SHORT COMMUNICATION

Innovation in health care for proactive care delivery and strategic clinical decision-making: integrating research, technology and practice

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ABSTRACT

To achieve high-value care, health systems and organizations must reorient planning, research and care delivery towards a longer-term and proactive outlook. While the focus of health care innovation is often on technological innovation, the paper argues that in order to achieve more strategic decision-making, not only technological advances, but also innovation in processes and integration of research, practice and technology are needed. To support this, examples are provided of how an integrated payer-provider health care organization in Israel, Clalit Heath Services, is assimilating research, technology and clinical practice to more effectively direct allocation of health care services, improve disease prevention policies and strategically inform program implementation.

Keywords: STRATEGIC CLINICAL DECISION-MAKING, DATA-DRIVEN PRACTICE, ELECTRONIC HEALTH RECORDS

INTRODUCTION

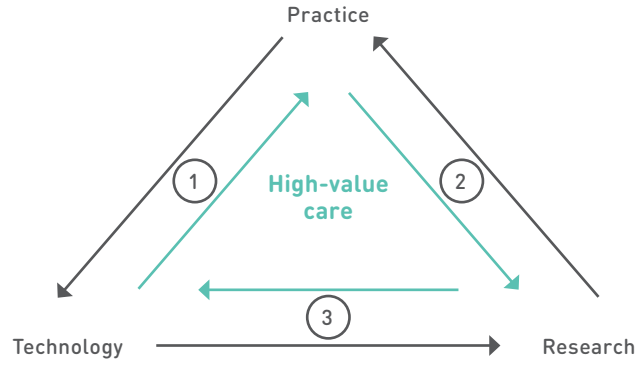
The pursuit of high-value care is shifting the orientation of health systems and care providers from an acute, reactive paradigm towards a proactive and preventive outlook to achieve greater quality and efficiency in care delivery *(1)*. Concurrently, a shortage of health care resources requires health organizations and health systems to do more with less *(2)*, by directing limited resources towards the most clinically-effective and cost-effective practices, treatments and interventions *(3)*. These pressures to improve health service delivery, intervention targeting, health monitoring and disease surveillance all necessitate coordination between population health strategies (research and planning) and clinical care delivery. Access to research tools and comprehensive data-driven knowledge are prerequisites for clinical managers and policy-makers to determine effectiveness and best practices, and to allow for strategic decision-making. Thus, innovation in terms of not only technology but also processes and structures is needed to bring relevant medical research closer to practice, so that clinical decision-making can be supported by accurate and timely health information *(4)*. Greater integration of research, practice and technology can help improve clinical practice workflows, assess intervention effectiveness, predict high-risk cases and validate epidemiological research among large, diverse populations. While advances in technology offer the promise of improved coordination, the full potential of such research-practice-technology integration is often far from being realized.

Clalit Health Services (Clalit) in Israel is an integrated payer and health service provider system. Clalit also has an embedded research institute and extensive data warehouse of more than 15 years of electronic health record (EHR) clinical and administrative data that exemplifies integration of research, technology and clinical practice. Clalit is the largest of four payer-provider health organizations in Israel, covering more than 4 million members, which represents 53% of Israel's population, and providing most of the health care services within its system. Additionally, the four health care organizations in Israel receive age-adjusted capitated funding from the state. Because of this financial structure, and given that members rarely switch funds (the switching rate is approximately 1% per year) *(5)*, there is strong economic

incentive for a long-term patient-centred view of health care provision, with an emphasis on prevention.

Clalit's integrated research institute and comprehensive database support practical decision-making and strategic organizational policy-making to meet current health service delivery challenges. The central role of health data management has been highlighted as one of the strengths of Israel's health care system contributing to its ability to plan, implement and measure reforms *(6)*. Clalit's data warehouse, with EHR data from 1998 onwards, collates patient-level clinical data from community clinics, specialty clinics, hospitals, prescriptions, laboratory and imaging results, demographic data, and real-time costs. This paper aims to demonstrate how the integrated capabilities of a multi-disciplinary research institute, a comprehensive EHR database, and analytical tools can support decision-making and improved care delivery at the organization level, institution level (clinic or hospital), and individual patient care level. We present several examples of how the coordination between research insights, technology and clinical practice provides a strategic feedback loop that can improve disease prevention strategies, resource allocation and monitoring of care quality to identify best practices and reduce disparities (Fig. 1).

FIG. 1. HIGH-VALUE CARE IS AT THE INTERSECTION OF INTEGRATED RESEARCH, TECHNOLOGY AND CLINICAL PRACTICE



1. The integration between Technology and Clinical Practice allows for unmet clinical needs to be supported by technology innovations and analytical platforms for greater efficiency, targeted care and improved clinical workflows.
2. The integration between Research and Clinical Practice allows for intervention effectiveness assessments and validation of epidemiological research in specific practice-relevant populations.
3. The integration between Research and Technology allows for high-risk population stratification, individualized risk prediction and the development of research tools relevant for clinical practice.

High-value care can therefore be achieved through resource allocation informed by data trends and effectiveness assessments, interventions targeted through research design, and care delivery tailored to patients' individual needs based on EHR data.

DISCUSSION

ORGANIZATION LEVEL: PREDICTION OF VACCINATION PREVENTION COVERAGE AND EFFECTIVENESS EVALUATION TO INFORM VACCINATION STRATEGY

The Clalit organizational policy for pneumococcal vaccination had previously been aligned with international recommendations to vaccinate all members aged 65 and older. In 2013, a newer conjugate vaccine was being considered for expanded use among adults in the local market and the decision had to be made whether to modify the organization's current pneumococcal vaccination policy and target population. In order to inform this decision, a Clalit population-specific predictive model for pneumococcal diseases was developed and options for vaccination strategies—including resource consideration assessments—were determined through insights from the model development research *(7)*. While details of the population-specific prediction model development and validation have previously been described, briefly, the model was developed for individuals aged 50 and older to predict cases of hospital-treated pneumonia, invasive pneumococcal disease (IPD) and community-treated pneumonia. Risk factors included in developing the predictive model were sociodemographic variables, morbidity burden and pneumococcal disease-related variables. Various vaccination strategies were compared using the Clalit predictive model and international guidelines based on criteria, including an age-based strategy targeting all individuals aged 65 and older as well as individuals who were high- and moderate-risk *(7)*. These potential vaccination strategies were considered along with the results of a real-world vaccine effectiveness evaluation conducted within Clalit's research institute, which found that the vaccine was protective against the most severe, invasive and costly forms of pneumococcal disease (OR 0.58; 95% confidence interval 0.41–0.81) *(8)*. Since the vaccine was shown to be effective against the most severe forms of disease within multiple substrata of its own population and the highest sensitivity (89%) for IPD was achieved based on the age-targeted vaccination strategy *(7)*, Clalit decided to maintain the age-targeted vaccination policy for older adults. Access to Clalit's extensive EHR data warehouse, a research arm dedicated to addressing clinically-relevant management questions and the infrastructure to provide these policy insights through established channels of communication to the organization's management, all enabled an insight-driven vaccination strategy.

INSTITUTION LEVEL: EHR-BASED QUALITY MEASURES FOR TARGETING, IMPLEMENTING AND MONITORING A DISPARITY REDUCTION INTERVENTION

In view of disparities in the health status and life expectancy of different geographic regions and variations in the prevalence of chronic diseases by minority status and education *(9)*, starting in 2007, Clalit undertook efforts to measure and narrow the gap in these health care inequities. Over 70 EHR-based primary care quality measures tracked through the central database from daily clinical input served as the basis for setting disparity reduction intervention targets. These quality measures are built into the EHR system and are part of the primary and secondary care patient record systems that physicians access daily. Seven of these EHR-based quality indicators were used to ascertain which clinics were encumbered with the greatest disparities in health and access, and would, therefore, be target clinics for the intervention. Low-performing clinics (55 out of 436 clinics) serving about 10% (390 000) of members of low socioeconomic status and minority populations were targeted *(10)*. The effectiveness of this organization-wide intervention was evaluated through Clalit's research institute by utilizing the EHR database to monitor and compare progress among clinics participating in the initiative; the results of this evaluation were reported back to the clinic and organization managers in charge of overseeing the program.

In an effort to reduce disparities, Clalit's EHR and administrative data were used in several ways to target and tailor the intervention implementation and evaluation at the institution level, with 454 interventions implemented across clinics *(11)*. The Clalit data warehouse supported clinic and organization managers in the evaluation of the intervention's effectiveness with its ability to: 1) identify quality indicators in which gaps between groups were determined by disparities in socioeconomic status, and 2) document, compare and monitor progress of clinic- and patient-level quality measures across all units of the organization. After three years of implementation, results demonstrated that the rate of improvement in quality measures was markedly stronger among target clinics participating in the intervention, with a 67% decrease (of the overall quality measure) in the gap between target and non-target clinics *(12)*. E-quality measures integrated into an EHR system and research-based assessments at various points throughout the development and implementation of the intervention supported clinical practice management to achieve progress towards levelling the discrepancies in health outcomes for disadvantaged populations.

INDIVIDUAL PATIENT CARE LEVEL: IDENTIFYING INDIVIDUALS AT HIGH RISK FOR PREDIABETES AND PATIENT PREVENTION MANAGEMENT ON MANY LEVELS OF THE ORGANIZATION

Given the availability of detailed historical patient clinical information and the overarching incentive to prevent new onset of major chronic illnesses such as diabetes, Clalit took steps towards designing and implementing a prospective targeted intervention. Clalit's research institute conducted an evaluation of trends in diabetes prevalence and incidence, with a particular focus on understanding the contribution of mortality and screening practices to these trends. This evaluation found that from 2004 to 2012, diabetes prevalence trends were decelerating despite declining mortality and increasing testing rates, and that previously-screened incident cases were declining *(13)*. The challenge was then to direct attention and resources towards preventing the onset of new diabetes by targeting prevention efforts towards those at high risk for diabetes. Instead of using a limited set of internationally defined criteria to identify high-risk individuals, Clalit, through its research institute, built and tested an internal prediabetes prediction score to identify patients for intervention by their primary care physicians. These risk predictions were converted to risk scores for individual patients and incorporated into the organization-wide EHR system for primary care clinics. Planning for a prediabetes intervention was undertaken by the community division of Clalit, which included updating organizational care recommendations with particular emphasis on referring preventive services related to diabetes. The EHR-integrated groups of high-risk patients are used at different levels of practice within Clalit in order to manage prevention outreach, as well as an ongoing evaluation of the intervention. Primary care clinic physicians see a high-risk flag in the EHR patient file for their patients who are at high risk for diabetes, and clinic managers see an aggregated view of all the patients at high risk in their respective clinics. This example demonstrates how population-specific research observations on disease burden and diabetes testing trends can help to inform intervention planning, and predictive analytics tools can be integrated through technology platforms to flag individual high-risk patients to be recommended preventive care by practicing physicians.

CONCLUSIONS

Today, health care systems and organizations increasingly need to provide care and health services in the context of swelling medical expenses and shrinking budgets. In the face

of limited resources, prioritization and strategic planning are vital *(14)*. Clalit, as a provider and payer with a very low rate of membership attrition, has many incentives to invest in preventive and proactive care. These economic incentives coupled with the technological capacity of an extensive EHR database and analytical tools give the organization decision-making capabilities for practice and research.

While the potential to integrate data analytics technology into decision-making and clinical practice has been extensively endorsed, there are only a few examples of this theory being translated into practice, and they mostly exist in hospital or single-institution settings *(15–18)*. It has been highlighted that it is important not only to achieve accurate predictions and analytics but also to consider how these tools are integrated within clinical systems to support decision-making *(14)*.

The examples presented in this article illustrate how data-driven and data-supported process solutions can help in the coordination of research, technology and clinical care delivery. Resource allocation informed by data trends, organizational goals set and evaluated through research design, and care directed and tailored to patients' individual needs based on detailed EHR clinical data, allow for meaningful steps to be taken towards realizing high-value care on a continuous basis. Integrated and interoperable EHR infrastructure that includes clinical and health care utilization data and a research arm dedicated to deriving these insights, are essential to this end. This kind of infrastructure can be created in contexts other than integrated health systems, through data exchanges and collaborations between disparate organizations. To achieve this, however, it is not enough to simply computerize health data; health care providers, payer organizations and other health care institutions need to integrate health information systems, analytical tools and research insights into practice and decision-making processes. Traditional health care organizations will need to rise to the challenge of innovating by aiming for greater integration, coordination and strategic decision-making, in collaboration with the private sector and other non-health care industry players, to improve the delivery of care.

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