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MARKET OPPORTUNITY

While traditional CDS tools were limited to medical textbooks and journals, and perhaps the help of a colleague, today's CDS includes a wide range of technologies that are able to draw from the large amount of medical information available and thus immediately improve care and potentially decrease healthcare costs over time. However, the fundamental cultural changes that need to take place in medicine, together with the lack of technology adoption and steep investment that must be made to fully implement CDS, are high barriers to adoption. This section of the report will define CDS and highlight the reasons healthcare organizations are and are not implementing CDS solutions:

- The next step after EHRs: CDS;
- CDS addresses top of mind healthcare pain points; and
- The inhibitors to CDS adoption are not easily overcome.

The next step after EHRs: CDS

As more healthcare organizations realize the value of and need for EHRs, early adopters of EHRs are already moving to add more advanced functionalities, including CDS tools. Without CDS, EHRs are not much more than a compilation of paper records in an electronic format. While complete, searchable information is helpful, the real value of EHRs is being able to use the data in them to make better clinical decisions and improve care. This could be done by checking for medication interactions at the point of care, or drawing on patient information for research purposes, for example. CDS tools can be used without EHRs, but the full benefits of each are realized only when the two technologies are successfully integrated together, increasing the efficiencies of both solutions. Thus, the rise in EHR adoption is spurring interest in CDS.

Datamonitor defines CDS solutions as technologies that provide information to aid the diagnosis and treatment of patients. This broad, general definition is intentional as CDS is still an emerging market that will undoubtedly change over the next few years. While today most CDS tools are targeted towards providers (hospitals, physicians, nurses, physician assistants, pharmacists, physical therapists, etc.) and payers, in the future governments and patients will use CDS to a greater extent. As depicted in Figure 1, CDS technologies include online reference materials and guidelines, alerts built into electronic prescribing (eRx) and CPOE, data mining and artificial intelligence. CDS provides anytime, anywhere access to the most recent research on new procedures, as well as guidelines on how to treat specific diseases. Alerts inform providers of drug-drug interactions, patient allergies and even formulary information, thus allowing clinicians to avoid adverse reactions and make better treatment decisions at the point of care. Data mining utilizes patient data and clinical research to search for trends that should be applied to the practice of medicine to systematically improve health outcomes. In the future, CDS will become more personalized, predicting patient outcomes based on each individual's health profile. The focus of CDS will also shift from how to improve treatment to having a greater emphasis on accurate diagnoses and tracking patient outcomes. Patients, too, will use CDS tools directly. While CDS is an emerging market, interest in it is already substantial. Healthcare stakeholders in countries around the world will be looking to invest in these solutions in the next five years, particularly as the technology continues to improve.

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Tools of the future will be patient-centric and focus on diagnosis

Many of the CDS solutions available today have not yet been widely accepted or adopted by the healthcare community. Given this, the possible CDS technologies that Datamonitor expects to see in the future may, at first, seem radical, much in the way that cloning or face transplants used to be viewed as unlikely if not impossible. However, Datamonitor does not expect these tools to be adopted immediately; rather, they will be accepted over years, or even decades. The future of CDS is nonetheless exciting as more information is compiled and technologies such as artificial intelligence improve.

One aspect Datamonitor expects CDS to move towards is the patient. As the healthcare system is already trying to become more patient-centric, rather than provider-centric, this seems like a logical next step in CDS as well. The alerts and reminders that providers receive will be personalized to each individual patient. For example, if a 55 year old, white, female patient presents with breast cancer and diabetes, the physician will receive an instant message about how other 55 year old, white, female patients with breast cancer and diabetes are treated and their outcomes. Genetic information will be included in patient records and used by providers as more genetic research is available. Patients will also have their own personal health targets and appropriate health ranges: for instance, an athlete would have a different body mass index (BMI) than an expecting mother. Providers will be able to 'prescribe' specific patient education information to patients before and after they leave the hospital or doctor's office. Finally, patients will use CDS tools themselves to help aid in their own diagnosis and treatment. Already, some patients are using technologies like telehealth to help them remember when to take the medication or check their blood pressure and, generally, patients do not think twice about searching the internet for information about their diagnoses and treatment options. Symptom checkers are available today on websites like WebMD and the Mayo Clinic for patients to use. In the future, patients could check their symptoms online and, based on the results, know immediately if they should go directly to a specialist, rather than waiting two weeks to see a primary care physician and another four weeks to see the specialist. Just as remote patient monitoring has the potential to improve patient care while decreasing healthcare costs, directing patients to the appropriate caregiver will improve the efficiency of the healthcare system.

If providing tools to let patients diagnosis themselves may seem like a recipe for a disaster to many providers and patients today, then perhaps giving diagnosis assistance to providers will seem more palatable. Today's CDS solutions tend to focus on aiding providers with the treatment plans for patients. While this is necessary, CDS should also be used earlier in the process to help physicians diagnose patients. Misdiagnoses occur often in medicine; while this area has not been widely studied, it is believed that approximately 20–40% of diagnoses are incorrect and that this rate has not changed drastically over time. Furthermore, the correct diagnosis is sometimes not reached until multiple incorrect diagnoses have been tested, resulting in inappropriate and possibly harmful treatments before the delayed appropriate treatment is given. Complete, 100% accuracy may not be feasible, but 80% should not be acceptable either. If one out of every five planes crashed, then the airline would be out of business. With the technology and information available today, providers should not be complacent with the current misdiagnosis rate. Isabel is one company that is addressing this issue. But, medical culture is steeped in tradition and resistant to change. Getting clinicians to use CDS tools, CAD technologies, even to have them question initial diagnoses and press each other to make sure that they have thought of every possible diagnosis, will take time. Providers should not take the diagnosis provided by CDS at face value, but, at the same time, they should not assume that technology is unable to provide accurate information. As CDS technologies mature, Datamonitor believes there will be a growing emphasis on improving diagnoses.

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CUSTOMER IMPACT: EFFECTIVELY IMPLEMENTING CDS

Implementing most CDS tools is no easy feat. Even the low hanging fruit is difficult to pick, particularly if end users are not ready to accept the technology. Culture will remain the most difficult barrier to implementing CDS; more research will be needed to show the effectiveness of CDS and vendors will have to focus on educating providers on the benefits. However, once a decision to invest in a CDS solution has been made, the implementation does not suddenly become easier. As the technology matures and more early adopters share their experiences, implementation will become smoother. For the time being though, it is best to take a measured approach, implementing CDS step by step. Datamonitor offers the following advice to organizations installing CDS solutions:

- Despite the fact that it is a well-known pitfall, hospitals are still plagued with alert fatigue;
- The quality of patient data will determine the quality of CI results; and
- Interoperability is not just a technology issue.

Despite the fact that it is a well-known pitfall, hospitals are still plagued with alert fatigue

The number one complaint physicians have about CPOE with CDS is that too many inappropriate or incorrect alerts pop up on the computer screen as they are trying to quickly order a test or medication. When this happens, providers begin to ignore the alerts, even the correct ones, negating the reason why the alerts were set up in the first place. This problem has been an issue since the first CPOE with CDS systems were built, and yet it continues to occur in new implementations. Alerts and reminders need to be accurate, relevant to the patient, unobtrusive to the provider's workflow and quick to use if clinicians are to gain the full value of CPOE with CDS. If the information given is incorrect, it is of no value to the provider. Furthermore, if it does not pertain to the correct patient, it will not be useful. Finally, the user needs to be able to access the information easily. Too many time-consuming clicks or having to go to a computer terminal rather than pulling up information on a personal digital assistant (PDA) or smart phone will decrease the potential benefit of CDS solutions. Unfortunately, because every hospital, particularly in the US, chooses to establish its own set of guidelines and order sets, each implementation is different. Implementation in universal healthcare systems like the UK and Canada will be easier because there will be more consensus on standards. In the US, however, two neighboring hospitals using the same vendor and product could have two completely different implementation outcomes. This uniqueness makes it difficult to build upon the experience of others. Standardizing clinical practices will help with this issue, but there will always be exceptions to the rules in medicine. Tracking how alerts are used and which are overridden may be the best information for early adopters to share with their peers. As other aspects of CDS become more mature and enter the spotlight, attention on alerts will decrease. Alerts, however, will continue to be used as they play an important role in CDS. Therefore, it is important that their full value is achieved through successful implementations.

The quality of patient data will determine the quality of CI results

A CI solution may be a useful tool for analyzing data, but if the data used in the analysis is incorrect then the validity of the research is compromised. Thus, the quality of the data entered into EHRs must be verified. Ensuring that data is entered correctly the first time as well as conducting regular data cleansing activities like checking for typographical errors, inconsistencies, inaccurate associations between a patient and someone else's record, etc. is crucial to an effective CI solution. This will require both behavioral changes by end users as well as better tools. End users will need to become more aware of the ways they document patient information and try to use a common medical terminology. Policies and

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