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Investment Area of Interest:

Clinical Decision Support Systems

November 2019

Executive Summary:

In a growing, dynamic healthcare regulatory environment it is becoming consistently more important for vendors to provide extremely flexible software solutions to all clinicians. Clinical decision support systems are poised to become the user interface of choice for clinical interactions with health IT.[1]

As decision support becomes a critical component of both healthcare delivery as well as regulatory compliance, the market is forecasted to grow from $3.79 billion in 2018 to $6.4 billion in 2024, a compounded annual growth rate (CAGR) of 9.3%.[2] Historically, clinical decision support systems (**CDSS**) have been seen as an auxiliary tool to electronic health records (EHRs) and electronic medical records (EMRs) however recent market studies have pointed towards substantial adoption of CDSS in the area of patient surveillance and linkage between EHR / EMR complexity and clinical workflow.

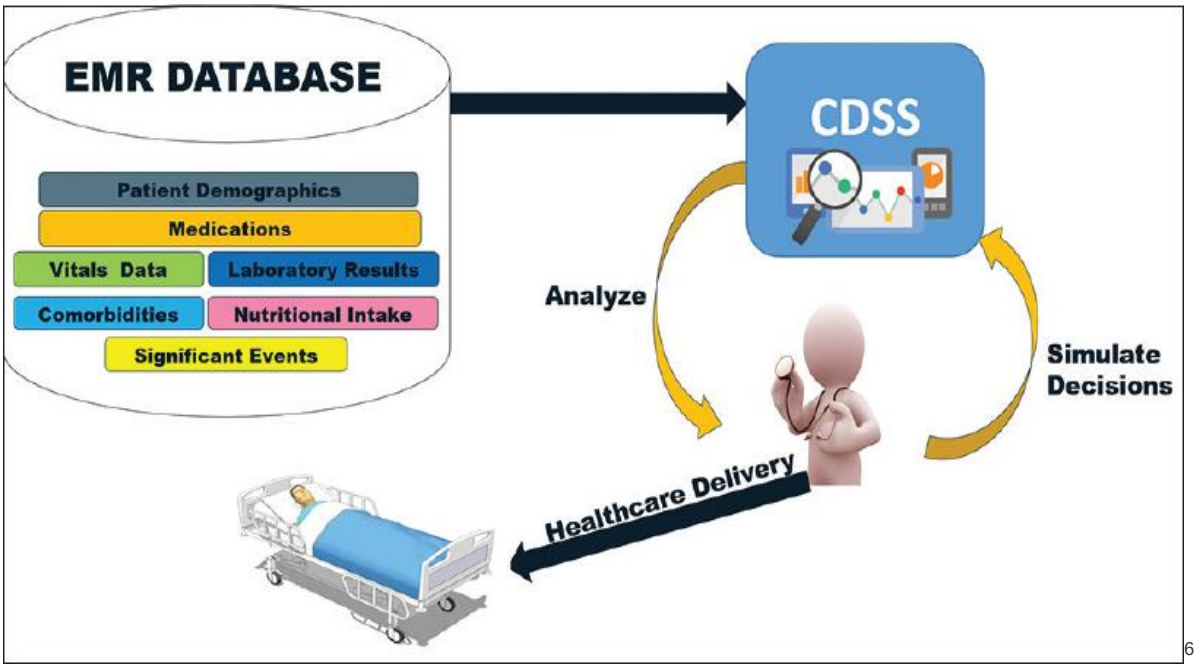
CDSS is evolving beyond a selection of point solutions to a platform on which other healthcare IT functions can be integrated. This offers an incredible opportunity to accelerate the progress of value-based reimbursements, population health management, and connected health. Payers are interested in these solutions as a source of content and an systematic program that can reduce costs by ensuring that patients‘ care conforms to regulatory and treatment guidelines. That being said, care must be exercised in the application of CDSS solutions to the clinical workflow. CDSS mistakes can significantly contribute to physician burnout and process inefficiency.[3] CDSS is beginning to be perceived as an important facilitator of compliance activities in healthcare.

The regulatory environment is complex and virtually impossible to navigate without automated assistance, which can be provided via CDSS. While the availability of healthcare data is consistently rising, the number of solutions provided through various CDSS companies is rising as well.

Healthcare Environment

Aggregation of patient data to improve healthcare processes is a major focus of the industry and has been for the last decade or so. Electronic clinical data comes from numerous sources, and the necessity to form streamline models for data consumption has created an outsized business need.

The Healthcare sector is notoriously fragmented in nature which has prevented clinical stakeholders from accessing and interpreting important data sets that have the ability to significantly improve patient care.[4] The next generation of healthcare will operate with the patient in mind and allow stakeholders to share and analyze real-world data, allowing insight and better decisions to be made in a dynamic real-time environment. This need has significantly increased as EMR/EHRs have proven ineffective due to the reliance on physicians to spend significant amounts of time updating patient data. The goal of the majority of CDSS firms and products is to resolve these issues by eliminating the burden placed on the individual and ensuring vendors include CDSS data within the properties of the electronic record.[5]



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Clinical workflow is a production process which, ideally, takes in ill patients as an input and discharges well patients as an output. In the process, it consumes resources in the form of clinician and physician time and expertise as well as the use of diagnostic equipment and pharmaceuticals. Digital health technology that increases the throughput of this process adds to its efficiency and efficacy; technology that simply adds cost or slows the process detracts from its efficiency and efficacy.[7] CDSS technology has the potential to do the former, but can also add to the latter.

Barriers for Adoption

While the need for CDSS adoption and/or integration with EHR/EMR platforms has been demonstrated, the widespread adoption of these systems has yet to entirely occur. This can be attributed to, but not limited to the following:

Necessity of Interoperable Systems

Health data exchange architectures, application interfaces and standards enable data to be accessed and shared appropriately and securely across the complete spectrum of care, within all applicable settings and with relevant stakeholders, including by the individual.[8] Currently, not all CDSS systems are Interoperable, which limits ability to securely communicate data to and from other systems. Lumiata, a CA-based startup, aims to conquer this obstacle with its AI & predictive analytics CDSS software which has been quite successful in providing real-time

"With the delivery of healthcare becoming more complex, there is an urgent need for a superior user interface, both to reduce the load on the physician, as well as ensure that the physician is informed of the latest treatment options and protocols. The trend towards more regulatory oversight and the adoption of new information technology will further drive the need for CDSS."

- Mike Jude, Research Manager, Digital Health

scaled solutions to hospitals.[9] Another firm, EvidenceCare, based in TN, has been able to implement curated protocols by the industry's leading physicians to provide evidence-based clinical knowledge instantly at the point of care.[10] These sourced analytics have successfully managed the need for interoperable systems and ensure effective communication and shared decision – making with patients and stakeholders.

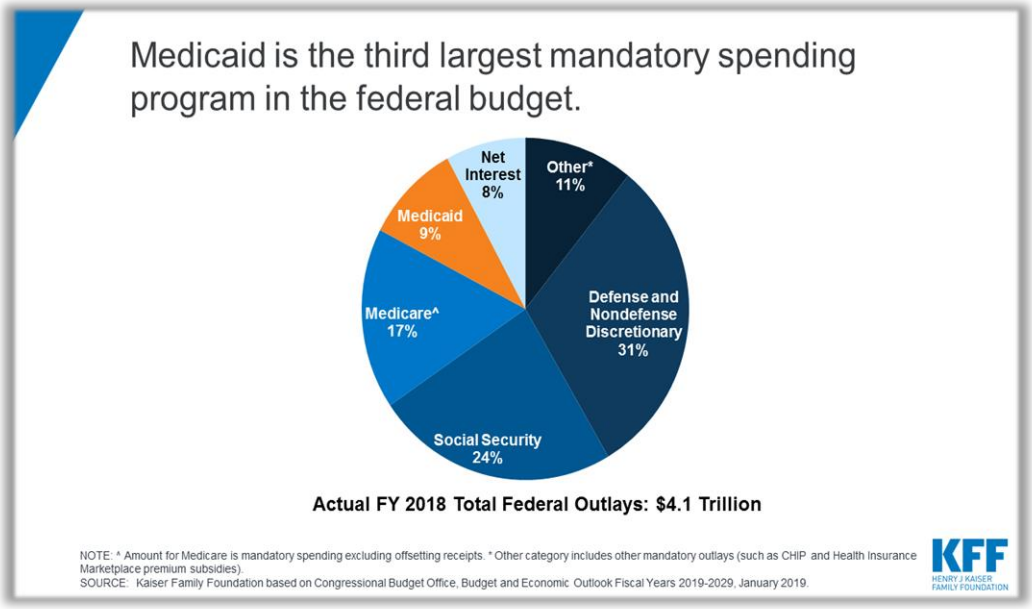
Population Health Coverage

As databases are developed that can identify patients with specific diseases, with risks of complications, or in need of specific interventions it is imperative to use population management to provide a form of decision support for groups of patients. Some clinical decision support is also aimed directly at patients, in terms of alerts, reminders, or aids to interpretation of information; techniques for assessing prognosis and risk of alternative strategies should involve shared decision making between providers and patients which is an important area of focus and improvement for existing technologies.[11]

The shift to population level thinking is not without its challenges; looking at larger cross sections of the patient population has caused a number of issues related to analyzing considerable amounts of data. The gathering of data is considerably easier than analysis, which has been quite difficult. Numerous new technologies are being developed to comb through the data, and many healthcare organizations are finding these new technologies necessary for tracking and implementing solutions around the data.[12]

Government Incentives for Competing Systems

Since 2011, U.S. hospitals have been eligible to receive financial incentives through Medicare and Medicaid for adopting and using EHRs.[13] Whilst this has proven mostly effective in successful adoption of EHR systems at U.S. hospitals, this has also caused issues that may impact the subsequent adoption of clinical decision support systems at the same hospitals. The significance of Medicare and Medicaid programs at hospitals is growing, as the government spending on these programs continues to be quite significant.[14] Hospitals participating in the Medicare portion of the EHR incentive program have faced penalties for not meeting requirements, and these substantial costs have left some potential clients of CDSS firms less willing to take on the risks of implementing new systems.[15] Clinical decision support systems have been heavily impacted by two regulations. The Health Information Technology for Economic and Clinical Health (HITECH) and the Health and Human Services requirements for interoperability and patient empowerment.[16] These regulatory requirements have imposed new standards for EHR vendors and will encourage interoperability with CDSS systems within the electronic health record.



Requirements for CDSS

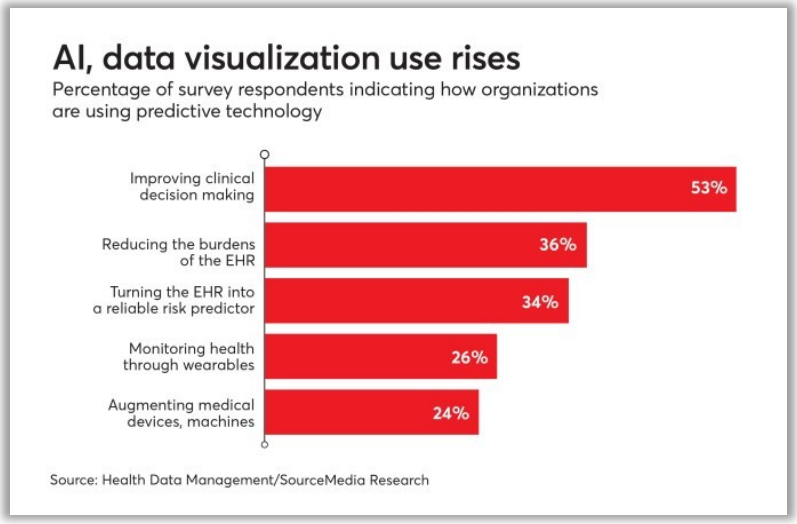
For complete buy-in from the physicians and providers in particular there are a few requirements for excellent decision making which fall into the following three categories:[17] The following needs have created a wealth of opportunity for companies in the CDSS space. By

providing accurate knowledge to healthcare providers these companies can vastly improve patient outcomes. In assisting physicians to determine pertinent knowledge the CDSS providers can improve upon timeliness in clinics, and also minimize costs driving further profits for hospitals. Lastly, by assisting providers and equipping them with appropriate problem solving skills these CDSS systems become an important extension of the patient care system and have the ability to improve healthcare in the future.

Accurate Data

The importance of accurate data in the healthcare ecosystem is paramount, and this has been increasing in terms of relevance due to added transparency in today's digital age. The digitization of healthcare has been vastly improving patient outcomes and experiences, but there is still very much room to grow.

Accurate patient data allows for individual patient's care to be monitored, tailored, and optimized while contributing to a collective archive of data allowing physicians and practitioners to find new correlations and ways to improve treatment, recoveries and overall patient care.[18] Before the digital age it was difficult to track trends in treatment and apply them at point of care. Due to improvements in databases and the abilities of providers to access this data in real time via CDSS patient results have the opportunity to improve immensely.



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A study done by SourceMedia research gives a bit of insight into how CDSS systems and AI have the ability to impact healthcare. It was found that 53% of healthcare professionals surveyed are using AI to improve clinical decision making. This majority gives a glimpse into just how big of an impact this new technology can have. AI and data visualization enable superior care delivery of accurate data at lower cost.

Pertinent Knowledge

Building upon the need for accurate data is the importance of pertinent knowledge being provided to practitioners in order for them to be able to efficiently apply results of the clinical decision support systems into their care routines. Illumicare, an Alabama based CDSS startup does just that. Illumicare has developed a software that takes an immense amount of data from the EMR system and deciphers the necessary information to provide to the physician in order to integrate seamlessly with their workflow, giving them real-time data in order to better determine what tests and medications will suit treatment regiments most optimally.[20]

This is just one example of a software or digital application that helps physicians monitor their progress and process necessary information from EMR/EHR databases. This improves treatment, cuts cost, and helps overall healthcare results. By improving results and cutting costs these systems allow funds to be more readily available to hospitals to push research, treat more patients, and take up more initiatives to improve the healthcare ecosystem.[21]

Appropriate Problem-Solving Skills

With the vast availability of data and technological systems in hospitals it is increasingly necessary to be able to discern the necessary problem solving skills for each patient situation for providers. Multiple clinical decision support system companies are undertaking the task of improving the processes behind care systems to incorporate proper data and proper processes to better results overall. Proskriptive, a startup headquartered in Idaho specializes in predictive analytics algorithms using previous patient data available in EHR/EMR systems to anticipate care results and provide point of care recommendations to improve outcome probabilities.[22] Forward looking algorithms such as the one Proskriptive uses have immensely benefitted

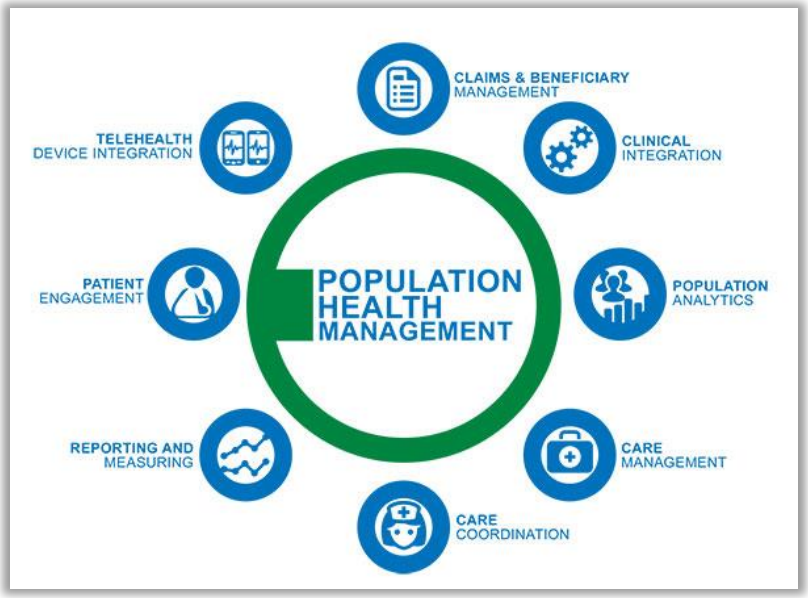
healthcare professionals through CDSS systems and being able to identify risks and mitigate them prior to treatment. By improving these processes and avoiding risks CDSS drive better results and lower costs.

The goal of many of these process – improvement systems is to equip providers with the problem solving skills and situational knowledge they need faster and clearer than they have previously been able to gain this knowledge. With AI and machine learning systems this improved analytics will enable clinicians to provide extremely personalized and efficient protocols.[23] With better treatment protocols hospitals hope to be able to achieve higher quality at a much lower cost.

Healthcare Trends Driving the Need for Support Systems

In the ever changing Healthcare sector there has been a push for patient empowerment, interoperability of information technology systems, and overall adoption of efficient technologies to improve patient outcome. These three trends have caused the emergence of new healthcare data technologies to occur more rapidly than they previously have.[24]

Healthcare providers have been doubling down efforts to optimize treatment outcomes and costs for patient communities. Transparency due to information technology and improvement of knowledge base as a whole has been a main driver of this need. Many information technology companies seek to connect CDSS technology and EHRs in order to improve physician outcomes. This allows for improved data at point of care to improve how providers make decisions.[25] As the need for data to improve patient outcomes increases private partnerships



with healthcare providers will increase, and the shift to value based care will create new collaborations. Through predictive analytics, hospitals have been able to achieve better patient outcomes and drive more optimal results.

As more technologies are becoming available to all healthcare professionals, providers are increasingly seeing the potential to adopt these high tech solutions to their everyday procedures related to patient information. Patient data has been collected through multiple EHR/EMR systems to date, but the struggle for those in the industry has been consolidating the information to a useable form.[26] The long-term goal of many of these new companies is to create efficient systems for visualizing and implementing solutions using these vast arrays of data. To do this, the companies have been developing solutions to optimize data visualization using AI. The long-term goal of many of these solutions is to assist clinicians with decision support, reduce financial risk, establish population health initiatives, and improve overall results in the field of patient health.[27]

In today's day and age there is a greater understanding of the patient role, and a greater input the patient has on the success of their own healthcare. Consumerization of the industry appears to be a trend that has grown substantially and experience management for the patient is at the forefront of healthcare. These changes have caused a ripple effect in behavior of medical professionals, and healthcare organizations alike. Healthcare organizations will invest in care delivery models to meet new patient needs at point of care, and this has become especially apparent through new technologies.[28] The need for superior interactions with patients at point of care has driven new products via portals, medical apps, remote patient monitoring, and many other new technologies.

Digitization is all around us. This has become especially apparent in the healthcare industry. This means the application of various forms of technologies is growing, and will continue to grow in the coming years. New uses for existing and emerging technologies will give consumers and providers more options in the realm of care.[29] The pressure on these organization to improve processes will continue the growth of emerging technologies.

Select Firms Impacting the Industry

The following pages outline some of the companies operating in the clinical decision support system space, either by providing web based solutions, applications, database integration, or various solutions that impact CDSS and EHR/EMR integrations.

Companies are organized in the following two categorie:

- Startups
- Larger companies

Clinical Decision Support System Startups

EvidenceCare is a provider of a clinical decision support system platform to healthcare organizations.

Headquarters: Franklin, TN

EvidenceCare enables healthcare organizations to effectively communicate treatment plans and shared decision making with patients and their families.

EvidenceCare delivers instantly accessible evidence-based clinical knowledge at point of care.

Total Funding: $14.4 million
25 Employees

United States
https://evidence.care/

Avhana provides a clinical decision support system and population health platform.

Headquarters: Baltimore, MD

Avahana Health's clinical decision support platform offers patient-specific recommendations and relevant patient data, enabling patients to receive comprehensive care.

Avhana delivers significant time savings for providers while streamlining processes.

Total Funding: $800K
10 Employees

United States
https://www.avhana.com/

Illumicare operates a real-time application designed to deliver predictive health analytics.

Headquarters: Birmingham, AL

IllumiCare provides information that is embedded within the EMR and gives providers real-time data within the physician workflow.

IllumiCare's electronic medical record application presents cost, patient risk, and other data enabling clinician decision making.

Total Funding: $5.92 million
25 Employees

United States
https://www.illumicare.com/

Proskriptive provides predictive analytics technology and services to healthcare organizations.

Headquarters: Boise, ID

Proskriptive's technology is a predictive model marketplace for healthcare to connect all organizations with proactive patient targeting capabilities.

Proskriptive assists in compliance with government mandates and delivers lower cost solutions.

Total Funding: $1.6 million
5 Employees

United States
https://proskriptive.com/

RxRevu is a platform designed to holistically manage and measure clinician's performance.

Headquarters:
Denver, CO

RxRevu delivers custom reporting to analyze actionable insights and tracks critical metrics around prescribing drugs.

RxRevu operates as a prescription decision support system for clinicians and any practitioners.

Total Funding: $20.64 million
40 Employees

United States
https://rxrevu.com/

Lumiata functions as an AI powered health analytics provider.

Headquarters:
San Mateo, CA

Lumiata's predictive analytics tools combine big data and physician and medical science to deliver personalized actionable analytics.

Lumiata makes years of healthcare IP, data, and machine learning tools open to the healthcare space and CDSS tools.

Total Funding: $31 million
35 Employees

United States
https://www.lumiata.com/

Medicomp System's documentation tools enable physicians to see more patients.

Headquarters:
Washington, DC

Medicomp provides physicians with comprehensive problem-oriented views of clinically contextual information that lead to improved clinical decision-making at the point of care.

Medicomp offers a flagship Quippe Clinical Data Engine in collaboration with clinical teams and data scientists from Cornell, Harvard & the Department of Defense.

Total Funding: $20 million
20 Employees

United States
https://medicomp.com/

Pepid provides web and application based point-of-care solutions.

Headquarters:
Phoenix, AZ

Pepid enables healthcare professionals to efficiently pinpoint diagnoses, treat diseases and medical conditions, and provide quality patient education.

Pepid streamlines concise medical information through a built-in workflow developed by years of engagement with doctors, nurses and pharmacists.

Total Funding: <$1 million
55 Employees

United States
https://www.pepid.com/

Larger Companies

UpToDate is an evidence based CDSS software delivered through multiple systems.

Headquarters: Waltham, MA

UpToDate is a point-of-care system that integrates with EMR / EHR systems to deliver big data decision making analytics.

UpToDate is the most widely adopted CDSS system with 1.7 M providers using it

Acquired by Wolters Kluwer (2008)
275 Employees

United States
https://www.uptodate.com/

Zynx software attempts to bridge the gap between CDSS and EHRs.

Headquarters:
Los Angeles, CA

Zynx is a market leader in providing evidence-based and experience-based clinical decision support solutions proven to measurably improve the quality, safety, and efficiency of patient care.

The Zynx solution is deployed at point of care and is used to unite clinical decision support solutions and EHRs.

Subsidiary of Hearst Communications
90 Employees

United States
https://www.zynxhealth.com/

Clinical Decision Support Systems from an Investor's Perspective

At FCA Venture Partners we are actively looking for additional investments in the healthcare data business sector. The Clinical Decision Support System space is particularly interesting and attractive to investment, but it also presents risks. Businesses in the software and internet service space are very scalable with high operational leverage. These companies offer incredible possibility of growth and impact as an investor.

On the other hand, the risks in the healthcare space are not surprising. There are high barriers for entry in the space, and risks of failure for adoption of healthcare professionals. These risks must be taken into account when considering the attractiveness of these companies.

Digital technology will be packaged with an expected ROI. Healthcare organizations and being continuously pressured by patients, clients, and funding to focus on measurable outcomes. Continued downward pressure on budgets and margins will mean further investment in packaged solutions in the CDSS space that embed technology with current data solutions to achieve benefits in terms of both clinical and financial outcomes.[30] Expect these trends to be magnified in the coming years as technologies are developed and an emphasis on the industry is noticed.

Founded in 1996, FCA Venture Partners has a long history of investing in successful healthcare entrepreneurs. We are passionate about building sustainable businesses and providing strategic value to our portfolio companies.

FCA invests $3-6M in fast growing healthcare companies making processes in the industry faster, better, and cheaper while improving the quality of care and the patient experience.

With its location in Nashville, roots with Clayton Associates and the McWhorter Family, and deep involvement in the growth of the U.S. healthcare community, FCA Venture Partners is poised to take advantage of disruptive opportunities that help move healthcare forward.

Investing in Entrepreneurs that Improve Healthcare

110 Winners Circle North | Suite 100

Brentwood, TN | 37027

Phone: 615-326-4848 | www.fcavp.com

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