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Medical Practice Variations

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Medical Practice Variations in Acute Care Hospitalization

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Abstract

Acute hospitals are the largest single component of health care budgets. Only a small percentage of the population encounters acute inpatient care in any given year, but these are the sites for the most intensive (and most expensive) care provided in the health care system. Anyone who is admitted to acute care will also use other parts of the health care system, and many who do not use hospital care may be considered at risk for admission.

The literature on acute care variations is extensive. Studies about varying rates of admission, readmissions, and length of stay are common, as are studies of different types of procedures performed in hospital settings. Most studies of hospital care, however, do not situate that care in this broader context of ongoing patient trajectories.

This chapter draws on existing literature to describe medical practice variations in acute care in that broader context. These variations have implications for the overall cost and quality of any health care system. Acute care must be understood not as an entity in itself but as both a precursor to and outcome of events and services that occur in other parts of the health care system.

Introduction

A landmark study on medical practice variations published in 1973 showed differences in health care service use across hospital service areas in Vermont (Wennberg and Gittelsohn [1973](#)). One of the most striking variations reported in that study was the 10-fold difference across these small areas in the rate of hospitalization for tonsillectomy. Since then, there have been more than 1,000 medical practice variation studies, and the annual number of those publications has been increasing in recent years (Corallo et al. [2014](#)). Of these, more than 200 studies were about acute care admissions,

readmissions, or length of stay, and another 200 plus assessed variations with the hospital as the unit of analysis.

Why Acute Care?

Clearly there is a broad interest in acute hospital services. From a funder's perspective, this is understandable because acute care hospitals consistently represent the single-largest expenditure in any health care budget. When Wennberg and Gittelsohn published their initial article in 1973, hospitals in Canada, for example, accounted for 45 % of total health care spending and 55 % of public spending (Canadian Institute for Health Information [2012](#)). By 2012 they were still the most significant single sector, but the percentages have decreased to 30 % and 38 % respectively, which is on the low end of OECD countries (OECD [2012](#)).

From a researcher's perspective, the focus on hospitals certainly relates to its dominance in health care expenditures but also flows from the simple fact that after vital statistics (births and deaths), hospital data are usually the most comprehensive and comparable across institutions and are the data most commonly available for research purposes. There has been a great deal of effort put into setting coding standards, collecting comparable information, and ensuring quality of that information ([CIHI n.d.](#)), not least because these data are used to set payment rates and inform payment policy decisions. Standardized hospital information exists in most countries, usually at a national level. And since coding is often based on national or international standards, such as the International Classification of Diseases ("WHO|International Classification of Diseases (ICD)," [n.d.](#)), there is the potential for cross-national comparisons.

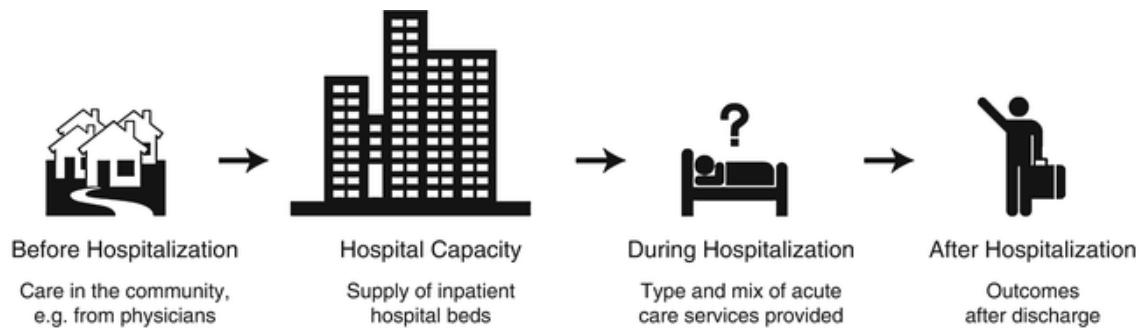
It is no surprise, then, that so much of the existing variation literature touches in some way on acute hospital care. The results of this research, nevertheless, have not been organized or described other than to categorize the types of questions and analyses addressed (Corallo et al. [2014](#)). This chapter is intended to fill that gap by organizing and summarizing the current state of research on acute inpatient care and offering some direction for future studies.

An Organizing Framework for the Chapter

Studies on medical practice variations in acute inpatient care are often about very particular areas of care, such as specific surgical intervention or care for people with specific diagnoses. This chapter takes a step back from that micro focus to one that considers *how* acute care hospitals are used and what might create variations in the use of acute inpatient hospital care.

The organizing idea used here is that of understanding acute care as part of the broader set of health care services that people use. Acute care services are never used in isolation. They are intertwined with care provided by physicians; they may either result in or result from use of pharmaceuticals, physician care, and other types of care in the community or in other facilities. Our understanding of variations in the use of acute inpatient care then depends on setting research on the use of those services in a broader context.

This chapter attempts to organize the discussion of variations in acute inpatient care in a logical sequence from the patient point of view, as shown in Fig. [1](#). It starts with studies that look at the structure or supply of acute hospital beds, then moves to studies of variations in the likelihood of being admitted to hospital, then to variations in care that occur while in hospital, and finally to studies on variations in the outcomes of acute hospital care.



Variations in acute inpatient care can be organized into several broad potential sources. The overall supply of inpatient hospital beds sets a finite limit on utilization. Care in the community can lead to differences in the likelihood of admission. There can be variations in the type and mix of services provided once patients are provided once patients are admitted, and there can be variations in outcomes after discharge.

Fig. 1

Sources of variation in use of acute inpatient care

Approach to the Work

The literature used started with the results of the systematic review reported by Corallo et al. ([2014](#)). The same search strategy was then used to identify additional medical practice variation articles published after that review up through December 2012. The focus was on differences among acute care hospitals or across geographic regions and not on changes or trends in the use of acute care hospitals over time.

This is not a systematic review. It is not an exhaustive classification of every study conducted that touches on acute inpatient care. Hospitals are the sole focus of a good deal of variation analyses and are often implicated in one way or another even when they are not the sole focus. As a consequence, the literature is vast and the nuances many. The focus here is instead on providing a broad frame for summarizing the existing literature and then illustrating the use of that frame with the existing research literature.

Hospital Capacity

The supply of hospital beds is not evenly distributed across geography. Across OECD countries, the number of acute care beds per 1,000 population ranges from 1.6 in Mexico to 2.0 in Canada, 3.5 in Denmark, 8.3 in Germany, and 13.8 in Japan (OECD [2012](#)). Even within countries there can be marked differences in the availability of acute care beds. For example, there is a twofold variation in acute beds per capita across the 306 hospital referral regions in the USA (Fisher et al. [2000](#)).

In addition to the simple supply of beds, hospitals differ in their status (e.g., teaching hospital, community hospital) and in the availability of services, especially specialized services or technical capacity (Alter et al. [2005](#); Oliver and Thomson [1999](#)). Even when technology is readily available, there may be a difference in the availability of technicians who can operate the machinery (Alter et al. [2003](#)).

The supply of resources is, in fact, one factor that many researchers point to as a key explanation for variations in service use. This is a theme that permeates all other aspects of acute inpatient hospital use.

Before Hospitalization

The most basic feature of utilization that might be of interest is the likelihood of admission to acute inpatient care. Many studies have found variations in admission rates, and as already noted these variations are often attributed to capacity (Fisher et al. [2000](#); Goodman et al. [1994](#)), pointing to the adage from Milton Roemer that a built bed is a filled bed (Roemer [1961](#)). Patients of course do not decide to admit themselves to hospitals; an admission has to be the decision of a practicing physician. It does appear (as should be expected) that there is physician influence on the likelihood of admission. In Scotland, one study found that after controlling for age, sex, and area deprivation there was still a twofold difference in the likelihood of emergency medical admissions across different GP practices (Blatchford et al. [1999](#)). In Canada, studies have documented differences in physician practice style (Roos [1992](#)), manyfold variations in admissions for chronic conditions such as congestive heart failure, chest pain and angina (Hall et al. [2003](#)), and the influence of physician “enthusiasm” on the prevalence of orthopedic surgery (Wright et al. [1999](#)).

In some cases, the fact of a hospitalization is thought of as a failure of care in another part of the health care system. A study in Australia, for example, found higher rates of hospitalization for heart failure in rural versus urban areas and attributed that observation to differences in the practice of primary care (Ansari et al. [2003](#)). This and other studies of differences in hospitalization rates for low-severity pneumonia and congestive heart failure (Rosenthal et al. [1997](#)), differences in hospitalization between urban and rural areas (Ansari et al. [2003](#)), variations in primary care providers’ admission rates for a number of ambulatory care sensitive conditions (Ansari et al. [2002](#)), and attribution of readmission rates of premature infants to the location of their outpatient care (Lorch et al. [2010](#)) suggest that the availability and/or quality of primary care can help explain differences in acute care hospital use. The term “ambulatory care sensitive conditions” was in fact coined specifically to refer to hospital admissions that could be avoided if appropriate, high-quality care is available in the community (Purdy et al. [2009](#)).

This is not, however, the only possible interpretation of variations in admission rates to acute inpatient care. Higher rates of admission in rural compared to urban areas, for example, may have to do with decisions about travel times and distance to hospital (Finegan et al. [2010](#)) and thus a different assessment of patient risk in admitting (or not admitting) when someone presents to the hospital. The challenge is that urban–rural differences do not always cut the same way. In the USA, admissions for acute myocardial infarction (heart attack) and congestive heart failure have been shown to be lower in rural areas (Harris et al. [2008](#)), whereas another study showed that proximity to hospital is inversely related to likelihood of admission (LaVela et al. [2004](#)).

Here is where supply sneaks back in as an important factor. Another possible interpretation is that pressure on the availability of acute care beds can lead to different decision-making about the appropriate time for a patient to be admitted. In areas with plentiful supply the bar may simply be lower. Many of the conditions that fall under the banner of “ambulatory care sensitive” (e.g., chronic obstructive pulmonary disease, congestive heart failure) are also considered “supply-sensitive conditions,” meaning conditions that are particularly sensitive to the availability of hospital beds in a local area (Wennberg et al. [2002](#)). This creates a set of competing hypotheses – that variations in care might reflect a failure of primary care but also might reflect the differential availability of hospital beds, which influences decisions about who “needs” a hospital bed.

Differences in availability of hospital beds mean that some areas may have slack capacity while others are more constrained. One implication of constrained supply is that patients may not be admitted

when they need to be. A study from Italy found that in overall low-hospital-use areas patients were admitted later in the course of disease than in higher-use areas (Taroni et al. [1997](#)), suggesting that in some cases patients were reaching care later than they should. On the other hand, a study in Ontario showed regions with higher and lower rates of hip and knee replacement surgery but no difference among those regions in the proportion of surgeries that were deemed appropriate on retrospective review (van Walraven et al. [1996](#)). This same conclusion of “higher rates for everyone” was found when looking at hospital admissions for medical conditions in the USA (Rustuccia et al. [1996](#)). Another implication of constrained supply is that patients may be discharged from hospital “quicker and sicker” in order to free up beds for the next patient in need. It has been argued that this can lead to differential rates of readmission. For example, an international comparative study found that hospitals with (relatively) shorter lengths of stay had higher rates of readmission, and these were largely readmissions for ambulatory care sensitive conditions (Westert et al. [2002](#)). All of these influences lead some researchers to describe geographic variations in care as arising from a complex interplay between the supply of a region and the local practice style or culture of the physician community (Fisher [2008](#)). There is empirical evidence to support this view (Burns and Wholey [1991](#)). The interplay occurs because the availability of resources influences how physicians choose to act (are hospital beds readily available? If so, a physician may be more likely to admit a patient, and vice versa). Over time, habits become instilled and become part of the way things are done in that area or community.

One interesting study supporting this explanation examined practices of physicians who work at two different hospitals and found that length of stay of their patients tended to conform to the norm at the particular hospital, i.e., institutional factors driving length of stay were dominant over whatever individual physician “preferences” might be involved (De Jong et al. [2006](#)). At a more aggregate level, the fact that regional variations occur even in closed health systems (with salaried physicians) that operate in many different geographic areas such as the Veterans Health Administration system in the USA (Ashton et al. [1999](#)) provides evidence in support of local practice supply and culture modifying individual practice habits.

In summary, as shown in Fig. [2](#), there are a variety of influences on whether patients are admitted to acute care. The supply and quality of primary care, the practice styles of specialists, and the supply of acute care beds may all exert independent influences. As the figure illustrates, the way these influences might interact to drive rates of admission is quite complex. The important point here is that there are large differences in admission to acute inpatient care and no simple mechanistic explanation for how those differences are produced. Studying admission rates to acute care thus requires careful consideration of the proposed mechanisms of action and ideally a variety of measures that can help isolate the various factors that drive variations in utilization.

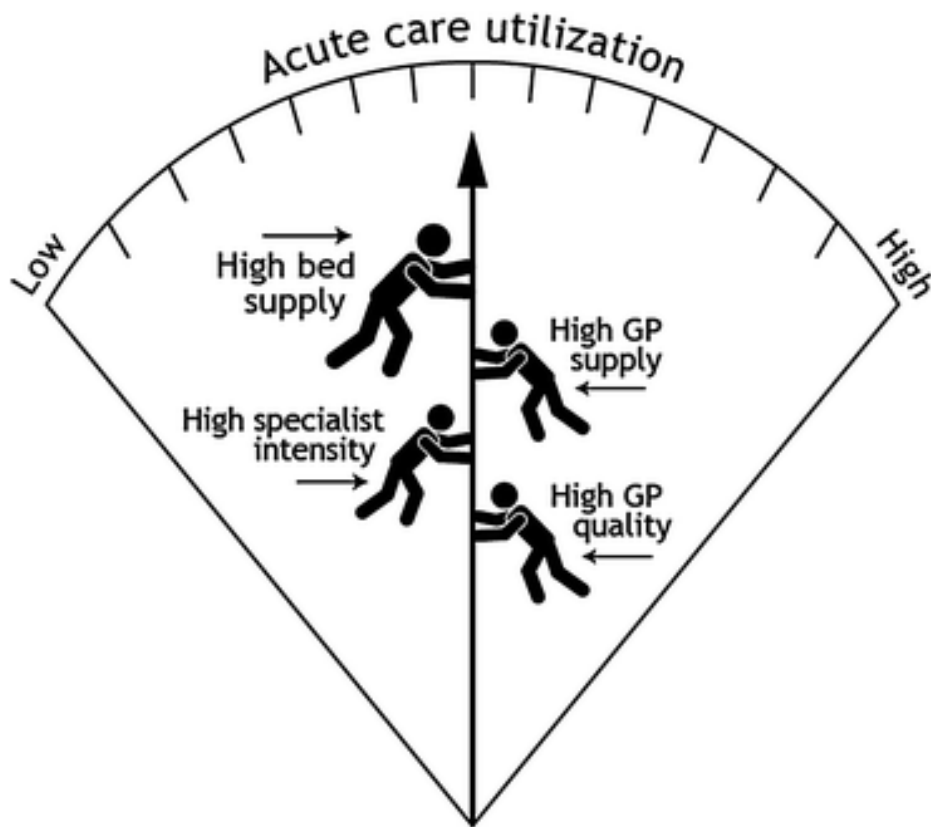


Fig. 2
Influences on acute care admission rates

During Hospitalization

The research literature shows that there are many – and sometimes competing – explanations for variations in the likelihood of admission to acute inpatient care. The next issue of interest is what happens to patients once they are in an acute care bed.

Patient characteristics are one factor that can influence the care provided. After controlling for hospital capacity, Alter et al. ([2003](#)) found that there was a strong relationship between patients' neighborhood socioeconomic status and receipt of revascularization after acute myocardial infarction. This exemplifies that even where there is agreement about the need for an admission and the diagnosis of a patient, there are still many different possible responses to the condition. In some cases this might mean different types of procedures – such as revascularization versus open-heart surgery for coronary artery disease – or a different mix of resources used to undertake the same procedure. On the former, in the case of mitral valve disease, in the UK in the mid-2000s the overall consensus (supported by research evidence) was that repair of the valve was associated with better outcomes than replacement. Analysis of UK data, however, showed that there was a more than fourfold variation across hospitals in the proportion of patients receiving repair versus replacement, from 20 % to 90 %, depending on the hospital (Anyanwu et al. [2010](#)).

As already discussed, apparent preferences will (or can) be shaped by the availability of hospital resources. That applies to the decision about admission but also pertains as well to the course of treatment. For example, given differences in interventions available at hospitals (such as for cardiac care) it is perhaps not surprising that patients experience care differently (Birkhead et al. [2006](#);

Wennberg et al. [1997](#)). The fact that patients might need to be referred from one hospital to another to receive recommended care is why many researchers look at care within specified periods of time or within “episodes of care” rather than simply at single institutions.

The sorts of variations described here are not limited to a narrow or select type of service. A study from Europe showed very different approaches to care for stroke patients – including imaging but also access to rehabilitative therapy services (Beech et al. [1996](#)). Care of pediatric patients with urinary tract infections, including length of stay and use of imaging, varied significantly across hospitals in the USA (Conway and Keren [2009](#)). The resource use for cesarean sections and vaginal deliveries (analyzed separately) varied across physicians in Arizona (Burns et al. [1994](#)). The use of blood transfusions during coronary artery bypass graft (CABG) surgery varies across hospitals in the USA from almost never to almost always (Bennett-Guerrero et al. [2010](#)).

Perhaps more importantly (and in parallel to the discussion of admissions above), it is not necessarily the case that access to higher-level resources will translate to appropriate use of those resources. For example, in one study on cardiac interventions, patients at all levels of risk were more likely to receive catheterization in “high-intensity” regions. In other words, high-risk patients were more likely to receive catheterization, but so were moderate-risk and low-risk (i.e., inappropriate) patients (Ko et al. [2008](#)).

It is also important to note that the “resources” available to hospitals are not limited to technology, such as specialized equipment or facilities. Some studies have considered the presence of hospitalists – physicians devoted specifically to inpatient acute care. One found that having these physicians is associated with lower length of stay, particularly for older, complex, medical patients (Kuo and Goodwin [2010](#)). Another found that hospitalists were more likely than community-based physicians to use therapies with proven benefit and less likely to use those with unproven benefit (Conway et al. [2006](#)).

One of the most studied in-hospital features is length of stay. Variations are consistently found here, for example, among chronic obstructive pulmonary disease (COPD) patients in the UK (Price et al. [2006](#)), for stays following joint replacement surgery in Finland (Rissanen et al. [1996](#)), and among moderately preterm infants in Sweden (for whom length of stay is up to 2 weeks different, as measured by the postmenstrual age at discharge) (Altman et al. [2009](#)). Moreover, the differences in length of stay have been shown to be greater between hospitals than within (Westert et al. [1993](#)). Length of stay is also related to availability and use of different resources. In the UK COPD example, length of stay was lower where there was greater availability of specialists in the hospital and local care management plans for COPD (Price et al. [2006](#)). In some cases, differences in care appear to be related to differential adoption (or perhaps speed of adoption) of care quality recommendations (Shah et al. [2009](#); Stevenson et al. [2010](#); Stukel et al. [2010](#)). A related area is the study of adverse events in hospital care, which have been shown both to be relatively high in prevalence (Baker et al. [2004](#)) and variant across hospitals (Van den Heede et al. [2006](#)).

The same features of quality of care, preferences of providers, and availability of resources (human and otherwise) that influence likelihood of admission also affect variations in care once patients are in an acute care setting. A similar influence of local patterns of practice is also apparent, which is not to suggest that there are not differences in choice of care across physicians in the same practice setting but that often the differences are far greater between settings than within.

After Hospitalization

Ultimately, outcomes for patients ought to be the yardstick by which success in health care is judged. While few might argue with that statement, the devil is in the details of what outcomes matter, how they can be measured, and with what fidelity those outcomes can be attributed to anything that happens in the health care system.

When the outcomes are more proximal to the hospitalization, attribution is somewhat easier. A study in Ohio found more than sixfold variations in mortality at ten trauma centers, despite similarity in the structure of those centers and in the mix of patients they cared for (Cudnik et al. [2010](#)). Studies of Hospitalized Standardized Mortality Rates have found variations across hospitals. In one study from the Netherlands, the twofold variation in adjusted mortality rates across hospitals was related both to hospital type (higher mortality with teaching hospitals) and local (community) supply of general practitioners (lower supply was associated with higher mortality) (Heijink et al. [2008](#)). Supply of GPs in the community was also found to be inversely related to hospital standardized mortality rates in the UK (Jarman et al. [1999](#)). This makes it difficult to see whether the hospital-based mortality is a function of what happens in the hospital or is instead a function of what happens in the community and thus who is admitted to acute care and in what condition they arrive.

There is some research that speaks to the former. A recent study from the USA suggested that postsurgical complication rates are actually quite similar across high- and low-mortality-rate hospitals. What differs is the mortality for people with serious complications, in other words, the ability of the hospital to respond effectively when something goes awry (Ghaferi et al. [2009](#)). This in turn appears to be related to adherence to quality standards, with better adherence associated with a lower rate of failure to rescue (Brooke et al. [2012](#)).

One critical thing the literature on variations suggests is that costs are not a useful surrogate for quality of care and thus for outcomes. One study in New York State found a threefold variation in the cost of CABG surgery across hospitals that was in no way related to differences in inhospital mortality (Cowper et al. [2002](#)). A comparison of end-of-life care between Los Angeles and San Diego found costs of care to be higher in LA but quality to be higher in San Diego (with LA having a 35 % higher supply of acute care beds) (Kaplan [2011](#)). Classic studies of the relationship between cost and outcomes show that high-cost areas are not associated with any improved outcome, whether measured as hard outcomes like mortality or self-reported outcomes such as patient satisfaction or physician satisfaction (Fisher et al. [2003a, b](#); Fowler et al. [2008](#)).

Even here, however, conclusions from research are not always consistent. A study from Ontario focused on patients with a few select conditions found that higher-spending hospitals had lower mortality, lower readmissions, and lower cardiac event rates (Stukel et al. [2012](#)). Higher spending was associated with more nurse staffing in the hospital and more postoperative collaborative care, among other things. The relationship between spending and outcomes, then, is likely modified by the larger health system context within which acute care hospitals operate and may not be generalizable across disparate systems.

Longer-term outcomes are also of interest, including both mortality and ongoing morbidity. Hospital characteristics and the care received in hospital may have some influence on these longer-term outcomes, but the direct relationship is often difficult to measure. Measures of process of care in hospital are often put forward as surrogates of the longer-term outcomes, but the empirical evidence suggests that processes, while important, may not help explain differences across hospitals in outcome measures such as short-term mortality rates (Bradley et al. [2006](#)). In all likelihood there will be multiple influences (Alter et al. [2001](#)), and not all of these will necessarily pull in the same direction.

Discussion and Conclusion

It should be abundantly clear at this point that there is no simple way either to summarize or characterize variations in acute inpatient hospital care, except to say that they exist and are in some cases quite extensive.

This survey of the nature, extent, and origins of variation in hospital use cannot explain every nuance and mechanism underlying a very complex phenomenon in one large sector of the health care system. However, understanding has advanced enormously in the past 30 years, and as seen in this chapter, the research has moved beyond the merely descriptive to attempts to generate actionable findings. Notwithstanding the incompleteness of the picture, some elements appear to be well supported by high-quality evidence.

First, variation is a multilevel phenomenon, involving micro-level (individual patient characteristics and preferences; physician practice characteristics), meso-level (program and institutional policies and cultures), and macro-level (high-level policies, community characteristics, economic circumstances) phenomena. It is therefore context dependent, and most variables will, or could be, both dependent and independent. There is very little possibility that any comprehensive problem statement or one-size-fits-all solution can or will be found to address variations in acute hospital inpatient care.

Second, the mere fact of variation in itself means little. Some variation is justified by real differences in population need; other variation is inexplicable. There is no consensus on the signal-to-noise ratio in relatively low rates of variation – say, ratios of 1.5:1 or even 2:1. But there are innumerable studies, practice atlases, and other reports that reveal threefold and higher variations in rates of interventions even after careful adjustment. The highest and lowest observed rate in these circumstances cannot both be appropriate by any reasonable standard. There is almost no literature that declares what rate will deliver the best combination of fairness, effectiveness, and efficiency. A more promising avenue may be studies that consider best practices or care guidelines and variations as they relate to deviations from those. But guidelines will not exist for every type of service, and they are fraught with their own issues, both in production (where scientific evidence may not be represented accurately) (Grilli et al. [2000](#); Shaneyfelt et al. [1999](#)) and in their useful shelf life (in a system where both science and technology are always advancing).

Third, of all the factors that predict both utilization and variation, supply in its various facets is the most important. In one sense this is a tautology: you cannot put a patient in a bed that does not exist, and more surgeons can perform more operations than fewer surgeons, all else equal. But the issues rapidly become nontautological when one ponders how supply came to vary in the first place. Do highly interventionist practice cultures generate a need for more personnel, beds, and equipment – i.e., do they uncover or produce more need – or does the existence of more supply encourage a more interventionist practice culture? As in much of health care, causation takes place in both directions, although the literature suggests that on the supply side, practitioners tend to adapt to rather than create meso-level practice cultures.

Fourth, variation will tend to persist where there is relatively scarce information on its consequences. Ultimately health care decisions are individualized – practitioners and patients (mainly the former) determine what is needed and what should be done to address it. Simply reporting that variation exists might generate some curiosity but will do little to persuade practitioners to change their practices. They practice the way they do because they think it is the best way to practice and believe it delivers the best results for their patients. The natural tendency of a complex, multistep process that takes place in very diverse geographic settings is to produce variation. The eventual remedy is greater standardization of work – the hallmark of quality improvement and the foundation of improved performance (Montgomery [2009](#); Spear and Bowen [1999](#)). Standardizing work, however, tends to cause allergic reactions among many clinicians who view autonomy, instead, as the hallmark of a professional. Variation looms large in cultures that prize individualism and self-management;

standardization demands a culture of mutual accountability and collective problem-solving. Variation is therefore partly a cultural phenomenon, and addressing it requires a cultural transformation. That is why it is so prevalent, and so difficult to reduce. To reduce it requires behavior change, and for most people behavior change requires compelling evidence that what they are doing is bad for patients or, for the more stewardship conscious, makes no difference to the patient but costs the system a lot of resources. Similarly, if we want to involve patients in genuine and effective shared decision-making, they will need valid information on how similar patients fare on outcomes of interest to them.

Fifth, most variation studies understate the degree of true variation because they tend to aggregate at a fairly high level. Provincial or state-level variations in utilization will smooth out much larger variations at the regional and local level. There may be major practice differences within a single hospital department or unit or specialty group. It is difficult for practitioners to see themselves in highly aggregated data. Just as variation is a multilevel phenomenon, so too is meaningful and actionable information. The higher-level data can signal potential problems but can also mask real problems because very high and very low utilization rates will cancel each other out. There is increasing interest in health services research in multilevel studies, which take into account and quantify variations both within and across levels of aggregation. This is a fruitful area for future research as some of the most intriguing empirical findings provide these sorts of intra- versus intercontrasts.

Finally, variation data should generate curiosity, not premature judgment. Once clinicians and organizations take seriously the question of why their practices vary from others', the road to improvement has already been mapped. In some high-performing organizations one does not have the option to make light of or ignore the question. Identifying and discussing it are organizational requirements, and clinicians are expected to participate in efforts to understand variation and ultimately develop protocols to reduce it.

A grand unified theory of variation, including variation in acute inpatient care, would not only identify all of its causes but would also describe precisely how they operate, their relative contributions to total observed variation, how they interact, and all relevant consequences. It would put patients rather than places of care at the center of the investigation, understanding that variation in one part of the system may either cause or result from variations in another part of that same system. It would acknowledge that "standardization" first and foremost is about maximizing outcomes for patients, acknowledging that absolute consistency is neither possible nor likely desired in a system that serves patients in, for example, urban and rural areas where "supply" will never be equivalent. We are a long way from this level of understanding. What can be said with certainty is that variation in acute care utilization is widespread and that a significant proportion of it cannot be explained by differences in need or outcomes. That alone should be sufficient to motivate continued research that aims not simply to describe the problem but also to understand its causes and the consequences for patients and the health care system.

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