

# Systematic Overuse of Healthcare Services: A Conceptual Model

Najlla Nassery · Jodi B. Segal · Eva Chang ·  
John F. P. Bridges

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**Abstract** A perfect storm of factors influences the overuse of healthcare services in the USA. Considerable attention has been placed on geographic variation in utilization; however, empiric data has shown that geographic variation in utilization is not associated with overuse. While there has been renewed interest in overuse in recent years, much of the focus has been on the overuse of individual procedures. In this paper we argue that overuse should be thought of as a widespread and pervasive phenomenon that we coin as *systematic overuse*. While not directly observable (i.e., a latent phenomenon), we suggest that systematic overuse could be identified by tracking a portfolio of overused procedures. Such a portfolio would reflect systematic overuse if it is associated with higher healthcare costs and no health benefit (including worse health outcomes) across a healthcare system. In this report we define and conceptualize systematic overuse and illustrate how it can be identified and validated via a simple empirical example using several Choosing Wisely indicators. The concept of systematic overuse requires further development and empirical verification, and this paper provides an important first step, a conceptual framework, to that end.

N. Nassery (✉) · J. B. Segal  
Division of General Internal Medicine, Johns Hopkins  
University School of Medicine, 5200 Eastern Ave, MFL  
Building Center Tower, Suite 2300, Baltimore, MD 21224, USA  
e-mail: nnasser3@jhmi.edu

J. B. Segal · E. Chang · J. F. P. Bridges  
Department of Health Policy and Management, Johns Hopkins  
Bloomberg School of Public Health, Baltimore, MD, USA

J. F. P. Bridges  
National Bureau of Economic Research (NBER), Cambridge,  
MA, USA

## Key Points for Decision Makers

The overuse of healthcare services is a cost and quality problem in the USA.

Current overuse measures target very specific procedures, conditions, or clinical specialties.

To better address the high cost and lagging quality of the US healthcare system, attention must be shifted away from this piecemeal approach and towards one that accepts the existence of systematic overuse.

If systematic overuse is defined as a broad and pervasive phenomenon, then it could be identified by tracking a portfolio of overused services.

To be consistent with systematic overuse, such a portfolio should be associated with high costs and no health benefit (including worse health outcomes) across a healthcare system.

Systematic overuse is a rare target for US healthcare policy, with far-reaching effects that may bend the cost curve and simultaneously improve quality.

## 1 Introduction

Healthcare expenditures remain disproportionately high in the USA [1, 2], yet health outcomes lag behind other developed nations [3–5]. This disparity between costs and outcomes has led many to assume that healthcare services are overused [6–12]. Overuse is impacted by a perfect storm of factors in the USA [13] and can cause financial,

physical, and psychological harm to patients [8, 14–17]. Given its system-wide consequences [18], reduction in overuse could contribute to the ‘triple aim’ of the healthcare system (i.e., reducing expenditures, and improving the health of the population and the care experience) [19–21].

While many efforts have targeted and promoted the appropriate use of healthcare services [22], these efforts have historically focused on reducing underuse rather than overuse [23–25]. The few efforts that have targeted overuse reduction have been clouded in controversy [25–27], and only a small number of overuse indicators are routinely monitored today [28]. Several recent initiatives have focused on identifying new and diverse indicators for overuse [8, 11, 29, 30], but these approaches target very specific procedures, conditions, or clinical specialties.

The purpose of this brief report is to refocus attention away from piecemeal approaches to measuring overuse, and towards the study of systematic overuse that we define as a broad and pervasive phenomenon identified by tracking a portfolio of overused services. Furthermore, we illustrate how systematic overuse could be measured by constructing a simple portfolio of Choosing Wisely indicators, and demonstrate that the portfolio, consistent with our conceptualization of systematic overuse, is associated with higher costs and no health benefit (i.e., worse health outcomes).

## 2 Defining Overuse

A seventeenth century physician, John Cotta, first used the word overuse to describe the “ignorant and rash” use of healthcare services of his time [31]. More recently, overuse has been defined as resource utilization in the “absence of evidence” for benefit [32]. It is more specifically described by the Agency for Healthcare Research and Quality (AHRQ) as the provision of care “in circumstances where the potential for harm exceeds the potential for benefit” [33]. Overuse research parallels work on the wasteful [34, 35], inappropriate [36, 37], and inefficient [38, 39] use of healthcare resources.

Overuse is a phenomenon distinct from geographic variation in utilization (studies of geographic variation focus on areas of high resource utilization), and this difference has been empirically demonstrated [40–45]. Despite these data, work on geographic variation in utilization is often confused for overuse research [27, 46]. Utilization describes the volume of services provided, but it does not address the appropriateness of the care. Areas of relatively high resource utilization can be inappropriately using resources, or they can be appropriately using resources if, for example, their patient populations are

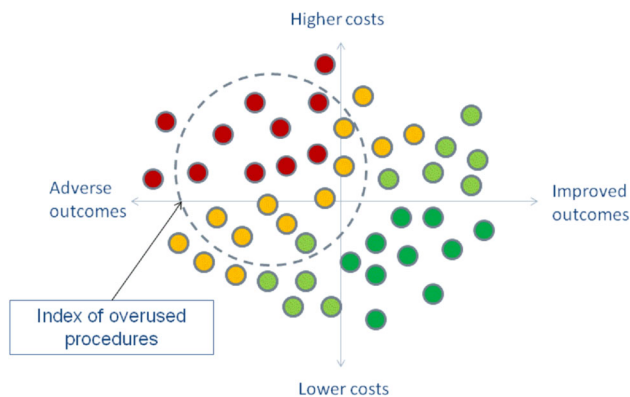
relatively sicker. In contrast, overutilization specifically focuses on the inappropriate commission of services.

There are multiple challenges to studying overutilization. Investigating overuse requires identifying patients for whom a procedure is inappropriate, and this requires an assessment of a subjective tradeoff between benefits and harms. This subjectivity, coupled with uncertainty, implies that individual measures of overuse will be subject to noise. To reduce noise researchers generally study overuse in narrowly defined populations and in very specific clinical scenarios. Such a perspective creates additional challenges; one needs documentation of patients’ exact diagnoses, prognoses, and other relevant factors such as personal preferences which are not readily available. Other environmental or organizational factors may also make the identification of even a single case of overuse an expensive and arduous exercise.

## 3 Defining and Conceptualizing Systematic Overuse

We theorize that systematic overuse is a pervasive phenomenon, impacting a range of services, which is associated with higher healthcare costs and no health benefit (including poor health outcomes). We believe that systematic overuse impacts a range of procedures, either in specific clinical areas and/or settings, or across the entire system. Similar to the conceptualizations of patient safety and hospital quality, systematic overuse is a latent (unobserved) phenomenon that can only be identified indirectly by its impact/consequences across a health system. We hypothesize that it can be indirectly measured by observing the usage of a portfolio of procedures. Such ‘bellwether’ procedures may be relatively insignificant (i.e., individually they may not be costly or harmful), but they can be seen as markers of a more serious and widespread problem. By combining multiple procedures, the measure becomes more generalizable and less subject to measurement error. Similar to a stock market portfolio, grouping multiple indicators of overuse, each of which is measured with error, decreases the overall volatility of the measure. Developing a portfolio of procedures has been aided by the recent growth of literature on overused procedures; albeit with varying definitions of what constitutes overuse [7–12, 47].

Similar to notions inherent in cost-effectiveness analysis, determining whether an intervention constitutes overuse requires a consideration of the impact it has on costs and outcomes. As seen in Fig. 1, we can graph this impact on a standard four-quadrant diagram. Some interventions, such as those in the southeast quadrant, are clearly beneficial since they are associated with lower costs and improved outcomes. Interventions that lie in the



**Fig. 1** A conceptual model of systematic overuse. The figure demonstrates how an index of overused procedures can be created to represent systematic overuse. If we consider all possible procedures, we would have those that are desirable (southeast quadrant), some that are not desirable (northwest quadrant) and those that would depend on a specification of an acceptable tradeoff between costs and outcomes (northeast and southwest quadrants). An index of procedures may contain a combination of interventions that may or may not be desired. If the index in aggregate is associated with higher cost and no health benefit (including adverse outcomes), then it would be consistent with the conceptualization of systematic overuse

northeast and southwest quadrants require the specification of an acceptable trade-off between costs and outcomes. As such, these interventions may or may not be considered beneficial. Those interventions in the northwest quadrant are clearly undesirable (i.e., for the average patient) as they are associated with high costs and adverse outcomes. Conceivably, these interventions may be cost saving or beneficial in a minority of cases.

If a portfolio reflects systematic overuse, then two consequences should be detectable—the systematic component should be associated with higher expenditures and no health benefit (including poorer health outcomes). The individual procedures may be associated with net cost saving, but to be defined as systematic overuse, the portfolio of procedures should result in a net cost to the health system (i.e., the direct costs of the procedures should not be offset by cost savings elsewhere in the system). Likewise, the systematic overuse of services should not be associated with health benefit (e.g., improvement in health status, decrease in adverse events, increase in life expectancy). If a portfolio of procedures is associated with higher costs and better outcomes, such services could at least be effective and potentially cost effective. On the other hand, if the portfolio of potentially overused procedures is not associated with aggregate good outcomes (i.e., no health benefit) or positively associated with aggregate poor outcomes (i.e., harms), then one cannot call these services effective, let alone cost effective.

While not a formal requirement for identifying systematic overuse, it would be more convincing to

demonstrate associations with structural characteristics. Here, we could hypothesize that the supply of services, the degree of competition (both in terms of markets for provision and insurance), the penetration of managed care, and other market characteristics may be associated with systematic overuse. Likewise, the validity of the measure would be demonstrated if it could be shown to respond to policy interventions targeted at reducing overuse broadly across healthcare systems, such as the implementation of accountable care organizations.

#### 4 Empirical Example

To illustrate the measurement of systematic overuse, we created a simple portfolio of procedures identified by the Choosing Wisely Campaign [48]. Using data described elsewhere [49], we explored the properties of these procedures using Medicare claims, considering variation at the level of hospital referral region (HRR). Consistent with our definition of systematic overuse, we aimed to demonstrate that (1) a systematic relationship existed across the procedures; (2) overall, the procedures were associated with higher total costs; and (3) overall, they were not associated with health benefit. We used 30-day inpatient mortality as a (simple) global measure for no health benefit/poor health outcomes.

Paralleling methods used in measuring healthcare quality [50, 51], we identified the systematic component within six Choosing Wisely procedures using a multilevel model. Assuming  $P_{ijk}$  is a binary variable indicating if patient  $i$  was subject to the overuse of procedure  $k$  in the health system  $j$ , the model was run as:

$$P_{ijk} = \beta X_i + \gamma_j + \delta_k + \varepsilon_{ijk} \tag{1}$$

where  $X_i$  was a vector of patient level characteristics (age, race, gender, and case mix),  $\gamma_j$  was a set of fixed effects for the six procedures,  $\delta_k$  was a set of fixed effects accounting for the system differences across the 306 HRRs, and  $\varepsilon_{ijk}$  was the error term.

This model (excluding the procedural fixed effects) was run in a subset of the data relevant to each of the six procedures (i.e., in patients that could have been subjected to that overused procedure), and then these data were pooled to estimate the systematic effect in a way consistent with Eq. 1. From each model, the fixed effects for the systematic component were estimated and saved, resulting in seven indices across each HRR: six procedure-specific measures and one for the systematic component.

The results of this preliminary analysis were consistent with our hypothesis of systematic overuse. All six measures were positively correlated with the global measure ( $p < 0.01$ )—with Pearson’s correlation coefficient ( $\rho$ )

ranging from 0.2 to 0.8. As seen in Fig. 2, only some of the individual measures were associated with higher costs and poorer outcomes. Despite this, the overall index was quite significantly ( $p < 0.001$ ) correlated with higher total costs ( $\rho = 0.29$ ) and poorer outcomes ( $\rho = -0.27$ ). The overall level of correlation exceeded that of any one single procedure, demonstrating the potential importance of measuring systematic overuse with a portfolio of procedures.

## 5 How Can Measuring Systematic Overuse Have an Impact?

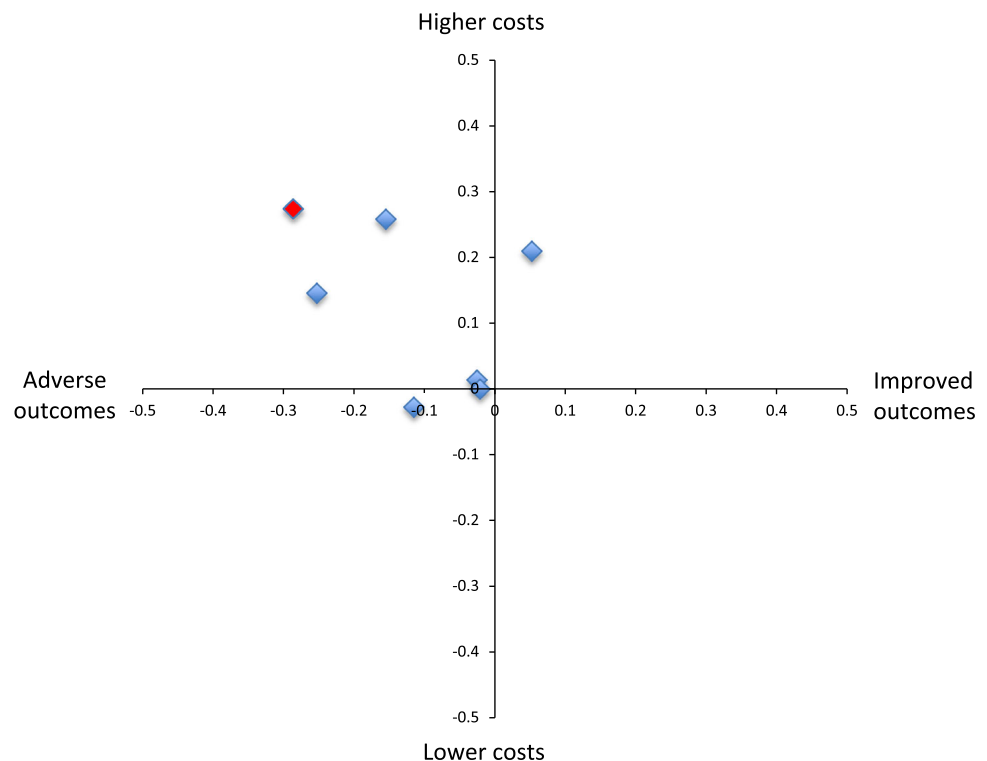
Although the term overuse has existed in a medical context for over 400 years, it remains an obscure concept. Moving the focus away from single episodes of overuse and reframing the phenomenon as systematic overuse may be useful for researchers, payers, and policy makers who want to implement, monitor, and evaluate the impact of comprehensive cost containment and quality improvement interventions. Measuring systematic overuse, rather than the overuse of individual procedures, would provide a more global perspective of serious structural problems inherent across entire health systems. Moreover, targeting systematic overuse, rather than expenditures or utilization at a health system level, would more specifically target inappropriate care. Focusing on just expenditures or utilization

could decrease appropriate care—decreasing costs at the expense of quality.

Measuring systematic overuse would improve transparency and accountability among health systems. While the proposed measurement of systematic overuse is an indirect approach (i.e., using a portfolio of procedures as a proxy for the underlying phenomenon), the technique is also advantageous. It incorporates a broad range of structural and system-wide determinants, and makes gaming the system more difficult for health systems (i.e., relative to the use of individual overuse quality metrics).

An indicator of systematic overuse would also allow for assessment of the patient, provider, and institutional factors that impact overuse [13]. Patient-level factors such as preferences [52, 53], health literacy [54], medical/psychological conditions [55, 56], and wealth [57, 58] are likely to have broad effects on overuse, as are differences in providers' skills [59, 60], financial interests [61], and other cultural factors [59, 62–65]. Measuring systematic overuse would also provide insight on the role of tort litigation and the practice of defensive medicine [66], and would elucidate industry's function in resource utilization [67]. Understanding this network of influence will be key in developing effective interventions to curb systematic overuse. Broad use of such a measure before the phenomenon is well understood may have unintended consequences.

**Fig. 2** This figure demonstrates the correlation between costs and health outcomes of six Choosing Wisely indicators (blue diamonds). Of these, only two are consistent with the notion of systematic overuse (i.e., associated with higher costs and no health benefit/poorer outcomes). When we construct an index of these six indicators and hold their individual specific characteristics constant, the resulting aggregate measure (red diamond) is strongly associated with higher costs and poorer outcomes (more so than any individual indicator). The numerical values on the  $x$ -axis and  $y$ -axis represent Pearson's correlation coefficient ( $\rho$ )



## 6 Conclusion

Identifying and measuring systematic overuse is challenging, but it may prove to be valuable. In contrast to approaches that have targeted specific procedures, conditions or clinical specialties, a global measure is more likely to inform health systems and policy makers of serious structural problems inherent across entire health systems. Moreover, policies aimed at curtailing systematic overuse could have the broadest benefits in terms of cost, quality, and outcomes. Further research on systematic overuse, its determinants, and its consequences is warranted. Systematic overuse is a rare target for US healthcare policies; reduction in overuse could bend the cost curve while concurrently improving quality.

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**Conflicts of interest** None.

**Author contributions** All authors contributed to the development of the conceptual model and theory for systematic overuse, and to the interpretation of our case study. JBS and JFPB developed the index for systematic overuse. JFPB and EC performed the statistical analysis. NN conducted the literature search for the background and discussion. NN and JFPB drafted and critically revised the manuscript. JBS reviewed and edited the manuscript. NN is the corresponding author. JFPB is the guarantor for the overall content.

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