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## Authors
Azar, Kristen
Greene, Sarah
Pletcher, Mark
et al.

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COMMENTARY

Learning Health Systems

# Learning health system, positive deviance analysis, and electronic health records: Synergy for a learning health system

Kristen M.J. Azar[1,2] | Mark J. Pletcher[2] | Sarah M. Greene[3] | Alice R. Pressman[2,4]

[1]Sutter Health, Sutter Health Institute for Advancing Health Equity, Sacramento, California, USA

[2]University of California -San Fransciso, School of Medicine, Department of Epidemiology and Biostatistics, San Francisco, California, USA

[3]National Academy of Medicine, The National Academy of Sciences Building, Washington, DC, USA

[4]Sutter Health, Sutter Health Center for Health Systems Research, Walnut Creek, California, USA

**Correspondence**
Kristen M.J. Azar, Sutter Health, Sutter Health Institute for Advancing Health Equity, 795 El Camino Real, Palo Alto, CA 94301, USA.
Email: azark@sutterhealth.org

## Abstract

**Introduction:** Over the past decade, numerous efforts have encouraged the realization of the learning health system (LHS) in the United States. Despite these efforts, and promising aims of the LHS, the full potential and value of research conducted within LHSs have yet to be realized. New technology coupled with a catalyzing global pandemic have spurred momentum. In addition, the LHS has lacked a consistent framework within which "best evidence" can be identified. Positive deviance analysis, itself reinvigorated by recent advances in health information technology (IT) and ubiquitous adoption of electronic health records (EHRs), may finally provide a framework through which LHSs can be operationalized and optimized.

**Methods:** We describe the synergy between positive deviance and the LHS and how they may be integrated to achieve a continuous cycle of health system improvement.

**Results:** As we describe below, the positive deviance approach focuses on learning from high-performing teams and organizations.

**Conclusion:** Such learning can be enabled by EHRs and health IT, providing a lens into how digital clinical interventions are successfully developed and deployed.

**KEYWORDS**
comparative effectiveness, learning health system, positive deviance, quality improvement

## 1 | LEARNING HEALTH SYSTEM IN THE TIME OF COVID-19

The COVID-19 pandemic has elucidated many shortcomings of the US healthcare system[1] and magnified inequities that have persisted within the United States for decades. Underserved and marginalized groups continue to bear a disproportionate burden of ambulatory sensitive, chronic conditions that not only increases the risk for adverse outcomes in COVID-19 (ie, hypertension, diabetes, obesity, etc.) but also continues to widen the equity gap in morbidity, quality of life, and life expectancy. Momentum is shifting healthcare and health systems toward data-driven, value-based models of care delivery to move beyond identifying inequities, and onto closing equity gaps.[2,3] As federal payers, quality measurement associations and others shift[4-7] their focus to accountability for health equity, the result is a rallying cry for health systems to produce demonstrable progress in improving care for populations currently have suboptimal and inequitable outcomes.

The National Academy of Medicine (NAM; formerly Institute of Medicine) and others[8] first conceptualized the learning health system (LHS) in 2007 as a conduit to value-based care through evidence generation and implementation of novel healthcare delivery models.[9] In 2006, the NAM offered the first working definition of an LHS as "a system in which science, informatics, incentives, and culture are aligned for continuous improvement, innovation, and equity—with best practices and discovery seamlessly embedded in the delivery process, individuals and families as active participants in all elements, and new knowledge generated as an integral by-product of the delivery experience." The LHS has further been described as a bidirectional relationship between health systems and researchers that aims to produce benefits so "evidence informs practice and practice informs evidence."[10,11] Over the past decade numerous efforts unfolded to encourage the realization of the LHS, including the establishment of an open-access journal in 2017 dedicated to the subject[9] and hundreds of millions of dollars in funding awarded by the Agency for Healthcare Research and Quality, the Patient-Centered Outcomes Research Institute and National Institutes of Health including training grants.[12-15] Despite these efforts, and the promising aims of LHS, the impact and value of research conducted within LHSs are uneven.[16-18]

Ideally, the fully realized LHS can facilitate a continuous learning cycle of data generation and infrastructure (ie, data collected via electronic health record (EHR), patient registries, or other sources), interpretation of data to set care-improvement targets using robust analytics, planning and coordinating data-driven solutions, and implementing an informed and systematic response.[1] While the United States has yet to realize the LHS at scale,[18] recent advances in technology coupled with a catalyzing global pandemic have spurred momentum.[1,19] Additionally, LHSs have lacked a consistent framework within which "best evidence" can be identified.

Such learning can be enabled by EHRs and health information technology (IT), providing a lens into how digital clinical interventions are successfully developed and deployed. We describe the synergy between positive deviance, an approach that focuses on learning from high-performing teams and organizations, and the LHS and how they may be integrated to achieve a continual cycle of health system improvement.

## 2 | THE EHR ADVANCES HEALTH IT AND INNOVATIVE CLINICAL INTERVENTIONS

With the rise of cloud computing accompanied by federal investment in EHRs and the concurrent implementation of the Fast Health Interoperability Resources (FHIR) standards, technology has finally evolved to allow for the theoretical LHS to become a tangible reality.[19] This harkens back to the first paper to articulate and coin the term LHS,[8] which called for consideration of such a system to coincide with the adoption of EHRs in clinical settings aimed at integrating clinical, financial, and administrative data.

Technology can be both a means of rapid and robust data collection but also solution development. The American Reinvestment and Recovery Act of 2009, and specifically the Health Information Technology for Economic and Clinical Health (HITECH) Act,[20] incentivized EHR adoption through financial payments for meeting specific "meaningful use" metrics and penalties for not meeting these metrics. This enabled and required the routine and regular collection of electronic health outcomes and utilization data necessary for longitudinal assessment, identification of high performers, risk adjustment, and long-term monitoring and reassessment. These advancements in health IT and data science are foundational to the LHS.

In addition to a vehicle for advancing health IT, the EHR has become a vehicle for the development and implementation of clinical interventions in its own right. While this potential was evident in years prior, the COVID-19 pandemic has forced the acceleration of remote care models and telehealth adoption throughout the healthcare industry, achieving in months what otherwise may have taken decades to realize in terms of digital healthcare.[21] These expanded capabilities throughout the healthcare sector provide yet another compelling source of innovation and advancement in clinical care where clinics have an opportunity to learn from early adopters and innovators. EHR-embedded interventions include practice alerts, decision support tools, flowsheets, integrated apps, remote devices, electronic nudges,[22] tailored electronic dashboards, and many other digital practice enhancement tools in an evolving field.[23]

Taken together, advancements in health IT and telehealth have resulted in an unprecedented opportunity to leverage emerging technological innovations to rapidly and continuously identify, test, and scale best practices *across* clinical settings. These advances, along with the availability of routinely collected EHR data that can be shared within and between large health systems may provide the means needed to apply a positive deviance approach[24] to accelerate the realization of an LHS. Thus, we can revisit positive deviance analysis in a new light as a means of facilitating ongoing health system improvement, truly operationalizing the LHS.

## 3 | POSITIVE DEVIANCE IN THE AGE OF THE EHR

Positively deviant groups or individuals within health systems are high performers who do things differently. The positive deviance approach was first articulated within international public health literature[25-27] during the 1990s, where it was applied toward a 74% reduction in severe childhood malnutrition over 3 years in Vietnam.[25,28,29] While quality improvement efforts tend to emphasize deficits and remediation of underperformance, a positive deviance approach focuses on the identification of high performers to analyze these performers and learn from their example.[25] Positive deviance approach can be an inward exercise where the wisdom to solve a problem is sought from within the organization, system, or network of units and is led by internal change agents.[29] It can also involve the sharing of that wisdom across similar institutions and settings, for an even broader impact.

Bradley (2009)[24] proposed a process for healthcare organizations to conduct positive deviance analyses (Figure 1, Stages 1–4).[24,25] Initial identification of positive deviants can be the result of either qualitative or quantitative analysis.[24,25,30] Once identified, qualitative and mixed methods can be used to characterize potentially replicable strategies used to achieve the results. These methods can then be empirically tested and, if feasible, disseminated. Practices and processes that result in high performance can be adapted for broader use, with subsequent evaluation to see if the practices can be applied successfully in another setting. Successful demonstrations can spur broader dissemination and implementation and can substantially expand impact. Positive deviance approaches can instigate change and quality improvement both within and across larger healthcare organizations that span wide geographies and serve diverse populations, and can be applied at the clinic, department, or system level. However, until recently, significant barriers existed to the sustainable integration of a positive deviance approach within health systems. For example, positive deviance requires the collection and analysis of large quantities of high quality, routinely collected longitudinal data. Without sufficient data on a large number of implementation units, it may be difficult to distinguish positive deviance from the variability due to patient mix, geography, or other non-modifiable factors.[24] While this approach is not new and, when applied, has yielded an impressive impact[24] much like LHSs, it has been somewhat limited in its adoption and widespread use. The maturation of the EHR, in its dual functionality as described above, has the potential to change this.

Along with facilitating routine data collection, the EHR itself has become a tool and vehicle for scaling and spreading clinical interventions. Technology-based processes and workflows that are already embedded within a given healthcare system may incorporate digital tools (eg, apps and remote monitoring devices) that are widely available and accessible throughout the organization and even across institutions, offering enormous potential for widescale dissemination and spread of effective solutions both within and across similar institutions. Distinguishing high performance (ie, positive deviance) can also be achieved without technology. Further, not all positive deviance is the result of a strategy that is easily implemented or scaled in different settings. Interventions that require specialized personnel, intensive resources, or unique features of a specific setting may not be feasible in conventional or resource-limited settings. For example, excellent outcomes may be the result of a high-touch care model or new, cutting-edge equipment. While these types of resource-intensive interventions will produce optimal outcomes, they may not be easily replicated or scaled in other clinics or settings, and thus are not well-suited for the concepts presented here. However, EHR-based interventions (eg, remote monitoring devices, nudges, dashboards, etc.) have the potential for scalability and rapid spread which can drive performance forward at a large scale, allowing for rapid iteration and refinement. Despite local idiosyncrasies, EHR installations may finally be mature enough to allow for the types of agile "tweaks" and manipulations we expect to identify as positive deviants with scalable interventions that can be tested and spread.

While a scalable positive deviant (SPD) may involve a low-tech intervention, such as a novel format for care team information exchange, there is enormous promise in health IT-related processes and interventions (eg, Smart on FHIR apps; decision support tools; and patient engagement tools) that can be rapidly deployed via EHRs and tested throughout a system. EHRs can be used to support intervention delivery or new clinical practices using a variety of decision support features that can be evaluated with thoughtfully designed pragmatic trials.[31] For example, custom EHR flowsheets or "smart phrases" that reduce ER wait times in one unit can be easily disseminated to other similar care settings within the same network, as well as networked clinical environments with shared IT/EHR infrastructures.

## 4 | POSITIVE DEVIANCE APPROACH TO THE LEARNING HEALTHCARE SYSTEM

Today, with the near ubiquity of the EHR and its dual utility described above, the positive deviance process introduced by Bradley (2009)[24] can be adapted to operationalize an LHS (Figure 1). Of note, LHSs have lacked a consistent framework with which "best evidence" can be identified. Core LHS elements can be combined with the positive deviance approach to achieve a dynamic feedback system of real-time

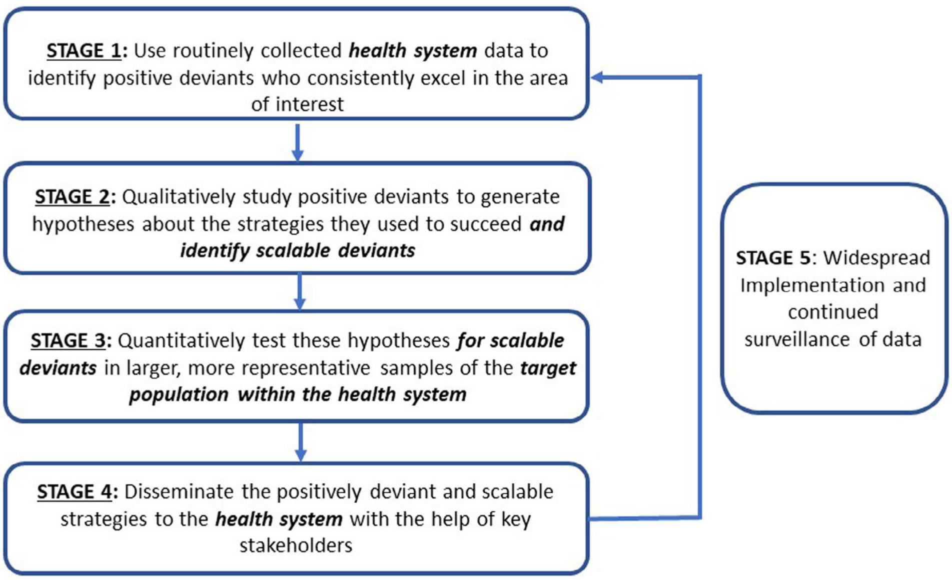


**FIGURE 1** Positive deviance process for learning healthcare organizations. (Adapted from Bradley et al 2009; Baxter 2016 BMJ)

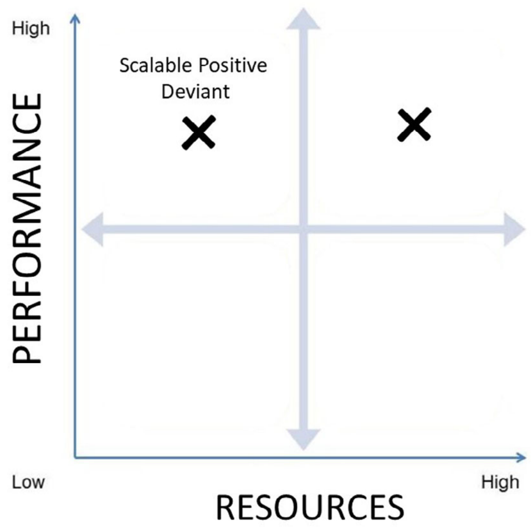


**FIGURE 2** Scalable deviant

data analysis, learning, and rapid translation to improve practice and outcomes in a tangible and sustainable manner. Health systems now have the tools needed to rapidly translate the knowledge generated by data analytics into action and impact. Further, with a focus on positive deviants identified with scalable interventions, this process enables a complete "ecosystem" approach for identifying, testing, and disseminating low-resource intensive but high-impact solutions (Figure 2). Our adaptation of the Bradley model includes the addition of a fifth step ensuring continued surveillance and learning—a "feedback loop" necessary for continual improvement to facilitate the learning aspects of the positive deviance approach (Figure 1, Stage 5). Modern healthcare systems are well-poised to leverage EHR data to identify positive deviants and evaluate those that are scalable. The idea is to identify processes that do not simply result in "the best" outcomes, but those that meet the target with the least resources used and are the easiest to translate. An SPD that leverages health IT provides a promising solution for rapid testing and implementation. In the context of an LHS, this is a crucial next step to making data actionable to successfully achieve change and impact. After an SPD is identified and replicated within the EHR, pragmatic clinical trials (PCTs) may allow for randomization at the clinic level and rapid testing in real-clinical practice (Figure 1, Stage 3). A PCT is "primarily designed to determine the effects of an intervention under the usual conditions in which it will be applied."[32] A major goal of pragmatic research is to evaluate and eventually promote changes in clinical practice that provide true benefit to patients, providers, administrators, and other stakeholders.[31] While recent PCTs like PROVEN[33] and STRIDE[34] have faced challenges with intervention fidelity and sufficient recruitment to detect changes, the testing of scalable EHR-based interventions at the clinic level may not be as vulnerable to these barriers. For example, a recent and successful health IT-based intervention designed to optimize waiting room time by helping patients self-identify top priorities for their visit may be scaled across other clinic settings where the same needs around wait times and provider communication are present but not addressed.[35]

A final and crucial stage in the process is health system translation and system-level adoption for SPDs has shown to be effective. It is critically important to have cooperation and sponsorship of system leadership—ideally those who oversee operations, health data, and analytics/IT. Optimally, the entire process should be embedded within an operational division of an institution, such as the quality improvement department. Further, articulation of the business case should be part of the process to ensure the adoption and long-term institutionalization of effective SPDs. In addition, although the process might not be considered "research," rigorous statistical methodology should be followed, and a determination (research vs QI) from the institutional review board should be obtained.

## 5 | POTENTIAL LIMITATIONS AND CHALLENGES

It is important to note that EHR data are primarily collected to facilitate clinical care and promote more accurate billing, and are not necessarily optimized for data analysis upon entry. However, there is a significant and ongoing effort designed to produce quality metrics using EHR data that are both meaningful and helpful for reflecting the quality of care. Examples of this include the Gravity Project[36] for social determinants of health data and the United States Core Data for Interoperability.[37] These initiatives collaborate directly and closely with large EHR vendors (eg, EPIC) to create a standardized set of health data classes and constituent data elements for nationwide, interoperable health information exchange. Interoperability affords new opportunities for standardizing data elements. In addition, validation studies may be helpful to ensure that data accurately and consistently represent the construct or variable in question. The issues of clinician variation in coding practices may be an important outcome that a positive deviance approach can help to investigate and improve. Further, this approach begins with quantitative analysis and then employs qualitative methods to assess factors influencing performance that may not be evident in discrete data. This mixed-method approach can help address concerns about the variability in coding between different providers and clinics.

When considering the translation of identified "best evidence," into practice, the methodology is evolving to allow for not only the rapid identification of translatable practices but novel mechanisms through which EHR-based interventions can be deployable across different sites. An example of this may be a highly effective practice alert or EHR-enabled workflow that can be feasibly adapted across similar, but different, practice settings. There may be gold standard evidence-based practices that are not adequately adopted, and that could be modeled based on real-world clinical practice, rendered in machine-readable format, and deployed, with the embedded ability to monitor outcomes across settings. Future work is needed to test these methods and assess the feasibility of our proposed approach.

## 6 | CONCLUSION

We propose that positive deviance analysis in combination with the growing technical maturity of EHR systems and associated decision support tools provides a combination that can usefully address many of the challenges of realizing the LHS. The proposed SPD approach to solving health issues is based on established validated methods, however, its application of it to the operationalization of a learning healthcare system is novel. We bring together two well-established paradigms, recognizing that the EHR allows us to realize a higher level of effectiveness for each, both independently and when used together. Advancements in EHRs have made it possible to implement positive deviance and LHS beyond what has previously been possible. The qualitative data capture activity depicted in Stage 2 of the model offers a means to learn from high-performers and extrapolate both motivational and mechanistic underpinnings of their high performance. Health systems can further leverage different types of intrinsic and extrinsic motivations such as competition (ie, being the best clinic); conformity (ie, belonging and fitting in with peers); and collectivism (ie, all in this together) to catalyze change and improve performance. The identification of SPD, combined with pragmatic evaluation, provides the means to improve outcomes in a large system. Despite the promise of LHS, the lack of progress underscores the urgent need for accessible methods. To this end, we propose the SPD approach be added to the methodology toolkits of healthcare systems to promote quality improvement, close equity gaps, and achieve optimal health outcomes for all.[38] More work is needed to evaluate the potential value of this approach and its feasibility in real-world healthcare settings.

### CONFLICT OF INTEREST

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