NCS
Northeast Computer Systems, Inc.

INDEPENDENT REVIEW

OF THE

VERMONT HEALTH INFORMATION EXCHANGE (VHIE) FY2017 OPERATION & MAINTENANCE AND DEVELOPMENT AGREEMENTS

For the
State of Vermont
Department of Information & Innovation (DII)
And
Department of Vermont Health Access (DVHA)

VERSION 2.3a

THIS DOCUMENT CONTAINS CONFIDENTIAL INFORMATION

Submitted to the
State of Vermont, Office of the CIO
by:

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1 EXECUTIVE SUMMARY

1.1 COST SUMMARY

IT Activity Lifecycle:	1 year	(FY2017 – Grant & 1 contract) & (CY2016 – 1 contract)	
Total Lifecycle Costs:	**$ 7,371,827.98**		
Total Implementation Costs:	--		
New Annual Operating Costs:	**$ 7,371,827.98**		
Difference Between Current and New Operating Costs:	**$ (65,693.20)**[1]	[O&M Grant Only]	
Funding Source(s) and Percentage Breakdown if Multiple Sources:	Medicaid Assistance Program	Federal	37.3%
	State Innovation Model	Federal	18.3%
	HITECH HIE (Federal Share FFP 90%)	Federal	12.5%
	HITECH HIE (State Match 10%)	State	1.4%
	State share to match Global Commitment (non-subrecipient funds)	State	30.5%

1.2 OVERALL SUMMARY

The present review considers the technical scope of three agreements (one grant and two contracts), which, aside from some differences in start and end dates, may be considered to represent one year of operation, maintenance, and development work on the Vermont Health Information Exchange (VHIE) by Vermont Information Technology Leaders, Inc. (VITL). We refer to these agreements collectively as FY2017 agreements (despite the date differences), and build upon a review of the FY2016 Operation & Maintenance (O&M) grant, conducted by the same reviewer.

Over the past year, the State has made significant progress in agreement specificity, deliverables tracking, security and privacy assessment, and performance measurement. More needs to be done. In 18 VSA § 9352, the Legislature created significant VITL oversight measures for budget (via Green Mountain Care Board) and technology (via DII review such as the present one).

Data Warehouse

[1] FY2017 O&M Grant (4,900,000) – FY2016 O&M Grant (4,965,693.20) = -$65,693.20.

The sparseness of specificity and measures in the agreements probably flows from the historical development of the VHIE. In early years, the emphasis was on getting it off the ground, and VITL was given great latitude in determining need among the initial primary stakeholders -- healthcare organizations (HCOs) at the point of care -- and developing a functional system to meet those needs. The funding agreements as they exist reflect this "block-grant-like" model, focusing on bottom-line costs and completed deliverables, with little attention paid to system architectural details. As a result, the VHIE is something of a "black box" to State personnel who manage the program, and to those who provide technical oversight.

One significant part of the VHIE enterprise as VITL has developed it is a "data warehouse," intended to prepare and appropriately direct data to certain authorized users, such as accountable care organizations, for further analysis. The State has implicitly supported this development by funding it over several agreement cycles, and continues to benefit from its functions, yet the State has never explicitly required nor specified a data warehouse.

As the VHIE matures, it becomes increasingly important to see it as an integral component of the Vermont Health Information Technology (HIT) enterprise as a whole, with a need for interoperability and functions that complement and go beyond that of the initial point-of-care needs. From the perspective of the State, it is far from certain -- because VITL's enterprise architecture is largely opaque to the State -- that the VITL "data warehouse" has the enterprise architectural characteristics that will be necessary to efficiently fill these coming needs, without duplication or increased cost. At the same time, the State has not determined with sufficient specificity what it will need in a data warehouse, nor indeed whether it properly should reside in the VHIE enterprise.

Therefore, two of our most important recommendations in this review are:

- The State should apply to VITL the established process known as an Architectural Assessment, to more fully understand the VHIE enterprise and to establish in detail how it aligns with both the State Information Technology Strategy and the Vermont Enterprise Architecture Framework
- The State should undertake a process to sufficiently define its needs for a data warehouse within the HIT enterprise.

Security Plan

The State has greatly improved oversight of VHIE security and privacy, by means of continuing review and discussion of the VITL third party security assessment, and remediation by staff of the State office of the Chief Information Security Officer. We acknowledge the firm basis provided by the assessment, and now recommend further development of the security plan, to provide sufficient context and confidence going forward. Although we identify the greatest number of risks in the Security and Privacy realm, this results largely from the fact that mostly detail work remains.

1.3 DISPOSITION OF INDEPENDENT REVIEW DELIVERABLES

Deliverable	Highlights from the Review *Include explanations of any significant concerns*

Acquisition Cost Assessment	**Overall cost**
	VHIE currently costs around $7.7 million per year to develop and operate. Although quickly maturing, it is still in a developing phase, and much of that cost represents new feature development. The ongoing Operation & Maintenance costs are close to $5 million.
	
	Although there are challenges in making comparisons to other states' HIEs, because their characteristics vary so widely, Vermont's initial HIE implementation costs seem roughly in line with the others.
	
	• In a strict "bottom-line" comparison to 6 other relatively similar state HIEs, Vermont's cost is appropriate. At total VITL expense in *FY15* of $7,292,032, it was just below the average cost of $7,442,818, and just above the median cost of $6,918,534.
	• In a comparison of per-capita expense for the same period, Vermont's cost at $11.64 is quite high.
	  ○ However, *if* per-capita cost is inversely related to population, the cost may be in line.
	  ○ Also, geographic factors and the VHIE MPI indicate that the served population may be significantly larger than the state population.
	
	Personnel Cost
	• Subject Matter Expertise rates quoted in the agreements are slightly below GSA median national industry rates for on-contractor site labor, assuming both to be fully loaded

Technology Architecture Review	In light of the 18 VSA § 9352 request for this review, we focused especially on the Security, Privacy, and Interoperability aspects of the agreements. Regarding security and privacy, we found that the State and VITL have made very significant progress in the past year in ensuring the proper performance measures for State oversight of VHIE security. We recommend requiring VITL to elaborate the existing Plan of Action and Milestones to form a more comprehensive security plan. We identified a number of security and privacy related risks in the agreements, tracking, and management of the project; but nearly all were already recognized by the State, with mitigation already planned or underway. In short, we feel a good start has been made, and subsequent agreements will require follow-through and detail work. Regarding interoperability, we identified significant questions regarding the "data warehouse" function of the VHIE enterprise, and recommend that the State

	undertake (1) an architectural assessment of the VHIE enterprise; and (2) a process to define State needs and specifications for an HIT data warehouse. (See Overall Summary, above, for more). We found one fairly technical issue resulting from a number of conflicts between the language of contract requirements, state privacy law, and VITL published policy. We think this issue will be fairly straightforward to resolve, but it points out the complexities of compliance and the need for adequate State expertise in this area
Implementation Plan Assessment	VHIE continues as a quite complex but generally well-organized key project in the VHIT Enterprise, following PMBOK principles and coordinating State and VITL project planning efforts. Although showing significant progress over the past year, the State continues to need improvement on tracking deliverables, measuring VITL performance, and documenting both. The State Auditor's report made several good recommendations for progress in agreement development. We have seen good collaboration and communication in project management for VHIE, between VITL and SOV and within SOV. Our concerns are largely with adequate in-agreement metrics and documentation that will lead to performance measurement.
Cost Analysis and Model for Benefit Analysis	The VHIE is a major healthcare reform component, which, because of its employment of the Single Designated Entity (SDE) model, accrues cost primarily within State government (with associated federal funding) while anticipating benefits in the polity. Although HIEs are such recent developments in healthcare that quantitative research on their effects are still relatively rare, yet a couple of well constructed studies show measurable cost savings in Emergency Department (ED) laboratory and radiology use when HIEs similar to the VHIE are regularly employed. As the primary source of in-state live data for healthcare cost and quality population study, Vermont healthcare reform efforts including work of Accountable Care Organizations rely strongly on VHIE's continued maturation. Intangible benefits are therefore widely expected, and seem likely.
Impact Analysis on Net Operating Costs	Vermont funds VHIE (and some other HIT initiatives) through a mix of federal funds and State HIT fund expenditures. Federal funding includes Vermont's Global Commitment for Health Medicaid 1115 Waiver and "HITECH" Medicaid "fair share" funding. For the past three years, additional federal funds have been available from the Centers for Medicaid and Medicare (CMS) State Innovation Models (SIM) Testing Grant. The total cost for one year of operation as represented by these three agreements (including non-technical scope items) and associated State cost is: **$ 7,873,337.98**

1.3.1 IDENTIFIED HIGH IMPACT &/OR HIGH LIKELIHOOD OF OCCURRENCE RISKS

NOTE: Throughout the narrative text of this document, **Risks and Issues are identified by bold red text**, and an accompanying tag (**_RISK-ID#-0_**) provides the Risk or Issue ID to reference the risk, response, and reference in the Risk Register. The following table lists the risks identified as having high impact and/or high likelihood (probability) of occurrence. Please see the **Risk & Issues Register, in Attachment H**, for details.

Probability:	Assessment of likelihood of risk occurring, scale of **1 – 9**, from least to most likely
Impact:	Assessment of severity of negative effect, scale of **1 – 10**, from least to most severe
Risk Rating:	An assessment of risk significance, based on multiplication of **(impact X probability ratings)** (*see below*). • **1-30 = low** • **31-60 = moderate** • **61 – 90 = high**

1.3.2 IDENTIFIED HIGH IMPACT &/OR HIGH LIKELIHOOD OF OCCURRENCE RISKS IN THIS PROJECT

(Note that ratings are generally low, reflecting mitigations *and* agreements well underway, but a few high ratings remain. Mitigations may take place going forward, rather than in this contract cycle.)

Risk Description	RISK RATING PROB / IMPACT	State's Planned Risk Response	Reviewer's Assessment of Planned Response
No evident incident response plan testing for VHIE at SOV and/or at VITL	50 5/10	MITIGATE: Conduct regular and documented incident response planning exercises (e.g., tabletop mock incident), including VITL, SOV, and other entities if appropriate. Exercises should include technical-, compliance-, and executive-level participants.	**concur**
The POAM, standing alone, does not constitute a complete security plan	50 5/10	MITIGATE: Require further elaboration of the security plan, including at least the items listed in the narrative below.	

The State has not defined in detail its need for an HIT data warehouse	70 7/10	MITIGATE: Conduct an architectural assessment of VITL's VHIE enterprise (both "sides"), according to established State procedures	**concur**
The State does not have a clear Enterprise Architectural understanding of the VITL "data warehouse", nor the VHIE as a whole	70 7/10	MITIGATE: Determine the applications, requirements and specifications, and uses of a data warehouse for HIT	
Technological (for example, EA) cooperation between SOV and VITL has generally taken place at executive (Senior) level, rather than with front-line implementers (such as Enterprise Architects)	40 5/8	MITIGATE: Some very recent sub-projects are initiating implementer level cooperation. Use this as a beginning of more regular interaction of this type.	**concur**
SOV lacks a comprehensive and single HIT-wide data governance plan and process that includes VITL/VHIE along with other HIT entities	40 5/8	MITIGATE: Draft proposal for data governance is underway and under discussion	**concur**
Grant and contract(s) execution have often been significantly delayed	42 6/7	MITIGATE: Continue to develop more streamlined processes for executing agreements with VITL and also timing and sequencing of various agreements and amendments. MITIGATE: accept recommendations of SOV audit report	**concur**

1.4 OTHER KEY ISSUES

We identified one relatively minor ***issue*** in this review. It is classified as an *issue* because it is a risk which has come to pass. In other words, until it is corrected, we believe the risk is realized; it should be relatively easy to correct in the current agreements.

Risk Description	RISK RATING PROB / IMPACT	State's Planned Risk Resolution	Reviewer's Assessment of Planned Response
Certain inconsistencies concerning breach notification requirements arising between SOV contract provisions (including the BAA), Vermont state breach notification law, and VITL Security Policy: InfoSec 4 (see narrative Section 6.5 Security and Privacy -- Compliance for further details)	50 10/5	MITIGATE: Correct these inconsistencies, both in SOV contract provisions (in the form of the standard BAA), and in related security and policy procedures at VITL.	**concur**

1.5 RECOMMENDATION

We recommend that the State continue operation, management, and development of the VHIE network as planned and agreed by the documents under review, with attention to the risks and issue identified in this review, especially:

- **Architectural Assessment of VITL**
- **Determination of State needs and requirements for a data warehouse**
- **Elaboration of VITL security plan.**

1.6 CERTIFICATION

I hereby certify that this Independent Review Report represents a true, independent, unbiased and thorough assessment of this technology project/activity and proposed vendor(s).

e-Signed by Paul Garstki
on 2017-02-26 19:24:46 GMT

Signature

February 26, 2017

Date

1.7 REPORT ACCEPTANCE

The electronic signature below represent the acceptance of this document as the final completed Independent Review Report.

e-Signed by Darwin Thompson
on 2017-03-01 20:35:10 GMT

State of Vermont Chief Information Officer

March 01, 2017

Date

e-Signed by John P Hunt
on 2017-02-27 21:47:18 GMT

February 27, 2017

2 SCOPE OF THIS INDEPENDENT REVIEW

2.1 IN-SCOPE

Request and Controlling Legislation

On June 14, 2016, the Secretary of Administration sent the following request to the State CIO and the Director of the Vermont Healthcare Innovation Project:

> *As you know, under 18 VSA § 9352 the Secretary of Administration has the ability to request that DII review VITL's technology for security, privacy, and interoperability with State government information technology. My understanding is that we are in the process of negotiating several agreements with VITL. With this email,* ***I am formally requesting that DII review VITL's technology by performing an Independent Review of the technical scopes identified in the DVHA SFY17 Core Grant, DVHA SFY17 IAPD Contract, and the 2016 SIM Contract.*** *Given the overlapping scopes and the fact that it is all for one organization, I would like DII to only perform one Independent Review for all of this as soon as possible. Because there was an Independent Review of VITL last year, I would assume that the review this year will build off of that review and not be unduly burdensome. Additionally, I would like these agreements to be executed prior to the Independent Review. If necessary, we can amend the agreements based on the recommendations of the Independent Reviewer.* (emphasis added by Independent Reviewer)

18 VSA §9352(c)(2) reads in part:

Notwithstanding any provision of 3 V.S.A. § 2222 or 2283b to the contrary, upon request of the Secretary of Administration, the Department of Information and Innovation shall review VITL's technology for security, privacy, and interoperability with State government information technology, consistent with the State's health information technology plan required by section 9351 of this title.

3 VSA §2222(g)(1) reads in part:

The Secretary of Administration shall obtain independent expert review of any recommendation for any information technology activity initiated after July 1, 1996, as information technology activity is defined by subdivision (a)(10) of this section, when its total cost is $1,000,000.00 or greater or when required by the State Chief Information Officer. Documentation of this independent review shall be included when plans are submitted for review pursuant to subdivisions (a)(9) and (10) of this section. The independent review shall include:

- an acquisition cost assessment;
- a technology architecture review;
- an implementation plan assessment;
- a cost analysis and a model for benefit analysis;

- a procurement negotiation advisory services contract; and
- an impact analysis on net operating costs for the agency carrying out the activity.

The State CIO interprets the Secretary's request for an Independent Review as meaning that the usual template for Independent Review of contracts be used as the template for the present review, with the exception that the scope of review is limited to "technical scopes" of the pertinent agreements, as determined by the Independent Reviewer.

2.2 OUT-OF-SCOPE

- A separate deliverable contracted as part of this Independent Review may be procurement negotiation advisory services, but documentation related to those services are not part of this report.

3 SOURCES OF INFORMATION

3.1 INDEPENDENT REVIEW PARTICIPANTS

Name	Title	Employer	Topic(s)
Susan Barrett	Executive Director	Green Mountain Care Board	GMCB oversight
Jon Brown	(2015) HIE Project Manager	Department of Vermont Health Access	Project Mgt.
Casey Cleary	Enterprise Architect	Department of Information and Innovation	Enterprise Architecture, Data Warehouse, Data Governance
John Evans	Chief Executive Officer	Vermont Information Technology Leaders, Inc.	Costs and Benefits
Michael Gagnon	Chief Technology Officer, Chief Security Officer	Vermont Information Technology Leaders, Inc.	VITL Technology, Security
Jack Green	Deputy Chief Information Security Officer	Department of Information and Innovation	Security
Tim Holland	Oversight Project Manager	Department of Information and Innovation	PM Oversight
John Hunt	Chief Enterprise Architect	Department of Information and Innovation	Enterprise Architecture, Data Warehouse, Data Governance
Meaghan Kelley	Grants Management Specialist	Department of Vermont Health Access	Business
Georgia Maheras	Deputy Director of Healthcare Reform for Payment and Delivery System Reform; Director, Vermont Healthcare Innovation Project	Agency of Administration	General Issues, Funding
Steven Maier	(2015) HIE Business Lead/ State HIT Coordinator	Department of Vermont Health Access	General Issues
Larry Sandage	HIE Program Manager	Department of Vermont Health Access	General Issues, Funding
Lauri Scharf	(2015) Systems Administrator	Vermont Information Technology Leaders, Inc.	VITL Technology
Glenn Schoonover	State of Vermont Chief Information Security Officer	Department of Information and Innovation	Security
William Sipsey	(2015) Enterprise Architect	Department of Information and Innovation	Enterprise Architecture
Richard Terriciano	Associate HIT Coordinator HIE/EHRIP Programs	Department of Vermont Health Access	General Issues, Business, Data Warehouse
John Stern	HSE Portfolio Director	Agency of Human Services	General Issues, Data Warehouse
Emily Wivell	Information Security Analyst	Department of Information and Innovation	Security
Emily Yahr	HCR-HIT Integration Manager	Department of Vermont Health Access	General Issues, Data Warehouse

3.2 INDEPENDENT REVIEW DOCUMENTATION

The following documents were used in the process and preparation of this Independent Review

Document	Source
Agency of Human Services, Data Governance Design Proposal, Date of Publication: 06/20/2016, Version: Draft 1.7	State of Vermont
Agency of Human Services, Data Quality Management Spreadsheet_VITL FY17 Contract DRAFT, 2016	State of Vermont
Department of Information and Innovation, Non-Functional Requirements Spreadsheet, Ver. 10.2	State of Vermont
Department of Vermont Health Access, Grant # 03410-256-17, Operation and Management of Vermont Health Information Exchange Network, 07/01/2016	State of Vermont
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Department of Information and Innovation, Information Security Policy, 11/02/2010	State of Vermont
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State Of Vermont, *Standard Grant Agreement, Vermont Information Technology Leaders, Inc., GRANT #: 3410-256-16*, Department Of Vermont Health Access, July 1, 2015.	State Of Vermont
State Of Vermont, *Standard Grant Agreement, Vermont Information Technology Leaders, Inc., GRANT #: 03410-1275-14*, Department Of Vermont Health Access, July 11, 2015.	State Of Vermont
State of Vermont, *Contract For Personal Services, Vermont Information Technology Leaders, Inc., CONTRACT #28155*, Department Of Vermont Health Access, March 12, 2015.	State Of Vermont

State of Vermont Green Mountain Care Board, *In re: Criteria for Creating or Maintaining Connectivity) to the Vermont Health Information Exchange (VHIE)*, February 27, 2015.	State Of Vermont
Justin Johnson, Secretary, Vermont Agency of Administration, *Re: Health IT-Fund Annual Report per 32 V.S.A. § 10301(g),* Memorandum to: Legislative Joint Fiscal Committee, September 2, 2015.	State Of Vermont
Robin J. Lunge, JD, Director of Healthcare Reform, *Strategic Plan for Vermont Health Reform, 2012 –2014*, Vermont Agency of Administration, July, 2012.	State Of Vermont
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HIETexas, THSA Releases Information on Interface Development Services for Texas HIEs, http://hietexas.org/news-archive/332-thsa-releases-information-on-interface-development-services-for-texas-hies September 17, 2015, retrieved November 15, 2015.	HIETexas

4 PROJECT INFORMATION

4.1 HISTORICAL BACKGROUND

4.1.1 HEALTH INFORMATION EXCHANGE

The term Health Information Exchange (HIE), as used in this review, is an information system managed by a Health Information Organization (HIO) for the purpose of storing and exchanging Protected Health Information (PHI) through the capability to electronically move clinical information among disparate Electronic Health Record (EHR) systems, while maintaining the meaning of the information being exchanged.[2] The EHR systems may belong to healthcare providers, private or public laboratories, mental health agencies, other public or non-profit care providers, etc. An HIE may be private -- for example, it may be internal to a large corporate hospital network -- or it may be public, implemented at a state or regional level.

A state-wide HIE may have several complementary purposes, among which are:

- To improve individuals' healthcare by facilitating effective, timely, and efficient movement of clinical information between providers
- To facilitate individuals' control of the use of their PHI
- To improve the quality and cost effectiveness of healthcare throughout the state by the continuing analysis of de-personalized, aggregated healthcare data
- To improve the quality and cost effectiveness of healthcare data by making appropriate data available for analysis by healthcare providers, for example via Accountable Care Organizations (ACOs)

VHIE is a state-wide HIE. The agreements under review provide for one year of funding for continued operation, maintenance, and development of the VHIE by VITL.

4.1.2 DEVELOPMENT OF THE VHIE

In 2009, the legislature designated the not-for-profit corporation Vermont Information Technology Leaders (VITL) as the sole operator of the nascent health information exchange (HIE)[3]. As the creation, development, and implementation of HIEs in Vermont and throughout the nation were expected to be

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[2] It has become common to talk of HIE "*the noun*" (to mean systems like VHIE) and HIE "*the verb*" to mean "*the electronic movement of health-related information among disparate organizations according to nationally recognized standards in an authorized and secure manner.*" (See for example http://www.himss.org/what-health-information-exchange) In spite of this obviously incorrect designation, we want to acknowledge that HIE has multiple meanings. (It's still a noun, though.)

[3] 18 V.S.A. § 9352(c)

funded initially by time-limited competitive federal grants, combined with State and regional fund sources, Vermont elected to employ a model known as "SDE-like,[4]" employing a "Single Designated Entitiy" (SDE) in the form of VITL, but receiving federal grant funds directly, and disbursing the funds as grants or as contract payments to VITL as SDE.

The method of implementing a state-wide HIE rests entirely at the state level, although the federal government -- initially through the Health Information Technology for Economic and Clinical Health (HITECH) Act – has provided incentive in the form of funding. The structure of the healthcare delivery and payment systems varies widely from state to state, and this fact, along with political imperatives, results in a variety of HIE implementation models. For example, some states have one or more commercial hospital systems, each of which may host its own internal HIE; and some states have a large number of payers. These realities may lead a given state to opt in favor of a "federated" HIE, facilitating connections between a number of regional HIEs, or a centralized, single HIE, or a "hybrid" system. The database may be created by a commercial HIE developer, by internal state resources, or by a selected mix of vendors. For these and other reasons, there exists simply no single model to hold out as a "typical" state HIE.

18 V.S.A. § 9352(c) reads:

> *Health information exchange operation. VITL shall be designated in the Health Information Technology Plan pursuant to section 9351 of this title to operate the exclusive statewide health information exchange network for this State. The Secretary of Administration or designee shall enter into procurement grant agreements with VITL pursuant to 8 V.S.A. § 4089k. Nothing in this chapter shall impede local community providers from the exchange of electronic medical data.*

Vermont Information Technology Leaders, Inc., (VITL) is a non-profit, 501(c)(3) Vermont corporation[5]. The statutory designation of VITL in 18 V.S.A. § 9352, from which the above is extracted, defines a governing board for VITL that includes significant stakeholders in the statewide HIE enterprise, including representatives of government, healthcare providers, healthcare payers, and private enterprise, to facilitate early and extensive statewide development and adoption of VHIE (while explicitly not "impeding" non-VHIE exchange of data between providers). VITL is not a part of State government. State government provides the largest portion of VITL funding (through direct State funds and pass-through of

[4] Dulluh, Ubri, and Hovey, *CASE STUDY REPORT, The State HIE Program Four Years Later: Key Findings on Grantees' Experiences from a Six-State Review*, NORC at the University of Chicago, p. 5 (December, 2014).

[5] Vermont Information Technology Leaders, Inc., *A Year of Informing Healthcare Decisions, 2014 Annual Report*, p.21 (January 15, 2015).

federal funding)[6]. VITL also receives direct federal funding, program service fees, and conference revenue[7].

Vermont's healthcare landscape has some characteristics which may favor strong adoption of HIE connection by providers. Among these characteristics (but not exclusively) are: low competition among hospitals; low population density; early legislative and administrative support for an HIE, with the creation of the Blueprint and designation of VITL. Additionally, decisions taken early on -- such as the inclusive stakeholder model of the VITL board, support for vibrant Accountable Care Organizations (ACOs), inclusion of the Regional Extension Center (REC) in VITL, and a connectivity incentives for providers -- established a supportive backdrop to the HIE. As a result, although the HIE is statutorily operated exclusively by VITL, the function of the HIE is explicitly "plugged in" to the statewide health reform effort.

In light of the national and Vermont HIE landscape, VHIE can be fairly characterized in a number of ways. VHIE may be considered to be a "hybrid centralized" system, consolidating all specifically HIE data in a single database system, but separating some parts of the total information network (VHIEN)[8]. Although the HIE database and platform itself are designed (with direction and collaboration from VITL) and hosted by the HIE vendor, Medicity, VITL's entire HIE operation comprises two "sides," one side being the Medicity VHIE platform (the “VHIE proper”), and the other side housing related VHIEN programs -- such as terminology services, clinical data warehouse, and data quality services -- hosted at RackSpace[9],[10] (see Attachment A, **VITL VHIE Enterprise** Diagram, and **section 6.2 Enterprise Architecture**, below) VITL also maintains a secure development and accounting network in its Burlington, VT, location.

Through funding provided by the American Recovery and Reinvestment Act (ARRA), VITL was designated by the State of Vermont as the REC, with responsibility to assist primary care providers in the adoption and meaningful use of electronic health records[11]. With the sunset of ARRA REC funding, the State decided to continue VITL's role in this function[12]. As a result, VITL can directly assist and inform primary care providers in their connections and use of Electronic Health Record (EHR) and HIE technologies. This close integration, while not unique to Vermont, likely contributes to efficiency and rapid growth of HIE connection and use.

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[6] *Ibid.,* p.21.

[7] Vermont Information Technology Leaders, Inc., *Financial Statements and Supplementary Information, June 30, 2014 and 2013*, p. 4 (September 8, 2014).

[8] *Ibid.*

[9] VITL Chief Technology Officer, Systems Administrator, *Personal Interview* (August 17, 2015).

[10] VITL Systems Administrator, *Diagram of VITL Network Connections,* via Email (August 24, 2015).

[11] VITL Chief Technology Officer, Systems Administrator, *Personal Interview* (August 17, 2015).

[12] *Ibid.*

As anticipated, early funding for VHIE (through or from the State) was initially about 90% federal, with about 10% from the Health IT-fund, *32 V.S.A. § 10301(2*). (The Healthcare Claims Tax *, 32 V.S.A. § 10402*, imposes an approximately 1% tax on Vermont health insurance paid claims, and deposits one-fifth of this tax into the Health-IT fund.) Beginning around 2010, the federal HITECH Act, through the State HIE Program, provided a large portion of State-controlled funding. Prior to 2013, during the period which might be considered the "start-up" period for VHIE, the State granted funds to VITL in a "block grant-like" form, defining implementation activities and setting general targets for interface creation between VHIE and provider organizations. Starting in 2013, the State began to structure the grant more specifically, in 2014 settling on a combination of contract (for specific activities) and grants (for continuing operation & maintenance). Currently, one grant and two contracts are in force. The grants and contract are largely divided along funding source lines.

Early in 2015, the legislature enacted the current version of 18 V.S.A. § 9352, which set out some specific modifications to the relationship between VITL and State government. Especially relevant items for the present review include (1) assigning VITL budget oversight and approval (of State-funded initiatives, including Federal pass-through funding) to the Green Mountain Care Board; and (2) empowering the Secretary of Administration to request a review by the Department of Information and Innovation (DII) of VITL's HIE network architecture and security (partially the impetus for the present independent review).

This review concerns the technical scopes of three agreements between the State of Vermont (SOV) and VITL, which were currently in effect at the time of this review:

- **Grant # 03410-256-17**
  Operation and Management of Vermont Health Information Exchange Network
  Start: 07/01/2016
  End: 06/30/2017
- **Contract # 31204 (Amendment #1)**
  "to develop and implement a population-based infrastructure within VITL"
  Start: 01/01/2016
  End: 12/31/2016
- **Contract # 32349**
  "personal services generally on the subject of Vermont Health Information Exchange Network and related products and services."
  Start: 07/01/ 2016
  End: 06/30/2017

4.2 PROJECT GOAL

The O&M grant # 03410-256-17 supports one year of continued operation and maintenance of the HIE program (both "sides"), while continuing the State process of clarifying and increasing accountability of funding lines and sub-projects within the HIE enterprise. The grant itself introduces the Scope of Work with the following explanation:

> *Pursuant to 18 V.S.A. § 9352, the State is awarding this grant agreement to the Subrecipient in order for the Subrecipient to operate the Vermont Health Information Exchange (VHIE) network, the exclusive statewide health information exchange network for this State. This grant supports the operation and expansion of VHIE and related products and services. The Subrecipient shall conduct the business of this agreement in coordination and collaboration with the State and its other contractors. The parties have entered into this agreement so that health information is available to Healthcare Organizations from VHIE at the point of care. It is the intent of this agreement that the information available through VHIE at the point of care will allow for measurement and improvement of healthcare outcomes over time, and that the information is up to date, accurate, and can be shared with patients and providers as necessary and appropriate. This grant agreement supports Subrecipient's maintenance and operations expenses, of State Fiscal Year 2017, for months during which progress is demonstrated through the deliverables set forth in Section 8 of this agreement*[13].

The associated contracts set out support development work to expand and support features of the VHIE.

Contract # 32349 engages VITL to provide:

> *"…personal services generally on the subject of Vermont Health Information Exchange Network and related products and services."*[14]

Contract # 31204 (Amendment #1) engages VITL:

> *"…to develop and implement a population-based infrastructure within VITL"*[15]

[13] State of Vermont, *Standard Grant Agreement, Operation and Management of Vermont Health Information Exchange Network, GRANT # 03410-256-17,* Department of Vermont Health Access, p. 6 of 48.

[14] State of Vermont, Contract for Personal Services, *Contract # 32349,* p. 1 of 16, July 1, 2016).

[15] State of Vermont, Contract for Personal Services, *Contract # 312046,* p. 1 of 20, January 1, 2016).

4.3 PROJECT SCOPE

4.3.1 IN-SCOPE

Note: All 3 agreements below have some components relevant to both "sides" of the VHIE enterprise, i.e., VHIE proper and "data warehouse" sides.

GRANT # 03410-256-17

In **Attachment A, Scope of Work to Be Performed**, the grant sets out the following[16]:

- **State Responsibilities:** 10 major and 2 sub- responsibilities, identifying information, meetings, timelines and methodologies, and personnel required for the performance of grant activities

- **Subrecipient Responsibilities:** 17 major and 5 sub- responsibilities, ensuring that VITL continues to maintain all reporting, licensing, security, technology, reporting, and funding cost allocation capacities required for the performance of grant activities.

- **Scope of Work:** The Scope of Work comprise 2 lists of Activities:
  - **Base Monitoring and Operations Related Activities:** These activities cover operation, maintenance, monitoring, evaluation, and reporting of the basic HIE operation:
  - **Public Health Considerations**: These activities ensure the continued linkage of VITL's core activities with specific healthcare reform priorities at the State level

CONTRACT # 31204 (AMENDMENT #1)

In the **Amendment, Attachment A, Specifications Of Work To Be Performed,** the following tasks are defined (*note Items in **red** considered technical scope for this review)* :[17]

- **Customer and System Infrastructure Support**
- **Subject Matter Expertise**
- **Healthfirst Gateway**
- **Event Notification System**
- **Terminology Services (Phase 1 through June 2016)**
- **Data Quality for Designated Mental Health Agencies**
- **Home Health Agency VITLAccess Rollout and Interface Discovery (Phase 1: February 1, 2016-June 30, 2016)**
- **Home Health Agency VITLAccess Rollout and Interface Build (Phase 2: July 1, 2016-December 31, 2016)**

[16] *Ibid.*, pp. 9-17 of 48.

[17] State of Vermont, *Contract for Personal Services, Contract # 31204, Amendment #1,* Department of Vermont Health Access with Vermont Information Technology Leaders, Inc., pp. 3-5 of 20.

- **Home Health Agency VITLAccess Rollout and Interface Build (Phase 3: July 1, 2016-December 31, 2016)**

CONTRACT # 32349

In **Attachment A, Specifications Of Work To Be Performed, 5. Scope of Work, ,** the following tasks are defined (*note Items in **red** considered technical scope for this review):*[18]

- **Interfaces – New Types**
  - **Vermont Chronic Care Initiative (VCCI) Interface**
  - **Vermont Psychiatric Care Hospital (VPCH) Interface**
  - **Department of Corrections (DOC) Interface**
- **VITLAccess On-boarding**
- **Clinical Data Quality Analysis**

4.3.2 OUT-OF-SCOPE

- Any activities, projects, operations, or deliverables not identified in the grant and contracts' Scope of Work are out-of-scope for the VHIE project, for the purposes of this review.

[18] State of Vermont, *Contract for Personal Services, Contract # 30205,* Department of Vermont Health Access with Vermont Information Technology Leaders, Inc., pp. 3-5 of 20.

4.4 MAJOR DELIVERABLES

NOTE: The following tables list deliverables according to agreement tasks or projects, with due dates and/or report frequency, exactly as itemized in the agreements under review. References in the table below to "Sections" refer to agreement sections, not sections in the present review.

4.4.1 O&M GRANT DELIVERABLES:

Task	Deliverable	Report Due Date or Report Frequency
4.10 Subrecipient's Security Plan	Subrecipient shall provide the State the Subrecipient's current Security Plan	12/31/16
4.10 Quarterly Security Report Metrics	The Subrecipient shall provide the State report metrics for compliance with relevant National Institute of Standards and Technology (NIST) 800-53 guidelines and 45 CFR 95.621	Quarterly (within 15 days of the end of the quarter)
5.1.1. Infrastructure Status Report	Subrecipient shall provide the State updates on the status (achievements, risks, issues) of each of the items listed in Section 5.1.1.	Quarterly (within 15 days of the end of the quarter)
5.1.1.2 Services Status Report	Subrecipient shall provide the State updates on the status (achievements, risks, issues) of each of the items listed in Section 5.1.1.2 unless already detailed in other sections of this report.	Quarterly (within 15 days of the end of the quarter)
5.1..2.4.1 Data Quality Consulting	• Provide report on the identity, number, assigned resources, and status of data quality projects in progress within the scope of this agreement • Attachment of Pipeline Report to Progress Report	Mid-Month
5.1..2.4.7 Client Training Materials	Subrecipient shall provide the State with examples of relevant client training materials	12/31/16
5.1..2.4.8 Provider Satisfaction Survey	Subrecipient shall provide the State with a copy of a summary report of all customer satisfaction surveys for all services rendered under the Client Services section of this agreement, as well as the surveys themselves	Quarterly (within 15 days of the end of the quarter)

Task	Deliverable	Report Due Date or Report Frequency
5.1.2.1 Semi-Annual Data Quality Evaluation	Subrecipient shall provide the State with a state-wide data quality evaluation, reporting on the data quality status of each participating Health Care Organization	12/31/16, 6/30/17
5.1.3 Connectivity of HIE infrastructure	Subrecipient shall provide the State a report on number, site, and interface types: • In progress • Completed	Mid-month
5.1.4 Semi-annual Connectivity Report	Subrecipient shall provide the State a report on the connectivity status (numbers of types of connections with the VHIE) of each Health Care Organization and health care entity	1/15/17, 7/15/17
5.1.5 Technological Capability Survey	Subrecipient shall provide the State with aa summary survey report as well as copies of the surveys, detailing the technological capability of health care organizations that are not connected to the VHIE.	TBD
5.1..2.2.4 Semi-Annual VITLAccess Utilization Evaluation	Subrecipient shall provide the State a report on the usage of this VITLAccess service as detailed in section 5.1..2.2.4	12/31/16, 6/30/17
5.1.8 Interface Development Reimbursement Plan	Subrecipient shall provide the State a prioritized list of providers to be reimbursed for interface development within the term of this agreement	Within 30 days of signing this agreement
5.1.8 Interface Development Reimbursement Status	Subrecipient shall provide the State a cumulative list of any reimbursements administered to providers for interface development	Mid-month

4.4.2 #32349 IAPD CONTRACT DELIVERABLES:

Project	Report Detail	Report Frequency
Interfaces - New Types	A report detailing all Interfaces planned, or in progress under the scope of this agreement. This report shall include the following information: Health Care Organization, site, interface types, and projected completion date.	Initial Project Status Report
Interfaces - New Types	A report detailing all completed Interface projects each month within the scope of this agreement. These reports shall include the following information: Health Care Organization, site, interface types, lessons learned, and actual completion date.	Monthly Project Status Report
Interfaces - New Types	A report detailing all Interface work completed within the term of this agreement. This report shall include the following information: Health Care Organizations, site, interface types, completion date, lessons learned, non-completed interfaces remaining, anticipated completion date of non-completed interfaces, and shall be accompanied by any supporting documentation.	Final Project Status Report, due 6/30/2017
VITLAccess On-Boarding	A report detailing all VITLAccess On-Boarding projects planned, or in progress under the scope of this agreement. This report shall include the following information: Health Care Organization, site, users added per site, and projected completion date.	Initial Project Status Report
VITLAccess On-Boarding	A report detailing all completed VITLAccess On-Boarding projects each month within the scope of this agreement. These reports shall include the following information: Health Care Organization, site, users added per site, lessons learned, and actual completion date.	Monthly Project Status Report

Project	Report Detail	Report Frequency
VITLAccess On-Boarding	A report detailing all completed VITLAccess On-Boarding projects completed within the term of this agreement. This report shall include the following information: Health Care Organizations, site, completion date, users added per site, lessons learned, and shall be accompanied by any supporting documentation.	Final Project Status Report, due 6/30/2017
Data Quality	A report detailing all Data Quality Dashboards, Query Capabilities, Reporting Capabilities, and Data Extracts planned or in progress under the scope of this agreement.	Initial Project Status Report
Data Quality	A report detailing all Data Quality Dashboards, Query Capabilities, Reporting Capabilities, and Data Extracts completed each month under the scope of this agreement.	Monthly Project Status Report
Data Quality	A report detailing all Data Quality Dashboards, Query Capabilities, Reporting Capabilities, and Data Extracts completed under the scope of this agreement.	Final Project Status Report, due 6/30/2017

4.4.3 # 31204 (AMENDMENT #1) SIM CONTRACT DELIVERABLES:

Task	Scope	Deliverable	Due No Later Than
1) Customer and System Infrastructure Support (Note: due date in this section is commencement of the customer support)			
	CHAC Medicare, Medicaid and Commercial	Provide customer support to ACO participants and encompasses: patient identify management; interface maintenance, upgrades and replacement; continuously measuring and improving data quality; and the provision of a twenty-four hours a day, seven days a week support center. 12 months of support for Jan-Dec 2016.	January 2016
	Health*first* Commercial	Provide customer support to ACO participants and encompasses: patient identify management; interface maintenance, upgrades and replacement; continuously measuring and improving data quality; and the provision of a twenty-four hours a day, seven days a week support center. 6 months of support for July-Dec 2016.	July 2016
2) Subject Matter Expertise			
	Provide Subject Matter Expertise	Provide Subject Matter Expertise to support the four tasks within this Agreement described in section 2 above.	July 2016
3) Gateway-Health*first* ***[ED: See Section 6.1.3, below]***			
	Health*first*		
	Build Medicity functionality - Beneficiary file	A *Healthfirst* master person index is created for Health*first* commercial beneficiaries	June 30, 2016
	Health*first* Labs, ADT, CCD, VXU	Health*first* beneficiary commercial filtering, ie. selecting the correct beneficiaries, on lab, ADT, CCD and VXU is complete and production-ready	June 30, 2016

4.5 PROJECT PHASES, MILESTONES AND SCHEDULE

The current set of agreements each cover one year of operation. However, there are two non-synchronous timeframes, as shown in the list below:

- **Grant # 03410-256-17**
  Start: 07/01/2016
  End: 06/30/2017
- **Contract # 31204 (Amendment #1)**
  Start: 01/01/2016
  End: 12/31/2016
- **Contract # 32349**
  Start: 07/01/ 2016
  End: 06/30/2017

The tables of deliverables above show deliverable due dates and/or expected report frequency for each of the deliverables in each of the reviewed items.

5 ACQUISITION COST ASSESSMENT

Acquisition Costs	Cost	Comments
Hardware Costs	$ 399,351.00	
Software Costs	$ 957,717.00	
Implementation Services	$ 1,578,022.00	
System Integration Costs	$ 280,000.00	
Professional Services VITL (e.g. Project Management, Technical, Training, etc.)	$ 4,019,875.00	
Professional Services State	$ 119,610.98	
Independent Review	$ 17,252.00	
Total Technical Acquisition Costs	$ 7,371,827.98	
Agreement Costs Not In Review	$ 501,510.00	
Total Acquisition Costs	**$ 7,873,337.98**	

For breakdown of above figures, see **Attachment C, Acquisition Cost Spreadsheet**

5.1 COST VALIDATION:

State business and project personnel reviewed for us the process of funding for these agreements, both in the context of historical funding and specifically for FY2017. Initial estimates originated with the State, although determined in light of VITL-supplied budget estimates. Agency of Administration and DVHA worked closely with the Governor's Office, Legislature, and Green Mountain Care Board (for budget oversight) to refine and adjust amounts throughout the agreements' budget and overall State budget development process. The State also employed frequent consultation with VITL.

During this review, we elicited State estimates of State personnel required for this grant. These estimates are shown in Attachment E, State Personnel Cost. We add the total figure, and the actual Independent Review cost, to the Total Acquisition Costs above, although these amounts are naturally not included in the agreements, as they do not go to VITL. Finally, we add in the cost of non-technical scope items in the agreements. The sum reflects the total cost to the state of VHIE operation, management, and development for FY17.

5.2 COST COMPARISON:

This review concerns the technical portions of the FY17 agreements for VITL/VHIE operation. However, the separation of functions and costs among contract and grants, technical and non-technical scopes, while logical and useful for purposes of funding and accountability, creates difficulties for evaluating the costs against those of other states, who do not necessarily use comparable categories. For this reason, the following comparisons use the expenses and funding of VHIE/VITL as a whole. We believe this results in a more useful comparison.

Comparing the cost of Vermont's VHIE to other state HIE's is not a simple matter. For one thing, there are few state HIE's as well developed as Vermont's. For another, Vermont has chosen a path of aggressively timed and functionally far-reaching healthcare reform, the HIT portion of which depends upon early and extensive employment of a near-universal HIE, while other states may choose a different approach.

5.2.1 INITIAL (START-UP) COSTS

Probably all existing state HIE's may be said to be still in a development stage. Most or all are still reporting significant yearly growth in connectivity and usage. As new functions are brought online, implementation costs incur, while other functions mature and settle into operation/maintenance cost modes. The different models of HIE purpose, participation, and funding, mentioned above, complicate our comparison. Nonetheless, we can gain a certain amount of insight into comparative costs by looking at a recently published report of annual expense for a number of state HIE's. All these states, like Vermont, participated in the Federal HITECH program State Health Information Exchange Cooperative Agreement Program.

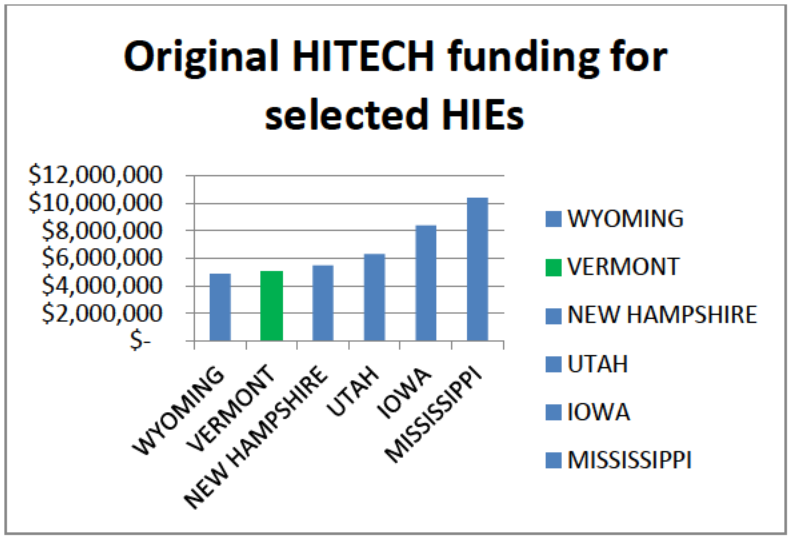
The December, 2014 NORC comparative study of six state HIEs[19] -- including Vermont's VHIE -- includes information used to create the following table. The funding shown is the grant amount received from the Federal HITECH program. The amount shown is not the full cost of an HIE, but may be assumed to be a significant portion of the start-up, or acquisition cost.

State	Population	HITECH funding	Cost / Population
IOWA	3,090,416	$ 8,375,000	$ 2.71
MISSISSIPPI	2,951,996	$ 10,387,000	$ 3.52
UTAH	2,900,872	$ 6,296,705	$ 2.17
NEW HAMPSHIRE	1,323,459	$ 5,457,856	$ 4.12
VERMONT	626,630	$ 5,034,328	$ 8.03
WYOMING	582,658	$ 4,873,000	$ 8.36

NOTE: The above figures, including VITL's, are taken from the NORC report and should not be assumed to represent financial statements or audits, either for VITL or any of the other entities. They are used here because they were gathered by the NORC study and are thought to represent comparable figures taken at a comparable timeframe. Since the study was conducted in 2014 using figures from earlier years, it does not reflect the current agreements' cost.

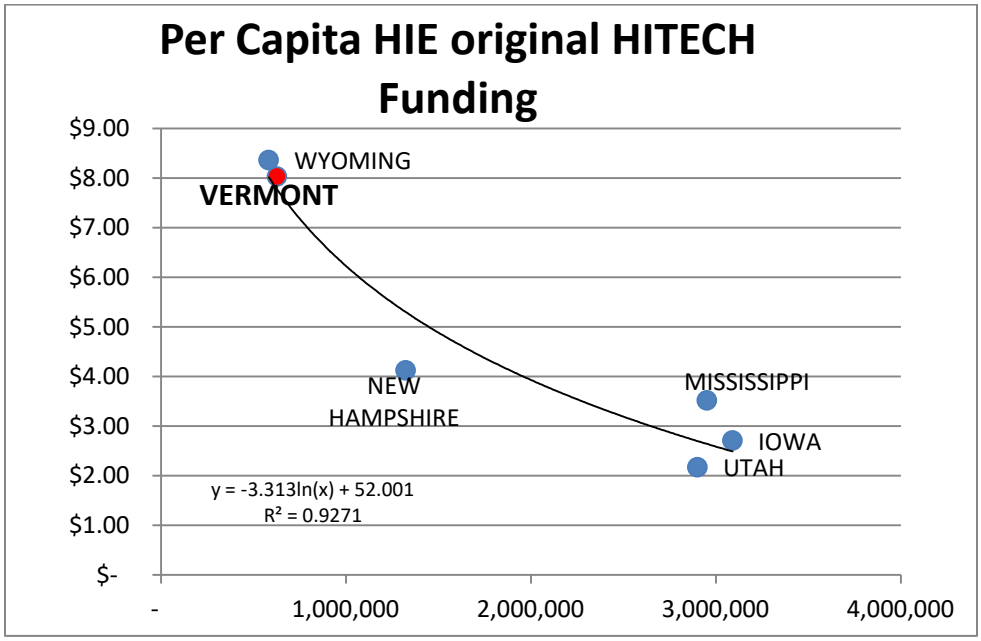
Obviously, no single fair comparison is apparent.

By simple totals, Vermont's HIE cost to HITECH was among the lowest:



[19] Dulluh, Ubri, and Hovey, *CASE STUDY REPORT, The State HIE Program Four Years Later: Key Findings on Grantees' Experiences from a Six-State Review*, NORC at the University of Chicago, Appendix A (December, 2014).

On a straightforward cost/population basis, Vermont's HIE seems to be expensive (acknowledging the significant unknowns, as described above). However, we have noticed that a closer look shows that there may be an inverse relationship between **per-capita cost** and **population** size, as demonstrated graphically below. Of course, this sample of 6 is very small; yet we may be seeing the result of an economy of scale.



Various interpretations may apply: Larger states may get better offers from HIE hosting and developer firms. Or, larger states may have more existing internal technical resources that the HIE may draw upon, not reflected in these simple totals.

Since participants in this federal funding self-select, and as the sample is small, forces other than economy of scale may be in play. The NORC study attempts to catalogue several features of each state's healthcare "landscape" and market forces (such as prevalence of hospital competition), to conclude that low hospital competition results in a more "active" HIE (by metrics -- mostly counting interfaces -- defined in the study), but states no conclusions about the effect of these realities on baseline costs[20].

Whatever the reason, it does seem from this simple comparison that **Vermont's HIE startup costs were not out of line**.

[20] *Ibid.*, p. 6.

5.2.2 SUSTAINABILITY MODELS

The original HITECH funding grants assumed that each grantee would develop its own model of "sustainability," i.e., appropriate funding streams to assure continued operation. A variety of sustainability models have since emerged. (See section ***5.2.4 Other HIE Sustainability Models***, below). At the current time, Vermont has chosen to provide VHIE as a public good, funded as described immediately below.

5.2.3 VERMONT'S HIE FUNDING

The Vermont Health Information Technology (HIT) fund, 32 V.S.A. § 10402, accumulates receipts raised by a 0.199% charge on private health benefit claims (i.e., not including Medicaid, Medicare, or other federally-funded programs). The claims tax is administered by the Department of Taxes and expenditures from the fund are delegated by the Agency of Administration to DVHA. The HIT fund assessment under current law will sunset on June 30, 2017.[21]

Vermont funds VHIE (and some other HIT initiatives) through a mix of federal funds and State HIT fund expenditures. Federal funding includes Vermont's Global Commitment for Health Medicaid 1115 Waiver and through "HITECH" Medicaid "fair share funding." For the past two years, additional federal funds have been available from the Centers for Medicaid and Medicare (CMS) State Innovation Models (SIM) Testing Grant. (See ***Attachment G: Funding Sources***)

Further information on future funding projects are provided by the State in its Health Information Technology Plan 2016 draft.

5.2.4 OTHER HIE SUSTAINABILITY MODELS

A recent survey[22] of 14 HIEs' (6 state, 6 non-state) sustainability models showed subscription based funding to be the most commonly reported form (12 out of 14 respondents). The breakdown[23] was:

- Monthly Fee / Annual Subscription (9 of 14)
- Combination of subscription and fee for service (3 of 14)
- Fee for service (1 of 14)
- Public Good (1 of 14)

VHIE is funded by the State for the public good. While this is a minority approach, we should not conclude that there is currently a "best approach" to sustainability.

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[21] *See* Vermont Health Information Technology Plan, March 2016 Draft, pg 16.

[22] Healthcare Information And Management Society (HIMSS), *HIE Sustainability Models Survey Results and Analysis* (May 31, 2016)

[23] *Ibid.,* pg 3

One conclusion of the report was that there was no apparent correlation of size and sustainability. However, achieving "critical mass" – adoption by at least 50% of the potential user community – *does* seem to be important.[24]

Significantly, in view of Vermont's health reform aims, the report acknowledges that a market-driven approach may not easily support HIE functionality (such as image exchange, reports and analytics, and Clinical Quality Measure support) that although desirable for providers and the public good, may increase costs for those members who are not using that functionality.[25] So, a community which desires to improve cost and quality across the whole health landscape may find that a market-driven approach is too short-sighted to support future benefits. Each state or community must consider factors such as these when developing a sustainability model.

Whatever the model employed, the point to keep in mind in the analysis which follows is that HIEs employ a very wide variety of models, some of which employ public funds even if they aspire to market sustainability, and all of which aim to satisfy state or community needs and priorities. As we have stated repeatedly, HIEs and their associated policy, funding, technology, and health reform aspects continue to evolve, although they are significantly more mature than just a few years ago.

5.2.5 COMPARISON: ON-GOING COSTS AMONG 6 HIES

The national HIE landscape has changed even since the HITECH funding report in the first section above. Several of the included HIEs have changed funding models and objectives, or even ceased operation altogether. To get an idea of how on-going costs compare, we need to choose a different cohort.

We asked both State and VITL representatives to select state HIEs which might be held to be comparable to Vermont's VHIE (not necessarily in terms of cost, but rather holistically). A State participant suggested Maine's Health Infonet (INFONET) as comparable.[26] VITL additionally suggested Delaware's Delaware Health Information Network (DHIN); New York's HIXNY, one of several regional systems in the state[27]; Colorado's CORHIO, serving all but the Western Slope; and Rhode Island (RIQI). These suggestions are good and reasonable. DHIN is particularly similar in terms of governance structure and primary platform vendor (Medicity), as well as small population. None precisely resembles Vermont in terms of sustainability model (see section ***5.2.4 Sustainability Models).***

For purposes of this comparison, we used 2014 IRS 990 filings, where available. Once more, we remind the reader that State HIEs vary widely in terms of policy objectives, priorities, funding and sustainability models, and state of development. The division of labor between HIE and state health department may determine what costs are expensed to the state HIE and what costs are borne in parts of the state

[24] *Ibid.*, pg 3

[25] *Ibid.*, pg 4

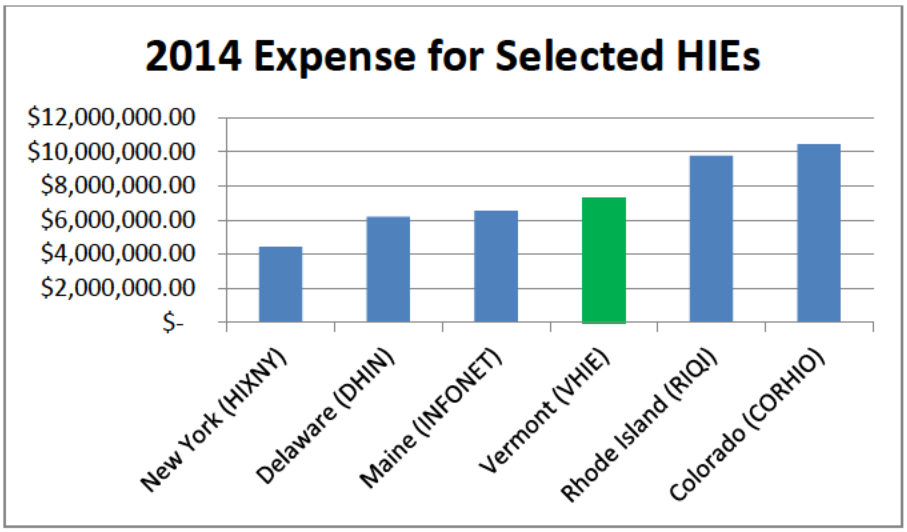
[26] Director, Vermont Healthcare Innovation Project, *Personal Interview* (August 3, 2015).

[27] VITL Chief Technology Officer, *Personal Interview* (August 17, 2015).

budget. For simplicity's sake, we took each organizations entire annual expense as the basis for comparison. What follows should be considered as a general overview, and in no way an "apples-to-apples" comparison.

HIE	State	Service Area In-State Population	2014 Total Expense[28]	Per-capita Expense
CORHIO	Colorado	4,000,000[29]	$10,430,451.00	$ 2.61
DHIN	Delaware	935,614	$ 6,177,667.00[30]	$ 6.60
HIXNY	New York	1,620,000[31]	$ 4,452,325.00	$ 2.75
INFONET	Maine	1,288,717	$ 6,545,037.00	$ 5.08
RIQI	Rhode Island	1,055,000	$ 9,759,397.00	$ 9.25
VITL	Vermont	626,562	$ 7,292,032.00[32]	$ 11.64

In this comparison, displayed in the table below, Vermont's cost of $7,292,032 is reasonable, being just below the average cost of $7,442,818, and just above the median cost of $6,918,534:



[28] Expense as shown on IRS 2014 990 Form, except as indicated in footnotes

[29] CORHIO serves all of Colorado except the Western Slope. Number here is from CORHIO 2015 Annual Report.

[30] Delaware costs from DHIN 2015 Annual Report, Financial Statement (DHIN no longer files 990)

[31] HIXNY 2015 Annual Report

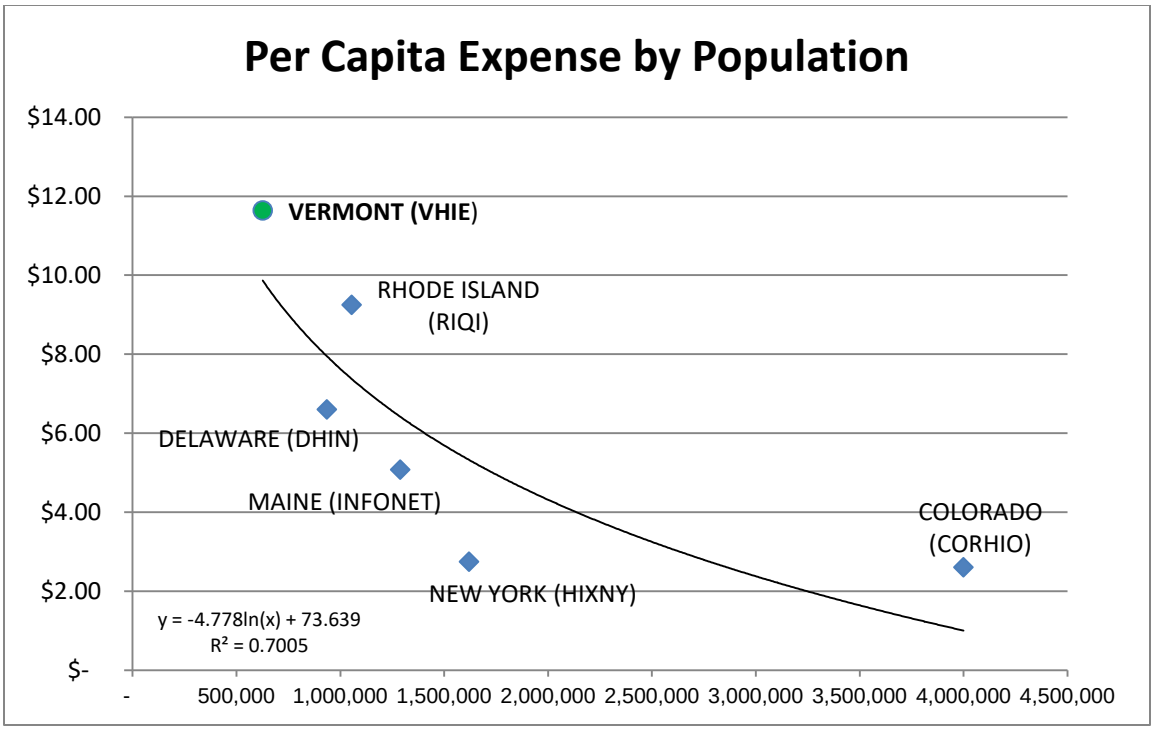
[32] VITL 990 follows Vermont State fiscal year, i.e., FY15, July 2014 to June 2015, not calendar 2014

5.2.6 COMPARISON: PER-CAPITA EXPENSE BY POPULATION

To compare the annual ongoing cost to State resources of HIEs, we might usefully compute a per-capita cost of State funds only. VITL receives funding from a number of sources: State, Federal (direct and State pass-through), program service fees, and annual conference income. If we include all expense on all programs of $7,292,032 with State population as the denominator the per-capita cost is **$11.64**.

> *A Note About Per Capita Calculations: Individuals who receive healthcare in Vermont do not all reside here. The number of discrete persons in the Master Person Index (MPI) -- currently about 1.6 million -- includes individuals who receive care in Vermont but do not reside here as well as residents. This total may be proportionately higher than that of some other States, as a factor of geography and the proximity of healthcare facilities to the borders of neighboring states. Taking the figure of 1.6 million as an denominator the per-capita cost for VHIE would be $4.56.*
>
> *This may be true in varying degrees for other HIEs as well. However, we have no way of calibrating this figure with the MPI figures of other HIEs, so we continue to use the state population figure in the comparison which follows.*

We took as our point of comparison the ***in-state population served by the*** HIE. Some HIEs (e.g., New York's HIXNY and Colorado's CORHIO) do not take an entire state for their service areas. In these cases, we used the HIE's statement of their service area population. For the basis of cost, we used the ***total expense*** of the organization operating the HIE, for our 6 comparison states, based on IRS data where available. On this basis, we compared per-capita cost to the in-state patient population to derive the following chart. As in the HITECH study, it shows a logarithmic relationship – but not as clearly as in the earlier example (R^2=0.70) – between population and per-capita cost. In this comparison, Vermont's cost is somewhat high but roughly conforming to the trendline.



NOTE: 2 of the HIEs in the above comparison – New York's HIXNY and Colorado's CORHIO – are each a member of a federated network in their respective states, in which regional HIEs are tied together technologically and through state administration to serve the entire state. These two have significantly lower per-capita costs. This may perhaps be related to the fact that the federation encompasses much larger populations thnt the comparison HIEs, not reflected in their target area populations.

5.2.7 DEVELOPMENT COSTS – PERSONNEL

Most of the technical initiatives in the FY17 agreements rely heavily on direct labor of Information Technology professionals, most often employed by VITL but sometimes employed via subcontractors. Much of the work of the "SIM" contract (#31204) amendment is billed subject matter expertise "related to health information integration and data transfer and storage that support the deliverables" of the agreement. These "subject matter experts" are divided into two categories, called "Leadership" and "Project Managers and Technical Staff." A single rate is identified for each of these two categories:

- Leadership: $200/hour
- PM and Technical: $125/hour

In keeping with common practice for employment of grant-funded subcontractors, we assume these costs are fully loaded personnel expenses. The agreements provide names of employees assigned to these two categories, but aside from that, do not provide more detailed breakdown of costs. To compare these costs to market, we used two approaches: (1) Bureau of Labor Statistics wage data for

Burlington and South Burlington, multiplied by the most recent Employment Cost Index; and (2) comparison to national General Services Administration median data for contractor on-site costs.

5.2.7.1 COMPARISON #1: ANALYSIS BY US DOL BLS DATA

Wage data from US Bureau of Labor Statistics is derived from https://www.bls.gov/bls/blswage.htm

BGS categories do not correspond directly to all contract personnel tasks (for example, does not have "Project Manager"). Weused the following BLS categories as generally mapping to services VITL might perform *on these agreements*:

- Leadership
    - Computer and Information Systems Managers(113021)
    - Financial Managers(113031)
    - Managers, All Other(119199)
- PM and Technical
    - Computer Systems Analysts(151121)
    - Information Security Analysts(151122)
    - Software Developers, Applications(151132)
    - Database Administrators(151141)
    - Network and Computer Systems Administrators(151142)
    - Computer Network Architects(151143)
    - Computer Occupations, All Other(151199)

The table below selects the following information

- **Burlington-South Burlington area data**. In general, these wages are slightly higher than Vermont as a whole.
- **Hourly wage data at the 90th percentile**, assuming this work is more specialized compared to other comparable Burlington area work, and/or may require recruitment from another area.
- ***NOTE*: BGS wage data "tops out" at $90/hr.** Where this occurred, I used $90/hr (which looks to be close, from the tables)
- **Employment Cost Index (ECI) for total compensation, Information industry, December, 2016 (24.9%) as multiplier to estimate total compensation with benefits**

Occupation (SOC code)	Hourly median wage	Hourly 90th percentile wage	90th percentile wage X ECI
LEADERSHIP			
Computer and Information Systems Managers(113021)	64.62	90.00+	112.41
Financial Managers(113031)	58.62	90.00+	112.41
Managers, All Other(119199)	52.16	67.17	83.90
		Median:	**$112.41**
		Average:	**$102.91**
PM & TECHNICAL			
Computer Systems Analysts(151121)	34.14	53.89	67.31
Information Security Analysts(151122)	37.23	69.20	86.43
Software Developers, Applications(151132)	37.05	57.64	71.99
Database Administrators(151141)	33.63	54.85	68.51
Network and Computer Systems Administrators(151142)	38.90	60.87	76.03
Computer Network Architects(151143)	31.65	67.18	83.91
Computer Occupations, All Other(151199)	42.80	53.75	67.13
		Median:	**$71.99**
		Average:	**$74.47**

Using median data, then, the VITL personnel costs compares as follows:

- Leadership: **180% of median wage** (200/112.41=1.78)
- PM & Tech: **174% of median wage** (125/71.99=1.74)

CONCLUSION for approach #1 (BLS data):

- **In comparison to US DOL BLS data 2015/16 for total compensation, VITL personnel prices are (quite) high, if fully loaded at &4-80% of median wages.**

5.2.7.2 COMPARISON #2: ANALYSIS BY US GSA DATA

In contrast to the above, the US Government Services Administration (GSA) publishes tables of actual quoted hourly rate prices for IT services *on the contractor's site* from 57 suppliers. The following (November 2016) GSA IT-70 table is termed "Year 8" and covers May 1, 2016 through April 30, 2017). We believe these costs to be representative of fully loaded labor rates for labor on the (sub)contractor's site.

For this selection, we have designated 2 levels:

- Master Level – equivalent to "Leadership"
- Senior Level – equivalent to "Project Managers and Technical Staff"

The GSA definitions[33] for these levels are as follows :

> ***Master*** *Provides technical/management leadership on major tasks or technology assignments. Establishes goals and plans that meet project objectives. Has domain and expert technical knowledge. Directs and controls activities for a client, having overall responsibility for financial management, methods, and staffing to ensure that technical requirements are met. Interactions involve client negotiations and interfacing with senior management. Decision making and domain knowledge may have a critical impact on overall project implementation. May supervise others.*
>
> ***Senior*** *Possesses and applies a comprehensive knowledge across key tasks and high impact assignments. Plans and leads major technology assignments. Evaluates performance results and recommends major changes affecting short-term project growth and success. Functions as a technical expert across multiple project assignments. May supervise others.*

We then chose a number of labor categories in each of these levels, roughly corresponding to deliverables and tasks identified in the agreements. These do not necessarily and in all cases correspond to titles and roles employed by VITL. A given individual may have multiple expertise areas, and some tasks required for deliverables may not correspond directly to GSA labor categories. Nonetheless, we believe our estimation gives a reasonable point of comparison.

The following table shows the labor categories we chose for comparison, along with the median rate for each (among 57 GSA contractors), and an average rate for each of the two levels

[33] Government Services Administration, *GSA Nov-2016 Labor Rates at Contractor Site*

GSA Nov-2016 Labor Rates at Contractor Site- Year 8 (May 1, 2016 through April 30, 2017)			
CLIN	**Labor Category**	**Median Rate, 57 GSA-approved contractors**	
	MASTER LEVEL		
106C	Chief Information Security Officer	$	189.41
127C	Program Manager	$	199.23
132C-3	Subject Matter Expert (Master)	$	253.12
	Master Level Average	**$**	**213.92**
	SENIOR LEVEL		
128C	Project Manager	$	160.39
102C-3	Applications Developer (Senior)	$	130.90
103C-3	Applications Systems Analyst (Senior)	$	125.84
111C-3	Data Warehousing Specialist (Senior)	$	129.30
110C	Data Architect	$	151.60
112C-3	Database Specialist (Senior)	$	134.68
126C-3	Network Specialist (Senior)	$	121.45
	Senior Level Average	**$**	**132.30**

Using median data, then, the VITL personnel costs compares as follows:

- Leadership: **93% of median master level rate** (200/213.92= 0.93)
- PM & Tech: **94% of median senior level wage** (125/132.30=0.94)

CONCLUSION for approach #2 (GSA data):

- **In light of the averages shown in the table above, we find that the Subject Matter Expertise rates quoted in the agreements are slightly below national industry rates, assuming both to be fully loaded**

5.2.7.3 CONCLUSION: PERSONNEL COST COMPARISON

2 CFR Part 225, Appendix B to Part 225—Selected Items of Cost, which sets rules for recipients of federal grants including costs for subcontractors, states in part:

> *8. Compensation for personal services. b. Reasonableness.*
> *Compensation for employees engaged in work on Federal awards will be considered reasonable to the extent that it is consistent with that paid for similar work in other activities of the*

governmental unit. In cases where the kinds of employees required for Federal awards are not found in the other activities of the governmental unit, compensation will be considered reasonable to the extent that it is comparable to that paid for similar work in the labor market in which the employing government competes for the kind of employees involved. Compensation surveys providing data representative of the labor market involved will be an acceptable basis for evaluating reasonableness.

In response to our questions concerning the State process for personnel cost reasonableness, the Deputy Director of Healthcare Reform for Payment and Delivery System Reform described the wage determination carried out by the State as "a blended fully-loaded rate based on the individuals in the group ," and noted , "The SME rate was approved, in part, with knowledge of the rates paid to various SIM contractors (for the most part significantly higher than $200/hour)." Contracts such as these VITL contracts are routinely submitted to Office of Acquisition and Grants Management (OAGM) of the Centers for Medicare & Medicaid Services (CMS), and "have at times asked for additional information regarding salary," though not about VITL contracts specifically. The OAGM has consistently approved the VITL contracts.

In our independent comparisons, we believe the second approach (GSA rate tables) more accurately represents a blended, fully loaded rate comparison, although it is not adjusted for region.

Therefore, our independent comparison of personnel costs indicates that the VITL costs are probably appropriate as fully loaded personnel costs for on-contractor-site labor. We suggest that the State continue to monitor comparable market rates for future contract purposes, and consider a more granular approach where appropriate.

5.3 COST ASSESSMENT:

An "apples-to-apples" comparison of HIE costs between states may not be feasible, for several reasons:

- HIEs are implemented with different objectives and timelines in different States. HIE operation is a manifestation of each State's healthcare policy objectives.
- HIEs in general are not fully matured, but in the process of development. Therefore, target objectives, even if similar, may not be reached in the same order, affecting the way cost is distributed year by year.
- Federated models in States which have a number of privately owned HIEs (such as hospital system HIEs) may not reflect the true cost of a State HIE.
- Differing models of sustainability complicate determination of actual costs.

With this in mind (and acknowledging the small sample size), we may look at the above comparative data in a number of ways to draw these conclusions:

- In a strict "bottom-line" comparison to 6 other relatively similar state HIEs, Vermont's cost is appropriate. At total VITL expense in *FY15* of $7,292,032, it was just below the average cost of $7,442,818, and just above the median cost of $6,918,534.
- In a comparison of per-capita expense for the same period, Vermont's cost at $11.64 is quite high.
    - However, *if* per-capita cost is inversely related to population, the cost may be in line.
    - Also, geographic factors and the VHIE MPI indicate that the served population may be significantly larger than the state population.

Therefore:

- **The current FY17 cost of these agreements, $ 7,773,360.15, being similar to cost in recent years, is appropriate as in a "bottom-line" comparison to other states, and relatively high when compared as a per-capita expense.**
- **Subject Matter Expertise rates in the agreements compare slightly favorably to current published GSA labor rate medians.**

6 TECHNOLOGY ARCHITECTURE REVIEW

(Please refer to ***Attachment A: VITL VHIE Enterprise Diagram***, in reading the following discussion.)

6.1 ARCHITECTURE OVERVIEW

Technologically, the core of the VHIE comprises a database system with external interfaces, via software provided, managed, developed, and physically hosted by the vendor Medicity, a major and broadly accepted HIE system provider. EHRs from participating HCOs connect directly (interface) to the VHIE via highly secure Virtual Private Networks (VPNs), which use the public Internet to transmit secure, encrypted information. Through the present report, we refer to " the VHIE proper" when considering this core technology.

The VHIE proper connects to a system VITL calls the "VITL Integration Engine," which extracts de-personalized healthcare information from the VHIE proper[34], and prepares it for use by VITL system commonly known as the "data warehouse." These systems are provided, developed, managed, and maintained by VITL using off-the-shelf (OTS) software such as Rhapsody, and are physically hosted by the highly secure hosting vendor RackSpace. (See section ***6.3 State's Strategic Plan*** for information about a pending change.) The "data warehouse" is intended by VITL to make available, appropriately authorized de-personalized data extracts for a variety of uses, such as reporting and analytics for participating HCOs and ACOs, and data quality services and reporting for participants and SOV. Over time, the "data warehouse" is intended, according to VITL, to also connect to certain other entities in the Health Information Technology (HIT) Enterprise, such as the Vermont All-Payer Claims Database known as VHCURES, and The Blueprint Clinical Registry.

The State raises significant questions about the "data warehouse" part of the VITL/VHIE enterprise, concerning its architecture, its data quality, and its future role in the VHIT enterprise. These questions and the risks they imply are discussed below in Section 6.2, Enterprise Architecture and Interoperability.

The grant agreement between VITL and SOV tiled "Operation & Maintenance of Vermont Health Information Exchange Network" (O&M Grant) provides for the continuing operation of these core systems, while the associated contracts provide for new development.

6.1.1 NEW INTERFACE TYPES

The term "interface" invites the mental image of physical, electronic connection between devices. In reality, the physical component of a VHIE interface uses routine high-quality internetworking components; the work of creating a new interface consists of software enabling the accurate translation of healthcare information between systems which may use the same "standards" in very similar yet not identical ways. Extensively tested and perfectly functioning interfaces are critical to VHIE functioning

[34] but see *Section 6.5, Security and Privacy,* below.

and public safety, as an HIE must not insert any erroneous information into individuals' healthcare records.

Each enumerated "interface" refers to a connection between 2 points (for example, VHIE and an HCO), a type of message (for example, a continuity-of-care document) and a direction of transfer (I.e., HCO to VHIE or VHIE to HCO). Therefore, a single HCO may have a number of interfaces.

The challenges of creating interfaces arise from the fact that many different vendors create the various EHRs used by HCOs around Vermont. Each type may have its own strengths, weaknesses, and priorities in the way it organizes data. This is the case even though standards such as HL-7 are in broad use and required for many kinds of certification, for several reasons, among them:

- The transition timeframe to newer versions of standards is not synchronized across vendors, and backward compatibility is not perfect
- Standards are evolving, and some data fields are still "catch all" fields designed to capture verbose forms of information
- Different HCOs may emphasize different data fields as essential; e.g., one may focus on last name, first and middle initial to identify a patient; another may use an address and birthdate; etc. When exchange health records, an exact identity match is absolutely critical.

The contract funds the development of new interface *types*. The "types" qualifier refers to the fact that these connections initiate the process of connecting different types of HCOs to the VHIE, compared to the types already connected. In the present contract, these types of HCO are included:

- Vermont Chronic Care Initiative (VCCI)
- Vermont Psychiatric Care Hospital (VPCH)
- Department of Corrections (DOC)

Our conversations with VITL and our reading of SOV project documents shows that the development of these new interface types follows a tried and tested process VITL has used to develop the existing, successful interfaces.

We find this to be an entirely appropriate approach, one which supports the SOV EA principles of reusability and configuration over customization. This is a good way to ensure quality and value. The cost of interface development is primarily a personnel cost.

(Also, see ***5.2 Acquisition Cost Assessment – Cost Comparison – Personnel costs***)

6.1.2 HOME HEALTH AGENCY INTERFACES

As the VHIE succeeds in engaging the vast majority of Vermont clinical HCOs as participants, the focus shifts to engaging different kinds of HCOs. This focus in the "SIM" agreement is on Home Health

Agencies. These development efforts have two components: the "rollout" of the VITLAccess user interface system for these agencies, and the development of custom interfaces (as in the above interface development effort). New interface types are needed, because Home Health Agencies use quite different vendors to supply EHRs. As above, the development of interfaces for these different EHRs employs VITL personnel to implement new interfaces following a tried and tested path of new interface development by VITL.

We find this to be an entirely appropriate approach, one which supports the SOV EA principles of reusability and configuration over customization. This is a good way to ensure quality and value. The cost of interface development is primarily a personnel cost.

(Also, see ***5.2 Acquisition Cost Assessment – Cost Comparison – Personnel costs***)

6.1.3 HEALTHFIRST GATEWAY

VITL uses the term "Gateway" to refer to a specialized data interface that connects a data analysis entity to the data warehouse, to access only properly authorized data (e.g., "attributed lives"[35]) for the purpose of healthcare analytics related only to that entity's beneficiaries. The generic example of a data analysis entity is an analytics vendor for an Accountable Care Organization (ACO). VITL has previously implemented this kind gateway, for example, for the OneCare ACO. Healthfirst is a commercial ACO whose members are independent Vermont physicians. The contract specifies that VITL will work with Heathfirst to develop "full-functionality" for their analytics vendor. Full-functionality is defined in the contract to ensure that only appropriate data (I.e., Healthfirst's beneficiaries' data) is selected; that demographics, lab results, clinical summaries, and immunizations are included; and that the data target is ready for use by the analysis entity.

VITL informs us, and SOV project documents confirm, that this gateway development builds up the successful and tested prior gateway work and existing expertise.

As in the interface development work described above, we find this to be an entirely appropriate approach. It supports the SOV EA principles of reusability and configuration over customization. This is a good way to ensure quality and value. The cost of gateway development is primarily a personnel cost.

(Also, see ***5.2 Acquisition Cost Assessment – Cost Comparison – Personnel costs***)

6.1.4 EVENT NOTIFICATION SYSTEM

In the HIE context, "Event Notification System" (ENS) refers to the automatic and instantaneous notification of a provider when one of their patients experiences a healthcare transition, for example, is

[35] *Lewis, V. A., McClurg, A. B., Smith, J., Fisher, E. S., & Bynum, J. P. W. (2013). Attributing Patients To Accountable Care Organizations: Performance Year Approach Aligns Stakeholders' Interests. Health Affairs (Project Hope), 32(3), 587–595. http://doi.org/10.1377/hlthaff.2012.0489*

admitted or discharged from a hospital, is brought to an emergency department, is seen by a specialist, etc. The aim is to improve the continuity of care by allowing providers to more easily track the movement of patients through the healthcare system. Vermont has contracted with a commercial ENS vendor, PatientPing, to provide ENS services to Vermont providers, hospitals, and ACOs at subsidized rate. (This overall State agreement with PatientPing is not part of the present agreements)

(See **Attachment A: VITL VHIE Enterprise Diagram**)

The contract provision in the current agreement engages VITL to develop an ***interface*** to PatientPing to provide Admission, Discharge, and Transfer (ADT) records to PatientPing. As with the interface types above, this development follows existing and tested development processes at VITL. **As above, we find this to be an entirely appropriate approach. It supports the SOV EA principles of reusability and configuration over customization. As with the above initiatives, this is a good way to ensure quality and value. The cost of interface development is primarily a personnel cost.**

(Also, see ***5.2 Acquisition Cost Assessment – Cost Comparison – Personnel costs***)

6.1.5 TERMINOLOGY SERVICES

Inconsistencies of terminology *within* clinical records and *between* clinical records present a significant challenge both to interoperability and to interpretation (including data analysis) of healthcare data. More importantly, these inconsistencies represent a danger to the safety of patients.

Even when relatively strict standard for data *records* are employed, semantic disparities can cause problems when different clinicians use different terms for the same thing. One could argue about whether clinicians do or don't read the full care notes of their predecessors in the care chain, but clearly there is a problem for data consistency.

For example, compare these blood panel results from two different labs on the same sample source. (The terms here are *exactly as reported by the labs*. Note that they differ in a way that might make them difficult to identify as equivalent; for example RDBlCnt is equivalent to RBC, but an HIE database would not necessarily treat them that way.)[36]

Lab #1 reports:	CBC [date]	RBC 9.6	WBC 4.3	HB 13.7	HCT 33.8	PLT 203
Lab #2 reports:	Comp Bld Ct [date]	RDBlCnt 9.9	WhBlCnt 4.8	Hgb 13.7	Hct 33.8	PltLt 210

[36] CareEvolution, Inc., *Terminology Services,* http://careevolution.com/TerminologyStandardization.pdf, retrieved November 1, 2016.

This issue is defined by the term *semantic interoperability*. (Incidentally, the problem is more acute in places like Europe, where clinicians frequently cross natural language boundaries.)

One possibility adopted in countries with a government-controlled medical profession is to compel clinicians to use a common terminology, such as SNOMED-CT (a standardized code; stands for *"Systematized Nomenclature of Medicine -- Clinical Terms"*) , but we suggest this is unlikely to be successful in a HIT environment that relies on voluntary participation, such as ours here in Vermont. The more productive solution, and the one chosen by SOV and VITL, is the use of a "terminology services engine", which is a teachable database system that maps various clinical usages to create equivalencies. Following a process of evaluating alternatives SOV and VITL agreed on the acquisition by VITL of a terminology services engine offered by the vendor Natural Language, Inc. This system may be considered to be the foremost health terminology services platform available, and has for one example been employed by the National Health Service of the United Kingdom -- probably the largest health database in the world -- since 2004.

This database translation engine was installed and then brought into production in June of 2016. Use of the terminology services engine requires both the core services licensed from the vendor and VITL staff efforts devoted to semantic mapping, with cooperation from healthcare providers.

See ***5.2 Acquisition Cost Assessment – Cost Comparison – Personnel costs*** for an overall evaluation of VITL personnel costs in these agreements.

6.2 ENTERPRISE ARCHITECTURE AND INTEROPERABILITY

The statutory basis for the present review calls for a review of "security, privacy, and interoperability." Interoperability describes the extent to which systems and devices can exchange data, and interpret that shared data. For two systems to be interoperable, they must be able to exchange data and subsequently present that data such that it can be understood by a user.[37] Interoperability is a primary focus of the developing information technology discipline known as Enterprise Architecture.

6.2.1 ENTERPRISE ARCHITECTURE

Over the past decades, Vermont's legislature has invested the Department of Information and Innovation (DII) with a degree of oversight concerning state government's acquisition of technology in its myriad forms, but especially when technology has -- or potentially has -- considerable cost associated with it. The driving factors are cost and quality: *"Is the state getting good value for money?" "Are technology acquisitions of good quality, independent of cost?"* The two statutes that inform the present review are examples of legislatively mandated DII oversight.

Enterprise architects working for SOV endeavor to maximize the value, quality, and reliability of the information technology across state government, by focusing on several guiding principles:

- **Configuration over customization** -- software should be designed from the start to be adaptable to new functions resulting from evolving business requirements, rather than needing custom software re-writes to implement changes
- **Reusability** -- "Buy it once, use it multiple times." If one agency has an IT need, perhaps SOV already owns the required technology in another agency. The need could be functionality, a personnel skill set, software features, etc.
- **Interoperability** -- systems should be able to "talk to each other" and "work together", for example by being able to exchange data with a minimum of translations. Enterprise architects sometimes use the term "*play* together," implying very robust and adaptable interoperability among a number of systems.
- **Scalability** -- Systems should be able to accommodate the need for growth, perhaps even extensive growth, by expansion rather than replacement.
- **Sustainability** -- Newly acquired systems should use limited state resources (whether financial or human) in a way that maximizes the long-term return on investment

6.2.2 NON-FUNCTIONAL REQUIREMENTS

[37] HIMSS, *What Is Interoperability,* http://www.himss.org/library/interoperability-standards/what-is-interoperability, retrieved November 1, 2016.

Working from these principles, SOV enterprise architects, specializing in several different areas, collectively develop an extensive and evolving set of *non-functional-requirements (NFR)*. They are called *non*-functional because they refer to the *operational* requirements of the system,[38] rather than the *functional* requirements. The DII Enterprise Architecture Group states, "Non-functional requirements (NFRs) define how a system should be, as opposed to what it should do; they are used to determine the quality of a technical solution."[39]

The SOV NFR tables contain over 1100 items, organized into 25 categories, covering operational areas like Disaster Recovery, Security and Privacy, and Relational Databases.[40] The NFRs are at this time properly considered as the embodiment of the EA guiding principles, rather than as a strictly enforced framework. Not every NFR applies to every situation. Also, the IT enterprise across state government comprises a wide variety of needs, functionality, age of systems, budgets, and planning priorities. By employing the NFRs, the SOV *gradually* brings value to the whole IT enterprise by enabling the guiding principles above.

The enterprise architects at DII use the NFRs in two main ways:

- Contracts with vendors for significant new SOV IT acquisitions incorporate the appropriate NFRs in various ways: as listed requirements, as parts of SLAs, as deliverables, etc. The aim is to employ the NFRs as broadly and deeply as practicable.
- SOV agencies using or acquiring major IT systems are encouraged, with the assistance of DII, to gradually bring their systems into NFR compliance, and to be a participating member of the reusability/interoperability community.

6.2.3 THE DATA WAREHOUSE

Our discussions with State stakeholders regarding the existing and potential uses of a data warehouse reveal a certain frustration with the current state of affairs. As the VHIE has developed, initially as a clinical message system *focusing on use at the point of care*, VITL has expanded its "data warehouse side" to fill the needs *of its primary data consumers: the HCOs*. The State acknowledges the experience and expertise of VITL thus far in eliciting and responding to these data consumers' needs, and has tacitly supported the development of this "data warehouse" over several years via the funding mechanism. However, the State has apparently never *explicitly required* a data warehouse, nor *specified the requirements* for a data warehouse function in its agreements with VITL. The following conditions currently exist:

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[38] Non-functional Requirements, In *Wikipedia,* https://en.wikipedia.org/wiki/Non-functional_requirement (Retrieved November 12, 2016).

[39] State of Vermont, Department of Information and Innovation, *Non-functional Requirements*, http://cto.vermont.gov/content/non-functional-requirements (Retrieved November 17, 2016).

[40] State of Vermont, Department of Information and Innovation, *Non Functional Requirements Spreadsheet v.10.2,* 2016.

- The data and information architecture of the "data warehouse" side of VITL/VHIE is opaque to the State.
- The State's Enterprise Architects suspect the VITL data warehouse may not meet the State's Enterprise Architecture requirements for a robust data warehouse, potentially resulting in data or function duplication and insufficient opportunity for proper data stewardship. Currently, this cannot be verified, as stated above.
- The State anticipates that proper uses of VHIE data, both within and external to State government, may go beyond those consumers VITL identifies as its HIE stakeholders. Therefore, the architecture of the data warehouse as it exists may potentially not serve these expanded needs if it is not sufficiently robust and flexible.
- The State has not determined in detail what it requires in a data warehouse, although some initial attempts have been made in this direction.
- Although 18 V.S.A. § 9352 clearly defines VITL as the operator of the (V)HIE, it is a matter for debate whether an HIE necessarily includes a data warehouse within its boundaries.

From these findings, we identify 2 primary risks:

1. The State has not defined in detail its need for an HIT data warehouse , **_RISK-ID#-A1_**
2. The State does not have a clear Enterprise Architectural understanding of the VITL "data warehouse", nor the VHIE as a whole, **_RISK-ID#-A2_**

We believe the State already holds the processes to meet these 2 planning needs.

Therefore,

1. **We recommend that the State conduct an architectural assessment of VITL's VHIE enterprise (both "sides"), according to established State procedures.**

An architectural assessment (AA) is a well-defined process, whereby enterprise architect(s), working on behalf of the State, measure the existing architecture of an enterprise against all the applicable items in the master list of NFRs. In effect, this is an "architectural audit," resulting in a clear picture of the assessed enterprise, with identification of its strengths and deficiencies. The assessment leads to further specifications for improvement or development.

The State routinely conducts architectural assessments both internally (State agencies conducting significant data projects) and externally (vendors proposing significant IT projects to the State). While a large vendor would likely have the EA resources to conduct the assessment with its own resources, an internal assessment is conducted by the State's EA staff, with expenses normally billed to the assessed Agency. This latter model could be employed in the present circumstance, with DVHA as the billed Agency and VITL as the subject.

It remains true that VITL's statutory status as a non-profit 501(c)(3) corporation designated by law to operate the VHIE creates some confusion and disagreement about the boundary between SOV and VITL authority in various technical areas. VITL's status means it is not quite a vendor and at the same time

not a part of state government, and hence creates some question how SOV should or could implement its enterprise architecture principles or certain other requirements in relation to the VITL. However, grant and contract provisions which have a particular basis in law, such as statutory or pass-through grant requirements, are not subject to the same disagreement or confusion, and are routinely included.

The State might select from a number of options to initiate the assessment process. The preferred option would be enthusiastic cooperation by VITL in the context of ongoing agreement (grant and/or contract) negotiations. Other options include (1) relying on the recommendation from the present review, as the current agreements bind VITL to complying with review recommendations at the State's request; (2) relying on the language of 18 V.S.A. § 9352, the same clause which authorizes the present review. Note that this statute (unlike 3 V.S.A. § 2222) does not require an *independent* review, although the Secretary requested one in the present instance. The entire clause (highlighted for emphasis):

> **18 V.S.A. § 9352.(2)** Notwithstanding any provision of 3 V.S.A. § 2222 or 2283b to the contrary, upon request of the Secretary of Administration, the Department of Information and Innovation shall review VITL's technology for security, privacy, and interoperability with State government information technology, consistent with the State's health information technology plan required by section 9351 of this title.

The clause above refers to the Vermont Health Information Technology Plan (VHITP), which is also defined in statute (excerpted for clarity):

> 18 **V.S.A. § 9351.** (b) The Health Information Technology Plan shall:
>
> …
>
> (3) ensure the use of national standards for the development of an interoperable system, which shall include provisions relating to security, privacy, data content, structures and format, vocabulary, and transmission protocols;
>
> …
>
> (6) incorporate the existing health care information technology initiatives to the extent feasible in order to avoid incompatible systems and duplicative efforts;
>
> (7) integrate the information technology components of the Blueprint for Health established in chapter 13 of this title, . . . and any other information technology initiatives coordinated by the Secretary of Administration pursuant to 3 V.S.A. § 2222a; and
>
> (8) address issues related to data ownership, governance, and confidentiality and security of patient information.

This terminology is consistent with, and reflects, the principles of enterprise architecture which lead to the formation of the architecture assessment requirements. We conclude from this that the Secretary of Administration could request the assessment directly if desired.

2. **We recommend that the State endeavor to determine the applications, requirements and specifications, and uses of a data warehouse for HIT, probably within the context of a data governance plan.**

It is conceivable that a State-specified data warehouse could combine and relate data from a number of data sources within the Health Services Enterprise (HSE), not only the VHIE, thus minimizing duplication of data and enhancing interoperability throughout the enterprise. However, this would require considerable pro-active architectural design on the part of the State. Therefore, we suggest a broader scope (HIT) for a data warehouse plan than only the VHIE, in order to maximize the integrity and interoperability of data, while minimizing duplication. (With the current VHIE, for example, the Blueprint extracts relatively raw data and performs operations on this data, resulting in possibly duplicated data within and without the VHIE. This in turn implies a difficulty in synchronization and a loss of integrity for those records when viewed from a global HIT perspective.)

The draft proposal for a State HIT data governance plan (see *Section 6.2.6*, below) already includes broad stakeholder participation, which would be critical for success of a data warehouse specification, and therefore may represent the appropriate planning context.

We leave open many questions about a potential data warehouse -- whether it would reside within or without the boundary of the VHIE, what part it would play in the HSE, how it would be funded, who would build, maintain, and operate it, etc. The answers to these questions will flow from the specification process. There is no intent on our part to specifically exclude VITL as a possible answer to many of these questions. There is broad agreement within the State that VITL's "data warehouse" operations currently fill a need (e.g., providing data extracts for analysis by ACOs) which represents a gap in the functions the State can provide. Further, there is little appetite for disrupting an important function for healthcare reform, especially without an up-and-running alternative in place. However, the EA principles embodied by statute in the VHITP require early and thorough attention to the data warehouse issue if VHIE information is to be fully interoperable with other HIT functions.

6.2.4 TECHNICAL COOPERATION

The principle of interoperability can go beyond technological specifications alone. For VITL and the rest of the SOV HIT enterprise to "interoperate" successfully, the technical personnel at all entities who are actually implementing projects -- such as interface design, data quality testing, terminology services, etc. -- have a need to communicate and collaborate. Prior to this year, there has been a tendency to negotiate and conduct projects between SOV and VITL at the "senior" or "executive" level of personnel only. We identify this as a risk, **_RISK-ID#-A3_** since it promotes duplication, waste, and excess negotiation (due to the "voltage drop" as specific technical requirements and reports are simplified in translation to executive-level understanding, and then re-interpreted by technical implementation personnel). VITL agreed with this perception, and stated that collaboration at the technical personnel level "has to be done." SOV also reached this conclusion, and informed us that such collaboration has begun on some projects in recent weeks.

We recommend that technical-worker-level collaboration between VITL and SOV continue and increase, as a matter of general practice.

6.2.5 DATA STANDARDS

VHIE was designed from inception to strongly support and utilize national data standards for health information. This design decision supports robustness in the implemented system, but it is forward-looking as well: As described above, although VHIE is initially confined largely to the State of Vermont, the national vision -- as well as the regional vision from State and VITL -- sees VHIE as interconnecting with national infrastructure, such as the Sequoia Project, other HIT systems at the federal level, and other regional systems, such as New York's HIXNY[41]. The eHealth Exchange Testing Program of the Sequoia project tests compliance for Health Information Exchange (HIE) standards as required by the eHealth Exchange Coordinating Committee for connecting to the national eHealth Exchange network[42]. VHIE has been validated for this compliance, one of the first state HIE's to receive this acknowledgment of interoperability[43].

The need to keep Vermont's providers and HIE compliant with Meaningful Use requirements[44] also drives the need for employment of national data standards. Impending Stage 3 Meaningful Use requirements will be stringent and extensive.

HIE data standards are commonly implemented as connectivity criteria. Under 18 V.S.A. § 9352(i)(2), VITL must "establish criteria for creating or maintaining connectivity to the State's health information exchange network" and provide those criteria to the Green Mountain Care Board (the "Board") by March 1 each year. [45]

Connectivity criteria define the capabilities and stages of compliance an HCO must meet to connect to the HIE. Connectivity criteria also define the precise format and content of data messages sent from provider to HIE (and hence from HIE to other provider and/or data user). The overarching standard for

[41] VITL Chief Technology Officer, *Personal Interview* (August 17, 2015).

[42] The Sequoia Project, *eHealth Exchange Testing Program,* http://sequoiaproject.org/ehealth-exchange/testing-overview/, (retrieved Sept. 30, 2015).

[43] VITL Chief Technology Officer, *Personal Interview* (August 17, 2015).

[44] "The **HITECH** Act outlined the intended plans for the adoption of electronic health records through **meaningful use**. The CMS Medicare and Medicaid EHR Incentive programs have evolved into three stages of **meaningful use** with their own goals, priorities, and their own final rule." – see HITECH Answers, *Meaningful Use,* http://www.hitechanswers.net/ehr-adoption-2/meaningful-use/.

[45] See https://www.vitl.net/sites/default/files/documents/HIE/2014-GMCB-connectivity-criteria-guidance.pdf

such messages is called Health Level 7 (HL7), and is further subdivided into specific interface types. VITL currently defines interface specifications for the following HL7 message types[46]:

Interface Type	Interface Name
Patient Demographics	Admit/Discharge/Transfer (ADT)
Laboratory Results	Laboratory Results (ORU format)
Pathology Results **Radiology Reports** **Transcribed Reports**	Textual Reports (ORU format) or Textual Reports (MDM format)
Immunizations	Immunization (VXU)
Continuity of Care Documents	Consolidated Clinical Document Architecture (C-CDA)

We note here that data standards and connectivity criteria in this context refer to the baseline standards by which clinical messages enter the HIE. While they form the essential *basis* for consistency and reliability of data, they do not alone speak to the stewardship, "cleanliness," and integrity of that data as it relates to all legitimate potential uses of the data. For that, both data quality efforts (see above) and proper data governance is necessary.

6.2.6 DATA GOVERNANCE

SOV, like other governments and organizations, increasingly recognizes that the data it collects, holds, and analyzes constitutes a significant and valuable body of assets. Those assets are most valuable if they can be used, compared, connected and collected over a wide range of SOV interests; conversely, they have less value, or may even lose value, if they cannot be properly kept, used, understood, and verified. The process of managing data as enterprise-wide assets, to make those assets readily available to support business needs throughout the enterprise, is known as Data Governance. It establishes and maintains goals, standards, practices, and processes that are aligned with the goals of the organization.

In our FY16 O&M grant review, we pointed out the need for data governance in the VITL/VHIE enterprise. Some HIT entities, notably the Green Mountain Care Board (GMCB), had by that time initiated excellent data governance plans and councils. This year, we note as a risk the lack of comprehensive data governance across the whole HIT enterprise. **_RISK-ID#-A4_** Late in CY 2015, SOV created a draft of a comprehensive Data Governance Plan Initiative for AHS, which would fill the lack we identify. **We recommend its continued development and implementation. It would create a HIT Data Governance Council with broad stakeholder engagement and a Data Governance Process with clearly**

[46] VITL, *Network Specifications,* https://www.vitl.net/explore/network-specifications (retrieved Sep 5, 2015).

identified roles and responsibilities. In combination with an Architectural Assessment, as described above, proper Data Governance could provide the necessary specifications, inputs, and expected outputs to help clarify data requirements for the improvement of agreements such as those in the present review.

We feel the stakeholder approach (which aside from SOV might include, for example, VITL, GMCB, Private HCO representation, ACO representation, etc.) would continue to engage VITL in a collaborative process which advances its own organizational needs as well as the EA data governance interests of SOV.

6.2.7 SPECIFICITY IN AGREEMENTS

Although not solely an EA concern, it is particularly in this area that we note as a risk the continued shortage of specificity, data quality metrics, targets, and reporting standards in these agreements. **_RISK-ID#-A5_** In some cases, this reflects the increased negotiation and/or disagreement reported above. In others cases, we find that the general outlines of deliverables (such as specifying a "security plan") exist in the agreements themselves, while the details are discussed outside the formal agreements and sometimes after the agreements are executed.

In addition to EA concerns, this shortcoming potentially imperils funding, as a result of inadequate performance reporting. (please see section ***8.2.2 Vermont Health Care Reform And The Need For Performance Measurement***)

SOV reports that it is working to address this particular concern, in part by engaging the services of DII at an earlier point in agreement negotiation than had been the practice in prior years. Most commonly, DII assistance is applied shortly before an agreement is executed (for example, the period at which Independent Reviews are often conducted). DVHA now employs DII input (for example, EA advice) at an earlier point in the agreement development process. **We agree this is a good mitigation, and recommend that SOV should use these internal resources -- along with the data governance process above, as it is realized -- to include appropriate metrics, targets, and reporting standards within the agreements themselves.**

6.3 STATE'S IT STRATEGIC PLAN

6.3.1 DESCRIBE HOW THE PROPOSED SOLUTION ALIGNS WITH EACH OF THE STATE'S IT STRATEGIC PRINCIPLES:

A. Leverage successes of others, learning best practices from outside Vermont.

The ideal model for a state or regional HIE is a work in progress, but most major characteristics are well understood nationally.[47] Several organizations,[48] as well as the Federal government,[49] represent forums for the discussion and sharing of design, implementation, usage, and connectivity information specific to HIEs. Both State and VITL participate actively in these information sharing activities.

Technically, a state HIE may be viewed as the employment of mature technologies (database design, data exchange formats, hosted solutions, secure data exchange networking) to support the development of a new use, the health information exchange itself. This development takes place in an economic and political environment which may be more or less incentivizing. Vermont, with a well-organized and active plan for healthcare transformation,[50] is often a leader in development.

The federal goal is an interconnected and interoperable national HIE (The Sequoia Project eHealth Exchange, formerly Healtheway).[51] To this end, state HIEs, including VHIE, are currently working to ensure that such national connectivity is developed hand in hand with local and regional connectivity. As a result, there is additional incentive to share approaches.

B. Leverage shared services and cloud-based IT, taking advantage of IT economies of scale.

Viewed from the perspective of the internal State network, no part of VHIE infrastructure resides on the State network.[52] Because the legislatively mandated organizational structure of VHIE is a "given," it is easy to lose sight of the fact that it represents a conscious choice by the legislature (which could have chosen other models, as evidenced in other States.) The implementation chosen results in a nearly pure Software-As-A-Service (SaaS) model for the State, with VITL as the provider, well-aligned with strategic preference.

Viewed in more detail from the perspective of VITL's network, VHIE still exhibits characteristics favored by the IT Strategic Plan. The VITL operation has two major "sides," as described above. One side is the HIE platform and database itself, hosted and provided by primary vendor Medicity. The other side is the population data analysis side, developed by VITL and hosted by RackSpace.

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[47] HealthIT.gov, *What is HIE?*, https://www.healthit.gov/providers-professionals/health-information-exchange/what-hie (retrieved August 30, 2015).

[48] See for example: Healthcare Information and Management Systems Society, www.himss.org (retrieved September 30, 2015).

[49] See for example: US Health Resources and Services Agency (HRSA), *Office of the National Coordinator for Health Information Technology (ONC)*, https://www.healthit.gov/ (retrieved August 30, 2015).

[50] *See:* Robin J. Lunge, JD, Director of Healthcare Reform, *Strategic Plan for Vermont Health Reform, 2012 –2014*, Vermont Agency of Administration, (July, 2012).

[51] The Sequoia Project, *eHealth Exchange History*, http://sequoiaproject.org/ehealth-exchange/about/history/ (retrieved September 30, 2015).

[52] Enterprise Architect, DII, *Personal Interview* (August 5, 2015).

Recently, VITL has begun discussing with SOV the possibility of moving the "data warehouse" side of the infrastructure to a new hosting vendor (VITL also mentioned this in an interview with us). In the process of discussing options, SOV has suggested that VITL consider a cloud-hosted environment, instead of owned hardware in a hosting facility. To do so would be a significant move towards the State's preference for cloud-based IT. Reportedly, VITL is interested in and considering the option.

C. Adapt the Vermont workforce to the evolving needs of state government.

As VHIE is operated by the independent organization VITL, State-supplied personnel are involved primarily in the effort to develop, monitor, and maintain the State portion of VHIE funding and support mechanism, i.e., contract and grants (such as the present O&M grant). Acknowledging that the fluid environment of a developing HIE may result in changing personnel needs over time, the State employs a mix of State personnel and independently contracted personnel to meet these needs. This seems to us to be appropriate and cost-effective for the task.

The in-state portion of the development and operation of VHIE requires personnel with general and specific technical knowledge of a high order. This means there could be challenges in replacing key competencies in a short timeframe in an organization such as VITL. However, this same challenge is faced by any operation within the State HIT infrastructure. Vermont has a small population base, but is known to have (in some geographic areas) a higher than usual proportion of skilled technical personnel. And yet, State government and associated HIT operations like VITL may not be able to offer compensation levels competitive to industry . We understand this to be a well-known issue in State IT planning.

D. Apply enterprise architecture principles to drive digital transformation based on business needs. Couple IT with business process optimization, to improve overall productivity and customer service

(*please see the above section **6.2 Enterprise Architecture and Interoperability***)

E. Optimize IT investments via sound Project Management

Both the State – in its management of the State portion of VITL funding via contract and grants – and VITL – in its management of VHIE and associated processes – employ skilled and competent project managers operating within broadly accepted, PMBOK-style project management guidelines. Both State and VITL maintain Sharepoint-hosted repositories for project management materials, records, and registers, and sometimes utilize mutual access to Sharepoint when appropriate. Frequent meetings, milestones, and checkpoints identified within and outside the grant ensure adequate monitoring of grant activity progress. Although State and VITL may, for their own purposes, emphasize different aspects of the project management process, there appears to be more than adequate compatibility between them.

F. Manage data commensurate with risk

6.3.1.1 SENSITIVE DATA

VHIE holds data which may be considered as highly sensitive: historical and current Protected Health Information (PHI) of Vermont citizens, as well as that of non-citizens who consume healthcare services in the State; diagnoses, clinical notes, codes, and other work product of healthcare providers; laboratory tests; hospital records; etc.

The danger to this data arises in three forms:

1. data loss – the unintentional, temporary or permanent, loss of data, for which the mitigation is redundancy, backup, and archiving. (*See Section **6.7 Disaster Recovery**, below*)
2. data breach – the unauthorized theft of data, for which the mitigation is appropriate security *(See Section **6.5 Security And Privacy**, below).*
3. data misuse – the inappropriate use of data by third parties, for which the mitigation is *data stewardship*.

*(Please see Section **6.5 Security And Privacy**, below, for more information).*

6.3.1.2 DATA "OWNERSHIP"

Databases naturally contain information, and the determination of who *owns* that information determines various legal and even ethical questions of who is responsible for the safety, protection, and use of that information. SOV, like all states, takes the approach when it acquires a database system for its own purposes, that "we paid for it: we own it." (Sometimes, federal funding complicates that equation, because the federal government in effect says, "*We* paid for it: *we* own it.")[53] A recent article in the Journal of the American Medical Association stated, "In the emerging era of electronic health informatics, few other medicolegal questions are more critical, more contested, or more poorly understood."[54]

The VHIE proper is a state-commissioned database, paid for by state and federal funds. It also contains personal health information (PHI) supplied by health care organizations (HCOs). However, according to our interview with State personnel, current Vermont law defines the HCO as the owner of the information.[55] If correct, that definition seems to define ownership of data in the VHIE proper, where PHI resides.

Looking further down the line, however, we have "de-identified" data (no longer PHI) residing in the VITL "data warehouse." The data warehouse was built and is funded by state and federal funds flowing as part of the VHIE initiative. Who owns this data? Although the State thus far takes its normal

[53] Director, Vermont Healthcare Innovation Project, *interview* (Oct. 26, 2016).

[54] Mark A. Hall, JD & Kevin A. Schulman, MD, Ownership of Medical Information, JAMA, March 25, 2009, Vol. 301, No. 12, 1282.

[55] Director, VHCIP, Oct. 26, 2016).

approach, there is some underlying uncertainty on the part of the State, and some disagreement from VITL, based on the presumption that, under State law, PHI is owned by the HCO where it originates. We identify this as a risk. **_RISK-ID#-PM4_** We are told[56] that the State is currently pursuing clarification of this matter through State legal channels.

G. Incorporate metrics to measure outcomes

As described above in section **6.2 Enterprise Architecture and Interoperability**, we identified as a risk the lack of specificity in the agreements. Although the state has made significant progress in recent years, focusing on inclusion of data quality and connectivity reports as deliverables for the O&M grant, more needs to be done. Addressing the need to apply appropriate NFRs would form the proper basis for performance metrics. In addition, we refer the reader to the recent report of the State Auditor regarding the VTIL agreements.[57]

6.4 SUSTAINABILITY

(See section ***5.2.2 Sustainability Models***.)

6.5 SECURITY AND PRIVACY

Confidentiality in healthcare refers to the duty of anyone entrusted with health information to keep that information private.[58] **Privacy**, as distinct from confidentiality, refers to the right of an individual to keep his or her health information private.[59] **Security** refers directly to protection, and specifically to the means used to protect the privacy of health information and support professionals in holding that information in confidence.[60] By statute, the primary subjects of this review are security, privacy, and interoperability.

To distinguish security from privacy, we can use the analogy of protecting a house from thievery. **Security** refers to the means by which you prevent or discourage a thief from entering the house – by locks, by window bars, by alarms which announce illegal entry – while **privacy** refers to the

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[56] *Ibid.*

[57] Vermont State Auditor, Report Number 16-06, *Vermont Information Technology Leaders, Inc. (VITL),* September 30, 2016.

[58] Centers for Disease Control and Prevention, *HIPAA, Privacy & Confidentiality*, https://www.cdc.gov/aging/emergency/legal/privacy.htm , accessed Nov. 7, 2016.

[59] *Ibid.*

[60] *see* 45 CFR 164.304

homeowner's right not to have the house contents stolen. The value of the contents, and the measure of that value – whether financial, sentimental, or cultural – drives the determination of the extent of security applied.

A bureaucracy – whether government or large organization – assures security primarily by means of compliance. Compliance requires the choice of a widely accepted standard by which the means of security are verified. The extent of compliance is measured by means of a self test, or, ideally, an audit by a third party independent auditor. Where an audit discloses shortcomings in compliance, a plan is devised to increase compliance to 100%.

When an organization, such as a database hosting company, achieves complete compliance to a standard, it may publish an attestation from the auditor to the effect that the facility is 100% compliant.

A security/privacy standard decreases the *probability* of a data breach or security incident. Compliance with a standard does not *guarantee* by itself that security measures will always prevent loss, but it does ensure that the covered organization (and a state funding the enterprise) is very likely doing the best it can to protect the data within.

The HIE itself – the VHIE proper -- comprises a combination of hardware and software, entirely hosted and managed by Medicity, a third-party vendor. This contains the most sensitive portion of the enterprise.

Medicity maintains a very high standard of security measures and demonstrates these standards through various third party certifications and attestations. Medicity is a major vendor serving several other state and private HIEs. Vermont HIE operations at Medicity, including all data, are segregated physically and logically from all other HIE operations. Backup, redundancy, and reliability are assured through a well-documented and extensive process.

From a security perspective, the VHIE enterprise also includes the "data warehouse" side, hosted at Rackspace, and any connections to third parties.

The federal Health Insurance Portability And Accountability Act (HIPAA) defines rules to protect all "individually identifiable health information" held or transmitted by a covered entity or its business associate, in any form or media, whether electronic, paper, or oral. This information is called "protected health information" (PHI). HIPAA creates both security and privacy rules. The Security Rule is located at 45 CFR Part 160 and Subparts A and C of Part 164 and the Privacy Rule is located at 45 CFR Part 160 and Subparts A and E of Part 164. These rules apply to all PHI within the VHIE enterprise. In general, federal law supersedes state law; however, state law which does not contradict federal law (e.g., by enforcing a stricter standard) may also apply. A good guide to applicable law may be found in the current 2016 draft of the VHITP.

A wide variety of standards and guidelines apply to organizations and systems holding PHI. In general terms, however, a combination of two federal standards in combination apply in the present case:

- Federal Information Processing Standards (FIPS) 200, Minimum Security Requirements for Federal Information and Information Systems
- National Institute of Standards and Technology Special Publication 800-53 revision 4 (NIST SP 800-53 r4), Security and Privacy Controls for Federal Information Systems and Organizations

6.5.1 VITL SECURITY PLAN

The FY16 VITL VHIE O&M grant required VITL to initiate a "security plan" as a deliverable, and the FY17 agreement requires the continuation of the deliverable with regular reports. To initiate the plan, VITL engaged CynergisTek to conduct an audit of security and privacy measures in light of FIPS 200 / NIST 800-53, and to make recommendations for any necessary remediation. The resultant report, "Information Security Program Assessment - FIPS 200 / NIST 800-53 r4 Controls - 2015," prepared for VITL, become the basis for an Excel spreadsheet file referred to as the "Security Plan of Action and Milestones" (POA&M or POAM), based on a pre-existing POAM template . VITL and SOV security personnel have used this POAM as a common working document to devise an ongoing remediation plan to bring VITL into full compliance. The CynergisTek report appears to be highly thorough and well-organized for compliance purposes, and we fully support its use as a basis for remediation and compliance, and incorporate by reference its recommendations.

In the early part of our review process, a key SOV security employee was temporarily unavailable, and we were unable to determine via existing documentation and questioning of SOV staff whether VITL had providing the "security plan" deliverable. In the event, the POAM *was* available via the SOV project documentation store (Sharepoint) -- however, we were unable at that time to confirm we were viewing the actual "security plan" deliverable. We identify this problem as a risk in this project **_RISK-ID#-PM2_**, although a small one, because we feel it showed a certain lack of critical documentation (of the receipt of a deliverable) and redundancy (I.e., more than one person knowing a deliverable had been received and assessed). **This risk is easily mitigated, and we expect it will be quickly resolved by our recommendation of establishing redundancy of understanding and ensuring proper documentation.**

The POAM document itself forms a solid basis for advancing security and privacy compliance, but we note that risks exist from shortcomings in the way it has been used to date.

1. We believe that the POAM, standing alone, does not constitute a complete security plan. We identify this as a risk. **_RISK-ID#-S5_** The POAM, as crucial as it is, lacks several features necessary to a complete plan, for example:

    - Narrative description, both overall and in sections
    - An explicit plan for periodic re-evaluation and testing
    - Benchmarks for ongoing improvement
    - Documentation and reporting mechanism for changes and remediation
    - Data relationship diagrams
    - Security boundary definitions

We recommend the State require further elaboration of the security plan, including at least the items listed. We note here that the State has already begun this process in part, requiring several of the above details before the current iteration of the plan is accepted.

2. Although greatly improved from some earlier versions of the POAM, we identified gaps in VITL's compliance with the format and content of the POAM template. _RISK-ID#-S9_For example, several items had missing or misplaced "scheduled completions dates," "completion dates," and "milestones with completion dates." These and other deviations from the template could lead to disagreement about the status and projected timeline of security remediation. **We recommend strict adherence to the template.**

3. In some cases where VITL disagreed with findings carried over from the original CynergisTek Security Assessment document, comments were inserted into inappropriate fields in the POAM, making it difficult to audit or assess POAM performance, and perhaps leading to disagreement about POAM status. _RISK-ID#-S10_ **Here again, we recommend strict adherence to the template, along with complete commentary in appropriate template locations, along with SOV assessments both *within* the template, and in *other* appropriate project documentation, where relevant project personnel will be aware of changes to items needing remediation.**

4. The *adequacy* of Medicity security and privacy controls, although evident to all concerned, has not been explicitly *documented as satisfactory to SOV*, either within the POAM or elsewhere. _RISK-ID#-S4_**We believe that if the POAM constitutes the "security plan" deliverable, some statement of SOV's assessment of Medicity as a third party vendor should be contained within the plan.**

[redacted]

[redacted]

The controls prescribed by a security standard like NIST SP 800-33 r4 are not concerned only with physical security and logical network configuration, but also with the policy and associated procedures that govern these aspects and direct the people who implement them. Furthermore, compliance is an ongoing process, requiring regular review of policy and procedures, and testing where appropriate.

Although both SOV and VITL have relevant policies in place, we do have concerns the indicate some risk with the current status of these policies and associated procedures.

- Current SOV Security Policies, as promulgated on the DII website, appear to date from 2010. It is not clear that they have been reviewed or assessed since that time. _RISK-ID#-S8_ The year 2010 represents a much earlier point in maturity of the VHIE, and no linkages are identified between SOV and VITL policy. NIST SP 800-53 r4 requires documented annual review, even if there is no changes. **We recommend SOV review existing policy including special attention to VITL's role in light of VITL's statutory definition, and revise if/when appropriate. We further recommend these policies undergo documented review at least annually.**

- SOV does not explicitly track or evaluate *implementation procedures, testing, and periodic review* of VITL's HIPAA-related security ***policies***, although VITL reports that that the procedures exist and are documented, and that CynergisTek continues to assess procedures, tests, and periodic review. _RISK-ID#-S6_ **We recommend that SOV monitor and document assessment of VITL's security policies and procedures at least annually.**

- SOV and VITL both publish incident response plans (policies). However, these plans are not explicitly coordinated and tested. **_RISK-ID#-S3_** Considering the overlap of interests, **we recommend that SOV consider coordinating incident response plans and policies between SOV, VITL, and perhaps participating healthcare organizations (HCOs).** The coordination might include not only HIPAA-required notification, but also public relations and reputational responses.

- No incident response plan testing, such as so-called tabletop exercises, has taken place in regard to VHIE at either SOV or VITL. **_RISK-ID#-S1_ We recommend regular and documented incident response planning exercises (e.g., tabletop mock incident), including SOV, VITL, and perhaps other invited entities if appropriate. Exercises should include technical-, compliance-, and executive-level participants.**

This last point needs some further explanation. HIPAA rules require certain notifications for particular kinds of security incidents and privacy breaches. Vermont state law also requires certain notifications, and in some cases the requirements may exceed federal requirements (without contradicting them). But, beyond compliance with statutory requirements, there is a need for the state to be prepared for *all* the implications of a privacy breach or security incident, particularly a serious or high-profile one. In the event of such an incident, it may be something of a red herring to be concerned only with who has liability under HIPAA rules. If a serious incident occurs in the midst of the State's HIT enterprise, the public may be less concerned with who is technically responsible under the law, and more concerned with the quality, timing, and efficacy of the State's response and that of other involved parties. We suggest it is in the best interest of the state to be certain that the overall response is coordinated and efficient. To this end, it seems important to have relevant and well-informed executive-level participants in a tabletop incident response exercise, and not only technical personnel. "We found the problem and we'll make sure it doesn't happen again" may not be an adequate response. Healthcare quality and cost reform forms a major part of Vermont's legislative, policy and budget efforts, and being prepared so as to avoid reputational harm to that effort would seem to offer a significant return on investment.

6.5.2 BEYOND COMPLIANCE

Although federal standards, guidance, grant rules, and statutory mandates provide the required and appropriate basis for security and privacy implementation in the HIE enterprise, at times the state may want to move *beyond* required federal compliance and impose its own requirements. As long as these do not conflict with federal law, they may be applied where the state legislature and/or contracting authorities deem appropriate. One example occurring in several states, including Vermont, comes about when the state decides by legislation to increase requirements for protection of its citizens' personal information, including PHI, beyond that required by HIPAA. The Vermont statute in question, 9 VSA § 2435, defines (among other things) the reporting requirements when a breach of personal information has occurred. These requirements shorten the maximum time before an individual victim of a data breach is notified to 45 days, compared to the 60 days required by HIPAA. Additionally, there is a requirement to notify the State's Attorney as soon as possible after the breach is discovered. SOV embeds these requirements by reference in the VITL agreements in the form of a standardized Business

Associate Agreement (BAA, which is itself required by HIPAA when connecting PHI from "Covered Entities" (CE) like Health Care Organizations (HCOs) to data users like HIEs).

In the process of this review, we found certain inconsistencies concerning breach notification requirements arising between SOV contract provisions (including the BAA), Vermont state breach notification law, and VITL Security Policy: InfoSec 4 **_RISK-ID#-S5_** :

1. Contract Attachment F – AGENCY OF HUMAN SERVICES' CUSTOMARY CONTRACT PROVISIONS, Section 7 (Privacy and Security Standards), Protected Health Information, requires the contractor to "**follow state and federal law**" relating to PHI privacy and security, including HIPAA.
2. Contract Attachment E – BUSINESS ASSOCIATE AGREEMENT, Section 6 (Documenting and Reporting Breaches), 6.1, requires the BA (VITL) to notify the Covered Entity (i.e., a Participating Health Care Provider) of a breach **as soon as reasonably possible, but no later than 2 days after discovery**
3. (same as above) Section 8 (Providing Notice of Breaches), 8.3, requires the Covered Entity or the BA (if requested by the CE) to notify the individual whose PHI was compromised **as soon as reasonably possible, but no later than 60 days** after discovery.
4. Vermont statute 9 VSA § 2435 requires that a security breach be reported to an affected individual "in the most expedient time possible and without unreasonable delay, but **not later than 45 days after the discovery** "
5. VITL Policy: InfoSec 4 requires notification to the Participating Health Care Provider(s) whose PHI was breached "**no later than 10 business days" following discovery (in contradiction of the BAA)**, and notification to the individual **"without delay and in no case later than 60 days" from discovery (in contradiction of 9 VSA § 2435 but conforming to the BAA).**
6. VITL Policy: InfoSec 4 also incorporates various requirements by referring to "**January 1, 2007, Vermont Act 162, subchapter 2**," which is a very outdated earlier version of **9 VSA § 2435.** This earlier statute required notice to be given "**in the most expedient time possible and without unreasonable delay.**" This allows the contradiction in #5 above.

(State law, of course, does not supersede federal law, but it can apply stricter requirements if it does not contradict federal law (notification requirements are stricter than federal in several states).

The situation taken as a whole presents a risk of possible non-compliance with state law, as well as SOV contract provisions. **We therefore recommend that these inconsistencies be corrected, both in SOV contract provisions in the form of the standard BAA, and in the related security policies and procedures at VITL.**

6.5.3 PUBLIC INTERFACES AND VITLACCESS

Almost all of the VHIE enterprise (such as interfaces) employs Virtual Private Networking (VPN)to ensure highly secure, encrypted exchange of data, rendering interception of information extremely unlikely.

The third-party audits and vulnerability assessments described above show that VITL would be doing everything practical to ensure continued high security and protected privacy.

The only *public*-facing user interface (in the general sense) is the VITLAccess platform, which uses a web-based interface for participating HCOs to authorized VHIE information and consent management. As described elsewhere, VITLAccess is based on a secure, off-the-shelf platform, configured for VHIE. Access is controlled by password, as described in the VITLAccess User guide:

> A username and password is required to log into VITLAccess. The first time you log in, the system will prompt for a password change, and ask for answers to three security questions. Passwords are valid for 180 days, and the system will not allow re-use of the last three passwords.[61]

We believe this is an appropriate approach thus far, while at the same time we note that many HIEs are beginning to implement more extensive access controls, such as 2-factor authentication . We expect Vermont and VITL will monitor these trends and evolve to adapt.

6.5.4 SOV SECURITY EXPERTISE

In the course of our review, the SOV suggested, that in light of the security requirements described above, the SOV CISO would benefit from additional on-staff or contracted specialized security and privacy expertise focused specifically on PHI and HIT security. We concur, and identify the lack of such expertise as a risk. **_RISK-ID#-S7_** Existing SOV security expertise is broad and quite deep, but the rapid development and sensitive nature of the HIT enterprise presents particular challenges. The United States federal privacy laws are *sectoral* in nature, defining different rules, rights, and remedies depending upon the subject of the data. (In contrast, the majority of countries have *omnibus* privacy laws, applicable equally to data in all sectors.) In addition, most states have implemented their own privacy and security laws, which may supplement federal laws. Laws from other states could conceivably apply to data contained in the VHIE, which includes HCOs and patients' PHI from outside Vermont. **We agree that acquiring specific health security expertise is advisable, and recommend that SOV continue to pursue the possibility of adding about 1 FTE of such expertise to SOV staff.**

6.6 COMPLIANCE WITH THE SECTION 508 AMENDMENT TO THE REHABILITATION ACT OF 1973, AS AMENDED IN 1998:

The VITLAccess web-based portal, built on a platform by CPSI (Computer Programs and Systems, Inc.), provides the common Human User Interface to all VHIE-related services commonly accessed by HCO participants in the VHIE. The original vendor Q&A for this CPSI's development of this portal includes the following agreed NFR:

[61] VITL, *VITLAccess User Guide V 7.4.3.2,* May 2016.

T3.6 The System will conform with the sub-parts of Section 508 of the Americans with Disabilities Act (ADA), and any other appropriate State or Federal disability legislation.[62]

Use of VITLAccess requires choice and use of certain commonly-available combinations of computer operating system and browser.[63] These operating systems and browsers all provide appropriate accessibility features, functionality, and/or extensionality.

6.7 DISASTER RECOVERY

The HIE side of VHIE is hosted by Medicity, with redundant geographically separate facilities in Colorado and Utah. Medicity's data centers are SSAE-16 certified: best practice in healthcare and exceeds HIPAA standards.[64] The "data warehouse" side of VHIE is housed in VITL servers hosted by Rackspace.

Both Medicity and Rackspace provide extensive data recovery measures. (See ***Service Level Agreement***, below)

As part of the FY16 "Security Plan" deliverable, VITL supplied to SOV for evaluation detailed information from Rackspace concerning the "Managed Backup" features employed by VITL to protect data housed at Rackspace.

6.8 DATA RETENTION

FEDERAL RULES

The HIPAA privacy rule does not set periods for record retention.[65] Section 164.316(b)(2)(i) states,

> *"Retain the documentation required by paragraph (b)(1) of this section for 6 years from the date of its creation or the date when it last was in effect, whichever is later."*

This section is generally interpreted to mean that transaction logs (such as for databases) must be retained for at least 6 years.

CMS requires Medicare managed care program providers to retain records for 10 years.[66]

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[62] Strategic Technology Services, *Independent Review Electronic Health Record Solution for State of Vermont AHS, DMH, and DII,* April 21, 2015.

[63] VITL, *VITLAccess User Guide V 7.4.3.2,* p. 3, May 2016.

[64] Vermont Information Technology Leaders, Inc., *2013 Annual Report*, 8 (January 15, 2015).

[65] https://www.healthit.gov/sites/default/files/290-05-0015-state-law-access-report-1.pdf

[66] 42 CFR 422.504 [d][2][iii]

https://www.healthit.gov/sites/default/files/appa7-1.pdf states no existing VT retention period for PHI covering specifically MDs; but does cite statute for hospitals, below

> ***18 V.S.A. § 1905 License Requirements****, states:*
>
> *(8) Professional case records shall be compiled for all patients and signed by the attending physician. These records shall be kept on file for a minimum of 10 years*.

So this seems to indicate a baseline for necessary retention for some HCOs.

The default medical records retention baseline at the level of states is the medical malpractice statute of limitations, if the state has one. Vermont SOL is generally referred to in this way (various legal information sites):

> **Medical malpractice: 3 years Vt. Stat. Ann. tit. 12, § 521 (2016)**

But it should probably be considered as **7 years** for our purposes. See (emphasis added):

> ***12 V.S.A. § 521 Medical malpractice***
>
> *Notwithstanding section 512 of this title, and except as provided in sections 518 and 551 of this title, actions to recover damages for injuries to the person arising out of any medical or surgical treatment or operation shall be brought within three years of the date of the incident or two years from the date the injury is or reasonably should have been discovered, whichever occurs later, but not later than seven years from the date of the incident. No statute of limitations shall limit the right to recover damages for injuries to the person arising out of any medical or surgical treatment or operation where fraudulent concealment has prevented the patient's discovery of the negligence. Where the action is based upon the discovery of a foreign object in the patient's body, which is not discovered within the period of limitation under this section, the action may be commenced within two years of the date of the discovery of the foreign object. (Added 1977, No. 248 (Adj. Sess.).)*[67]

Health information data in VHIE is intended to cover both current PHI (for clinical use) and historical information (for health data analytics, clinical improvement, policy development, etc.). VITL reports that "Clinical data is kept indefinitely since providers decide medical decisions from the data we provide," and "audit files are kept for 6 years."[68] As the former quote indicates, clinical data is currently kept "live," without an expiration date specified. As such, although redundancy and data backup ensures that clinical data will not be accidentally lost, there exists no plan for archiving clinical data. We do not identify this as an issue in the current agreements, as long-term data archiving of clinical data represents a health policy issue as yet unresolved on a national or regional scale. Although it would seem at first glance that clinical data need only slightly outlive the individual it refers to, in fact the health policy

[67] http://legislature.vermont.gov/statutes/section/12/023/00521

[68] VITL Chief Technology Officer, *Email* (October 15, 2015).

research function of HIEs imply a very long term – indeed, "indefinite" – archival requirement. A recent industry report projects an overall volume of healthcare data of 2,314 exabytes by 2020.[69] We expect that all states with health data networks will need to address the archival questions in coming years. 1 V.S.A. § 317a, Disposition of public records, states "A custodian of public records shall not destroy, give away, sell, discard, or damage any record or records in his or her charge, unless specifically authorized by law or under a record schedule approved by the state archivist pursuant to 3 V.S.A. § 117(a)(5)." No general or Agency-specific record schedules are currently listed by the State as specifically applicable to VHIE. [70]

6.9 SERVICE LEVEL AGREEMENT

VITL maintains contractual service level agreements with both the primary VHIE provider, Medicity, and the VITL data use network hosting service, RackSpace.

Medicity assures response to network problems in a three-tier plan, briefly summarized as:

- Priority 1 (most serious, persistent inability to access clinical information)
    - Contact Client with problem report and begin resolution within 15 minutes during daytime and 30 minutes during night hours.
    - Report plan of action within 1 hour
    - Provide updates hourly
- Priority 2 (Performance less than optimum, product feature non-functional)
    - Contact Client to acknowledge report within 1 hour
    - Verify problem and provide plan of action within 4 hours
    - Provide updates hourly
- Priority 3 (Failure of system which does not have any effect on normal operations)
    - Contact Client, verify problem, and provide plan of action within 48 hours.
    - Provide updates at least once every 5 business days or at mutually agreed frequency.[71]

Rackspace guarantees:

- 100% Network uptime in a given month, excluding scheduled maintenance.
- 100% infrastructure functioning time in a given month, excluding scheduled maintenance.
- Replacement of any failed hardware/server component at no cost within one hour of problem identification.

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[69] Health Data Archiver, *Health Data Volumes Skyrocket, Legacy Data Archives On The Rise*, http://www.healthdataarchiver.com/health-data-volumes-skyrocket-legacy-data-archives-rise-hie/ (retrieved November 11, 2015).

[70] *See* Vermont Secretary of State, *Records retention*, https://www.sec.state.vt.us/archives-records/records-management/records-retention.aspx (retrieved October 21, 2015).

[71] VITL Systems Administrator, *Email* (October 7, 2015).

- Credit is supplied for failure to meet these criteria at the rate of 5% of monthly fee for each 30 minutes of network or infrastructure downtime in a given month, and 5% of monthly fee per hour of hardware/server downtime beyond guaranteed time in a given month.[72]

These targets seem consistent with industry expectations and best practices. However, a better definition of remedies in written contractual form, including for example acceptable evidence of failure and a perhaps finer granularity or pro-rating of downtime, would be advisable.

6.10 SYSTEM INTEGRATION

6.10.1 IS THE DATA EXPORT REPORTING CAPABILITY OF THE PROPOSED SOLUTION CONSUMABLE BY THE STATE?

Under 18 V.S.A. § 9352(i)(2), VITL must "establish criteria for creating or maintaining connectivity to the State's health information exchange network" and provide those criteria to the Green Mountain Care Board (the "Board") by March 1 each year. On February 27, 2015, the GMCB voted to accept the criteria presented to the board. Statement is available at http://gmcboard.vermont.gov/sites/gmcb/files/documents/GMCB_guidance_connectivity_criteria%20withJ_App_A%282%29.pdf

6.10.2 WHAT DATA IS EXCHANGED AND WHAT SYSTEMS (STATE AND NON-STATE) WILL THE SOLUTION INTEGRATE/INTERFACE WITH?

Please create a visual depiction and include as Attachment 1 of this report.

(see Attachment A, **VITL VHIE Enterprise Diagram**)

Will the solution be able to integrate with the State's Vision and financial systems (if applicable)?

N/A. VITL is a separate organization and not part of State government.

[72] Rackspace, *The Rackspace SLA covers three components that support the availability of your web site:*, http://www.rackspace.com/managed-hosting-support/service-levels/managed-sla (retrieved October 21, 2015).

7 ASSESSMENT OF IMPLEMENTATION PLAN

7.1 THE REALITY OF THE IMPLEMENTATION TIMETABLE

7.1.1 AGREEMENT DELAY

We identify as a risk that Grant and Contract execution have often been significantly delayed. _RISK-ID#-PM3_ VITL identifies this to us in discussion, and to GMCB when making their periodic budget reports, as a significant source of frustration and impediment to planning. GMCB in their analysis of VITL's budget agrees. SOV acknowledges these delays, and offers various explanations: one is that federal approval of activities is often delayed, and another is that extended negotiations with VITL also delay agreements. All of the above seems plausible to us; and yet, these delays must be minimized. All parties agree that timely execution is imperative.

We do not see a single straightforward solution, but components present themselves:

- **First, we recommend that SOV continue any efforts as described by the Commissioner of the Department of Vermont Health Access and the Deputy Secretary of Administration, who wrote that "Since early 2016, DVHA has developed more streamlined processes for executing agreements with VITL and also timing and sequencing of various agreements and amendments."**
- **Second, we support adopting the various recommendations of the Vermont State Auditor report on the VITL agreements. None of these recommendations specifically address the agreement delays, but all of them make for more robust and usable agreements, which can only help.**

7.1.2 TRACKING DELIVERABLES

Partly concurrent with the present review, the office of the Vermont State Auditor conducted an internal audit of SOV oversight of VITL activities and performance by DVHA and AOA in FY15 and FY16, and including current agreements. We did not in general attempt to duplicate their efforts, but fully concur with their recommendations. In one important particular we wish to point out, the report highlights the fact that VITL's "clinical data warehouse," although at this point agreed by SOV to be valuable for state HIT purposes, was not *explicitly* required and agreed in the text of grants and contracts. Consequently, there have not been performance measures defined for this activity. (We refer the reader to **Section 6.2, Enterprise Architecture and Interoperability**, for further details.)

In the process of assessing documentation for this review, we note as a risk the sparseness of comprehensive and organized tracking, assessment, and documentation of deliverables required by the VITL agreements. _RISK-ID#-PM1_ When deliverables comprised written reports, they were not necessarily assessed with documentation , archived and cross-referenced in a way that enabled us to match them with agreement provisions. The project Sharepoint site (which has since been replaced with

an updated site, we should note) did not always contain current information on the status of deliverables and performance.

During the period of this review (Aug-Oct, 2016), and especially since the prior year, tracking of deliverables has improved significantly. The primary evidence for this is contained in the monthly "Progress Reports" shared among project personnel. These reports are organized in tabular form by deliverables and associated timelines. At the outset of the present review, the report contents were thinly populated with information. Now, they are much more informative and useful for analysis. So, there has been significant progress on this front.

We suggest it is important for SOV project personnel to ensure that current assessment and tracking of agreement deliverables are available *at any time* and *for any authorized user* (whether transparency requires anything more, we leave for a different review). In other words, although it is important -- perhaps *most* important -- for senior project personnel to know the state of the project, it is also important that other individuals with a legitimate need -- which may be a SOV business need seemingly unrelated to the project at hand, or may belong to a project worker with a minor role -- are able to quickly check on the state of the project. If availability of project personnel and time is a limiting factor, then SOV should assess that factor.

We recommend that SOV continue to improve and centralize tracking of deliverables for timeliness and adequacy of use by SOV business, project management, and technology interests.

*(For description of a related risk, see section **6.5 Security and Privacy**, above)*

7.2 READINESS OF IMPACTED DIVISIONS/ DEPARTMENTS TO PARTICIPATE IN THIS SOLUTION/PROJECT (CONSIDER CURRENT CULTURE, STAFF BUY-IN, ORGANIZATIONAL CHANGES NEEDED, AND LEADERSHIP READINESS).

In out FY16 review of the VHIE O&M grant, we identified the persistent tension -- with both parties pulling in slightly different directions -- between SOV and VITL personnel surrounding the negotiation of grant terms and conditions, along with other project matters. We speculated that the tension arose partly from the statutory, SDE model of HIE operation, and partly from a cultural difference between organizations, with VITL having an "entrepreneurial" culture, and SOV having a (appropriately) bureaucratic culture. We pointed out that this tension could be both positive and negative in effect, I.e., it could result in creative solutions to problems which arise during the process. In many ways, this has proven to be the case. Both SOV and VITL have learned to work with, rather than against, the unique challenges of the SDE operational model.

These challenges have become so embedded in the way that these agreements have developed, that in the present review, we now characterize them as a persistent "friction" in the agreement negotiation process. This friction could become a positive risk.

This requires some explanation, because positive risk is a relatively rare, indeed controversial, but useful component of the PMBOK risk model. In effect, it is the identification of a risk that may arise from the occurrence of a positive, or ostensibly desirable, event. The classic hypothetical example is a project that concludes well under budget. On the surface, this is a positive event (the project didn't cost as much as it might), but viewed another way, it is a planning failure (funds were allocated and unused -- they might have been allocated to something else that was foregone).

In the present case, we use the term friction, because, like friction in a mechanical system, it can be anticipated, accommodated, and compensated. We suggest that SOV currently does this, with some planning, negotiation, and project management resources dedicated to developing VHIE agreements that might not be necessary either in dealing with a traditional vendor or with an internal State agency. But, also as in a mechanical system, the absence of friction would mean the system was over-resourced.

While we refrain from identifying a positive risk at this point in the evolution of State's relationship with VITL, we suggest that some thought be given to the resources that must be dedicated to, for example, agreement negotiation. Perhaps the emphasis on metrics for performance, specificity in agreements, and non-functional requirements may lead to a personnel benefit for the State.

7.3 DO THE MILESTONES AND DELIVERABLES PROPOSED BY THE VENDOR PROVIDE ENOUGH DETAIL TO HOLD THEM ACCOUNTABLE FOR MEETING THE BUSINESS NEEDS IN THESE AREAS:

A. PROJECT MANAGEMENT

Project management liaison between VITL and SOV has thus far taken place mainly at an Executive (Senior) level. As described above, we have recommended that more efforts be made to coordinate project activities at the project manager / technical staff level.

B. TRAINING

In its original role as REC, and continuing with activities in this grant, including Sprint Management teams, Data Quality activities, and Meaningful Use activities, VITL is supported by the State in various aspects of training and education. This training is appropriately specifically aimed at providers, for onboarding and interface development.

C. TESTING

Individual project initiatives, such as Interface Development and Terminology Services, are extensively tested by VITL in-scope, throughout these agreements, generally with reporting required as deliverables.

D. DESIGN

N/A

E. CONVERSION (IF APPLICABLE)

N/A (…strictly speaking. Interface design, is, by a certain view, a conversion activity. But we take this item to mean conversion from an earlier system, which is not relevant here.)

F. IMPLEMENTATION PLANNING

We view Enterprise Architecture, and associated NFRs, as the proper basis for comprehensive implementation planning. As described above in section **6.2 Enterprise Architecture and Interoperability**, some risk exists because of the lack of comprehensive EA collaboration between VITL and SOV.

G. IMPLEMENTATION

7.3.1 SPECIFICITY IN AGREEEMENTS

In all these agreements, the responsibility for implementation rests with VITL. By all accounts of SOV personnel, VITL's performance on projects has been of extremely high quality. However, as mentioned earlier, and as explained in the State Auditor's Report, the lack of specificity in agreements to date makes quantitative performance measurement challenging.

7.3.2 CHARACTERIZATION OF CONTRACTS

We note in passing that the VITL contracts (not the grant) are each defined in their respective Section 1 as "***a contract for personal services***." These contracts include hardware and software items; furthermore, they do not align with the federal government's definition of such a contract. Our question about this characterization elicited the following response from the State:

> *"We have always generally called our contracts personal service contracts, even if they have other components. However, our updated AA-14 form for contracts has a place to identify whether hardware or other services are also being procured."*[73]

Whether or not this is continuing SOV practice, identifying these contracts as "personal services" contracts may cause some confusion, especially as they are funded in part by federal funds, and we identify this minor risk. **_RISK-ID#-PM1_**

FEDERAL RULES

48 CFR 37.104 - Personal services contracts.

> **(a)** A personal services contract is characterized by the employer-employee relationship it creates between the Government and the contractor's personnel. The Government is normally required to obtain its employees by direct hire under competitive appointment or other procedures required by the civil service laws. Obtaining personal services by contract, rather

[73] Meaghan Kelley, Contract Specialist, *via email*, Dec. 22, 2016.

than by direct hire, circumvents those laws unless Congress has specifically authorized acquisition of the services by contract.

(b) Agencies shall not award personal services contracts unless specifically authorized by statute (e.g., 5 U.S.C. 3109) to do so.

(c)(1) An employer-employee relationship under a service contract occurs when, as a result of (i) the contract's terms or (ii) the manner of its administration during performance, contractor personnel are subject to the relatively continuous supervision and control of a Government officer or employee. However, giving an order for a specific article or service, with the right to reject the finished product or result, is not the type of supervision or control that converts an individual who is an independent contractor (such as a contractor employee) into a Government employee.

By federal rules, these contracts are probably not "personal service contracts." While the distinction may be minor for SOV purposes, this could cause a problem in the event of a federal audit. The SOV form AA-14, referenced by the SOV employee above, indicates the possible designation of "non-personal service."

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3 VSA § 341. Definitions

. . .

(2) "Personal services contract" means a contract for services that is categorized as personal services in accordance with procedures developed by the Secretary of Administration and is consistent with subdivisions 342(1), (2), and (3) of this title.

...

(4) "Contract for services" means an agreement or combination or series of agreements by which an entity or individual agrees with an agency to provide services as a contractor, rather than as an employee. (Added 1999, No. 75 (Adj. Sess.), § 2; amended 2009, No. 54, § 107, eff. June 1, 2009; 2015, No. 78 (Adj. Sess.), § 2.)

3 VSA § 342. Contracting standards; contracts for services defines the conditions for a "contract for services" in various ways, including that the State *not* "exercise supervision over the daily activities or methods and means by which the contractor provides services other than supervision necessary to ensure that the contractor meets performance expectations and standards;". This is obviously the exact opposite of the federal definition for *personal* services, and seems appropriate.

Whatever the reason for this usage, we recommend that the appropriate State of Vermont authority review the contract language for clarity and appropriateness, and suggest considering the use of the

federal definition, or reference to it where appropriate for compliance purposes, and at least the "non-personal service" designation via SOV form AA-14.

7.4 DOES THE STATE HAVE A RESOURCE LINED UP TO BE THE PROJECT MANAGER ON THE PROJECT? IF SO, DOES THIS PERSON POSSESS THE SKILLS AND EXPERIENCE TO BE SUCCESSFUL IN THIS ROLE IN YOUR JUDGEMENT? PLEASE EXPLAIN.

Yes, the State has employed project managers (for the agreements and for project oversight) with extensive experience specifically on VHIE and generally on Vermont HIT implementation. Both are experienced in PMBOK principles and application. The project team (Project Manager, Business Lead/State HIT Coordinator, Assoc. State HIT Coordinator, Program Manager, Business Analyst, and Grants Mgt. Specialist) have a deep understanding of Vermont HIT and healthcare reform efforts generally, and appear to work together closely, efficiently, and in the context of PMBOK principles generally.

8 COST BENEFIT ANALYSIS

8.1 ANALYSIS

Here, as in the Cost Comparison in Section 5, *above*, we must at times consider VHIE as a whole, rather than attempting to identify benefits particular to individual projects within the enterprise.

To further complicate matters, the quantitative measurement of HIE effectiveness is still in its infancy. Most studies that do exist are predictive in nature. A widely-quoted "internal study" by a major EHR provider purportedly claims that the current (non-electronic) method of information exchange accounts for approximately $17,160 of the expenses of a single-clinician practice. In fact, we were unable to acquire a copy of this study, and those that quoted the study seem to be quoting each other, rather than a primary source[74].

In the following narrative, we review some of the credible evidence for both tangible and intangible benefits to be expected from a successful state HIE. Note that the benefits identified accrue in general not necessarily to Vermont State government, but to the Vermont polity (and by extension to the geographically nearby areas partaking of Vermont's healthcare system). This is consistent with Vermont's reform efforts to improve cost and quality across the healthcare system.

8.2 TANGIBLE BENEFITS

8.2.1 FINANCIAL BENEFITS OF HIE

One of the few quantitative studies available is a 2015 study from the Center for Technology Innovation at Brookings, entitled "The benefits of health information exchange platforms: Measuring the returns on a half a billion dollar investment.[75]" The study, while identifying the paucity of quantitative information mentioned above, reports the results of a controlled study of Emergency Departments (EDs) in Western New York State, where HIE participation is high.

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[74] See for example: Wikipedia, *Health Information Exchange,* https://en.wikipedia.org/wiki/Health_information_exchange (retrieved August 20, 2015);
FreedomPACS, *Three Business Challenges Every Medical Practice Needs to Know About*, http://www.freedompacs.net/wp-content/uploads/2012/05/FreedomPACS-trends.pdf (retrieved September 30, 2015); and
Merge Healthcare, *Merge Honeycomb™ The nation's largest medical image sharing network,* http://www.merge.com/MergeHealthcare/media/LandingPages/Merge_Honeycomb2.pdf (retrieved October 1, 2015).

[75] Niam, Yaraghi, *The Benefits Of Health Information Exchange Platforms: Measuring The Returns On A Half A Billion Dollar Investment*, Center for Technology Innovation at Brookings, (May, 2015).

The study's author proposes that the value of an HIE "is proportional to two conditions: (1) its volume of available medical data and (2) the extent to which its members access the available data.[76]"

The study states:

> "In this study, the above conditions are met: (1) it is done in a setting where there is a wealth of available medical data for each patient and (2) the database of HIE platform is being queried in 100 percent of patient encounters. In the first ED setting, querying RHIO's database is associated with respectively, **a 25 percent and 26 percent reduction in the estimated number of laboratory tests and radiology examinations.** In the second ED setting, querying RHIO's database is associated with a **47 percent reduction in the estimated number of radiology examinations.[77]"**

If the author of the study is correct, then Vermont's VHIE approach would seem to be the right approach: early and widespread incentivized participation with an emphasis on getting patient data into the system early in the project, so that it can be used as soon as possible in clinical settings.

A similar study by the same author, "An Empirical analysis of the financial benefits of health information exchange in emergency departments," published in the Journal of the American Medical Informatics Association in June, 2015, in a different ED setting, found that

> " HIE usage is associated with, respectively**, 52% and 36% reduction in the expected total number of laboratory tests and radiology examinations ordered per patient at the ED**."[78]

A verifiable reduction in tests required by an ED using access to an HIE would result in a tangible benefit to the state, in the form of a decrease in the cost of healthcare, as a result of the cost increase the state assumed in commissioning the VHIE.

8.2.2 ACCOUNTABLE CARE ORGANIZATIONS

Some of the benefits of VHIE are realized through the participation of providers in Accountable Care Organizations (ACOs). ACOs are voluntary groups of providers who collaborate in providing coordinated care to Medicare patients, with the cooperation of the Centers for Medicare and Medicaid Services (CMS) under the Medicare Shared Savings Program (MSSP).[79] When an ACO delivers quality evidence-based, coordinated care with associated cost savings, the ACO participants share in the savings it achieved (the "upside"; there can also be a "downside"). VITL receives some of its non-State funding

[76] *Ibid.*, p. 2.

[77] Ibid., p.2.

[78] Niam Yaraghi, *An empirical analysis of the financial benefits of health information exchange in emergency departments*, Journal of the American Medical Informatics Association, (June, 2015).

[79] State of Vermont State Innovation Model, *Overview of Shared Savings Programs and Accountable Care Organizations in Vermont* (July 8, 2014).

from an ACO that benefits from the use of VHIE services. ACOs typically rely on shared clinical data to plan and then assess care initiatives. Using and interpreting this data may involve both VHIE and Blueprint. CMS predicts the cumulative average of ACO shared savings payments from 2016 through 2018, combined with average aggregate start-up investment and continuous operating costs of $822 million, will yield a net private benefit of $278 million. Successful Vermont ACOs would participate in this benefit[80]. At least one Vermont ACO, Community Health Accountable Care, has already received "more than $2 million" through this program.[81]

8.2.3 VERMONT HEALTH CARE REFORM FUNDING AND THE NEED FOR PERFORMANCE MEASUREMENT

Vermont's healthcare reform efforts are designed around four goals:[82]

1. Reducing healthcare costs and cost growth
2. Assuring that all Vermonters have access to and coverage for high quality care
3. Assuring greater fairness and equity in how we pay for healthcare
4. Improving the health of Vermont's population

As described in the discussions above and the one following, VHIE has the potential and *likelihood* of delivering measurably on reform goals number 1 and 4, as well as functioning as a critical component of the HIT structure to deliver tangible benefits on the other goals.

Under VHIE's current sustainability model (see section ***5.2.2 Sustainability***) VHIE depends on the continuation of certain public funding streams, both federal, and increasingly State, for its operation. Access to these streams will depend upon accurate and quantifiable measurement and reporting of both the performance and the effects of the VHIE and its various component projects. In this context, we emphasize the earlier described risk arising from the finding that agreements lack specificity concerning data quality metrics, targets, and reporting standards. **_RISK-ID#-A5_**

(Please see section ***6.2.5 Specificity in Agreements***, for more about this risk.)

8.3 INTANGIBLE COSTS & BENEFITS:

A 2006 meta-study by the Agency for Healthcare Research and Quality (AHRQ) on the costs and benefits of HIT (not specifically HIE) concluded that substantial benefits were predicted for adoption of HIT in

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[80] Jacqueline DiChiara, *Improved ACO Participation Saves $240M, Says CMS Final Rule*, RevCycleIntelligence, http://revcycleintelligence.com/news/improved-aco-participation-saves-240m-says-cms-final-rule (retrieved Aug. 1, 2015).

[81] VTDigger, *ACOs Show Mixed Results In Medicare Program,* (http://vtdigger.org/2015/09/15/acos-show-mixed-results-in-medicare-program/ (Retrieved November 18, 2016).

[82] Vermont Agency of Administration, *Health Care Reform*, http://hcr.vermont.gov/ (Retrieved November 18, 2016)

clinical settings, but that benefits breakeven point varied from 3 to 13 years after implementation[83]. The studies reviewed included some conducted as much as 14 years earlier, when the technology available was much different than it is in 2016[84].

8.3.1 VITLACCESS

VITL's provider portal, VITLAccess, is considered by VITL to be "key to determining return on investment, justifying future funding, and understanding the value provided to healthcare reform initiatives." VITL anticipates that clinician use of VITLAccess will provide more informed care, higher quality, improved patient safety, and reduced cost[85]. This seems consistent with the conditions of the Brookings study.

8.3.2 GENERAL BENEFITS OF HEALTH INFORMATION EXCHANGES

HealthIT.gov identifies the following benefits to Health Information Exchanges[86] (without quantitative evidence, however):

- Provides a vehicle for improving quality and safety of patient care by reducing medication and medical errors
- Stimulates consumer education and patients' involvement in their own healthcare
- Increases efficiency by eliminating unnecessary paperwork
- Provides caregivers with clinical decision support tools for more effective care and treatment
- Eliminates redundant or unnecessary testing
- Improves public health reporting and monitoring
- Creates a potential loop for feedback between health-related research and actual practice
- Facilitates efficient deployment of emerging technology and healthcare services
- Provides the backbone of technical infrastructure for leverage by national and State-level initiatives
- Provides a basic level of interoperability among electronic health records (EHRs) maintained by individual physicians and organizations

[83] Southern California Evidence-based Practice Center, *Costs and Benefits of Health Information Technology*, Agency for Healthcare Research and Quality, p. v (April, 2006).

[84] *Ibid.,* p. 51-53.

[85] VITL CEO, *Email in response to questions* (August 25, 2015).

[86] HealthIT.gov, *HIE Benefits,* https://www.healthit.gov/providers-professionals/health-information-exchange/hie-benefits (retrieved August 30, 2015).

8.3.3 INITIAL PROJECT OBJECTIVE BENEFITS

In the planning phase of this grant, during development of the IT ABC form, State planners identified a number of benefits which identify the State's main objectives for the VHIE network. The following excerpt lists these objectives:

This Program will

- *improve care management,*
- *allow better population analytics,*
- *provide better patient information at the point of care, and*
- *lower the growth in the cost.*
- *Simply having a complete, accurate, and up-to-date patient heath care record available to the providers will accomplish all three of the Affordable Care Act's Triple Aims.* ***(sic)***
- *By providing accurate data at the population level, HIE will support the aims of the Accountable Care Organizations (ACOs), Meaningful Use (MU), and other goals of the Vermont healthcare system towards better measurement and accountability.*[87]

[87] State of Vermont*, IT Activity Business Case & Cost Analysis: Health Information Exchange (HIE),* pg. 2 (October 14, 2014).

8.4 FUNDING:

Agreement	Fund	Source	% of agreement total	Amount
# 03410-256-17	Medicaid Assistance Program	Federal	55%	$ 2,695,000.00
# 03410-256-17	Global Commitment (non-subrecipient funds)	State	45%	$ 2,205,000.00
# 31204 (Amendment #1)	State Innovation Model	Federal	100%	$ 1,326,720.00
# 32349	HITECH HIE (Federal Share FFP 90%)	Federal	90%	$ 907,420.50
# 32349	HITECH HIE (State Match 10%)	State	10%	$ 100,824.50
	Total			**$ 7,234,965.00**

(Also see other State costs in Section 9.2, *below*)

8.5 ASSUMPTIONS:

The analysis above assumes that the present grant is a key component of VHIEN enterprise as a whole, and that all components of VHIEN contribute to any benefits the State may gain .

8.6 COSTS VS. BENEFITS:

Although computing the benefits of HIEs in general, and of VHIE in particular, will require substantial research and analysis before generalized statements can be made, it is quite clear that national HIT policy and the Vermont HIT plan as part of healthcare reform policy depend on the efficient functioning of a vibrant HIE. Healthcare reform efforts nationwide are betting heavily on the usefulness of HIEs in transforming healthcare, and we see no evidence to the contrary. The present grant seems a reasonable investment for the potential of a very significant return over time.

8.7 IT ABC FORM REVIEW

The Information Technology Activity Business Case & Cost Analysis (IT-ABC) form for this project was completed in October 14, 2014. It was compiled at a significantly earlier stage of VHIE development, and although it continues to reflect accurate the aims and goals of the HIE project, it is *somewhat* out of date in other ways, particularly in funding projections. Taking FY17 as FY3 in the Estimated 5 Year Costs, we would expect VHIE costs to be $2,841,400 (including state and federal fund sources). Funding for IT ABC FY2 totals $4,371,400. This is at least close to the current O&M grant total for FY17 of $4,900,000.

The IT ABC anticipated the current funding source analysis, including the projected 2017 sunset of the HIT Fund Claims Tax Assessment Allocation, which remains a source of planning focus for the State.

Item V.9 Business Case projects planning for generation of private revenues (such as service or subscription fees) to offset ongoing operating costs of VHIE, which the State has since chose not to pursue, for policy reasons.

9 IMPACT ANALYSIS ON NET OPERATING COSTS

9.1 INSERT A TABLE TO ILLUSTRATE THE NET OPERATING COST IMPACT.

See **Attachment B, Cost Spreadsheet**

9.2 PROVIDE A NARRATIVE SUMMARY OF THE ANALYSIS CONDUCTED AND INCLUDE A LIST OF ANY ASSUMPTIONS.

As is true of other State HIEs, Vermont's VHIE developed initially through Federal funding leveraged by State funds, specifically the Health Information Technology Fund (HIT Fund), defined by 32 V.S.A. § 10301 as "a special fund to be a source of funding for medical healthcare information technology programs and initiatives such as those outlined in the Vermont health information technology plan administered by the secretary of administration or designee." VITL is explicitly named in § 10301(a)(2) as a recipient of these funds to "build and operate the health information exchange network." At the time of this writing, the HIT fund portion of the Healthcare Claims Tax is scheduled to sunset at the end of FY2017.

Federal funding was never intended or expected to continue at the relatively high level created by Congress to encourage HIE initial development. Consequently, every public HIE program effort has known from the start that a model for sustainability would be required to ensure that HIE services would be available into the indefinite future. (see section ***5.2.4 Sustainability Models***)

From 2011 – 2014, the State's Cooperative Agreement Grant from the Office of the National Coordinator (ONC), matched 90/10 with the HIT Fund, was the primary source of State funding for VITL through a grant agreement between DVHA and VITL.

The Vermont Health Information Technology (HIT) fund, 32 V.S.A. § 10402, accumulates receipts raised by a 0.199% charge on private health benefit claims (i.e., not including Medicaid, Medicare, or other federally-funded programs). The claims tax is administered by the Department of Taxes and expenditures from the fund are delegated by the Agency of Administration to DVHA. The HIT fund assessment under current law will sunset on June 30, 2017. In recent years, the State has managed the HIT Fund in compliance with guidance from the Department of Finance and Management regarding appropriations.[88] Additionally, the State has been conservative in expenditures to ensure continued support of programs beyond the fund's sunset date. However, if state funds are identified at the current level, and using current internal state projections, the fund is projected to be sustainable through FY2021.[89]

Vermont funds VHIE (and some other HIT initiatives) through a mix of federal funds and State HIT fund expenditures. Federal funding includes Vermont's Global Commitment for Health Medicaid 1115 Waiver

[88] State of Vermont, *Vermont Health Information Technology Plan (VHITP), DRAFT dated March 2016,* p. 88.

[89] *Ibid.,* p. 88.

and “HITECH” Medicaid “fair share” funding. For the past three years, additional federal funds have been available from the Centers for Medicaid and Medicare (CMS) State Innovation Models (SIM) Testing Grant.

The current funding breakdown of the agreements is therefore:

Agreement	Fund	Source	% of agreement total	Amount
# 03410-256-17	Medicaid Assistance Program	Federal	55%	$ 2,695,000.00
# 03410-256-17	Global Commitment (non-subrecipient funds)	State	45%	$ 2,205,000.00
# 31204 (Amendment #1)	State Innovation Model	Federal	100%	$ 1,326,720.00
# 32349	HITECH HIE (Federal Share FFP 90%)	Federal	90%	$ 907,420.50
# 32349	HITECH HIE (State Match 10%)	State	10%	$ 100,824.50
	Total			**$ 7,234,965.00**

In addition, some costs are incurred by the State outside of the grant for personnel to develop, monitor, and manage the grant. These costs, as well as the cost of this Independent Review, are added to total grant costs in the Cost Assessment spreadsheet, for a total cost over a 1 year lifecycle of:

$ 7,873,337.98

9.2.1 SUSTAINABILITY

(In addition to the discussion above, please see section ***5.2 Cost Comparison, .2-.4 Sustainability Models.)***

9.3 EXPLAIN ANY NET OPERATING INCREASES THAT WILL BE COVERED BY FEDERAL FUNDING. WILL THIS FUNDING COVER THE ENTIRE LIFECYCLE? IF NOT, PLEASE PROVIDE THE BREAKOUTS BY YEAR.

(See above)

9.4 WHAT IS THE BREAK-EVEN POINT FOR THIS IT ACTIVITY (CONSIDERING IMPLEMENTATION AND ON-GOING OPERATING COSTS)?

These agreements are intended to continue support for one year of VITL’s operation of VHIE and associated development activities, and not as a replacement for a previous system. The currently projected sustainability model (see above) does not at this point include revenue generating offerings by VITL to offset or replace funding.

10 ATTACHMENTS

Attachment A – VITL VHIE Enterprise Diagram

Attachment B – Cost Spreadsheet, Excel File Tab 2

Attachment C – Acquisition Cost Spreadsheet, Excel File Tab 3

Attachment D – Acquisition Cost By Category, Excel File Tab 4

Attachment E – State Personnel Cost, Excel File Tab 5

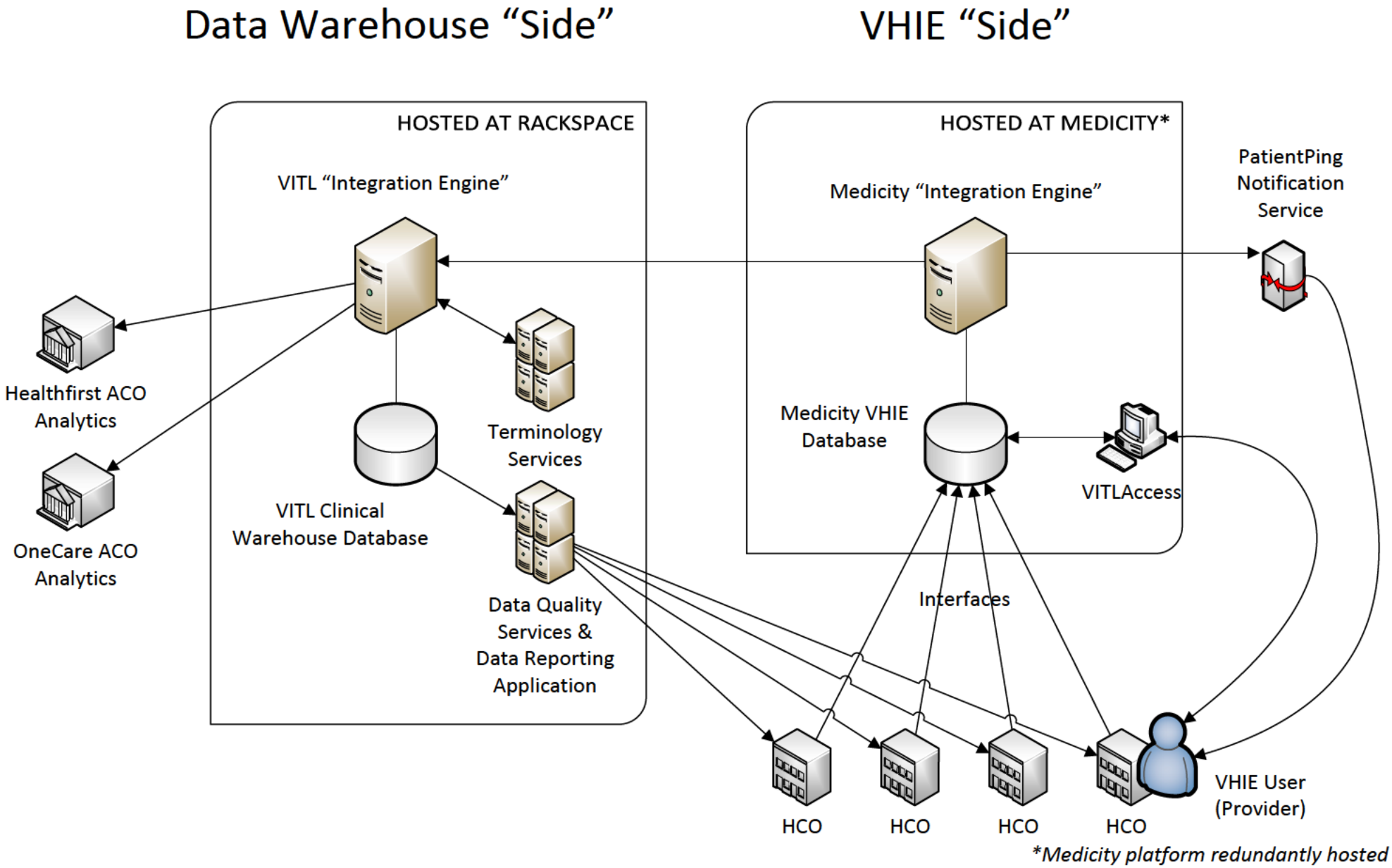
Attachment F – Comparison Totals, Excel File Tab 6

Attachment G – Funding Sources, Excel File Tab 7

Attachment H – Risk Assessment

Attachment I – Risk and Issue Register Summary, Excel File

VITL VHIE Enterprise



Project Name				VHIE FY17 Development Agreements			
Description	Included in Vendor Fixed Price	Qty	Unit Price	Initial Implementation	Maintenance	Refresh & Maintenance	Total
Fiscal Year				FY 2017	FY 2017		
Hardware							
Server Hardware				$ 55,200.00	$ -	$ -	$ 55,200 00
Network Upgrades				$ -	$ -	$ -	$ -
Desktop Hardware				$ -	$ -	$ -	$ -
Other (VITL Direct IT Expense)				$ -	$ 344,151 00	$ -	$ 344,151 00
Hardware Total				**$ 55,200.00**	**$ 344,151.00**	**$ -**	**$ 399,351.00**
Software as a Service							**$ -**
Product License (H E Vendor Contrract Expense)				$ -	$ 957,717 00	$ -	$ 957,717 00
Medicity Interface				$ -	$ -	$ -	$ -
Provider Interface Reimbursement				$ -	$ 280,000 00	$ -	$ 280,000 00
Product Per-User Charges				$ -	$ -	$ -	$ -
Database				$ -	$ -	$ -	$ -
Operating System Software				$ -	$ -	$ -	$ -
Additional Server Software				$ -	$ -	$ -	$ -
Additional Network Software				$ -	$ -	$ -	$ -
Other				$ -	$ -	$ -	$ -
Software Total				**$ -**	**$ 1,237,717.00**	**$ -**	**$ 1,237,717.00**
Consulting				$ -	$ -	$ -	$ -
Third-Party - Technical				$ -	$ -	$ -	$ -
Third-Party - Business (Direct Consulting)				$ -	$ 132,404 00	$ -	$ 132,404 00
Direct Travel				$ -	$ 32,552 00		
Deployment				$ -	$ -	$ -	$ -
Upgrade				$ -	$ -	$ -	$ -
Other (Project Management)				$ -	$ -	$ -	$ -
Consulting Total				**$ -**	**$ 164,956.00**	**$ -**	**$ 164,956.00**
							$ -
Training							**$ -**
Trainer				$ -	$ -	$ -	$ -
Other				$ -	$ -	$ -	$ -
Training Total				**$ -**	**$ -**	**$ -**	**$ -**
Other							
Outreach and Education				$ -	$ 144,354 00	$ -	$ 144,354 00
Occupancy / Rent				$ -	$ 138,945 00	$ -	$ 138,945 00
Telecommunications				$ -	$ 38,063 00	$ -	$ 38,063 00
Operational Expense				$ -	$ 93,485 00	$ -	$ 93,485 00
Professional & Legal				$ -	$ 123,297 00	$ -	$ 123,297 00
Insurance				$ -	$ 83,490 00	$ -	$ 83,490 00
Interest & Depreciation				$ -	$ 23,896 00	$ -	$ 23,896 00
Meetings, Travel, Prof. Dev.				$ -	$ 42,390 00	$ -	$ 42,390 00
Implementation Services				$ -	$ 1,163,175 00	$ -	$ 1,163,175 00
Customization / Development				$ -	$ -	$ -	$ -
Deliverables				$ -	$ -	$ -	$ -
Independent Review				$ 17,252.00	$ -	$ -	$ 17,252 00
Other Total				**$ 17,252.00**	**$ 1,851,095.00**	**$ -**	**$ 1,868,347.00**
Personnel - Additional							
Professional Services					$ 1,111,070 00		
Business Staff (Administrative Personnel VITL)				$ -	$ 2,470,776 00	$ -	$ 2,470,776 00
State Personnel (note 1)				$ -	$ 119,610 98	$ -	$ 119,610 98
Personnel - Additional Total				**$ -**	**$ 3,701,456.98**	**$ -**	**$ 3,701,456.98**
Grand Total				**$ 72,452.00**	**$ 7,299,375.98**	**$ -**	**$ 7,371,827.98**

V.1.4.a

NOTES / ASSUMPTIONS

[1] See State Personnel Cost Tab

Attachment C: Acquisition Cost

Cost	Hardware	Software	Implementation Services	System Integration Costs	Professional Services	Agreement Totals
Administrative Personnel Cost					$ 2,470,776.00	
Insurance					$ 83,490.00	
Professional & Legal					$ 123,297.00	
Outreach and Education			$ 144,354.00			
Occupancy / Rent			$ 138,945.00			
Telecommunications			$ 38,063.00			
Operational Expense			$ 93,485.00			
Meetings, Travel, Prof. Dev.					$ 42,390.00	
Interest & Depreciation					$ 23,896.00	
Direct IT Expense (equipment, software)	$ 344,151.00					
Direct State-wide HIE Vendor Contract Expense		$ 952,197 00				
Direct Consulting					$ 132,404.00	
Direct Travel					$ 32,552.00	
Medicity Interface				$ -		
Provider Interface Reimbursement				$ 280,000.00		
O&M GRANT TOTAL	$ 344,151.00	$ 952,197.00	$ 414,847.00	$ 280,000.00	$ 2,908,805.00	$ 4,900,000.00
Interfaces -- New Types					$ 147,000.00	
VITLAccess On-Boarding					$ 265,000.00	
Data Quality						
Warehouse Architect					$ 260,000.00	
Data Architect					$ 260,000.00	
Tableau Server Licenses		$ 5,520.00				
Hardware	$ 55,200.00					
Tableau Training			$ 15,525.00			
CONTRACT 32349 TOTAL	$ 55,200.00	$ 5,520.00	$ 15,525.00	$ -	$ 932,000.00	$ 1,008,245.00
Subject Matter Expertise					$ 29,070.00	
Project Management						
Leadership						
Healthfirst Gateway						
Build Medicity Functionality			$ 12,650.00			
Labs, ADT, CCD, VXU			$ 172,500.00			
Event Notification System						
Consent Service Design & Testing			$ 26,250.00			
Secure VPN Network			$ 5,000.00			
ADT Interface Build			$ 26,250.00			
Terminology Services						
System Implementation			$ 45,000.00			
Staff Time for Implementation			$ 15,000.00			
System Implementation			$ 45,000.00			
Staff time for Implementation			$ 15,000.00			
Data Quality for Designated Mental Health Agencies						
Data Quality: e-Health Specialists					$ 150,000.00	
Home Health Agency: Phase 1						
VITLAccess Rollout			$ 122,000.00			
Interface technical discovery			$ 45,000.00			
Home Health Agency: Phase 2						
VITLAccess Rollout			$ 68,000.00			
VITL Interfaces			$ 150,000.00			
Home Health Agency Interfaces			$ 125,000.00			
Home Health Agency: Phase 3						
VITLAccess Rollout			$ 50,000.00			
VITL Interfaces			$ 100,000.00			
Home Health Agency Interfaces			$ 125,000.00			
CONTRACT 31204 (Amended) TOTAL	$ -	$ -	$ 1,147,650.00	$ -	$ 179,070.00	$ 1,326,720.00
Agreements Subotal:						$ 7,234,965.00
State personnel cost (not in agreements)						$ 119,610.98
Independent Review						$ 17,252.00
						$ 7,371,827.98

Attachment D: Acquisition Cost by Category

Acquisition Category	Cost
Hardware Costs	$ 399,351.00
Software Costs	$ 957,717.00
Implementation Services	$ 1,578,022.00
System Integration Costs	$ 280,000.00
Professional Services VITL (e.g. Project Management, Technical, Training, etc.)	$ 4,019,875.00
Professional Services State	$ 119,610.98
Independent Review	$ 17,252.00
Total Acquisition Costs	$ 7,371,827.98

Attachment E: State Personnel Cost

Estimated State Personnel for VITL Grant	Est. Hrly.[1]	Hrs/Wk	Wks/Yr	Salary[1]	FTE Cost fully loaded[2]	FTE needed	Total	Column1
HIE Business Lead/ State HIT Coordinator – 10% or 0.1 FTE	$ 55.00	40	52	$ -	$ 114,400.00	10%	$ 11,440.00	
Assoc. State HIT Coord. – 15%	$ 55.00	40	52	$ -	$ 114,400.00	15%	$ 17,160.00	Terriciano
HIE Program Manager – 25%	$ 55.00	40	52	$ -	$ 114,400.00	25%	$ 28,600.00	Sandage
HIE Project Manager – 15%	$ 55.00	40	52	$ -	$ 114,400.00	15%	$ 17,160.00	Stone
HIE Business Analyst – 5%	$ 55.00	40	52	$ -	$ 114,400.00	5%	$ 5,720.00	Surthy
Grants Management Specialist (DVHA Business Office) – 15%	N/A	N/A	N/A	$ 51,522.00	$ 59,250.30	15%	$ 8,887.55	Kelley
HSE Contract Manager - 5%	$ 55.00	40	52.00	$ -	$ 114,400.00	5%	$ 5,720.00	Watt
HIE Program Tech - 10%	N/A	N/A	N/A	$ 45,448.00	$ 52,265.20	10%	$ 5,226.52	Slagle
Enterprise Architect - 5%	N/A	N/A	N/A	$ 64,979.00	$ 74,725.85	5%	$ 3,736.29	Cleary
Information Security Officer - 5%	N/A	N/A	N/A	$ 82,222.00	$ 94,555.30	5%	$ 4,727.77	Green
Oversight PM - 10%	N/A	N/A	N/A	$ 97,677.00	$ 112,328.55	10%	$ 11,232.86	Holland
						TOTAL	$ 119,610.98	

1. According to Vermont Transparency Web Site, November, 2016. Compensation entered in GREEN is not yet verified., but computed according to DII IT-ABC form instructions at $55/hr.

2. If salary is known, fully-loaded (i.e., with benefits) FTE calculated as salary X 1.15.

Attachment F: Comparison Totals

On this page, costs of items contained in the agreements, *but not under review for this report*, are added back to the acquisition costs to arrive at a "Comparison Total." The Comparison Total is used for comparison to similar efforts by other States.

Agreement	Under review	Not under review	Total
O&M Grant Total	$ 4,900,000.00	$ -	$ 4,900,000.00
Contract 32349 Total	$ 1,008,245.00	$ -	$ 1,008,245.00
Contract 31204 (Amended) Total	$ 1,326,720.00	$ 501,510.00	$ 1,828,230.00
VITL Agreements Total FY17			**$ 7,736,475.00**
Professional Services State			$ 119,610.98
Independent Review			$ 17,252.00
GRAND TOTAL			**$ 7,873,337.98**

Attachment G: Funding Sources

Agreement	Fund	Source	% of agreement total	Amount	SubTotal
# 03410-256-17	Medicaid Assistance Program	Federal	55%	$ 2,695,000.00	
# 03410-256-17	Global Commitment (non-subrecipient funds)	State	45%	$ 2,205,000.00	
					$ 4,900,000.00
# 31204 (Amendment #1)	State Innovation Model	Federal	100%	$ 1,326,720.00	
					$ 1,326,720.00
# 32349	HITECH HIE (Federal Share FFP 90%)	Federal	90%	$ 907,420.50	
# 32349	HITECH HIE (State Match 10%)	State	10%	$ 100,824.50	
					$ 1,008,245.00
	Total			**$ 7,234,965.00**	

Medicaid Assistance Program	Federal	37%	$ 2,695,000.00	
State Innovation Model	Federal	18%	$ 1,326,720.00	
HITECH HIE (Federal Share FFP 90%)	Federal	13%	$ 907,420.50	
HITECH HIE (State Match 10%)	State	1%	$ 100,824.50	
Global Commitment (non-subrecipient funds)	State	30%	$ 2,205,000.00	
		100%		

ATTACHMENT H: RISK & ISSUES REGISTER

The risks identified throughout this review are collected below, along with an assessment of their significance, a description of the State response and timing, and our evaluation of the State response.

The risks identified for this review are collected below, along with an assessment of their significance.

Risk ID:	Identification number assigned to risk or issue. The IDs are organized according to the following scheme for convenience. However, a given risk may impact or arise in more than one area of review. • **S***x* **Security and Privacy** • ***E****x* **Enterprise Architecture** • **PM***x* **Project Management** • **IS***x* **(Identifies an issue, i.e., a realized risk)**
Risk Rating:	An assessment of risk significance, based on multiplication of **(impact X probability ratings)** (*see below*). **1-30 = low** **31-60 = moderate** **61 – 90 = high**
Impact:	Assessment of severity of negative effect, scale of **1 – 10**, from least to most severe
Probability:	Assessment of likelihood of risk occurring, scale of **1 – 9**, from least to most likely
Finding:	Review finding which led to identifying a risk
Risk Of:	Nature of the risk
Risk To:	What may be impacted, should the risk occur
State's Planned Response:	Decision to *avoid*, *mitigate*, or *accept* risk Detailed description of response to risk, in order to accomplish decision
Timing:	When the response should occur
Reviewer's Assessment:	Reviewers evaluation of the State's planned response

Risk ID: S1	Rating: Probability: Impact:	50 5 10
Finding:	No evident incident response plan testing for VHIE at SOV and/or at VITL	
Risk Of:	confusion, misinformation, delay	
Risk To:	security, privacy, reputation	
State's Planned Response:	MITIGATE: Conduct regular and documented incident response planning exercises (e.g., tabletop mock incident), including VITL, SOV, and other entities if appropriate. Exercises should include technical-, compliance-, and executive-level participants.	
Timing:	As soon as practical	
Reviewer's Assessment:	Concur	

	Rating:	20
Risk ID: S2	Probability:	2
	Impact:	10
Finding:	VITL determined by internal assessment that "Social Engineering / Phishing" comprised their biggest vulnerability, and engaged a test process along those lines. (And VITL calls it a Phase 1 test, which I assume here is CEH Phase 1, i.e., "reconnaissance.") In the POA&M, the original milestones (reflecting the CynergisTek recommendations) are struck out, and replaced by the "Social Engineering" approach, with "Phishing" test of employees, training and testing, and re-testing (of employees) "at a later date." The item is classified as completed (colored green, noted as "This is done.")	
Risk Of:	privacy or other information breach; inadequate conformance for funding	
Risk To:	security, privacy	
State's Planned Response:	MITIGATE: Re-open planning for item CA-8 in the POA&M, define what State expects in a vulnerability assessment and any resultant test plan.	
Timing:	Immediately	
Reviewer's Assessment:	concur	

Risk ID: S3	Rating: Probability: Impact:	20 2 10
Finding:	SOV and VITL incident response plans not explicitly coordinated and tested	
Risk Of:	funding noncompliance; conflicting public messages	
Risk To:	privacy, reputation, privacy or other breach under-mitigated	
State's Planned Response:	MITIGATE: Consider coordinating SOV, VITL, HCOs, etc. in PHI incident response planning, including not only HIPAA-required notification, but also public relations and reputational responses.	
Timing:	In planning going forward	
Reviewer's Assessment:	concur	

	Rating:	2
Risk ID: S4	Probability:	1
	Impact:	2
Finding:	Adequacy of Medicity security, privacy, and testing is accepted by SOV, but is not apparently documented in SOV project documentation	
Risk Of:	funding noncompliance; breach of contract terms for subcontractors	
Risk To:	assessment, evaluation, performance	
State's Planned Response:	MITIGATE: Assess Medicity security attestations and document. Refer to requirements in contract(s).	
Timing:	Immediately	
Reviewer's Assessment:	concur	

Risk ID: S5	Rating: Probability: Impact:	50 5 10
Finding:	The POAM, standing alone, does not constitute a complete security plan	
Risk Of:	privacy or other information breach	
Risk To:	security, privacy, liability, project performance evaluation, funding	
State's Planned Response:	MITIGATE: Require further elaboration of the security plan, including at least the items listed below: o Narrative description, both overall and in sections o An explicit plan for periodic re-evaluation and testing o Benchmarks for ongoing improvement o Documentation and reporting mechanism for changes and remediation o Data relationship diagrams o Security boundary definitions	
Timing:	Immediately	
Reviewer's Assessment:	concur	

	Rating:	20
Risk ID: S6	Probability:	2
	Impact:	10
Finding:	SOV does not track or evaluate procedures, testing, and periodic review of VITL's HIPAA related security ***policies***	
Risk Of:	funding noncompliance; privacy or other breach	
Risk To:	security, privacy, funding	
State's Planned Response:	MITIGATE: Review Cynergistek's assessment of procedures and testing, for adequacy, and/or review and assess VITL procedures and testing directly, at least annually	
Timing:	As soon as practical	
Reviewer's Assessment:	concur	

Risk ID: S7	Rating: Probability: Impact:	35 5 7
Finding:	SOV may not have sufficiently specialized resources on staff to conduct in-depth assessment of some aspects of VITL security planning	
Risk Of:	non-compliance with HIPAA requirements; privacy or other breach	
Risk To:	security, privacy, liability, project performance evaluation, funding	
State's Planned Response:	MITIGATE: Consider developing funding for and employ third party security assessment within SOV CISO office	
Timing:	Follow normal procedures	
Reviewer's Assessment:	concur	

	Rating:	10
Risk ID: S8	Probability:	10
	Impact:	1
Finding:	SOV current Security Policies date from 2010. It is not clear that they have been reviewed or assessed since that time. The year 2010 represents a much earlier point in maturity of the VHIE, and no linkages are identified between SOV policy and VITL policy. NIST SP 800-53 r4 requires documented annual review even if there is no change.	
Risk Of:	non-compliance with fed and/or state requirements; ambiguity of responsibility; privacy or other breach under-mitigated	
Risk To:	security, privacy, incident control, reputation	
State's Planned Response:	MITIGATE: Review and revise existing policies including special attention to VITL's role in light of VITL's statutory definition;	
Timing:	Starting immediately	
Reviewer's Assessment:	concur	

	Rating:	30
Risk ID: S9	Probability:	10
	Impact:	3
Finding:	Although greatly improved from earlier versions, there are gaps in VITL's compliance with the format and content of the shared security POA&M document (e.g. see "scheduled completion dates" "completion dates" "milestones with completion dates" etc.)	
Risk Of:	disagreement or misunderstanding of POA&M status between VITL and SOV;	
Risk To:	security, privacy, liability, project performance evaluation, funding	
State's Planned Response:	MITIGATE: CISO office performs strict audit of POA&M; negotiate changes to form where desired	
Timing:	Immediately	
Reviewer's Assessment:	concur	

	Rating:	20
Risk ID: S10	Probability:	10
	Impact:	2
Finding:	VITL disagreements with certain items in the 2015 Information Security Program Assessment, used as the basis for the POA&M, are embedded inappropriately in POA&M fields	
Risk Of:	difficulty in auditing or assessing POA&M performance; misunderstanding or disagreement of POA&M status	
Risk To:	security, privacy, liability, project performance evaluation, funding	
State's Planned Response:	MITIGATE: Create base document reflecting ISPA findings/recommendations and agreed changes with documentation, to be used as basis for POA&M. Revise as needed. (This could also be used to add SOV security requirements not in ISPA, and as a reference point in future G.)	
Timing:	With next audit	
Reviewer's Assessment:	concur	

Risk ID: A1	Rating: Probability: Impact:	70 7 10
Finding:	The State has not defined in detail its need for an HIT data warehouse	
Risk Of:	Increased expense, duplication, diminished capability	
Risk To:	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	
State's Planned Response:	MITIGATE: Conduct an architectural assessment of VITL's VHIE enterprise (both "sides"), according to established State procedures	
Timing:	Now, going forward	
Reviewer's Assessment:	concur	

	Rating:	70
Risk ID: A2	Probability:	10
	Impact:	7
Finding:	The State does not have a clear Enterprise Architectural understanding of the VITL "data warehouse", nor the VHIE as a whole	
Risk Of:	Increased expense, duplication, diminished capability	
Risk To:	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	
State's Planned Response:	MITIGATE: Determine the applications, requirements and specifications, and uses of a data warehouse for HIT	
Timing:	Going forward	
Reviewer's Assessment:	concur	

Risk ID: A3	Rating: Probability: Impact:	40 5 8
Finding:	Technological (for example, EA) cooperation between SOV and VITL has generally taken place at executive (Senior) level, rather than with front-line implementers (such as Enterprise Architects)	
Risk Of:	delay; diminished reusability; possibly diminished interoperability	
Risk To:	interoperability	
State's Planned Response:	MITIGATE: Some very recent sub-projects are initiating implementer level cooperation. Use this as a beginning of more regular interaction of this type.	
Timing:	Ongoing project development	
Reviewer's Assessment:	concur	

Risk ID: A4	Rating: Probability: Impact:	40 5 8
Finding:	SOV lacks a comprehensive and single HIT-wide data governance plan and process that includes VITL/VHIE along with other HIT entities	
Risk Of:	unusable, incomplete, or incompatible data; delay; increased expense; un-met business needs	
Risk To:	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	
State's Planned Response:	MITIGATE: Draft proposal for data governance is underway and under discussion	
Timing:	Continue ongoing process	
Reviewer's Assessment:	concur	

	Rating:	28
Risk ID: A5	Probability:	7
	Impact:	4
Finding:	Agreements lack specificity concerning data quality metrics, targets, and reporting standards	
Risk Of:	inability to effectively understand status and effectiveness of program as a whole and as sub-projects in HIT context	
Risk To:	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline, funding	
State's Planned Response:	MITIGATE: Adopt HIT-wide data governance plan; Use VHITP, data governance process, and SOV EA resources to actualize appropriate metrics, targets, and reporting standards	
Timing:	Subsequent agreements	
Reviewer's Assessment:	concur	

	Rating:	10
Risk ID: PM1	Probability:	10
	Impact:	1
Finding:	Deliverables are not centrally tracked and archived in reference to SOW items in Grant and contract(s), assessment of same not always documented	
Risk Of:	misinformation or confusion, leading to delay	
Risk To:	cost, planning, project performance evaluation, EA, funding	
State's Planned Response:	MITIGATE: Centralize tracking of deliverables timeliness and adequacy for use by SOV business, project management, and technology interests, using e.g., SharePoint site. ALSO - adopt audit office recommendations; possibly connect meeting minutes to deliverables tracking?	
Timing:	As soon as practical	
Reviewer's Assessment:	concur	

	Rating:	10
Risk ID: PM2	Probability:	10
	Impact:	1
Finding:	VITL security deliverables and SOV assessment of same have not been well documented; articulating SOV position on VITL security plan dependent on one individual SOV employee	
Risk Of:	liabiity, confusion, delay	
Risk To:	planning, project performance evaluation	
State's Planned Response:	[see above, re: deliverables and documentation.] MITIGATE: Ensure some redundancy of project information within CISO office and throughout project scope(s)	
Timing:	Immediately	
Reviewer's Assessment:	concur	

Risk ID: PM3	Rating: Probability: Impact:	42 6 7
Finding:	Grant and contract(s) execution have often been significantly delayed	
Risk Of:	failure to meet SOV needs; delay; unnecessary expense	
Risk To:	synchronization of HIT efforts; funding; ability of VITL to progress on projects	
State's Planned Response:	MITIGATE: accept recommendations of SOV audit report	
Timing:	Subsequent agreements and as soon as practical	
Reviewer's Assessment:	concur	

	Rating:	20
Risk ID: PM4	Probability:	10
	Impact:	2
Finding:	Data "ownership" is not always clear, particularly in the "data warehouse" portion of VHIE, and this may lead to disagreement about responsibility	
Risk Of:	delay, additional expense incurred; potential non-compliance with VT records statutes and rules	
Risk To:	interoperability, funding, planning, SOV flexibility	
State's Planned Response:	MITIGATE: 1. Seek advice and/or determination from DVHA legal staff and other appropriate State resources for precise statement of data ownership; 2. Include resulting clear language in future agreements	
Timing:	As soon as practical	
Reviewer's Assessment:	Concur	

	Rating:	4
Risk ID: PM5	Probability:	2
	Impact:	2
Finding:	Contracts are characterized as "for personal services." This characterization does not align with contract rules for Federal agencies.	
Risk Of:	Confusion; delay in audit; delay in funding	
Risk To:	funding	
State's Planned Response:	MITIGATE: Review contract characterization under Vermont law in light of Federal definitions	
Timing:	As soon as practical	
Reviewer's Assessment:	Concur	

ISSUE ID: IS1	Rating: Probability: Impact:	50 10 5
Finding:	Certain inconsistencies concerning breach notification requirements arising between SOV contract provisions (including the BAA), Vermont state breach notification law, and VITL Security Policy: InfoSec 4 (see narrative **Section 6.5 Security and Privacy -- Compliance** for further details)	
Risk Of:	state law noncompliance, contract noncompliance	
Risk To:	security, privacy, liability, project performance evalutaion	
State's Planned Response:	MITIGATE: Correct these inconsistencies, both in SOV contract provisions (in the form of the standard BAA), and in related security and policy procedures at VITL.	
Timing:	Current and Subsequent agreements	
Reviewer's Assessment:	concur	

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RISKS

Risk #	Finding	risk of	risk to	Notes regarding VITL	SOV response	probability	impact	total rating
S1	No evident incident response plan testing for VHIE at SOV and/or at VITL	confusion, misinformation, delay	security, privacy, reputation	Planning tabletop exercise	MITIGATE: Conduct regular and documented incident response planning exercises (e.g., tabletop mock incident), including VITL, SOV, and other entities if appropriate. Exercises should include technical-, compliance-, and executive-level participants.	**5**	**10**	**50**
S2	VITL determined by internal assessment that "Social Engineering / Phishing" comprised their biggest vulnerability, and engaged a test process along those lines. (And VITL calls it a Phase 1 test, which I assume here is CEH Phase 1, i.e., "reconnaissance.") In the POA&M, the original milestones (reflecting the CynergisTek recommendations) are struck out, and replaced by the "Social Engineering" approach, with "Phishing" test of employees, training and testing, and re-testing (of employees) "at a later date." The item is classified as completed (colored green, noted as "This is done.")	privacy or other information breach; inadequate conformance for funding	security, privacy	Recommendations for further phase testing have been recommended by Cyngergistek and Symquest, are under evaluation, and are expected to be implemented	MITIGATE: Re-open planning for item CA-8 in the POA&M, define what State expects in a vulnerability assessment and any resultant test plan.	**4**	**7**	**28**
S3	SOV and VITL incident response plans not explicitly coordinated and tested	funding noncompliance; conflicting public messages	privacy, reputation, privacy or other breach under-mitigated	N/A	MITIGATE: Consider coordinating SOV, VITL, HCOs, etc. in PHI incident response planning, including not only HIPAA-required notification, but also public relations and reputational responses.	**2**	**5**	**10**
S4	Adequacy of Medicity security, privacy, and testing is accepted by SOV, but is not apparently documented in SOV project documentation	funding noncompliance; breach of contract terms for subcontractors (?)	assessment, evaluation, performance	N/A	MITIGATE: Assess Medicity security attestations and document. Refer to requirements in contract(s).	**1**	**2**	**2**
S5	The POAM, standing alone, does not constitute a complete security plan	privacy or other information breach	security, privacy, liability, project performance evaluation, funding		MITIGATE: Require further elaboration of the security plan, including at least the items listed below: o Narrative description, both overall and in sections o An explicit plan for periodic re-evaluation and testing o Benchmarks for ongoing improvement o Documentation and reporting mechanism for changes and remediation o Data relationship diagrams o Security boundary definitions	**5**	**10**	**50**
S6	SOV does not track or evaluate procedures, testing, and periodic review of VITL's H PAA related security ***policies***	funding noncompliance; privacy or other breach	security, privacy, funding	VITL says these procedures exist and are audited by Cynergistek	MITIGATE: Review Cynergistek's assessment of procedures and testing, for adequacy, and/or review and assess VITL procedures and testing directly, at least annually	**2**	**3**	**6**
S7	SOV may not have sufficiently specialized resources on staff to conduct in-depth assessment of some aspects of VITL security planning	non-compliance with HIPAA requirements; privacy or other breach	security, privacy, liability, project performance evaluation, funding	N/A	MITIGATE: Secure funding for and employ third party security assessment within SOV CISO office	**5**	**2**	**10**
S8	SOV current Security Policies date from 2010. It is not clear that they have been reviewed or assessed since that time. The year 2010 represents a much earlier point in maturity of the VHIE, and no linkages are identified between SOV policy and VITL policy. NIST SP 800-53 r4 requires documented annual review even if there is no change.	non-compliance with fed and/or state requirements; ambiguity of responsibility; privacy or other breach under-mitigated	security, privacy, incident control, reputation	Review with State re: any applicability of ***SOV policy*** and any linkages between SOV and VITL ***procedures*** (e.g., coordination of public statements)	MITIGATE: Review and revise existing policies including special attention to VITL's role in light of VITL's statutory definition;	**5**	**1**	**5**
S9	Although greatly improved from earlier versions, there are gaps in VITL's compliance with the ***format*** and ***content*** of the shared security POA&M document (e.g. see "scheduled completion dates" "completion dates" "milestones with completion dates" etc.)	disagreement or misunderstanding of POA&M status between VITL and SOV;	security, privacy, liability, project performance evaluation, funding	conform strictly to POA&M format or negotiate changes to format	MITIGATE: CISO office performs strict audit of POA&M; negotiate changes to form where desired	**2**	**5**	**10**
S10	VITL disagreements with certain items in the 2015 Information Security Program Assessment, used as the basis for the POA&M, are embedded inappropriately in POA&M fields	difficulty in auditing or assessing POA&M performance; misunderstanding or disagreement of POA&M status	security, privacy, liability, project performance evaluation, funding	[see recommended SOV response]	MITIGATE: Create base document reflecting ISPA findings/recommendations and agreed changes with documentation, to be used as basis for POA&M. Revise as needed. (This could also be used to add SOV security requirements not in ISPA, and as a reference point in future G.)	**5**	**5**	**25**
A1	The State has not defined in detail its need for an HIT data warehouse	Increased expense, duplication, diminished capability	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline		Conduct an architectural assessment of VITL's VHIE enterprise (both "sides"), according to established State procedures	**7**	**10**	**70**
A2	The State does not have a clear Enterprise Architectural understanding of the VITL "data warehouse", nor the VHIE as a whole	Increased expense, duplication, diminished capability	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline		Determine the applications, requirements and specifications, and uses of a data warehouse for HIT	**7**	**10**	**70**

Risk #	Finding	risk of	risk to	Notes regarding VITL	SOV response	probability	impact	total rating
A3	Technological (for example, EA) cooperation between SOV and VITL has generally taken place at executive (Senior) level, rather than with front-line implementers (such as Enterprise Architects)	delay; diminished reusability; possibly diminished interoperability	interoperability	VITL agrees that resolving this "has to be done."	MITIGATE: Some very recent sub-projects are initiating implementer level cooperation. Use this as a beginning of more regular interaction of this type.	**5**	**8**	**40**
A4	SOV lacks a comprehensive and single HIT-wide data governance plan and process that includes VITL/VHIE along with other HIT entities	unusable, incomplete, or incompatible data; delay; increased expense; un-met business needs	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	N/A (but should be included as stakeholder)	MITIGATE: Draft proposal for data governance is underway and under discussion	**5**	**8**	**40**
A5	Agreements lack specificity concerning data quality metrics, targets, and reporting standards	inability to effectively understand status and effectiveness of program as a whole and as sub-projects in HIT context	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	N/A	MITIGATE: Adopt HIT-wide data governance plan; Use VHITP, data governance process, and SOV EA resources to actualize appropriate metrics, targets, and reporting standards	**7**	**4**	**28**
PM1	deliverables are not centrally tracked and archived in reference to SOW items in Grant and contract(s), assessment of same not always documented	misinformation or confusion, leading to delay	cost, planning, project performance evaluation, EA, funding	N/A	MITIGATE: Centralize tracking of deliverables timeliness and adequacy for use by SOV business, project management, and technology interests, using e.g., SharePoint site. ALSO - adopt audit office recommendations; possibly connect meeting minutes to deliverables tracking?	**5**	**5**	**25**
PM2	VITL security deliverables and SOV assessment of same have not been well documented; articulating SOV position on VITL security plan dependent on one individual SOV employee	liabiity, confusion, delay	planning, project performance evaluation	N/A	[see above, deliverables and documentation.] MITIGATE: Ensure some redundancy of project information within CISO office and throughout project scope(s)	**5**	**4**	**20**
PM3	Grant and contract(s) execution have often been significantly delayed	failure to meet SOV needs; delay; unnecessary expense	synchronization of HIT efforts; funding; ability of VITL to progress on projects	VITL mentions this frequently (including in GMCB reports) as a source of frustration and impediment to planning	MITIGATE: Continue to develop more streamlined processes for executing agreements with VITL and also timing and sequencing of various agreements and amendments.MITIGATE: accept recommendations of SOV audit report	**6**	**7**	**42**
PM4	Data "ownership" is not always clear, particularly in the "data warehouse" portion of VHIE, and this may lead to disagreement about responsibility	delay, additional expense incurred; potential non-compliance with VT records statutes and rules	interoperability, funding, planning, SOV flexibility,	N/A	MITIGATE: 1. Seek advice and/or determination from DVHA legal staff and other appropriate State resources for precise statement of data ownership; 2. Include resulting clear language in future agreements	**5**	**5**	**25**
PM5	Contracts are characterized as "for personal services." This characterization does not align with contract rules for Federal agencies.	Confusion; delay in audit; delay in funding	funding		MITIGATE: Review contract characterization under Vermont law in light of Federal definitions	**2**	**2**	**4**

ISSUES

ISSUE #	Finding	risk of	risk to	Notes regarding VITL	Recommended SOV resolution	probability	impact	total rating
IS1	Certain inconsistencies concerning breach notification requirements arising between SOV contract provisions (including the BAA), Vermont state breach notification law, and VITL Security Policy: InfoSec 4 (see narrative Section 6.5 Security and Privacy -- Compliance for further details)	state law noncompliance, contract noncompliance	security, privacy, liability, project performance evalutaion	N/A	MITIGATE: Correct these inconsistencies, both in SOV contract provisions (in the form of the standard BAA), and in related security and policy procedures at VITL.	**10**	**5**	**50**

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RISKS

Risk #	Finding	risk of	risk to	Notes regarding VITL	SOV response	probability	impact	total rating
S1	No evident incident response plan testing for VHIE at SOV and/or at VITL	confusion, misinformation, delay	security, privacy, reputation	Planning tabletop exercise	MITIGATE: Conduct regular and documented incident response planning exercises (e.g., tabletop mock incident), including VITL, SOV, and other entities if appropriate. Exercises should include technical-, compliance-, and executive-level participants.	**5**	**10**	**50**
S2	VITL determined by internal assessment that "Social Engineering / Phishing" comprised their biggest vulnerability, and engaged a test process along those lines. (And VITL calls it a Phase 1 test, which I assume here is CEH Phase 1, i.e., "reconnaissance.") In the POA&M, the original milestones (reflecting the CynergisTek recommendations) are struck out, and replaced by the "Social Engineering" approach, with "Phishing" test of employees, training and testing, and re-testing (of employees) "at a later date." The item is classified as completed (colored green, noted as "This is done.")	privacy or other information breach; inadequate conformance for funding	security, privacy	Recommendations for further phase testing have been recommended by Cyngergistek and Symquest, are under evaluation, and are expected to be implemented	MITIGATE: Re-open planning for item CA-8 in the POA&M, define what State expects in a vulnerability assessment and any resultant test plan.	**4**	**7**	**28**
S3	SOV and VITL incident response plans not explicitly coordinated and tested	funding noncompliance; conflicting public messages	privacy, reputation, privacy or other breach under-mitigated	N/A	MITIGATE: Consider coordinating SOV, VITL, HCOs, etc. in PHI incident response planning, including not only HIPAA-required notification, but also public relations and reputational responses.	**2**	**5**	**10**
S4	Adequacy of Medicity security, privacy, and testing is accepted by SOV, but is not apparently documented in SOV project documentation	funding noncompliance; breach of contract terms for subcontractors (?)	assessment, evaluation, performance	N/A	MITIGATE: Assess Medicity security attestations and document. Refer to requirements in contract(s).	**1**	**2**	**2**
S5	The POAM, standing alone, does not constitute a complete security plan	privacy or other information breach	security, privacy, liability, project performance evaluation, funding		MITIGATE: Require further elaboration of the security plan, including at least the items listed below: o Narrative description, both overall and in sections o An explicit plan for periodic re-evaluation and testing o Benchmarks for ongoing improvement o Documentation and reporting mechanism for changes and remediation o Data relationship diagrams o Security boundary definitions	**5**	**10**	**50**
S6	SOV does not track or evaluate procedures, testing, and periodic review of VITL's HIPAA related security ***policies***	funding noncompliance; privacy or other breach	security, privacy, funding	VITL says these procedures exist and are audited by Cynergistek	MITIGATE: Review Cynergistek's assessment of procedures and testing, for adequacy, and/or review and assess VITL procedures and testing directly, at least annually	**2**	**3**	**6**
S7	SOV may not have sufficiently specialized resources on staff to conduct in-depth assessment of some aspects of VITL security planning	non-compliance with HIPAA requirements; privacy or other breach	security, privacy, liability, project performance evaluation, funding	N/A	MITIGATE: Secure funding for and employ third party security assessment within SOV CISO office	**5**	**2**	**10**
S8	SOV current Security Policies date from 2010. It is not clear that they have been reviewed or assessed since that time. The year 2010 represents a much earlier point in maturity of the VHIE, and no linkages are identified between SOV policy and VITL policy. NIST SP 800-53 r4 requires documented annual review even if there is no change.	non-compliance with fed and/or state requirements; ambiguity of responsibility; privacy or other breach under-mitigated	security, privacy, incident control, reputation	Review with State re: any applicability of ***SOV policy*** and any linkages between SOV and VITL ***procedures*** (e.g., coordination of public statements)	MITIGATE: Review and revise existing policies including special attention to VITL's role in light of VITL's statutory definition;	**5**	**1**	**5**
S9	Although greatly improved from earlier versions, there are gaps in VITL's compliance with the ***format*** and ***content*** of the shared security POA&M document (e.g. see "scheduled completion dates" "completion dates" "milestones with completion dates" etc.)	disagreement or misunderstanding of POA&M status between VITL and SOV;	security, privacy, liability, project performance evaluation, funding	conform strictly to POA&M format or negotiate changes to format	MITIGATE: CISO office performs strict audit of POA&M; negotiate changes to form where desired	**2**	**5**	**10**
S10	VITL disagreements with certain items in the 2015 Information Security Program Assessment, used as the basis for the POA&M, are embedded inappropriately in POA&M fields	difficulty in auditing or assessing POA&M performance; misunderstanding or disagreement of POA&M status	security, privacy, liability, project performance evaluation, funding	[see recommended SOV response]	MITIGATE: Create base document reflecting ISPA findings/recommendations and agreed changes with documentation, to be used as basis for POA&M. Revise as needed. (This could also be used to add SOV security requirements not in ISPA, and as a reference point in future G.)	**5**	**5**	**25**
A1	The State has not defined in detail its need for an HIT data warehouse	Increased expense, duplication, diminished capability	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline		Conduct an architectural assessment of VITL's VHIE enterprise (both "sides"), according to established State procedures	**7**	**10**	**70**
A2	The State does not have a clear Enterprise Architectural understanding of the VITL "data warehouse", nor the VHIE as a whole	Increased expense, duplication, diminished capability	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline		Determine the applications, requirements and specifications, and uses of a data warehouse for HIT	**7**	**10**	**70**
A3	Technological (for example, EA) cooperation between SOV and VITL has generally taken place at executive (Senior) level, rather than with front-line implementers (such as Enterprise Architects)	delay; diminished reusability; possibly diminished interoperability	interoperability	VITL agrees that resolving this "has to be done."	MITIGATE: Some very recent sub-projects are initiating implementer level cooperation. Use this as a beginning of more regular interaction of this type.	**5**	**8**	**40**
A4	SOV lacks a comprehensive and single HIT-wide data governance plan and process that includes VITL/VHIE along with other HIT entities	unusable, incomplete, or incompatible data; delay; increased expense; un-met business needs	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	N/A (but should be included as stakeholder)	MITIGATE: Draft proposal for data governance is underway and under discussion	**5**	**8**	**40**
A5	Agreements lack specificity concerning data quality metrics, targets, and reporting standards	inability to effectively understand status and effectiveness of program as a whole and as sub-projects in HIT context	interoperability, reusability, syncronization of HIT efforts, cost, planning, HIT timeline	N/A	MITIGATE: Adopt HIT-wide data governance plan; Use VHITP, data governance process, and SOV EA resources to actualize appropriate metrics, targets, and reporting standards	**7**	**4**	**28**
PM1	deliverables are not centrally tracked and archived in reference to SOW items in Grant and contract(s), assessment of same not always documented	misinformation or confusion, leading to delay	cost, planning, project performance evaluation, EA, funding	N/A	MITIGATE: Centralize tracking of deliverables timeliness and adequacy for use by SOV business, project management, and technology interests, using e.g., SharePoint site. ALSO - adopt audit office recommendations; possibly connect meeting minutes to deliverables tracking?	**5**	**5**	**25**

Risk #	Finding	risk of	risk to	Notes regarding VITL	SOV response	probability	impact	total rating
PM2	VITL security deliverables and SOV assessment of same have not been well documented; articulating SOV position on VITL security plan dependent on one individual SOV employee	liability, confusion, delay	planning, project performance evaluation	N/A	[see above, deliverables and documentation.] MITIGATE: Ensure some redundancy of project information within CISO office and throughout project scope(s)	**5**	**4**	**20**
PM3	Grant and contract(s) execution have often been significantly delayed	failure to meet SOV needs; delay; unnecessary expense	synchronization of HIT efforts; funding; ability of VITL to progress on projects	VITL mentions this frequently (including in GMCB reports) as a source of frustration and impediment to planning	MITIGATE: Continue to develop more streamlined processes for executing agreements with VITL and also timing and sequencing of various agreements and amendments.MITIGATE: accept recommendations of SOV audit report	**6**	**7**	**42**
PM4	Data "ownership" is not always clear, particularly in the "data warehouse" portion of VHIE, and this may lead to disagreement about responsibility	delay, additional expense incurred; potential non-compliance with VT records statutes and rules	interoperability, funding, planning, SOV flexibility,	N/A	MITIGATE: 1. Seek advice and/or determination from DVHA legal staff and other appropriate State resources for precise statement of data ownership; 2. Include resulting clear language in future agreements	**5**	**5**	**25**
PM5	Contracts are characterized as "for personal services." This characterization does not align with contract rules for Federal agencies.	Confusion; delay in audit; delay in funding	funding		MITIGATE: Review contract characterization under Vermont law in light of Federal definitions	**2**	**2**	**4**

ISSUES

ISSUE #	Finding	risk of	risk to	Notes regarding VITL	Recommended SOV resolution	probability	impact	total rating
IS1	Certain inconsistencies concerning breach notification requirements arising between SOV contract provisions (including the BAA), Vermont state breach notification law, and VITL Security Policy: InfoSec 4 (see narrative Section 6.5 Security and Privacy -- Compliance for further details)	state law noncompliance, contract noncompliance	security, privacy, liability, project performance evalutaion	N/A	MITIGATE: Correct these inconsistencies, both in SOV contract provisions (in the form of the standard BAA), and in related security and policy procedures at VITL.	**10**	**5**	**50**