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Telemedicine and Rural Health

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Telemedicine and Rural Health

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Bachelor of Science
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2007

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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2019

Abstract

Telemedicine and Rural Health
By Jimica Tchamako Djonkam

In the United States (U.S.), health disparities are a complex and multi-factorial construct that exist across race, ethnicity, sex, sexual identity, age, disability, socioeconomic status, and geographic location (rural and urban).[i] The National Institutes of Health defines health disparities as "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States."[ii] Ultimately, health disparities present both moral and ethical dilemmas for the U.S. healthcare system.[iii] This thesis presents a technical recommendation for addressing a population group that experiences significant health disparities, rural Americans.

The Federal Office of Rural Health Policy (FORHP) provides guidance to the U.S. Department of Health and Human Services (HHS) on health care issues that impact rural communities, including: access to quality health care and health professionals; the viability of rural hospitals; and the effect of proposed rules and regulations on access to and financing of health care in rural areas.[iv] FORHP is currently funding grants to support the development and deployment of telemedicine solutions to address health disparities in rural populations. As an emerging field, telemedicine seeks to enhance and in some respects replace the traditional approach to clinical care to address practical and ethical concerns within the existing U.S. healthcare model. To address both the clinical care opportunities and ethical dilemmas faced by rural populations, we must develop a clear set of principles and recommendations for virtual care platforms and continue educating the public about the opportunities afforded in telemedicine.

Telemedicine is necessary to provide better access to care for isolated populations, reduce the burden and costs of onsite patient visits, and improve the efficiency and effectiveness of care provided. Telemedicine combines the strengths of information technology, telecommunications, and medicine to provide clinical care to individuals and populations from a distance. "Telemedicine is the practice of assessing patients remotely using videoconference, digital photography, instant messaging or other technology. This saves time and money, and enables patients and physicians to meet no matter where they are located."[v] Telemedicine solutions that are HIPPA (Health Information Portability and Privacy Act) compliant, such as online video sessions, can significantly decrease hospital admissions without diminishing, and often improving medical outcomes.
To address both the clinical care opportunities and ethical dilemmas faced by rural populations, we must have a clear set of recommended solution requirements to support and promote the delivery of telemedicine in our communities. **This project is limited to the development of a telemedicine prototype for the purpose of proof of concept only.**

Telemedicine and Rural Health

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Table of Contents

Telemedicine and Rural Health

The Federal Office of Rural Health Policy is currently funding grants to support the development of telemedicine. As an emerging field, telemedicine seeks to 'replace' the traditional approach to clinical care.

I. Background Information

For people to realize optimal health, they must have access to high-quality health services. Yet, in the traditional U.S. healthcare delivery system, visiting the doctor in-person can be very expensive or outright inconvenient, even for those who have health insurance. For populations living in rural and underserved areas, commuting to a doctor can be even more expensive, time-consuming and burdensome. Consequentially, rural and underserved populations often face significant challenges in accessing health care services. These challenges include the inability to access preventative care options, cost-effective care solutions, and/or a sufficient supply of health care providers. This is a dilemma in public health because restricted or limited access to health care services affects one's physical, mental and social health status, quality of life and life expectancy.[vi] Health information technologies (HIT) have the capability to address some of the aforementioned practical and ethical challenges faced by the current U.S. healthcare delivery system in providing accessible, cost-effective, high-quality healthcare services. A major development in the field of HIT that has recently seen advances in the to address these challenges is Telemedicine – the intersection of medicine and technology.

Telemedicine uses numerous technical approaches in both software and hardware solutions to overcome geographical, economic, and social barriers. Telemedicine offers important benefits, such as better access to health care options and providers for isolated populations as well as options for reduced costs of care. Telemedicine is particularly beneficial for rural and underserved communities in America – often made up of people who traditionally suffer from *health disparities* or "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States."[vii] How so? Telemedicine serves as an effective channel to link patients' to providers where acute conditions can be diagnosed and treated without the patient leaving their home. People with a chronic condition, such as diabetes, neurological diseases, chronic heart failure, and more, are able to manage their condition from home using tele-monitoring to transmit vital information and online video sessions with healthcare professionals.[viii]

II. Problem Statement & Recommendation

i. **Problem:** Rural Americans are a population group that is challenged with disparities in health outcomes. Factors that underlie health disparities in rural populations include[ix]:

- **i.** a lack of access to health services;
- **ii.** non-cost effective care solutions; and
- **iii.** limited available providers in their area.

ii. **Recommendation:** The adoption and usage of Telemedicine. With cloud-based health information technology (HIT), and other technology such as two-way video, providers can provide clinical care in real time. Telemedicine offers important benefits, such as better access to health care options and providers for isolated populations, better preventive and clinical care and reduced costs of care.

iii. **Risks**[x]

i. Increased Medical Malpractice claims – Telemedicine may lead to incorrect diagnosis and/or prescriptions because a virtual exam or patient sending in pictures of an issue due to this 'visit' not being a complete physical exam as would normally take place in person.

ii. Risk of exposure of protected health information and/or data breach – personal health information is protected under a number of laws, including HIPPA, HITECH, and COPPA. Telemedicine requires the use of electronic data and internet-enabled device(s)/services which creates a risk of a data breach and exposure of protected health information.

iii. Legal risks – At this time, there is a lack of clear legal policies, regulations, and guidelines (i.e. state, federal) for what constitutes 'virtual' medical abuse and/or fraud as well as the question of jurisdiction when providers provide medical advice across state lines.

iv. **Mitigations**

i. Insurance companies (primarily), providers, and government officials should work to understand potential opportunities for medical malpractice and design the correct guidance in collaboration with physicians, providers, and legal entities like policymakers

ii. Hospitals/physicians/all providers who provide telemedicine services should work with their informatics/IT teams to ensure the proper network and security systems are in place to protect patient information and negate any potential data breaches.

iii. Legal policies, standards, guidelines at the local, state, and federal level for telemedicine practice and data management should be developed to ensure physicians can safely give medical advice to patients.

v. **Project Constraints:**

i. The system must use modern cloud technologies.

ii. The system must be HIPPA compliant.

vi. **Project Assumptions:**

i. The aim of the project scope, timeline, and budget is to develop a prototype of a telemedicine system that will support providing clinical services in rural populations. This aim is aligned with the need to develop a proof of concept.

ii. The catchment area is currently limited to the United States of America (for project scope, timeline, and budget purposes).

III. Approach

Collaborative Requirements Development Methodology™ (CRDM™) & Agile approach to defining requirements for Telemedicine adoption and usage.

I propose a **collaborative** and **agile approach** to designing and implementing a telemedicine solution. An agile approach is based on iterative development, where requirements and solutions evolve through collaboration between self-organizing cross-functional teams. Agile methods or agile processes generally promote a disciplined project management process that encourages frequent inspection and adaptation, a leadership philosophy that encourages teamwork, self-organization and accountability, a set of engineering best practices intended to allow for rapid delivery of high-quality systems and outputs, and a business framework that aligns development with organizational needs and goals. In practice, frequent interfacing will require the selected vendor to work closely with FORHP and key stakeholders to assess the current state of the existing information systems and information use, identify process and system gaps, and make recommendations for improvement and enhancements of business processes and information systems. Stakeholders may include HRSA

staff, clinical providers, state and local public health departments, and other leading public health experts.

i. **Business Process Analysis and Redesign.** CRDM™ begins with performing business process analysis. The project should conduct information gathering sessions with key stakeholders. The information collected will be used to understand the more detailed spectrum of work and activities performed by the key stakeholders and partners related to the identified business processes to develop the current state workflows. The processes should be vetted and validated for accuracy by the key stakeholders. The key stakeholders would then be able to examine tasks, identify inefficiencies and process gaps, and refine current state businesses processes to increase effectiveness and efficiency in the future state.

ii. **Requirements Gathering.** After completing the business process redesign, a collaborative requirement gathering workgroup session will be held to define functional system requirements for the development and implementation of a telemedicine system. The requirements gathered from the workgroup will be used as an input to the request for proposal in the identification of a telemedicine vendor.

iii. **Solution Recommendations for a telemedicine system.** Based on requirements and survey of potential technologies, a solution recommendation will be made for a telemedicine vendor. We will need to identify three (3) to five (5) customizable software solutions that meet the high-level requirements.

iv. **Proposed High-Level Activities**

    i. Perform key stakeholder analyses
    ii. Analyze business processes and information flows
    iii. Evaluate existing systems (develop a comprehensive list, comparison matrix, and recommendations)
    iv. Redesign business processes and information flows
    v. Develop the data dictionary
    vi. Gather functional system requirements
    vii. Conduct landscape analysis and develop the system architecture
    viii. Evaluate customizable solutions for telemedicine usage and adoption

v. **Detailed Project Plan**

1. Project Initiation (Months 1 – 2)
2. Develop Project Budget and Timeline (Assuming approval without cost/time constraint)
3. Gain Budget and Timeline Approval
4. Develop a Draft Project Charter
5. Gain Project Charter Approval from Sponsor
6. Conduct Project Kick-off Meeting
7. Project Plan (Months 1 – 2)
    7.1. Develop Plan
    7.2. Obtain Project Activities and Estimates and Update Plan (as needed)
    7.3. Gain Approval of Project Plan (and changes)
8. Requirements (Months 2 - 5)
    8.1. Conduct Initial Landscape Analysis
        8.1.1. Perform environmental scan
            8.1.1.1. Collect background information
            8.1.1.2. Identify existing systems
            8.1.1.3. Identify potential stakeholders, informants, project participants
        8.1.2. Perform key stakeholder Analysis
            8.1.2.1. Identify key stakeholders
            8.1.2.2. Schedule interview(s) with key stakeholders
            8.1.2.3. Conduct Interview(s) with key stakeholders
    8.2. Complete Landscape Analysis Report
        8.2.1. Draft landscape analysis report
        8.2.2. Finalize landscape analysis report
        8.2.3. Send an electronic copy of landscape analysis report to key stakeholders
    8.3. Make revisions to project activities/scope/charter if required
    8.4. Develop Business Architecture: Workflow and Process Integration
        8.4.1. Determine Workflow
        8.4.2. Create process flow of current and future state
            8.4.2.1. Conduct stakeholder working sessions

8.4.2.2. Conduct meetings to determine workflow changes needed involving participants

8.4.3. Finalize description and diagrams of current and future state workflows

8.4.3.1. Develop graphical report (task flows, context diagrams)

8.4.3.2. Develop a narrative report (business process matrices)

8.4.4. Develop functional system requirements

8.4.4.1. Draft functional system requirements documentation

8.4.4.2. Validate functional requirements with key stakeholders

8.4.4.3. Finalize functional system requirements documentation

8.5. Develop Network Architecture

8.5.1. Identify Hardware Solutions

8.5.2. Identify Software Solutions

8.5.3. Draft Enterprise Architecture

9. Data Management and Regulatory (Months 5 – 6)

9.1. Establish who can have access to data

9.1.1. Create user access roles

9.1.2. Create public and provide data domains

9.2. Define the guidelines and protocol during the viewing of the data

9.2.1. Define liability issues in accordance with state laws

9.2.2. Determine file storage needs and requirements (current and future)

9.2.3. Determine data backup needs (offsite, redundancy, disaster, etc.)

9.2.4. Determine auditing protocol

10. Rough Estimates Beyond (*Once a vendor/developer has been identified*)

11. Design Phase (with Developer) – (Months 2 – 24) - *This will be an agile project*

11.1. Software Design

11.1.1. Conduct architecture design review using Agile principles

11.1.1.1. Tech specs

11.1.1.2. Physical class models

11.1.1.3. Physical data model

11.1.1.4. Write Technical Specs

11.1.1.5. Perform Technical design review

11.1.1.6. Technical design sign off

11.1.2. Develop Test Cases

11.2. Complete/update dev project plan

11.2.1. Create an updated detailed design plan

11.2.2. Develop an updated network implementation plan

12. Software Development (Months 2-24)

12.1. Develop functionality for each build using Agile principles

12.1.1. Develop User Interface

12.1.2. Create business logic

12.1.3. Conduct unit testing

12.1.4. Conduct code review

12.1.5. Perform integration testing

12.1.6. Deploy build to Quality Assurance (QA)

12.2. Determine software readiness, defects and make fixes

12.3. Gain Functional QA sign off

12.4. Conduct User Acceptance Testing (UAT)

12.5. Finalize UAT

12.5.1. Gain UAT approval

12.6. Deploy System (Prototype)

IV. Business Analysis and Requirements Gathering

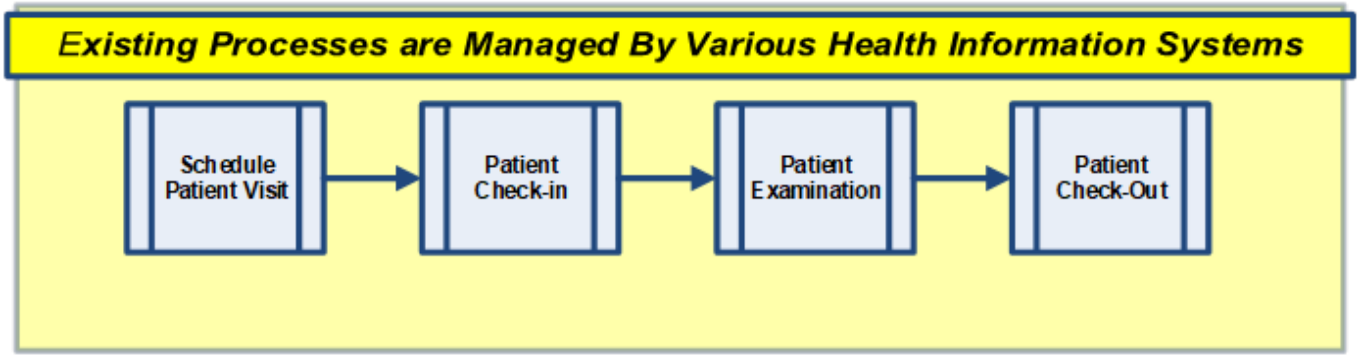
"Business Analysis is the set of activities performed to identify business needs and recommend relevant solutions; and to elicit, document, and manage requirements. More specifically, business analysis is the application of knowledge, skills, tools, and techniques to:

i. Determine problems and identify business needs;
ii. Identify and recommend viable solutions for meeting those needs;
iii. Elicit, document, and manage stakeholder requirements in order to meet business and project objectives;
iv. Facilitate the successful implementation of the product, service, or end result of the program or project."[xi]

ii. **Business Analysis of the Current State of Traditional Management of Patient Visits**

Current workflow is dictated by the use of various (often disparate) health information management systems. Thus, I argue that workflow in a completely software-driven model or – concept-driven model such as a telemedicine system prototype – calls for the development of new 'processes' that are vastly different from existing non-telemedicine workflows that is not cumbersome or costly to maintain (in an effort to reach the rural populations, curve costs to ALL, and drive efficiency). See Figure 1 below for the current state at a high level:

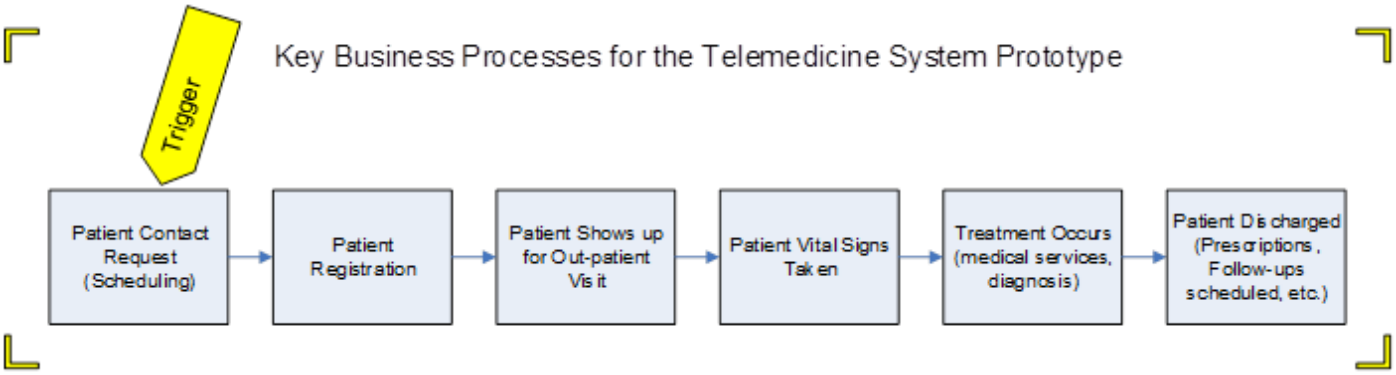
Figure 1 - *Current State Business Processes for managing patient visits with various health information systems*



iii. **Business Process Redesign for Future State Adoption of a Telemedicine System Prototype**

A successful prototype of the 'telemedicine system' encompasses the ability to bring together: people, process, and technology. The business architecture of a telemedicine system prototype embodies the process part of that trio. As previously noted in the project background, this solution is not focused on full deployment – just proof of concept. Thus, it is my opinion that there are no right or wrong workflow processes at this time. However, the Telemedicine system will support the following (Figure 2) as it relates to the current state:

Figure 2 *- Future State Business Processes for managing patient visits with a Telemedicine System*



iv. **Key Facts and Assumptions about Telemedicine as an emerging technology**[xii]

i. Telemedicine increases access to healthcare: Remote patients can more easily obtain clinical services. Remote hospitals can provide emergency and intensive care services.

ii. Telemedicine improves health outcomes: Patients diagnosed and treated earlier often have improved outcomes and less costly treatments.

iii. Telemedicine reduces healthcare costs: Home monitoring programs can reduce high-cost hospital visits.

iv. Telemedicine assists in addressing shortages and misdistribution of healthcare providers: Providers can serve more patients using Telehealth technologies.

v. Telemedicine applications can empower patients to play an active role in their healthcare.

vi. Telemedicine can help the environment by reducing extended travel to obtain necessary care reduces the related carbon footprint.

v. **Key Functional System Requirements for Adoption of a Telemedicine System Prototype:** The following (see also Figure 3) presents the key requirements for the telemedicine solution:

i. **Secure Platform** - The ability to provide access to a secure telehealth software platform both online and offline.

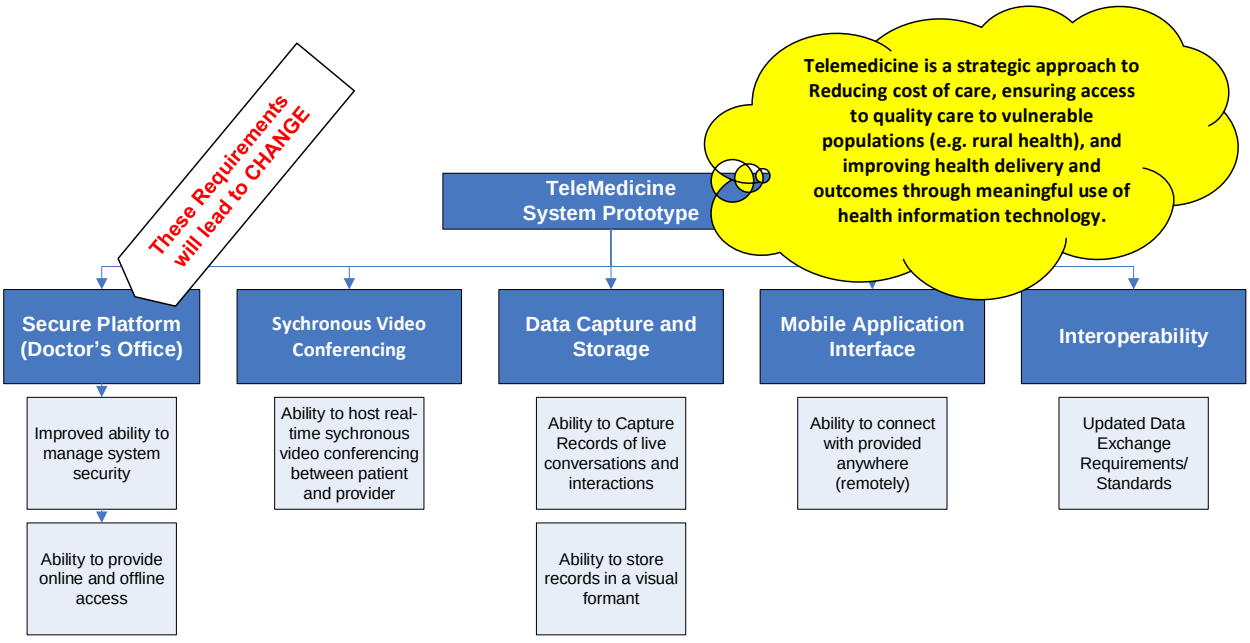
ii. **Synchronous Video Conferencing** - The ability to host live, real-time (synchronous) video conferencing between patient and physician (across bandwidths).

iii. **Capture and Storage** - The ability to capture and store still images, video clips, vitals, radiology, laboratory tests, and other clinical documents in a variety of formats which are transmitted to the physician.

iv. **Equipment/Mobile App/Browser** - The use of interactive telecommunications equipment that includes, at a minimum, audio and video equipment. In addition, the object of telemedicine is to make it as easy as possible for patients to get the care they need from anywhere. That's why it is important to provide the ability to use a mobile app and the ability to use a browser.

v. **Interoperability -** The ability to integrate into an existing Electronic Health Record/Physician Management system

Figure 3 - *Requirements for Telemedicine System Prototype*



vi. **Alternatives to the usage and adoption of a Telemedicine platform**

i. Status Quo/Traditional Physician Office Visit – (Traditional physician office visits are the alternative to telemedicine. Traditional physician office visits involve a physical or in-person meeting between a patient and a physician for treatment of a health-related symptom or condition.)

ii. Failure of patients to access preventive, specialty or diagnostic care.

vii. **Evaluation Criteria of Vendors for a Telemedicine System**

Evaluation involves having a systematic and objective assessment of an on-going or completed project as it relates to its design, implementation, and results. The goal of my evaluation framework is to determine fulfillment of project objectives, effectiveness, impact, and overall feasibility.

Scale:

- **0 - No - Does not meet**
- **1 - Yes - Meets**
- **2 - Yes - Exceeds**
- **3 – Yes - Exceptional**

viii. **Evaluation of Top Three Telemedicine Platforms using Key Requirements for Telemedicine:**

#	Requirement Description	TruClinic	VSee	ChironHealth
1	**Secure Platform** - The ability to provide access to a secure telehealth software platform both online and offline	Yes	Yes	Yes
2	**Synchronous Video Conferencing** - The ability to host live, real-time (synchronous) video conferencing between patient and physician (across bandwidths).	Yes	Yes	Yes
3	**Capture and Storage** - The ability to capture and store still images, video clips, vitals, radiology, laboratory tests, and other clinical documents in a variety of formats which are transmitted to the physician.	Yes	Yes	Yes

4	**Equipment/Mobile App/Browser** - The use of interactive telecommunications equipment that includes, at a minimum, audio and video equipment. In addition, the object of telemedicine is to make it as easy as possible for patients to get the care they need from anywhere. That's why it is important to provide the ability to use a **mobile app** and the ability to use a browser.	Yes	Yes	Yes
5	**Interoperability** - The ability to integrate into an existing Electronic Health Record/Physician Management system.	Yes	Yes	Yes

ix. **Evaluation of Top Three Telemedicine Platforms using Major Deliverables for Telemedicine:**

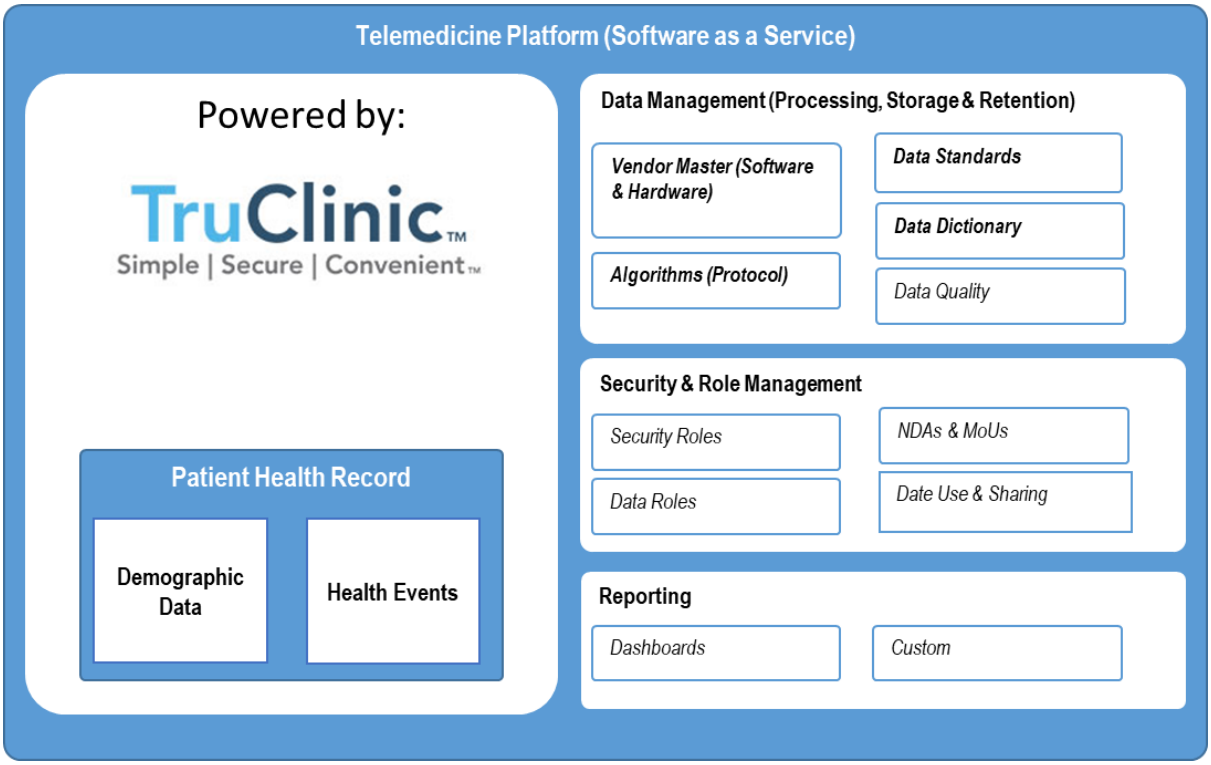
Major Deliverable	Deliverable Description	TruClinic	VSee	Chiron Health
1. Secure Platform	The platform to access and provide telemedicine services must be secure and meet all regulatory guidelines (e.g. federal, state, local, etc.)	Yes	Yes	Yes
2. Mobile and Browser Interface	The software should be made available via a mobile and browser interface solution.	Yes	Yes	Yes
3. Real-time Video Conferencing	Telemedicine must be made available in a synchronous format.	Yes	Yes	Yes
4. Data Transmission , Storage, and Integration	Data must be easily transmitted, stored, and integrated into the patient's electronic health record that exists in the same or a different data repository.	Yes	Yes	Yes

x. **Analysis of Alternatives**

	NAME OF TECHNOLOGY	PROS	CONS
1	**TruClinic** https://truclinic.com/ 'Virtual care telehealth platform for medical clinics, hospitals, healthcare systems, and government.'	- Customizable, modular platform - Compliant with HIPAA, HITECH, PIPEDA, and COPPA - Adapts to providers' workflow, - accessible via mobile devices and desktop systems - Cloud-based, SaaS - Easy to use - Scalable	-Recently acquired and redesigned (Jan 2018) by Intouch Health (questions about long-term sustainability and usage with recent acquisition and upgrades)
2	**VSee (Visual See)** https://vsee.com/ 'Funded by Salesforce.com, The National Science Foundation, and In-Q-Tel, VSee is NASA's official video chat + telemedicine platform aboard the International Space Station. It integrates secure health communications, virtual care workflows, and SDKs to easily build and grow any telehealth platform. Offerings include telemedicine kits & carts with medical devices.'	- Serves over 1000 companies including Walgreens, MDLIVE, DaVita, HCA, McKesson-US Oncology. - Funded by salesforce.com - Full suite of Telehealth platform options to fit any workflow - secure health communications, HIPAA compliant - telemedicine kits and carts with medical devices - VSee Chosen for Work Behind US Congress Firewall as well in Developing Countries - VSee API - Can develop a short proof of concept prior to full-scale deployment	- VSee is not an EHR software or module. I have concerns about ease of use and interoperability as it requires a web programmer and developer to integrate.
3	**ChironHealth** https://chironhealth.com/ 'Provides a modern approach to telehealth technology. Makes it easy to seamlessly integrate telemedicine into existing practice workflows, allowing physician practices to provide convenient and efficient care while driving incremental revenue for their practice.'	- User-Friendly - HIPAA Compliant - Seamless EHR, PM Integrations (interoperability), allows for no changes to workflow - Partners with major EHRs including EPIC, Cerner, Athena Health, Dr. Chrono - Focuses on Insurance eligibility checking, scheduling, virtual waiting room, and video. - InApp Support functions	- No approach to workflow - Heavy focus on insurance reimbursement, not patient care

V. Final Recommendation of a Vendor for a Telemedicine System Prototype

Based on the goals, requirements, and evaluation via the vendor analysis – I recommend using **TruClinic software** to launch the pilot project.



VI. Conclusion

i. Measuring Success

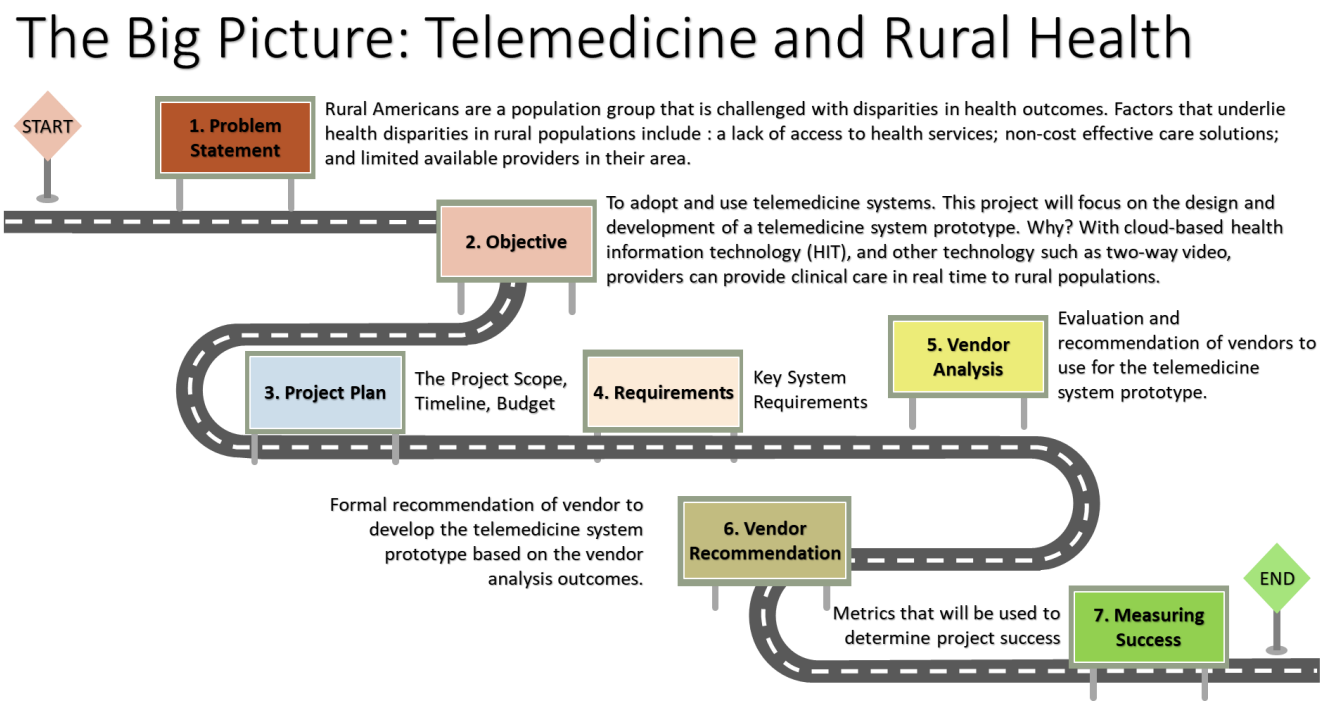
It is important to measure the success of any engagement, particularly for those that utilize public funds for the benefit of society. Metrics that will be used to determine project success for the adoption and usage of a telemedicine system prototype with the recommended software, TruClinic™ are as follows:

i. Schedule – Was the project completed on schedule?
ii. Scope – Was the project completed within scope?
iii. Budget – Was the project completed within budget?
iv. Did the design take advantage of modern cloud technologies?
v. Did the design include multiple "micro-services" which could be used to scale service delivery to other populations besides those in rural areas?
vi. Is the security of the systems in compliance with local and federal policies?

ii. The Big Picture

In summary, telemedicine is an emerging technology that has the ability to improve rural population health by creating greater access to clinical services. Telemedicine allows for the exchange of health information (between patient and provider) across geographic, economic, time and cultural barriers, in the face of challenges such as financing, safety standards, security, and infrastructure.[xiii] In an effort to fully explore the benefits and advantages of telemedicine, this thesis has proposed a technical approach and recommendation for adopting telemedicine systems, beginning with a prototype, to address the needs of rural populations in America. The overarching framework or 'big picture' approach detailed in this body of work is outlined below in Figure 4:

Figure 4 – The Big Picture: Telemedicine and Rural Health



Ultimately, having a clear problem statement, objective, project plan, requirements definition, vendor analysis, formal recommendation, and indicators for measuring success will assist the Federal Office of Rural Health Policy in advancing the implementation and adoption of telemedicine systems.

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