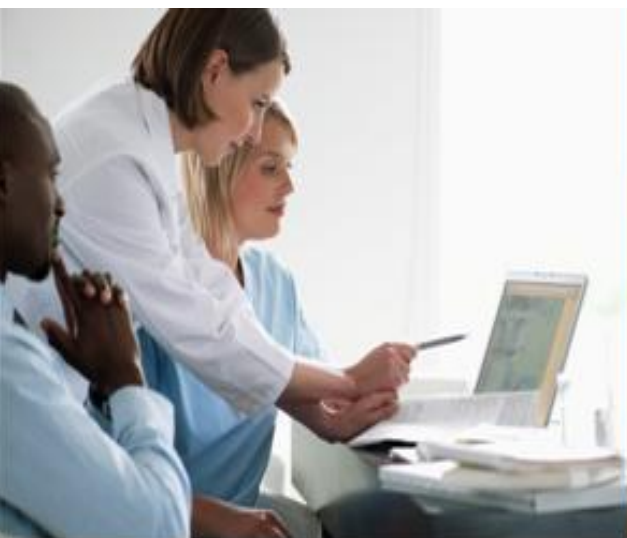


REALIZING THE PROMISE OF CDS

Strategies for overcoming real-world implementation challenges



White Paper

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EXECUTIVE SUMMARY

Clinical Decision Support (CDS) holds tremendous promise for improving care quality, reducing costs, and strengthening the provider/patient relationship. While CDS has grown continually over the last 30 years, historically, realizing the full potential of these solutions was incomplete, as several functional and technical barriers emerged. Overcoming these obstacles requires CDS systems to have a specific set of clinical and technological design criteria, as identified in this paper. Fortunately, there are already solutions in market that meet these requirements, and relative to other HCIT investments, CDS systems are easy to deploy.

BACKGROUND – CDS IS HOTTER THAN EVER

The term Clinical Decision Support is defined by Robert A. Greenes, MD, PhD as “the use of the computer to bring relevant knowledge to bear on the health care and well being of a patient.”¹ While not necessarily a new idea, today CDS is not only growing, it is exploding.

Since as early as 1960, care providers have been partnering with technologists to develop CDS solutions. Similar to other beneficial technologies, growth of CDS has been steady but not necessarily linear. After an initial infatuation in the 1960s and 1970s, interest in CDS slowed as several operational, clinical and technological challenges emerged. Starting with the late 1990s, however, improvements in computer technology and increased technology literacy of care providers coincided with a renewed focus on care quality. In particular, public as well as provider interest in quality was fuelled by the seminal IOM report *To Err is Human*, the Dartmouth Atlas of Health Care Project, and other analyses identifying known gaps in the healthcare system. In response to all these dynamics, providers began to deploy technology that digitized health information and structured clinical transactions, most notably electronic health records (EHRs) and Computerized Physician Order Entry systems (CPOEs). Not surprisingly, the interest in quality combined with the increased repository of digitized health information re-ignited CDS interest. (See Table 1.)

TABLE 1: Evolution of computerized Clinical Decision Support

Relationship phase	Approx. Duration	Characteristics
A long infatuation	1960-1985	<ul style="list-style-type: none"> • Enthusiasm for CDS • Research & initial innovation
A troubled courtship	1985-1998	<ul style="list-style-type: none"> • Successful implementations • First successes
Renewed passions	1998-2003	<ul style="list-style-type: none"> • Knowledge explosion • Safety & quality agendas
Building foundations for a lasting partnership	2003-present	<ul style="list-style-type: none"> • National call to actions • Growth of CDS enabling technology EHRs, CPOE, eRx, & PHRs
Regulatory & reimbursement reform	2008-present	<ul style="list-style-type: none"> • ARRA/HITECH acts • Healthcare reform • New payments models (e.g., ACO, P4P)

SOURCE: Adapted, with significant modification, from Greenes', "Clinical Decision Support: The Road Ahead" p. 5. The row "Regulatory & reimbursement reform" was added by the author, replacing one of Greenes' categories.

In the early years of the new millennium, there was significant growth in pay-for-performance (P4P) programs,ⁱⁱ along with its supporting compilation of standard “quality measures.” These were yet another accelerant of CDS. Then, in 2009, things really got interesting. The HITECH Act passed by President Obama authorized \$17B in incentives for providers to “meaningfully use” healthcare technology to improve care quality and efficiency. While the requirements to receive payment grow over time in three stages, even Stage 1 requires several CDS capabilities, including real-time targeted alerts, patient safety surveillance, patient reminders, evidence-based orders and public health reporting. Further, in 2010, the passage of the Patient Protection and Affordable Care Act (PPACA), established Medicare reimbursement for Accountable Care Organizations, whose very revenue model is dependent on improved quality scores. Not surprisingly, according to Frost & Sullivan, the CDS market is slated to almost triple from \$138M in 2009 to \$364M by 2016.ⁱⁱⁱ

THE COMPELLING PROMISE OF CDS FOR QUALITY IMPROVEMENT

There are a number of clinical arenas where CDS can help. According to a Medicare study, in 2008 13.5% of hospitalized beneficiaries experience an “adverse event,” with another 13.5% having a “temporary harm” event. Physician reviews of these events found that 44% of them were “clearly or likely preventable.”^{iv} In parallel, improved CDS may have actually reduced the number of admissions in totality. The actuarial and consulting firm Milliman found that 14% of hospitalizations can be avoided with better ambulatory care, so called “Ambulatory Care Sensitive Admissions (ACSAs).”^v

In the outpatient setting, compliance with preventative care guidelines is difficult. Another Milliman study identifies only 35%, 49%, and 61% of patients received the recommended screenings for colorectal, prostate, and breast cancer (mammogram), respectively.^{vi} For chronic disease management, where the care pathways are more complex, compliance rates can vary more. The national PPO average of the HEDIS® Comprehensive Diabetes measures ranged from 83% for HbA1c testing, to 46% for blood pressure control and 43% for retinal exam.^{vii} The Shared Decision Making Composite score, one that measures how engaged patients felt in the care process, was only 60% of optimal.^{viii}

The renewed and growing interest in CDS is spurred by the belief in its ability to address one or more of the aforementioned problem areas-- inpatient care, avoidable admissions, guideline compliance, preventative care, and error reduction. There is much data to support this belief. A 2005 meta-analysis of 28 controlled trials by Johnston et al. found “strong evidence suggest some [CDS] can improve physician performance.”^{ix} Since then, similar findings have appeared in the literature. On net, clinicians, hospital administrators, and public health officials look to CDS to help prevent avoidable errors, standardize care delivery, reduce deviations for the evidence-base, promote prevention, and improve the management of chronic illness.

HISTORICAL BARRIERS & THE CHANGING TIDE

Historically, CDS has met with some resistance both during and after the implementation process. As recently as January 2011, Romano et al. raised questions concerning EMR’s and CDS’s ability to improve care quality, finding limited correlation between self-described use of CDS and outcomes. In that paper, the authors

The Promise of CDS

- ✓ Reduced errors
- ✓ Greater adherence to guidelines
- ✓ Improve chronic care management
- ✓ Strong clinician/patient interaction

conceded the lack of correlation may be because “in the absence of governmental impetus and standards, current adoption patterns may have fostered incomplete implementation and use of less effective technologies.”^x In other words, an under-used and/or often ignored CDS system does not improve care. Romano’s results must be considered along with those published by Garg et al. in JAMA who wrote, “We identified 100 randomized and nonrandomized trials testing a wide variety of CDS..., of the 97 controlled trials assessing practitioner performance, the majority (64%) improved diagnosis, preventive care, disease management, drug dosing, and drug prescribing.”^{xi} Taken together, the implications seem clear. CDS, when used correctly, improve outcomes.

In the past, project management and technology groups have struggled with creating software that was easy-to-use, easily integrated with existing workflows/systems, and flexible enough to meet the needs of disparate users. Clinician acceptance challenges included reducing alert overload, creating sufficiently prescriptive alerts, and overall aligning the CDS with the broader organization strategy. Specifically, Sitting et al., in the 2008 Journal of Biomedical Informatics, identified, amongst others, the following challenges:^{xii}

- Improve the human-computer interface,
- Summarize patient-level information,
- Prioritize and filter recommendations to the user,
- Combine recommendations for patients with co-morbidities,
- Prioritize CDS content development & implementation,
- Mine large clinical databases to create new CDS.

Despite these well-known challenges, today attitudes toward CDS are improving. As early as 2005 The Commonwealth Fund found 25% of surveyed providers listed “more use of computer technology” as “very important” in improving quality-of-care.^{xiii} The 2005-2007 National Ambulatory Medicare Care Survey (NAMCS) found that EMR was used during 30% of outpatient visits, and 56% of those having at least some form of CDS.^{xiv} Part of the reason that these attitudes are maturing, adoption is growing, and the CDS market is expanding, is because so many provider organizations have found a path to success through the historical barriers.

STRATEGIES TO OVERCOME DEPLOYMENT OBSTACLES

Creating and maintaining CDS solutions that are easy to integrate into existing workflows, easy to use, and create prioritized, actionable alerts on patients leveraging all known data require two sets of innovations. Firstly, clinical challenges must be addressed. Secondly, a technology framework must be employed.

Meeting the clinical challenge – Actionable Advice

Meeting CDS’s clinical challenges means developing a system that creates *actionable advice*. The term refers to guidance that can actually positively impact the practice of medicine. Overall, creating actionable advice has seven clinical requirements:

1. **Useful to clinician and relevant to care delivery.** The guidance must be sufficiently broad so as to be applicable to a large portion of the patient population, yet specific enough to provide meaningful, non-trivial clinical alerts. Specifically it must include relevant preventative measures, lab

support, medication support (both drug/drug and drug/condition), chronic care guidelines, and all accepted quality measures (e.g., HEDIS, PQRI).

2. **Leverage all available data.** To accomplish the point above, the guidance must use medication, labs, diagnosis/condition information, allergies, pathology, genomics, risk assessment data, and even predictive models to trigger the various alerts.
3. **Prioritized and scored.** The alerts must be easily digestible by clinicians both pre- and intra-visit. Specifically, they must be scored and prioritized for sensitivity, specificity, and criticality to avoid “alert overload” and eliminate irrelevant noise.
4. **Sufficiently detailed, yet not overwhelming.** Alerts and guidance must be rendered in formats that support “drill down”-- allowing the treating provider to quickly scan the information and click-in, as appropriate. Included in the drill down information must be references, and information regarding conflicting recommendations if they exist, all to create confidence in the recommendation.
5. **Integrated with other workflows, notably order sets and patient education.** To be truly effective, CDS systems need not only generate alerts, but must use all available data to help streamline routine, yet data-intense elements of the care process. In particular, the alerts must be integrated with structured order sets that address the identified issue. To reinforce behavior change, so critical for guideline compliance, the CDS system must also help with patient education.
6. **Rigorously maintained based on most current literature.** As noted above, the guidance must be both broad and deep. Because the underlying medical evidence is constantly evolving, extensive infrastructure must be in place to keep the clinical content current. Given the dramatic increase in Comparative Effectiveness Research being federally funded in the HITECH Act, this maintenance will get ever more challenging.
7. **Ready out-of-box, yet customizable & extensible.** To quickly and cost effectively create clinician buy-in, CDS systems must be easily deployable, accessible both as stand-alone tools or within existing EMR/HCIT environments, and easy to adapt to existing workflows.

Establishing the proper technology framework

In addition to the clinical requirements, the underlying CDS technology framework must be easy to deploy, easy to maintain, flexible, and extensible. Specifically, CDS systems going forward will include the following five technical attributes:

1. **Web-service-oriented architectures.** Inherently, CDS solutions must operate in the context of several other clinical systems, including EMR, CPOE, e-Rx, and others. They must inherit data from these solutions and publish information back to them. Accordingly, they must be service-oriented, with transactions consumable by existing infrastructure in real-time on an as-needed basis.
2. **Standards-based designs.** To effectively communicate with existing clinical IT systems, the CDS must continually support an evolving set of standards including HL7v3, CCD, CCR, and clinical vocabularies like ICD9/10, CPT4, LOINC, SNOWMED, RxNORM, CVX, and others.
3. **Ability to expand in both content & functionality.** The past 30 years demonstrate clearly that CDS functionality is dynamic, as is the underlying clinical content. CDS systems going forward must separate workflow and business logic from clinical content to allow for future functionality growth. In parallel, best-practices around content management must be employed to avoid errors, ensure easy maintenance of the knowledge set, and allow for continual refinement of the clinical guidance.

4. **Intuitive user interfaces.** The user interface, be it as a stand alone application or consumed as back-end Web service by existing systems, must create easily synthesizable recommendations in the format and manner preferred by the individual clinician.
5. **Integrated analytics & reporting.** The value of CDS technology is not only improving the quality of the individual care encounter, but also developing comprehensive quality- and cost-improvement programs. To do so, analytics must be architected into the solution from the ground up. This means deploying CDS solutions with reports ready to satisfy the needs of today's stakeholders, as well as the infrastructure to support the yet unspecified needs of tomorrow's users.

It is not realistic for any one health system, save for perhaps the very largest, to develop such a solution in-house; however, when the investment is shared over multiple institutions either through a collaborative development effort or via a technology vendor, the costs become manageable, and the results achievable.

FROM PATIENT- TO POPULATION-MANAGEMENT

The ultimate goal of CDS going forward is two-fold. First and foremost, as previously noted, it is to cost-effectively enhance the management, and thus improve the outcome of each patient. Secondly, actionable CDS allows each health system to manage a patient population as well as the individuals within it.

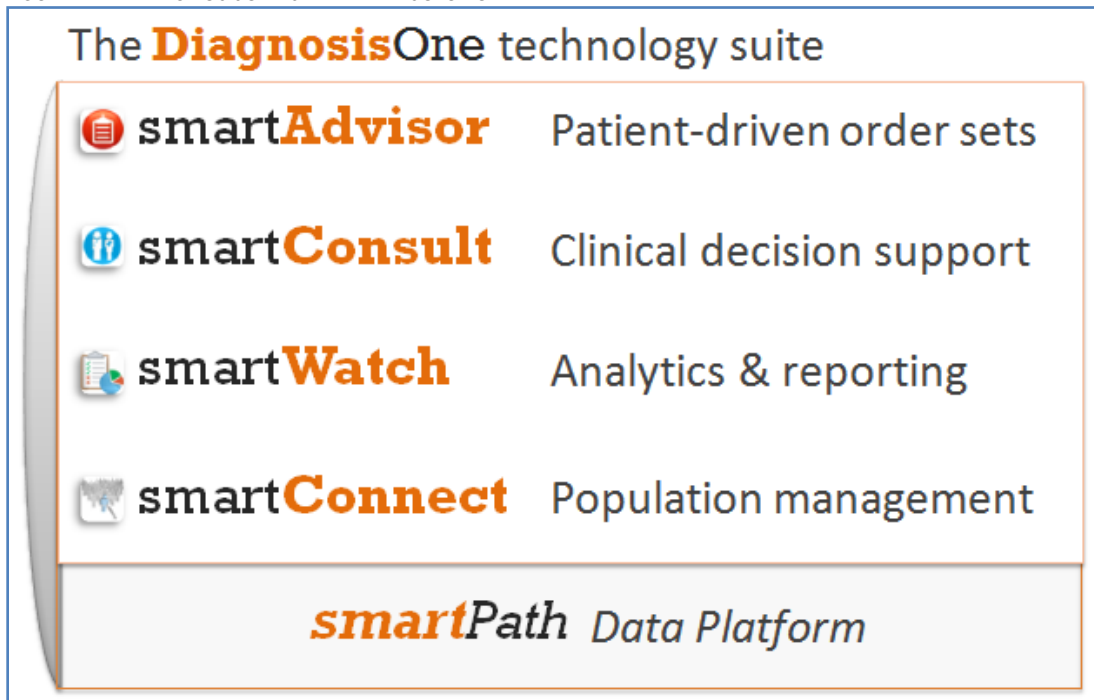
Specifically, CDS solutions allow health systems to focus investments on key problem areas, and lavish incremental attention to patient-segments that can most benefit from increased intervention. In parallel, CDS technology can help reduce unwanted variations in practice patterns, automate certain elements of chronic care management, limit avoidable errors, and in general improve provider productivity. Collectively, these capabilities position care providers to innovate around the delivery model, and in doing so, take on more financial and quality risk associated with patient care. One notable example of this is becoming an Accountable Care Organization (ACO). More generally, CDS will empower providers to spend their valuable time, energy, and constrained financial resources, where it can help the most.

DIAGNOSISONE, THE SMARTPATH FROM EMR TO CDS

One solution for meeting the clinical and technical criteria for a modern CDS system, while at the same time creating population management infrastructure, is the smartPath™ solution from DiagnosisOne.

Listed below (Figure 1) are the various functionality modules of the smartPath platform, including patient-driven order sets, clinical decision support, as well as analytics & population management. In general, smartPath is designed to be the single system through which any organization (e.g., an EMR technology vendor, a physician's practice, an IPA, a hospital system, or a payer) can manage and deliver the clinical policies that they wish to implement throughout their care provider network. Developed and deployed as an HL7 Web service, smartPath allows each set of users to access the tools, services, and clinical content through one or more user-specific products.

FIGURE 1: THE DIAGNOSISONE SMARTPATH SOLUTION



The smartPath knowledge base consists of over 25,000 evidence-based care rules, and can incorporate triggers that are based on patient demographics, age, sex, vital signs, state (e.g., pregnant, post-partum), status (hospitalized or not) as well as previous and present test results, diagnoses and medications. DiagnosisOne physicians rigorously reviewed hundreds of medical journals, texts, and physician associations, to develop clinical summaries and distill evidence-based guidelines. All guidelines are scored and prioritized to ensure relevancy. At the same time, clinician-friendly content authoring tools in the smartPath platform allow for self-customization—no need for programmer involvement.

The underlying technology is Web-service-oriented from the ground up, and designed to exchange data with existing systems employing all commonly used standards, vocabularies, and messaging modalities. The system combines all available patient data with the embedded guidelines to create order sets with smartAdvisor™, create alerts with smartConsult™, generate multi-level reports with smartWatch™, or identify and report on problem areas with smartConnect™.

TACTICAL & PRACTICAL NEXT STEPS

Deploying CDS & analytic solutions like smartPath is relatively easy, particularly when compared to other clinical systems. In contrast to EMRs, ePrescribing, and CPOE, clinical decision support & analytics requires minimal implementation resources, limited training, and has little disruption on clinician workflow.

To ensure success, health systems interested in CDS must identify opportunities for easily-achieved, high-impact, visible, initial wins. The positive momentum created can then be employed to rapidly expand the CDS footprint over time. Ideally, involving all stakeholders early on, including clinical, operational, and technological leadership, is certainly best practice for most organizations. Finally, identifying a solution provider with the expertise and experience to quickly create value, and a solution set with depth to meet today's and tomorrow's needs, is a critical early decision.

If you are interested in learning more about how DiagnosisOne and the smartPath platform can help your organization realize the promise of CDS, please contact us at:

(978) 856-4521

inquiry@diagnosisone.com

900 Chelmsford Street | Tower 3, 7th Floor | Lowell, MA 01851

About this report & its author

This report was authored by DiagnosisOne, a leading provider of clinical IT solutions to health systems, managed care organizations, and healthcare technology companies.

About DiagnosisOne

DiagnosisOne provides an unparalleled breadth and depth of analytics and clinical decision support solutions based on template and patient-specific order sets to the healthcare industry. Leveraging the world's largest library of evidence-based medical knowledge, DiagnosisOne's standards-based solutions integrate seamlessly with existing hospital and laboratory information systems to deliver actionable information that results in better patient care, reduced errors and better clinical outcomes. DiagnosisOne's customers include healthcare providers, payers, EMR companies, systems integrators and government entities, including the Centers for Disease Control (CDC), Massachusetts Department of Public Health and Blue Cross Blue Shield. Based in Lowell, Mass., DiagnosisOne was formed in late 2003 by a team of physicians and healthcare IT professionals.

About the author

Fauzia Khan, MD, FCAP, currently serves as chief medical officer of DiagnosisOne, where she is responsible for the development of the company's content and rules that power the order sets, clinical decision support, analytics, and public health reporting. Prior to forming DiagnosisOne, Dr. Khan was the Director of Informatics at UMass Memorial Medical Center with ten years of experience practicing pathology. She is the author, editor, and primary visionary of the "Guide to Diagnostic Medicine", Lippincott Williams & Wilkins, 2002. Dr. Khan is a diplomat of the American Academy of Pathology and Anatomic and Clinical Pathology.

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