart failure and pulmonary edema, and hypertension, as well as certain mental health conditions and problems such as drug and alcohol abuse.

Figure 1. Preventable Hospitalization Logic Model



** Ambulatory Care Sensitive Conditions include: angina, asthma, chronic obstructive pulmonary disease [COPD], diabetes, grand mal status and other epileptic convulsions, heart failure and pulmonary edema, and hypertension (1)

The third grouping lists the individual, behavioral, environmental, and systemic factors that have a tendency to channel patients to hospitals rather than primary care, or to other non-hospital alternatives such as home-based hospice care. One of these factors, unsurprisingly, is "lack of [health] insurance." By lack, we mean "no health insurance," certainly, but also "inadequate" health insurance. For example, consider Medicaid recipients, who are hospitalized more often for preventable conditions than those who are privately insured (16, 22). Because Medicaid reimbursement rates tend to be less than the reimbursement rates of many private health insurers, Medicaid patients, compared to privately insured patients, may find it more difficult to secure high-quality primary care (23). Nonetheless, the logic model we propose would also suggest that Medicaid status, a "third-tier" indicator in the logic model, may be closely associated with first-tier and second-tier indicators, and thus may be associated with higher rates of PH because of related socio-demographic and clinical factors.

The fourth grouping includes those hospital-level factors which influence the decision to admit, following a visit to an Emergency Department (ED). The latter, of course, may also be a preventable event, and should be (and frequently is, in the literature) considered an independent-but-related event, *vis-à-vis* PH. In short, a preventable ED visit does not necessarily translate into a PH. One study, for example, revealed a high rate of variability in admission from the ED for illnesses which do not require hospitalization, especially for those illnesses with unclear clinical guidelines, such as mood disorders and non-specific chest pain (24). Thus, our logic model suggests four distinct levels at which we might intervene to reduce the rate of PH.

In sum, we propose a logic model that utilizes evidence-based correlations to guide public health-focused thinking on how to reduce rates of PH. The model provides a basis for the strategic deployment of public health interventions at multiple points, based on the literature. As well, because that literature is strong at some "levels" of the logic model and not others, the model itself provides a basis for the strategic deployment of future research efforts.

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