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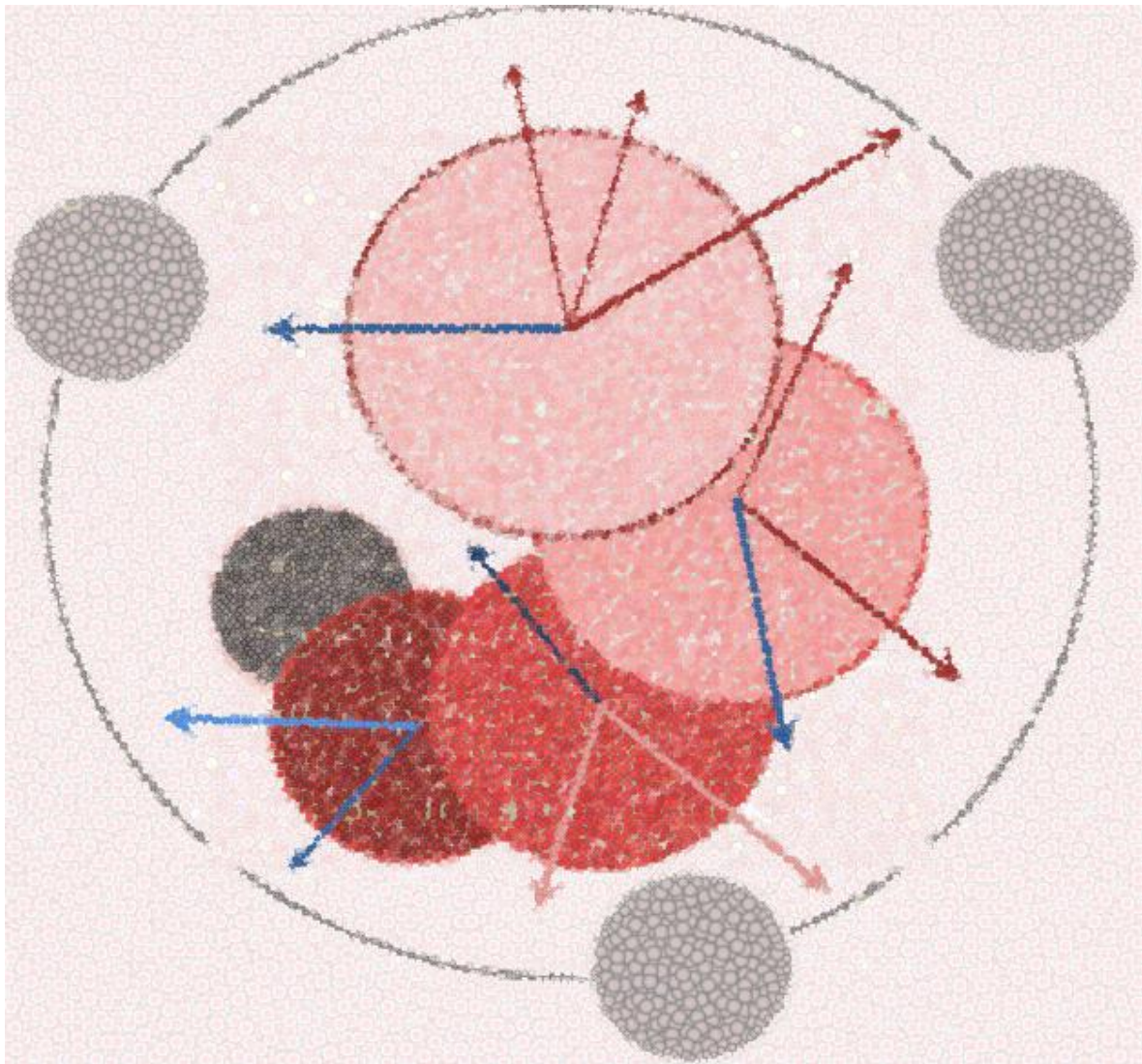# DEPARTMENT OF SOCIAL SERVICES
STRATEGIC PLAN FOR
BUSINESS INTELLIGENCE & HEALTH IT

JANUARY 2018

Prepared For:

RODERICK BREMBY, COMMISSIONER
DEPARTMENT OF SOCIAL SERVICES

Prepared By:

Minakshi Tikoo, PhD, MBI, MS, MSc
Director, Business Intelligence & Shared Analytics
HHS HIT Coordinator, DSS

Executive Summary

The Connecticut Department of Social Services (DSS) Business Intelligence (BI) and Health Information Technology (Health IT) Strategic Plan provides an achievable BI solution for transforming the most valuable asset "data" into actionable information while implementing a scalable Medicaid health information exchange (HIE). This solution will be fully interoperable across the Medicaid enterprise, building a robust and flexible foundational Health IT layer. This plan is focused on ensuring that the people receiving Medicaid and other social services in Connecticut are educated and empowered to make the "right decisions at the right time" about their care to improve their health and social outcomes. The BI strategy provides information and insight into DSS programs resulting in information-based decision-making.

Health IT and HIE

The Medicaid HIE solution will provide for secure electronic transfer of information between and among EHRs and other affiliated systems as needed for the care of the Medicaid beneficiary. The beneficiaries will have complete access to their information, thus supporting consumer-directed exchange. Consumer-directed exchanges empower people to take charge of their health information, which is both prudent and a fiscally sound policy. Additionally, the Medicaid HIE node leverages existing operational Health IT assets and builds services that can be used as shared services should other entities want to use them.

Business Intelligence

The BI solution will provide DSS information and insight into the effectiveness and efficiency of programs that support the needs of the people they serve. The innovative BI solution is scalable, incremental, and federated in design. Additionally, this solution will build and mature the vision of shared services of a service-oriented architecture (SOA) while adding additional granularity and dimensionality.

Overall, the proposed BI and Health IT strategic plan uses an incremental approach starting with a robust platform that offers foundational core services and adds other services as needed.

This plan above all is focused on delivering value to the people we serve.

Contents

Introduction

The U.S. Department of Health and Human Services (HHS) has developed a Ten-Year vision to achieve an interoperable Health IT Infrastructure to fulfill the national vision of a healthcare delivery system that is patient-centered, effective and less costly. HHS encourages states to adopt Health IT solutions that make the right data available to the right people at the right time across programs and organizations in a way that is reliable and actionable.[1] Specifically, the federal government has supported use of technologies such as certified electronic health records (EHRs), e-prescribing, personal health records and HIE.

Why invest in Health IT Infrastructure?

The Health Information Technology for Economic and Clinical Health (HITECH) Act aims to "improve health care and make it patient-centric through the creation of a secure, interoperable nationwide information network. **A key premise is that information should follow the patient, and artificial obstacles – technical, bureaucratic, or business related – should not be a barrier to the seamless exchange of information."** Potential benefits include:

> **ONC's vision for Consumer eHealth**
> *"The power of each individual is developed and unleashed to be active in managing their health and partnering in their health care, enabled by information and technology."*

- Empowering the person to be in charge of their health;
- Improved patient care coordination resulting in a better quality of life;
- Better health outcomes at the person, system, and population level;
- Reduction in unnecessary tests and procedures;
- Reduction in medical errors and missed diagnosis;
- Enhancing the use of data (structured and unstructured) for business intelligence and outcomes-based decision-making;
- Opportunities for improved quality reporting and public health surveillance; and
- Cost reductions for both public and private payers.

Why invest in a consumer-mediated Health Information Exchanges?

As with most Health IT solutions, there are multiple definitions of HIEs. The basic feature of HIEs is the electronic movement of health information between two entities with data transfers based on nationally recognized standards.

The Office of the National Coordinator for Health Information Technology (ONC) presents an operational definition, stating that, "HIE allows doctors, nurses, pharmacists and other health care providers to securely share a patient's vital medical information electronically—reducing the need for the patient to transport or relay their medical history, lab results, images or prescriptions between health professionals.

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[1] U.S Department of Health and Human Services, The Office of the National Coordinator for Health Information Technology, *Connecting Health and Care for the Nation: A Ten Year Vision to Achieve Interoperable Health IT Infrastructure*, June 2014.

Instead, this information is shared between health care providers before the patient arrives for an appointment or goes to the pharmacy to pick up a medication[2]."

Consumer-Mediated Exchange

Consumer-mediated exchange provides patients with access to their health information, allowing them to manage their health care online similar to how they might manage their finances through online banking. When in control of their own health information, patients can actively participate in their care coordination by:

- Providing their health information to others.
- Identifying and correcting wrong or missing health information.
- Identifying and correcting incorrect billing information.
- Tracking and monitoring their own health.[3]
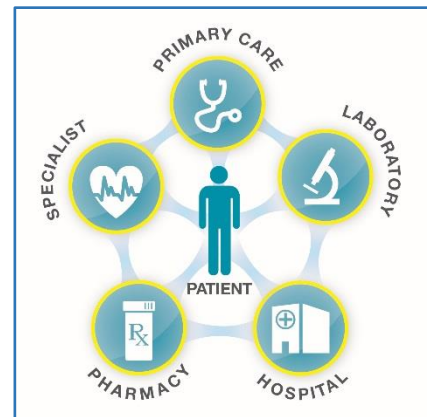
A reliable and secure Health IT infrastructure can benefit the people served by the DSS as well as assist enrolled providers in delivering better care while reducing costs. Having access to their information allows people to engage in their health care. We believe that consumer engagement will play a critical role in transforming delivery systems that are Health IT enabled. This transformation has the potential to generate lasting improvements the U.S. health care system.[4] **Unless consumers are willing and able to participate meaningfully in their care, the expected gains to the health care system may never be realized despite billions of dollars in government investments**.

Why Invest in Health and Human Service Business Intelligence[5]?

Business Intelligence (BI) will provide information that will assist DSS to:

- Design program and services that deliver individualized care matched to the person (just like precision medicine).
- Evaluate and identify services that are meaningful, cost-effective, efficient, add value, and improve people's lives.

The challenge is in predicting and prescribing services that are person-centered but can be delivered at the program-level.

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[2] ONC, https://www.healthit.gov/providers-professionals/health-information-exchange/what-hie, downloaded on 12/7/2015

[3] Claudia Williams, Farzad Mostashari, Kory Mertz, Emily Hogin and Parmeeth Atwal. From The Office of The National Coordinator: The Strategy For Advancing The Exchange of Health Information. Health Affairs, 31, no.3 (2012):527-536.

[4] Tripathi M, Delano D, Lund B, Rudolph L. Engaging patients for health information exchange. *Health Aff (Millwood)*. 2009;28(2):435-443.

[5] Tikoo, M (March 2016), Cost and Value of Big Data. http://chatter.uconn.edu/2016/03/

DSS will use data that are directly related to the services received enriched with contextual data. **This would happen when we "meaningfully" integrate clinical, non-clinical, cost, location, and social determinant data to understand the complexity of presenting social issues and challenges**. Once we have a better understanding of the context of these lives, only then can we address these challenges one at a time, learn from our processes, resulting in delivering services effectively and efficiently.

Human Services Value Curve[6]

The American Public Human Services Association[7], describe the Human Services Value Curve as a key framework for a Networked World. This model is designed to provide a roadmap for improving human services outcomes, value, and legitimacy through the lens of four different business models: regulative, collaborative, integrative, and generative. The DSS has selected to us the APHSA framework to help guide and inform their service delivery work.

Figure 1: APHSA's Human Services Value Curve
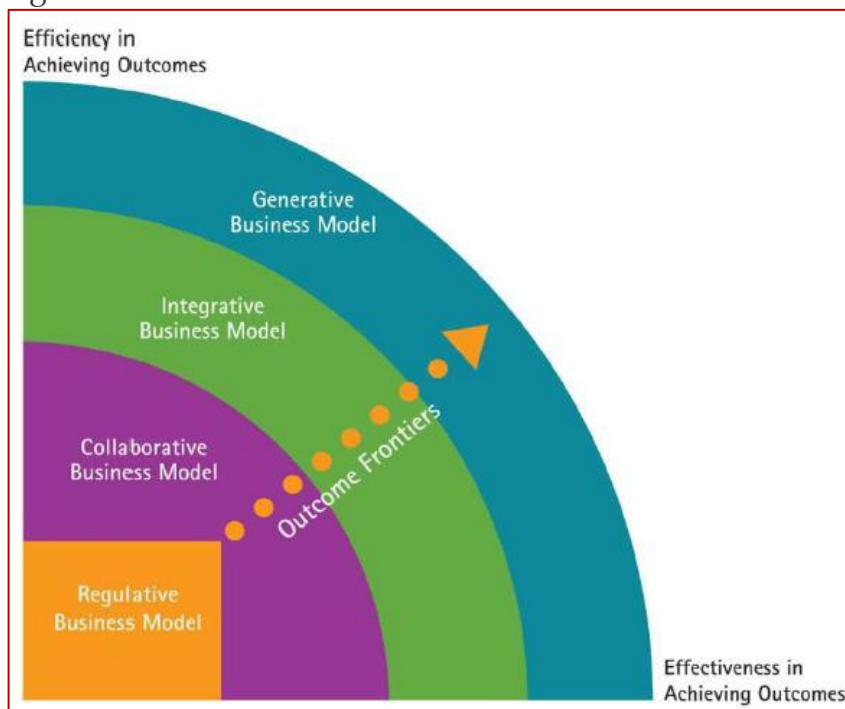
Human Services Value Curve[6]

Regulative Business Model: The focus is on serving constituents who are eligible for particular services while complying with categorical policy and program regulations.

Collaborative Business Model: The focus is on supporting constituents in receiving all the services for which they're eligible by working across agency and programmatic boundaries.

Integrative Business Model: The focus is on addressing the root causes of client needs and problems by coordinating and integrating services at an optimum level.

Generative Business Model: The focus is on generating healthy communities by co-creating solutions for multi-dimensional and socioeconomic challenges and opportunities.

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[6] http://aphsa.org/content/dam/aphsa/Toolkit/Human%20Services%20Value%20Curve%209-5-14.pdf. Downloaded 11/6/2016.
[7]http://www.aphsa.org/content/dam/aphsa/pdfs/Resources/Publications/TOOLKIT_Moving%20through%20the%20Value%20Curve%20Stages_.pdf . Downloaded 11/7/2016

DSS's Health IT Landscape

DSS Vision: Guided by our shared belief in human potential, we envision a CT where all have the opportunity to be healthy, secure and thriving.

DSS Mission: We, along with our partners, provide person-centered programs and services to enhance the well-being of individuals, families and communities.

DSS Goals:

1. *Drive decision-making, collaboration and service-coordination through enhanced use of data to improve services.*
2. *Instill public trust by continuously improving the way we administer programs, manage our resources and operate our infrastructure.*
3. *Improve access to health and human services to enable our customers to gain independence, enhance health and achieve well-being.*

One of the goals of the HITECH Act is to increase the use of Health IT to improve quality, safety and efficiency of health care while reducing disparities, engaging patients and families, improving care coordination, ensuring adequate privacy and security protections for personal health information and improving population and public health. **As of October 2017, the State of Connecticut had received a little over $396.17 million through the CMS's EHR incentive program.**

Almost 6,933[8] eligible professionals and all hospitals in Connecticut have received payments for adoption of certified EHRs and many have attested to achieving Meaningful Use. A survey to assess physicians EHR adoption rates was completed in 2011 and 2013. Based on the 1,346 responses, about 68-74% of physicians are either using EHRs or are in the process of implementing EHRs -- an increase from 53-56% of physicians in 2011.[9] Based on the current trends, by end of 2015, EHR adoption among physicians will exceed 75%. E-prescribing activities increased from 2011 to 2013 among pharmacies and prescribers. Ninety-six percent (96%) of pharmacies were enabled for processing e-prescriptions and 62% of prescribers were e-prescribing.[10] In 2013, 63% of Connecticut's hospitals were sharing lab results electronically, higher than the national average of 56%.[11] This represents a significant decrease from 77% in 2011-12. Fifty percent (50%) of the independent labs were sending lab results electronically in 2013, an increase from 37% in 2011-12.

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[8] https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/October2017_UniqueCountofProvidersbyState.pdf downloaded 1/9/2017

[9] Tikoo M, Costello D. Evaluating Connecticut's Health Information Technology Exchange: Physician Survey Report. Farmington, CT: University of Connecticut Health Center; 2014

[10] Ibid.

[11] Tikoo M, Roy A. Evaluating Connecticut's Health Information Technology Exchange: Laboratory Survey Report. Farmington, CT: University of Connecticut Health Center; 2014.

Based on a Connecticut resident survey completed in 2013, 54% of the participants described their health as excellent or very good, 89% of participants were satisfied with the care they received from their doctor or physician's assistant and 87% of participants said they understood what their doctor said to them during their last visit. [12] When asked about their views on the use of health information technologies in improving care, **83% of participants had heard about electronic medical records, 72% supported a national HIE that was driven by patient consent**, and 64% expressed support for an "opt-in" while 21% supported "opt-out" consent model.

DSS's Health IT and BI Framework

DSS Health IT (Health IT) framework is built upon the 2012 recommendations of the Health Technology Workgroup of the Connecticut Health Care Cabinet[13] and the 2013 Health IT Strategic and Operational Plan.[14]

The Health IT and BI framework (Refer Figure 2) is driven by a *person-centric* focus and follows the premise that technology needs to support the *health care systems, information*, and *business* needs. The ultimate goal is *better health outcomes* for people. The health care delivery system is built with the aim of improving *access* to services, *educating* and informing people, better *services* and *supports*, and a *transparent* system of care.

Figure 2: DSS's HealthIT Framework

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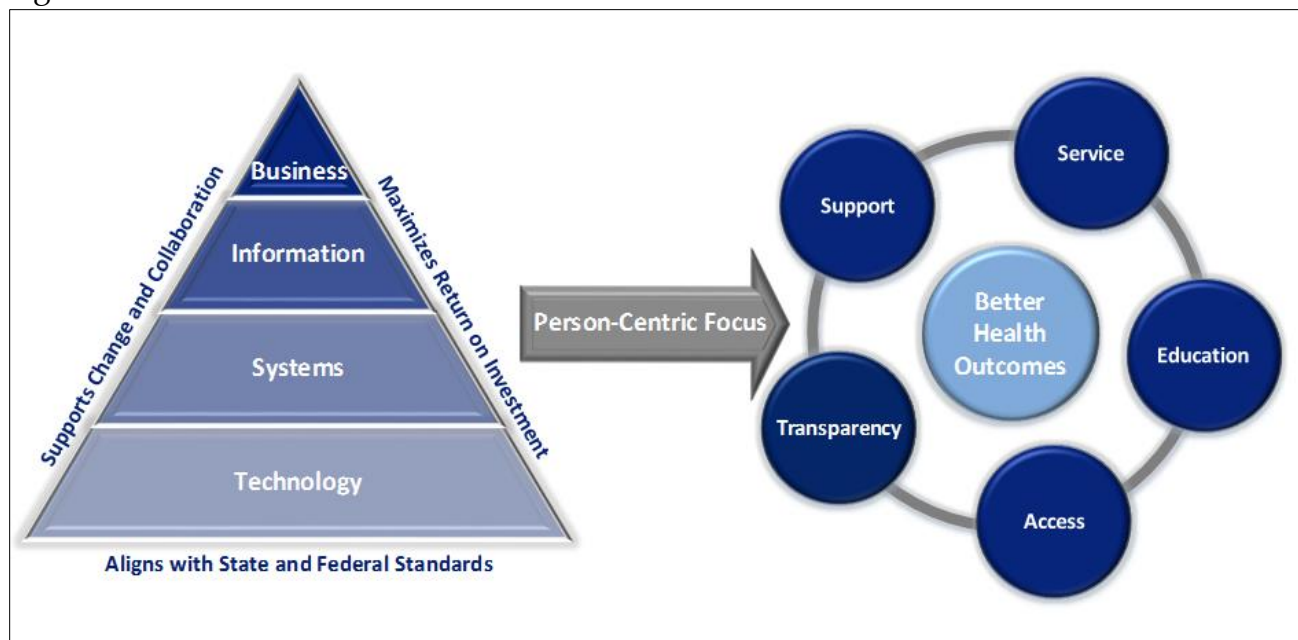
[12] Tikoo M, Costello D. Evaluating Connecticut's Health Information Technology Exchange: Consumer Survey Report. Farmington, CT: University of Connecticut Health Center; 2014.

[13] *Integrating Connecticut's Health Information Technology: A White Paper prepared by the Health Technology Workgroup of the Connecticut Health Care Cabinet*, August 29,2012.

[14] Department of Public Health, Update to Strategic and Operational Plan for Statewide HIE in Connecticut, February 28, 2013.

The Health IT infrastructure that supports this conceptual framework needs to align with state and federal standards, support rapid change, and collaborate with the broader Connecticut and national healthcare marketplace. The ultimate goal is to provide higher quality, lower costs, and an improved care experience for our people. Our approach considers the following key concerns:

- Re-use and expand the scope of current state investments in Health IT
- Be modular in nature to simplify integration with the Medicaid IT infrastructure
- Easily fit into the HIE network of networks model
- Provide flexibility for future yet to be determined needs
- Respect data security and consumer preferences
- Provide an environment that facilitates advanced population and outcomes-based analytics and research
- Meet the needs of program administrators and implementers by providing basic BI capabilities as well as advanced predictive and prescriptive analytics

To that end, the immediate Health IT strategy is the deployment of cohesive foundational components that address the following areas:

- Personal Health Record (PHR)
- Health Information Exchange (HIE)
- Business Intelligence (BI)
- Secure and agile deployment environment

DSS Health IT Infrastructure, Initiatives, and Assets

Over the last seven-years DSS has made steady progress in developing a pathway for Health IT and HIE in Connecticut. A number of technology and shared service solutions, such as the Enterprise Master Person Index (EMPI), Provider Registry (PR), and Health Information Services Providers (HISP), Alert Notification Engine, and Personal Health Record have been procured and deployed at the state's Bureau of Enterprise Systems and Technology (BEST). These assets are fundamental to building a robust modular and interoperable Health IT SOA infrastructure, which is essential for enhanced care delivery, payment reform, and implementing and operating a connected delivery system of care.

Health IT Infrastructure

Participation in a broad healthcare ecosystem demands the ability to transparently and securely move health related data between participants. This requires leveraging many complex Health IT standards simultaneous while respecting privacy concerns. A HIE infrastructure that supports these requirements must have the following characteristics:

- Exchange patterns based on broadly used Health IT standards
- Connected health capabilities (applications, processes, people, providers)
- Basic and advanced features such as a PHR, provider portals, and data access provisioning to name a few
- Extensible, allowing for the development of custom solutions
- Modular in nature and capable of fitting into the state IT Infrastructure
- Able to integrate seamlessly with current state enterprise level resources such as the EMPI and Provider Registry
- Provide capabilities to support federated access to data as well as a centralized clinical data repository for data visualization and analytics
- Allow for integration with other Health IT networks to support Connecticut's network-of- networks model
- Flexible deployment that can leverage emerging cloud based approaches

The ability to access health data for operational and evaluative uses will allow DSS to participate in the ONC's roadmap to a Learning Health System. Use of BI will meet current and future needs of people through the use of their data in real time. The Health IT Framework addresses those needs through a phased approach which initially leverages the use of the Zato health platform. Future capabilities will be enhanced as clinical data becomes available through ongoing departmental activities.

Operationalizing the Health IT foundational components requires a hosting environment that address the need for security, flexibility, scalability, and appropriate service levels (Refer Figure 3). Leveraging current advances in hyperconvergent hosting technology can provide for these requirements.

Figure 3: Health IT and BI Infrastructure
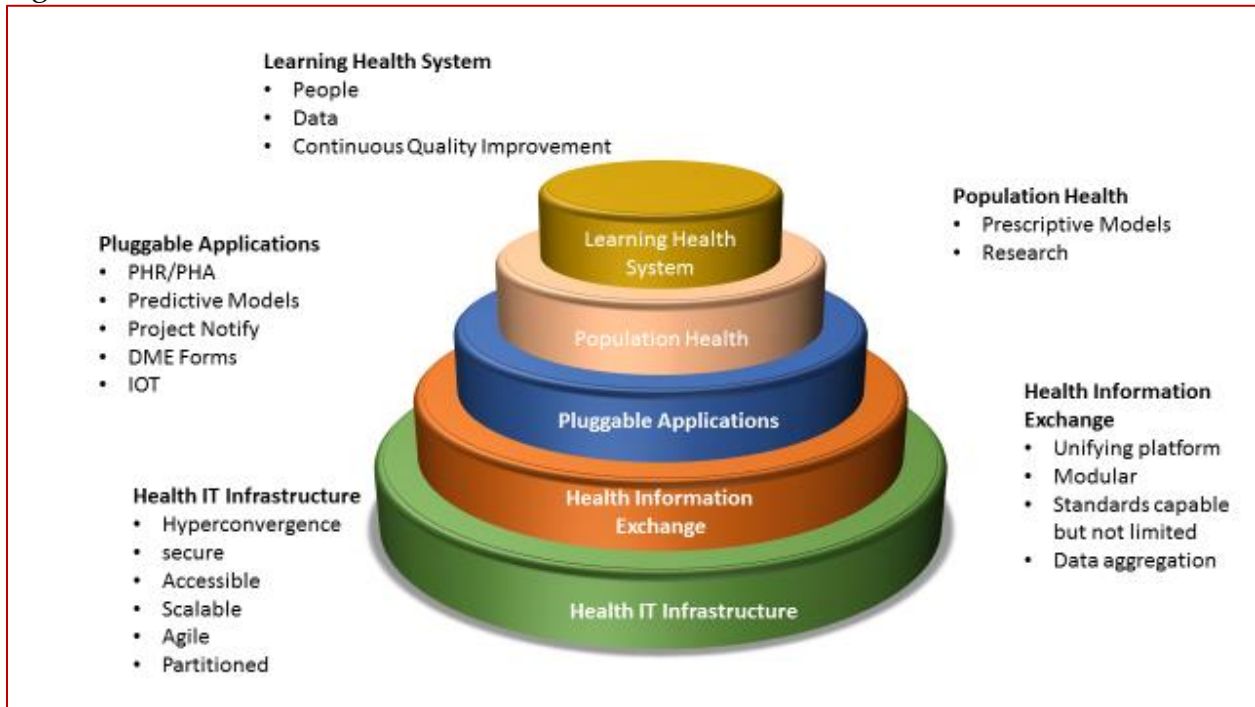
Health IT Initiatives

Medicaid Electronic Health Records Incentive Program

DSS launched the Medicaid EHR Incentive Program in July 2011, and the first incentive payments to eligible providers were issued in September 2011. **As of October 2017, 2,711 eligible professionals (EPs) and 29 eligible hospitals (EHs) have been paid under the Medicaid EHR Incentive Program**. This incentive program also supports the collection of electronic clinical quality measures and the infrastructure for Direct Secure Messaging.

HISP and Direct Secure Messaging (DSM)

In April 2014, DSS established a Health Information Service Provider (HISP) to provision Direct mailboxes for eligible providers (EPs) participating in the Medicaid EHR Incentive Program. DSS is promoting the use of Direct Secure Messaging (DSM) protocol to send messages between providers and/or systems to enhance care coordination for an array of program services (e.g., long-term post-acute care provider network, durable medical equipment) by ensuring secure exchange of documents (e.g., discharge summary, assessments, orders and continuity of care documents). DSM is a simple, secure, scalable, and a standards-based way for participants to send authenticated, encrypted health information directly to known,

trusted recipients over the internet. DSM is HIPAA compliant, and does not require the use of an EHR.

Electronic Clinical Quality Measures (eCQMs)

DSS is encouraging its healthcare provider network to submit data on clinical quality measures using defined standards, such as Quality Reporting Document Architecture (QRDA) Category I and III, CCDAs, etc. to report and measure clinical quality; ensure timely access to data for reporting and audits. DSS has purchased Zato Health Interoperability Platform, a data indexing technology[15] as an option to collect eCQMs as they relate to the Medicaid EHR incentive program[16]. This technology uses indices and edge servers to allow users to query data from multiple distributed sources simultaneously without the need for a central data repository.

> **Health IT Assets and Initiatives**
>
> - Standards-based Provider Registry
> - Enterprise Master Patient Index
> - Health Information Service Provider for Direct Messaging
> - Integrated Eligibility System
> - BI Tools including Indexing capability
> - Medicaid HIE Node/Personal Health Records

Integrated Eligibility System

In August 2017, DSS completed the deployment of their new integrated eligibility system for DSS. This new eligibility management system replaces an antiquated legacy system.

Health IT Assets

Enterprise Master Patient Index and Provider Registry

The DSS, implemented the EMPI in March 2016 and the Provider Registry in September 2017.[17] Both of these assets were previously procured by HITE-CT and are available as a shared service for enterprise use by state and non-state agencies at a cost assessed based on the fair-share principle. There are approximately 3.2 M unique people in the EMPI and 770,611 unique providers represented in the provider registry. In 2018, DSS is enhancing these two services by creating a relationship between the people and the providers creating a relationship registry, which will support the alert notification engine and will be used to generate and maintain attribution of people to providers for services and care coordination.

Alert Notification Engine

In 2017, the DSS executed an agreement with the Yale New Haven Health System (YNHHS) to receive the admission, discharge, and transfer (ADT) feed from the five

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[15] Annual licensing agreement; contracted vendor is Zato Health (www.zatohealth.com)

[16] CMS Meaningful Use Measures available at: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Meaningful_Use.html

[17] The contracted vendor for both EMPI and Provider Directory is NextGate.

participating hospitals. This data is being used to generate and share alerts/notifications with the practices and physicians that the Medicaid beneficiaries see in the outpatient setting to alert them to a change in a person's status. DSS intends to use Project Notify to reduce preventable emergency department readmissions and improve care coordination for better health outcomes for Connecticut's Medicaid beneficiaries. DSS will implement an automated real-time standard distribution and routing for ADT health alerts to Connecticut Medicaid providers and case managers, as well as provide alert notifications to primary care physicians (PCPs), specialists and other groups such as home health for Inpatient & ED Admit/Discharges. In 2018, we plan to receive additional feeds from other remaining hospital systems as well as using our notification engine for other use cases such as assisting with request for Meals on Wheels to be terminated or re-initiated when the person is admitted or discharged from a hospital or other inpatient/residential setting.

Project eDME – electronic submission of prescription orders for Durable Medical Equipment

Since 2016, the Connecticut Department of Social Services (DSS) offers the ability to place orders for Durable Medical Equipment (DME) electronically to Connecticut providers and practitioners that require the ability to submit DME orders electronically using HIPPA compliant Direct secure messaging standard. (Bill No. 5597).

Personal Health Records (PHRs)

The DSS is the recipient of a four-year grant from CMS (April 2014-18), Testing Experience and Functional Assessment Tools (TEFT). This four-year initiative is comprised of four components, of which two are related to Health IT (1) testing the use of PHRs in the long-term services and supports (LTSS) community and (2) aiding the development and testing of the eLTSS content and transport standard. In 2018, the DSS will implement the PHR among people participating in Money Follows the Person program and a web-based self-directed care plan process for people receiving services through the Community First Choice Program.

The first iteration of the PHR will provide consumers with access to their aggregated medical history. The aim is to combine clinical information, directly from providers, with claims data to form a single view of a person's healthcare journey. Subsequent versions will address many of the limitations of current PHR solutions:

- Ability to participate seamlessly in the context of the current and evolving HIT landscape
- Be conversational by providing verbal questions and response that help personalize the user experience
- Utilize advanced natural language processing to adapt the user experience to the context of the task being performed

- Provide a flexible security model that will allow users to easily configure ad-hoc sharing relationships that are secure, can be put in place for specific time periods, and engaged without advanced provisioning
- Allow DSS to develop a personalized content delivery channel that is based on consumer preferences (amazon like) and conditions

Medicaid HIE Node

DSS Medicaid is leveraging the Intersystems Platform to connect all the Health IT assets so that interoperability using standards can be achieved and seamless flow and exchange of data can be established for the DSS enterprise. It connects providers, patients, and payers with comprehensive patient records and analytics that span the care continuum within the DSS network of care.

The following Data Sources are planned for:

- Claims
- ADT
- CCDs, CCDAs, QRDAs, and other structured data
- Assessments, care plans
- Labs
- Pharmacy
- Immunization Registry
- Sequoia Carequality
- eHealth Exchange

DSS's Business Intelligence Landscape

In parallel with Health IT investments, the DSS has been investing in Business Intelligence solutions for over five years and as a result DSS is poised to use "big data" principles to create actionable information that supports its evolution from regulative to a generative business model. **Progressive** aggregation of voluminous (1983-2016, Refer Figure 4), varied (clinical, claims, services), and real-time data (velocity) begs for a supporting infrastructure that processes big data while checking for veracity. However, there is not much discussion about veracity and quality of the data being captured. These big data will assist us in identifying and designing cost-effective person-centered services.

DSS's Big Data

Since 2012, DSS has used the Zato Health Interoperability Platform (ZHIP) which uses a federated distributed model for aggregating and indexing large **volume** of data from a **variety** of programs and service area. This solution also uses natural language processing tools to mine text data in real-time to extract meaningful concepts for coding, analysis, and interpretations.

In 2016, DSS started integrating a **variety** of clinical and claims data to describe the population they served. In 2018, DSS will start receiving care summaries, assessments, admission-discharge-transfer feeds, in real-time, resulting in an increased velocity of data streams coming into the DSS. This type of large-scale integrated analysis is possible only if the foundational Health IT and BI infrastructure is robust, flexible, and inter-operational. The understanding of these person-level data will be further enhanced by integrating these data with data on social-determinants at community-level.

The Business Intelligence and Shared Analytics group at DSS continues to build and index databases that integrate statewide Temporary Assistance to Needy Families, Supplemental Nutrition Assistance Program, Medicaid, and other critical DSS data sets that are foundational to business intelligence, analytics, financial management, and client-care functions. In addition, real-time clinical messaging data will be online in 2018. The intentions are to improve care and support people, reduce or control costs, and improve quality through big data analytics and visualizations that support improved care coordination and delivery, and can be utilized by people and providers equally.

Geospatial Data Services, Analytics, and the Human Value Curve for Strategic Planning

Since 2016 DSS has made investments in ensuring a systematic collection, indexing, and analysis of geospatial data. As part of this initiative, innovative uses of geospatial and location information are proposed that combine indexed "Big Data" with parcel-level spatial data to integrate and analyze data at multiple temporal and spatial scales. Geospatial data and mapping visualizations play a key role in the Human Value Growth Curve (e.g. regulative, collaborative, integrative, and generative) as systems incorporate increased volume of data at faster rates.

Two specific benefits of location data and GIS analytic approaches over linear models are that spatial data:

- scales up and down easily allowing for analytics at different units of aggregation and
- the visual nature allows for communication and integration of big complicated data sets to a wide variety of people.

The innovative and unexploited value of these data may be released with the integration of person-level data (clinical, claims) with community-level location information to create new site and neighborhood specific knowledge. The evaluative geospatial techniques have enormous potential for change management and improving provider-patient relationships and health outcomes.

In 2016, data was collected for 20 towns in Connecticut that constitute about 70% of the DSS client base on physical infrastructure along with social, demographic, and economic data available at the Block Group scale (n=2585). We are currently geocoding person-level data using home address as that will allow for use of spatial statistical methods. These data are also available at the zip code and town level.

In 2018, we propose to extend this concept to identifying and exploring the social, demographic, economic, and medical geographies of clients as part of a broader effort to intensify usage of location analytics to improve client care and health, control costs, and provide location information for case management. Specifically, we propose to identify and understand the neighborhood and health context for the clients allowing case study projects for possible subject areas by visualizing and identifying statistical significant clusters of clients at parcel or site level with similar social determinant, health, and clinical characteristics. This greater understanding of neighborhood geography answers questions that identify ways to address barriers to improved outcomes. For example:

1. Evaluate access to transportation and medical facilities for time and cost efficiency and propose transportation routing alternatives;
2. Shift rental incentives to communities where people experience better lifestyles and improved health outcomes.

3. Compare clusters of populations that share similar social determinant and health characteristics using Diagnosis Related Groups (DRGs), Clinical Risk Groups (CRGs), or other classification systems to assess where costs and progression of disease are different. Further, these identified classification systems can be used to match people receiving services with case workers and care providers who have skill sets that match service needs.
4. Increase accuracy of data using geospatial techniques to create health score cards at micro- (neighborhood or block) rather than macro-level (town, county). This increased micro-level data accuracy will enable us to move from describing communities at the town level to being able to identify local concentrations of persons with particular health, income and environmental characteristics within individual neighborhoods, buildings, or families.
5. In the phase 2, the georeferenced DSS client data sets will be analyzed using innovative geographic analyses to find geographically important relationships between people and their local environment at fine local scales such as within neighborhoods.

In conclusion, the combination of the enormous indexed DSS and clinical data sets combined with location specific geospatial data at the neighborhood level help focus case management, financial investment, and clinical interventions towards specific targets. These new location-infused information products can provide inputs into all levels of the Human Growth Cover and be a new addition to dashboards that track client neighborhood and community health. Figure 5, shows the path forward from our current ecology to the phase of disruptive innovation and then emerging as a new adaptive system, very much akin to the processes highlighted in the complexity theory.
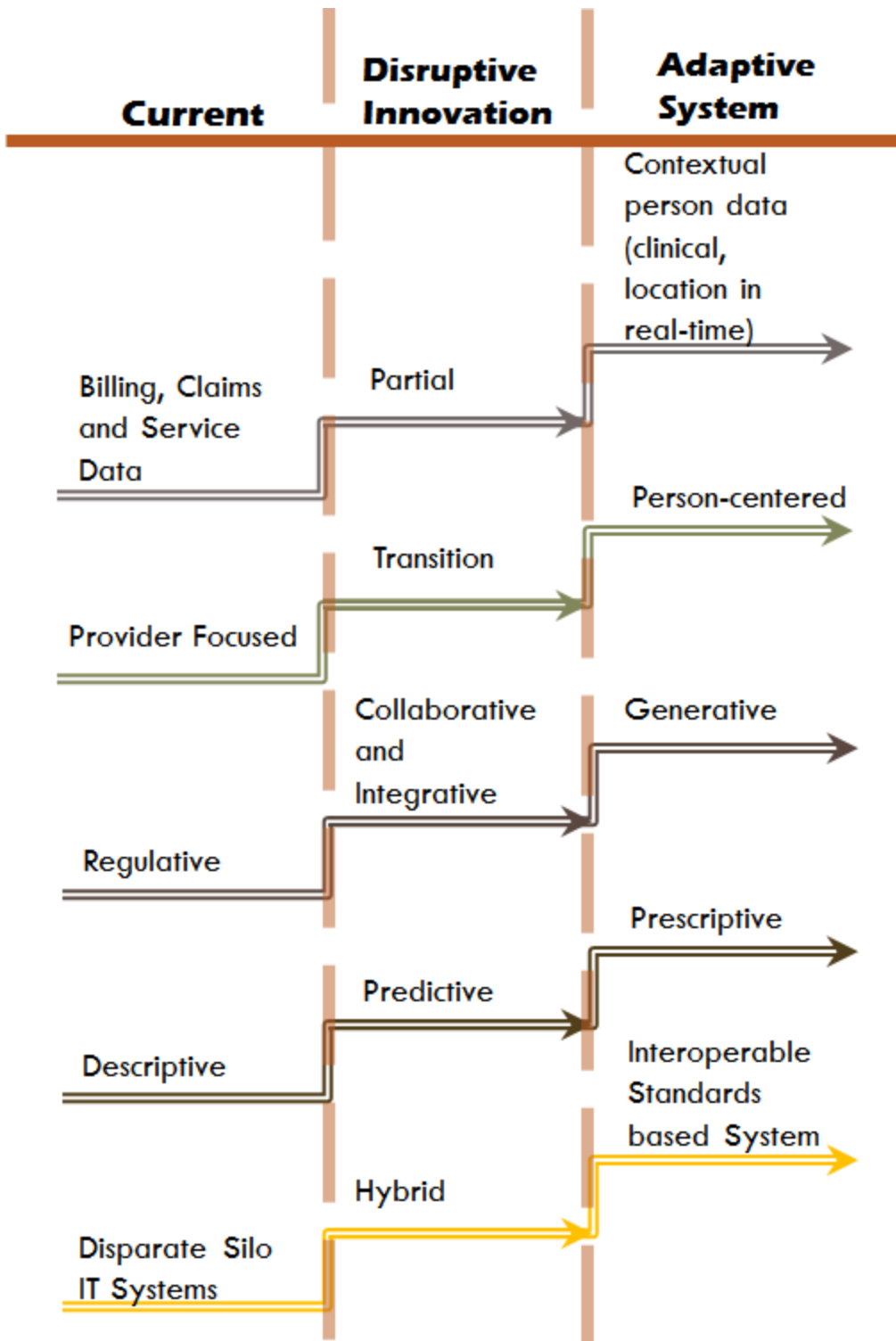
DSS Health IT and BI Logic Model

The DSS HealthIT and BI logic model (Refer Figure 5) depicts planned inputs, activities, outputs and health outcomes associated with investments in Health IT and BI. CT HealthIT is positioned to support initiatives that leverage technology solutions to improve health outcomes identified in the *Healthy Connecticut 2020 State Health Assessment* as needing immediate attention.[18]

Figure 5: Health IT and BI Logic Model

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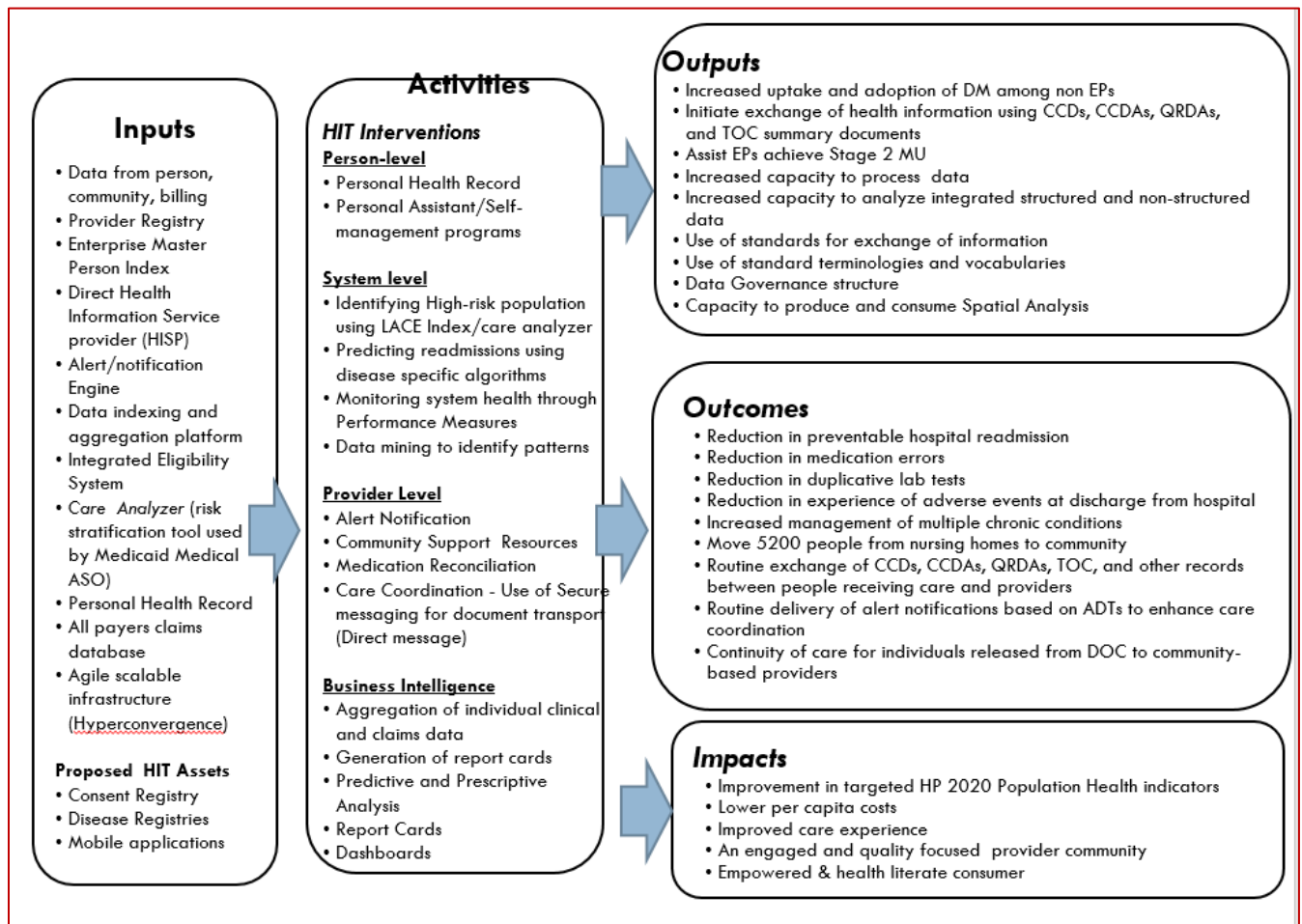
[18] Connecticut Department of Public Health. 2014. *Healthy Connecticut 2020. 1: State Health Assessment.* Hartford, CT: Connecticut Department of Public Health.

Health IT and BI Timeline

Over the last five-years the DSS has strategically and steadily enhanced and developed its BI and Health IT Infrastructure. 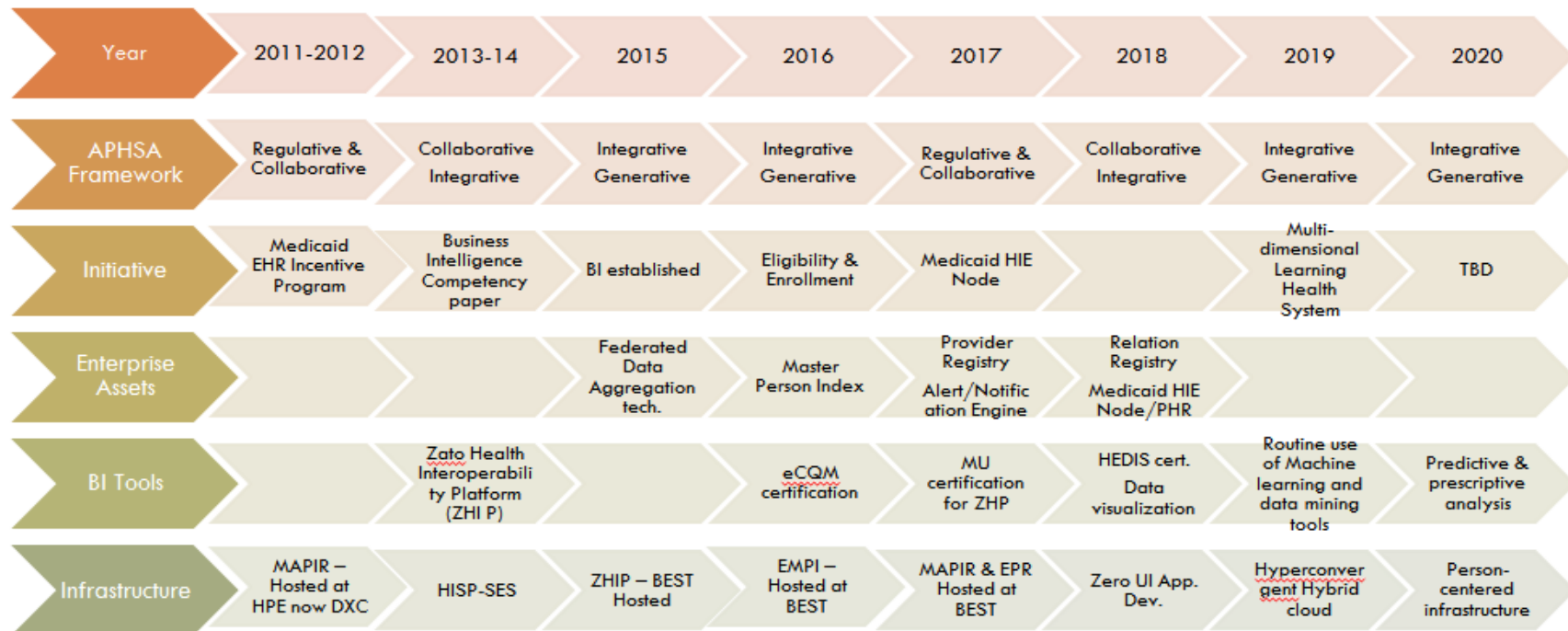Today, the DSS is well-positioned to use its health IT assets and data for informed delivery of care. Figure 6 below presents a timeline for Health IT and BI initiatives, assets, and infrastructure.

Figure 6: Health IT and BI Timeline 2011-2016 and 2017-2020

Year	2011-2012	2013-14	2015	2016	2017	2018	2019	2020
APHSA Framework	Regulative & Collaborative	Collaborative Integrative	Integrative Generative	Integrative Generative	Regulative & Collaborative	Collaborative Integrative	Integrative Generative	Integrative Generative
Initiative	Medicaid EHR Incentive Program	Business Intelligence Competency paper	BI established	Eligibility & Enrollment	Medicaid HIE Node		Multi-dimensional Learning Health System	TBD
Enterprise Assets			Federated Data Aggregation tech.	Master Person Index	Provider Registry Alert/Notific ation Engine	Relation Registry Medicaid HIE Node/PHR		
BI Tools		Zato Health Interoperabili ty Platform (ZHI P)		eCQM certification	MU certification for ZHP	HEDIS cert. Data visualization	Routine use of Machine learning and data mining tools	Predictive & prescriptive analysis
Infrastructure	MAPIR – Hosted at HPE now DXC	HISP-SES	ZHIP – BEST Hosted	EMPI – Hosted at BEST	MAPIR & EPR Hosted at BEST	Zero UI App. Dev.	Hyperconver gent Hybrid cloud	Person-centered infrastructure

BI and Health IT Metrics

Goals/Objectives	Policy, Practice, Process/ Structure, or Outcome
Drive decision-making, collaboration and service-coordination through enhanced use of data to improve services.	
Ensure that data are available to program staff for use in program planning easily	Practice
Generate count reports by program type by year and other identified demographic data (age, race, gender, ethnicity, town)	Policy Process/Structure
Select and implement standards-based technology solutions to improve delivery and measurement of outcomes	Practice Process/Structure
Instill public trust by continuously improving the way we administer programs, manage our resources and operate our infrastructure.	
Publish aggregate count reports by program type by year and other identified demographic data (age, race, gender, ethnicity, town) regularly	Process/Structure
Publish simple context specific articles quarterly based on agency data	Outcome
Publish data on efficiency and cost-effectiveness of programs as well as technology	Process/Structure Outcome
Improve access to health and human services to enable our customers to gain independence, enhance health and achieve well-being.	
Assist division/programs to use data to track person, program, division outcome by using standard metrics (reliable and valid) such as eCQMs, HEDIS measures, community index, maps, etc.	Outcome
Measure the success of the Personal Health Record by adoption metrics and behavior change	Process/Structure Outcome
Select and implement standards-based technology that assists people in self-direction and ownership of care	Process/Structure Outcome

In conclusion, for DSS to be successful we need to ensure that people are able to move data across platforms and among health and social-care delivery system easily and intuitively. To this end we plan to put the foundational interoperable platform in place so that all current technology assets and those procured in the future can interoperate. And above all, data collected via all these technology solutions can be used to create knowledge that helps create a continuous learning environment that supports person-centered improvements in care delivery.

Appendices

Appendix 1 – Connecticut's Health IT initiatives and legislation

2007	Center for Medicare and Medicaid Services awards $5.0M to Department of Social Services (DSS) to implement Medicaid Health Information Exchange (HIE) and Electronic Prescribing system (eRx) June 2007 **– PA 07-2 -** DPH to develop a statewide Health IT Plan
2009	Feb.　2009 – American Recovery and Reinvestment Act enacted Jun.　2009 – Dept. of Public Health (DPH) lead HIT agency and forms HITEAC (PA 09-232) Jul.　2009 – DPH publishes CT Health IT Plan Oct.　2009 – DPH establishes HITEAC (Health Information Technology & Exchange Advisory Council)
2010	Apr.　2010 – Office of the National Coordinator for Health Information Technology (ONC) awards $7.29M to DPH to create a statewide HIE Jun.2010 – **PA 10-117** - HITE-CT created Sep.　2010 – DPH submits Strategic and Operational Health IT Plan to ONC
2011	Jan.　2011 – Health Information Technology Exchange of Connecticut (HITE-CT) begins operation
2014	Jun.2014 – HITE-CT is sunset (PA 14-217) Jul. 2014 – **PA-14-217-**DSS responsible for state Health IT Plan development Resulting report, *CT HealthIT Strategic and Operational Plan for Governance*, was a result of a multi-agency workgroup effort that identified a vision, 　　*"empowers individuals and health resource providers by ensuring access to information necessary to achieve better health outcomes."* Dec.　2014 – CMS awards $45M to Office of the Healthcare Advocate for the State Innovation Model $10.7 M earmarked for Health IT and 1.9 M in state bond funds[19]
2015	**Jul.　2015 – PA 15-146** - DSS authorized to implement a statewide HIE. Aug. 2015 – DSS releases Health IT Governance Plan (PA 14-217) Aug. 2015 – First Advisory Council meeting
2016	Jan. 2016 – DSS submits HIE Plan to the Secretary of OPM for approval[20] April 2016 – Enterprise Master Person Index goes into production Jun. 2016 – SIM HIT Council is dissolved Jul. 2016 – **PA- 16-77** An Act Concerning Patient Notices, Designation of a Health Information Technology Officer, Assets Purchased for the State-Wide Health Information Exchange and Membership of the State Health Information Technology Advisory Council Jul. 2016 – OPM Secretary approves implementation of Provider Registry and alert notification for DSS.
2017	Provider Registry Project eDurable Medical Equipment Project Notify Zato Health Interoperability Platform certified for 2015 eCQMs
2018	Personal Health Record Web-based care plan tool for Community First Choice Offering EMPI and PR as a shared-service to sister state agencies

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[19] Connecticut SIM Model Test Proposal available at:
http://www.healthreform.ct.gov/ohri/cwp/view.asp?a=2741&q=334890
[20] Connecticut's Plan to establish a statewide HIE, Plan submitted by DSS to Sec. OPM on January 4, 2016.

Appendix 2 – Relevant sections from PA 15-146 and PA 16-77

Public Act 15-146

Vision

The Public Act 15-146 cites the following vison for the statewide HIE:

"There shall be established a State-wide Health Information Exchange to empower consumers to make effective health care decisions, promote patient-centered care, improve the quality, safety and value of health care, reduce waste and duplication of services, support clinical decision-making, keep confidential health information secure and make progress toward the state's public health goals (Section 21(a))."

Goals

The Public Act 15-146 cites the following goals for the statewide HIE:

"It shall be the goal of the State-wide Health Information Exchange to:

1. *Allow real-time, secure access to patient health information and complete medical records across all health care provider settings;*
2. *Provide patients with secure electronic access to their health information;*
3. *Allow voluntary participation by patients to access their health information at no cost;*
4. *Support care coordination through real-time alerts and timely access to clinical information;*
5. *Reduce costs associated with preventable readmissions, duplicative testing and medical errors;*
6. *Promote the highest level of interoperability;*
7. *Meet all state and federal privacy and security requirements;*
8. *Support public health reporting, quality improvement, academic research and health care delivery and payment reform through data aggregation and analytics;*
9. *Support population health analytics;*
10. *Be standards-based; and*
11. *Provide for broad local governance that (a)Includes stakeholders, including, but not limited to, representatives of the Department of Social Services, hospitals, physicians, behavioral health care providers, long-term care providers, health insurers, employers, patients and academic or medical research institutions, and (b) Is committed to the successful development and implementation of the State-wide Health Information Exchange (Section 21(b))."*

Public Act 16-77

The 2016 Connecticut General Assembly passed Senate Bill No. 289 authorizes the hiring of a HITO to implement a statewide Health Information Exchange (HIE). This act also establishes a 31-member state Health IT Advisory Council to guide this process.

> *"Sec. 4. (NEW) (Effective from passage) The Lieutenant Governor shall, within existing resources, designate an individual to serve as Health Information Technology Officer. The Health Information Technology Officer shall be responsible for coordinating all state health information technology initiatives and may seek private and federal funds for staffing to support such initiatives.*

Sec. 5. Section 17b-59a of the 2016 supplement to the general statutes is repealed and the following is substituted in lieu thereof (Effective from passage):

(b) The Commissioner of Social Services, in consultation with the Health Information Technology Officer, shall (1) develop, throughout the Departments of Developmental Services, Public Health, Correction, Children and Families, Veterans' Affairs and Mental Health and Addiction Services, uniform management information, uniform statistical information, uniform terminology for similar facilities, uniform electronic health information technology standards and uniform regulations for the licensing of human services facilities, (2) plan for increased participation of the private sector in the delivery of human services, (3) provide direction and coordination to federally funded programs in the human services agencies and recommend uniform system improvements and reallocation of physical resources and designation of a single responsibility across human services agencies lines to eliminate duplication.

(c) The [Commissioner of Social Services] Health Information Technology Officer, designated in accordance with section 4 of this act, shall, in consultation with the Commissioner of Social Services and the Health Information Technology Advisory Council, established pursuant to section 17b-59f, as amended by this act, implement and periodically revise the state-wide health information technology plan established pursuant to this section and shall establish electronic data standards to facilitate the development of integrated electronic health information systems for use by health care providers and institutions that receive state funding. Such electronic data standards shall: (1) Include provisions relating to security, privacy, data content, structures and format, vocabulary and transmission protocols; (2) limit the use and dissemination of an individual's Social Security number and require the encryption of any Social Security number provided by an individual; (3) require privacy standards no less stringent than the "Standards for Privacy of Individually Identifiable Health Information" established under the Health Insurance Portability and Accountability Act of 1996, P.L. 104-191, as amended from time to time, and contained in 45 CFR 160, 164; (4) require that individually identifiable health information be secure and that access to such information be traceable by an electronic audit trail; (5) be compatible with any national data standards in order to allow for interstate interoperability; (6) permit the collection of health information in a standard electronic format; and (7) be compatible with the requirements for an electronic health information system."