Data Management and Technology Avoidance in a Free Clinic

Abigail T. Corcoran

Edson College of Nursing and Health Innovation, Arizona State University

Author Note

There are no known conflicts of interest to disclose. Correspondence concerning this article should be addressed to Abigail Corcoran, Edson College of Nursing and Health Innovation, Arizona State University, 502 N. 3rd St, Phoenix, AZ 85004. Email: atcorcor@asu.edu

Abstract

Capturing and presenting high-quality data can be challenging for free clinics due to lack of resources and technology avoidance. If free clinics are unable to present impactful data to current and potential donors, this may limit funding and restrict care provided to underserved and vulnerable populations. The following is a quality improvement project which addresses utilization of information systems within a free clinic. For one month, volunteer providers completed appointment summary forms for each patient seen in the clinic. Electronic form submissions (E=110) were compared to paper form submissions (P=196), with quality of data determined by form completeness scores. Welch's t-test was used to determine statistical significance between electronic and paper form completeness scores (E=9.7, P=8.5) ($p < .001$). Findings suggest that utilization of electronic data collection tools within a free clinic produce more complete and accurate data. Barriers associated with technology utilization in this under-resourced environment were substantial. Findings related to overcoming some of these barriers may be useful for future exploration of health information technology utilization in under-resourced and technology avoidant settings. Results warrant future investigation of the relationship between quality of free clinic data, information management systems, provider willingness to utilize technology and funding opportunities in free clinics.

Keywords: data accuracy, information systems, technology, ambulatory care facilities, vulnerable populations

Data Management and Technology Avoidance in a Free Clinic

Free clinics across the country offer much needed care and services to underserved and uninsured populations, with the potential to produce positive patient outcomes with few resources (Laitman et al., 2017; Meng-Han et al., 2018). A free clinic is a private, nonprofit healthcare organization (NHO) driven by a specific mission rather than by profit. While vulnerable patient populations struggle with acute and chronic disease management, recent studies have reported that free clinics operating in underserved areas can improve outcomes and decrease costs associated with unnecessary emergency room visits (Patel & Cadet, 2017). Though the need for successful NHOs is evident, many free clinics find it challenging to manage paramount internal processes with limited resources. Data collection is one such internal operation, invaluable to the survival of an under-resourced free clinic.

Problem Statement

NHOs are unique because "success" of the organization may involve multiple different meanings. While providers and other volunteers may be concerned with carrying out the mission of the organization, board members may concurrently be concerned with funding and satisfaction of key stakeholders. Despite differing viewpoints between employees and board members, research suggests that structured data collection wholly catalyzes the success of a nonprofit healthcare clinic (Smeenge et al., 2016). Effective data management both analyzes direct patient care practices and also provides a snapshot for potential donors to identify impact of the organization. While data collection has the potential to provide a solid foundation for a thriving NHO, such clinics are often unable to organize internal data due to lack of funding and specialists, ultimately making it difficult to provide high quality care to a population in need.

Health disparities involving income, race and ethnicity, access to care, and insurance status greatly contribute to poor patient outcomes (Vanderwielen et al., 2015). According to the most recent data released by the Arizona Department of Health Services (ADHS), 28% of individuals in a small region of Southern Arizona were living in poverty in 2017, with a yearly income of $24,600 or less for a family of four (Arizona Department of Health Services [ADHS], 2017; U.S. Department of Health and Human Services [USDHHS], 2017). This region's poverty rate was 10% higher than Arizona's average poverty rate, one of the highest state average poverty rates in the nation (ADHS, 2017; USDHHS, 2017). In addition, 20% of people living in this area were uninsured with 75% identifying as Hispanic (ADHS, 2017). It can be determined that individuals living in this Southern Arizona region and surrounding areas are part of a vulnerable and underserved population, much in need of accessible healthcare.

Purpose and Rationale

Since 2010, it has been a national objective to increase the number of individuals with "a specific source of ongoing care" (Office of Disease Prevention and Health Promotion [ODPHP], 2014, p. 1). Additionally, the ODPHP has reported that Healthy People 2030 will aim to continue to decrease health disparities and fight for health equity (ODPHP, 2020). These national initiatives serve as the foundation for the exploration of data collection management in under-resourced NHOs providing care to underserved populations.

Background and Significance

Healthcare data collection processes have changed drastically over the past few decades. The Office of the National Coordinator for Health Information Technology (ONC, 2013) established a mandate to encourage healthcare providers to record and track all data electronically with an electronic health record (EHR) by 2015. As of 2017, 86% of in-office

providers and 96% of hospital providers had adopted an EHR (ONC, 2017). Today the EHR has been widely adopted across the United States, aiming to streamline care and improve primary care delivery with usage and assessment of quality indicators (O'Malley et al., 2015). Positive patient outcomes have been associated with the use of an EHR, however only when the EHR was adopted and utilized within an innovative, supportive, and collaborative culture (Regan & Wang, 2015). While the majority of providers are now recording data electronically as a result of the previously enforced mandate, free clinics are not required to use an EHR.

Free Clinics and Involved Patients

Free clinics often operate with few resources and care for underserved and uninsured patient populations that struggle to manage complex chronic diseases (Laitman et al., 2017). There are currently an estimated 1,400 free clinics registered with the National Association of Free & Charitable Clinics (NAFCC); clinics registered with the NAFCC provide care to underserved patient populations in the United States and are required to utilize an EHR (The National Association of Free & Charitable Clinics [NAFCC], 2020). There are currently 13 free clinics registered with the NAFCC in Arizona (NAFCC, 2020). Additionally, there are 23 community health centers (CHCs) in Arizona; CHCs are larger organizations that provide free or low-cost care to underserved populations, serving up to 100,000 patients (Arizona Alliance for Community Health Centers, 2020). Other smaller nonprofit healthcare clinics in Arizona may only serve around 3,000 patients (Clinica Amistad, 2018). Because it is more difficult for smaller NHOs to secure funding, tools such as EHRs are not commonly utilized. With a small patient population and poor report of provided care, it is difficult to identify how many small nonprofit healthcare clinics exist in Arizona.

Digital Tracking in Free Clinics

While there are barriers associated with adopting an EHR in a healthcare setting with limited resources, recent advancements in technology have allowed for the successful integration of EHRs built specifically for such healthcare facilities (Syzdykova, 2017). According to Syzdykova (2017), open source (OS) EHRs are highly accessible to low-resourced healthcare clinics; OS EHRs are able to be widely distributed and some are available to use for free. The World Health Organization (WHO) recently released a guideline specifically discussing the importance of utilizing such technologies in underserved areas in order to improve chronic disease management and "serve the vulnerable" (World Health Organization [WHO], 2019, p. v). This guideline states that services provided to patients, as well as their health status, should be digitally tracked in settings that can support such technologies in order to improve health outcomes (WHO, 2019).

Current EHR Use in Free Clinics

It has been reported that 44% of student-run free clinics utilize an EHR and it is likely this number will continue to grow slowly, as successful integration of an EHR in a free clinic is a complicated process (Smeenge et al., 2016). It is not clear how many NHOs (not specifically run by students) currently utilize an EHR, though many still rely on paper charts as healthcare providers feel that electronic charting is burdensome and makes the provider-patient interaction less personable (Flanagan et al., 2019). Additionally, free clinics operate with extremely limited resources, focusing on short-term goals centered around their mission; adopting an EHR is a long-term goal that requires expertise and additional resources to maintain (Tenney & Sheikh, 2019). A recent cross-sectional study involving 333 Indian Health Service providers reported that physicians believe EHR use in an under-resourced setting can improve quality of care, however, may also hinder patient-provider interactions (Kruse et al., 2017).

From Paper to Digital for Future Health Equity

As the ODPHP and WHO have addressed, it is of utmost importance to identify possible weaknesses surrounding care of vulnerable patient populations. Recent studies and explorations of literature have supported that available healthcare technology has the potential to assist in providing high quality care to underserved patients in low-resourced areas. By digitally tracking patient data, free clinics could potentially improve patient outcomes and present their impact of care to the community. Reporting positive impact of care through quality indicators (down-trending A1C values for example) could increase potential for funding from federal and local grants as well as private donors (Umar & Hassan, 2019; Zhou & Ye, 2019).

Internal Evidence

While complete digital tracking of healthcare data seems like it would be the most effective operation for free clinics, a nonprofit healthcare clinic in Southern Arizona has incorporated a different data collection process. Patient demographics, provided services, and health status reports are currently recorded on paper and transferred to excel spreadsheets. The data collection process is unorganized and involves much subjectivity when transferring information. This widespread discontinuity produces fragmented and inconclusive data. The clinic does currently collect some health status and health service data, though much of the data collected in 2018 was demographical. The clinic reports that they have difficulty providing interested donors with requested information concerning impact of care, thus struggling to secure and maintain much needed funding to care for their rapidly growing patient population.

PICOT Question

After reviewing relevant information regarding NHOs and their potential for occupying significant healthcare roles in underserved populations with the guidance of available

technology, it is necessary to analyze current conditions and consider impact of evidence-based interventions. This investigation invites the PICOT question, in a nonprofit free clinic caring for an underserved population (P), how would an EHR (I) compared to paper charting (C), affect documentation, tracking of quality indicators, and funding (O)?

Search Strategy

In order to explore the presented PICOT question, five databases (focused on medicine, technology and business-related content) were searched using relevant and related terms. Abstracted Business Information and the Inform (ABI/INFORM), Information Science & Technology Abstracts, Cumulative Index of Nursing and Allied Health (CINHAL), PubMed, and Academic Search Premier were searched with the following keywords: *nonprofit, free clinic, underserved, electronic, electronic health, electronic health record, data, quality, health,* and *funding.* Results were filtered to include content written in English, created within five years of the search date. Any searches that yielded greater than 500 results were reconstructed and refocused to ensure relevance of the content to the PICOT question. Background information related to the PICOT question was collected from peer-reviewed literature after searching the Modern Language Association directory of periodicals as well as the previously mentioned databases.

ABI/INFORM

This database provided content specifically focused on technology and business. The most relevant search included the keywords *electronic health record, nonprofit, free clinic, funding,* and *quality* with Boolean connectors to yield 449 results. These results were analyzed and narrowed down to three articles that were focused on nonprofit businesses as well as EHRs and their role in providing healthcare to underserved populations.

Library, Information Science & Technology Abstracts

With a focus on healthcare and technology, this database was searched with the keywords *electronic health record, underserved* and *quality* with Boolean connectors to yield five results. Two of these articles were selected as they offered highly generalizable and relevant findings.

CINAHL

The healthcare focused CINAHL database was searched with only two keywords: *electronic health record* and *free clinic*. This search yielded 11 results, with two selected for further exploration. While this search was the least detailed, the two selected articles were among the most relevant to all elements of the presented PICOT question.

Academic Search Premier

This database is broadly focused on university-related literature relating to social sciences, healthcare, and other scholarly subjects. The keywords *nonprofit health data* and *quality* were searched for a yield of 294 results, further filtered to a final selection of one relevant article.

PubMed

The PubMed database accesses literature that explores life sciences and biomedical topics, lacking focus on health information technology. The keywords *electronic health record, underserved, and data* yielded 106 results. Most of the literature was relevant to the population of focus with a plethora of data surrounding chronic health management, however few studies investigated the role of technology within this population. No studies were selected from this search.

Rapid Critical Appraisal (RCA) was completed for 20 articles and 10 were selected for use due to strength, validity, and/or applicability of the literature (Melnyk & Fineout-Overholt,

2005). Eight articles were selected from database searches and two additional articles were selected from searching reference lists of related literature. Five randomized control trials (RCTs), one longitudinal cohort study, one cross-sectional study, one crossover study, one survey study, and one case-controlled trial were explored.

Critical Appraisal & Synthesis

All reviewed literature directly or indirectly involved two or more elements of the previously proposed PICOT question (underserved population, EHR use compared to paper charting, documentation and tracking of quality indicators); an overview of these studies can be found in the Evaluation Table (see Appendix A, Table A1). All studies were considered high quality, as supported by the previously completed RCA. Much can be deduced from the synthesis of relationships between findings, ultimately providing an evidence-based foundation for future intervention. The Synthesis Table (see Appendix A, Table A2) provides a visual comparison of study characteristics and findings, suggesting most of the studies involve health information technology. Level of evidence is high overall (mostly one- and two-level studies) with the majority of sample sizes greater than 500. There is a moderate amount of heterogeneity amongst the sample demographics, though most patient populations have a mean age between 40 and 55. There is a high level of homogeneity in study settings, with primary care clinics and community health clinics being most prevalent. Additionally, multiple studies examine EHR use in underserved populations.

Overall, the literature supported that EHR use is positively associated with quality of care, quality of data, patient health literacy, positive patient outcomes, and staffing mix of unlicensed professionals. The literature suggested that EHR use in underserved populations decreases barriers to care and enhances chronic disease management. Electronic data capture

(EDC) (use of electronic forms and data management) was positively associated with data quality and inversely associated with time spent on data collection. Additionally, of note, EDC was not significantly related to patient satisfaction or adherence. Organizational support and educational opportunities for employees were also positively associated with data quality.

Conclusion of Evidence

EHR use is beneficial for underserved populations as well as under resourced clinics. With the ability to improve multiple direct and indirect patient care processes in the primary care setting, adoption of this health information technology tool should be considered. EDC reduces time spent on data collection and also improves data quality, regardless of patient population or setting. It seems the adoption of electronic form use without an EHR may be more appropriate for an organization that is specifically focused on data collection needs, as opposed to improving quality of care and patient satisfaction.

Theory Application

Because the evidence supports adoption of new technology, it is important to discuss behavior associated with this process. In order for technology to increase productivity and produce desired outcomes, it must first be accepted. The Unified Theory of Acceptance and Use of Technology (UTAUT) is a construct that merges multiple technology-related theories to explain acceptance and usage of technology (Venkatesh et al., 2003). Venkatseh et al. (2003) proposed there are four factors that determine technology acceptance and usage: “performance expectancy, effort expectancy, social influence, and facilitating conditions” (pg. 447). Age, gender, previous experience, and whether use is optional or mandatory can affect these factors (see Appendix B, Figure 1).

Performance Expectancy

If a potential technology user believes the use of a certain tool will improve job performance, they are more likely to accept and utilize this tool. This is the strongest determinant of use. According to the authors, younger male workers are more likely to experience this determining factor (Venkatesh et al., 2003).

Effort Expectancy

If a potential technology user believes that it will be easy to use a certain tool, they are more likely to accept and utilize this tool. According to the authors, older female workers with limited experience are more likely to experience this determining factor (Venkatesh et al., 2003).

Social Influence

If a potential technology user believes that use of the tool is important to other employees or team members, they are more likely to accept and utilize this tool. According to the authors, older female workers mandated to use new technology with limited work experience are more likely to encounter this determining factor (Venkatesh et al., 2003).

Facilitating Conditions

If a potential technology user believes their organization will offer proper technological support with sufficient knowledge surrounding this tool, use is more likely. According to the authors, older and experienced workers are more likely to endorse this behavior (Venkatesh et al., 2003).

Implementation Framework

After utilizing theoretical framework to consider expected behavior associated with the adoption of new technology, it is necessary to explore an innovation model to guide the adoption process. Rogers (2003) proposed a framework, known as the Diffusion of Innovations Model, which focuses on the adoption of new ideas or interventions within an organization. This model

includes five stages of innovation (see Appendix B, Figure 2) within an organization, including two stages prior to implementation and three stages of implementation (Rogers, 2003).

Pre-Implementation Stages

1. Agenda Setting

This is the first step of the innovative process and consists of initial identification of a problem within the organization. This process often involves multiple workers and may last for a number of years. This process is driven by a gap between expectations and performance, providing motivation toward a desired state of operation (Rogers, 2003).

2. Matching

This step of the journey to innovation is arguably the most important, as it may determine the lasting success of the intervention. Matching is the process of ensuring that the proposed solution is conceptually appropriate for the proposed problem. If the presented solution does not offer a sturdy bridge between the current and desired state, long-term adoption of the intervention is unlikely (Rogers, 2003).

Implementation Stages

3. Redefining and Restructuring

This ongoing process entails slightly molding both the intervention and the organization to achieve a workable "fit". The intervention may be changed to better complement the organization and the organization may change (internally and/or externally) to accommodate the intervention. It should be noted that Rogers (2003) warned of "radical innovations" which create increased discomfort and resistance; the implementation of computer technologies is considered one such innovation. Radical innovations increase the likelihood for organizational turbulence throughout this stage.

4. Clarifying

The intervention becomes increasingly popular and understood among organization members during this stage. It is important to identify a way to "frame", or explain the importance of, the intervention to involved workers. If the intervention is framed in a way that promotes the values of the organization and its members, it is more likely to be adopted and sustained. The process of clarifying the intervention often occurs through social interaction. During this stage it is important for an organization to select a member that highly supports the intervention to spread approval throughout the organization. This member is known as a "champion" (Rogers, 2003).

5. Routinizing

When an intervention is used routinely and becomes part of the organization, the innovative process is complete. The sustainability of the innovation becomes increasingly relevant during this stage and may be strengthened through widespread use and discussion. If one or few authority figures drive this process, failure of sustainable adoption is likely. If the intervention is not appropriate or capable of bridging the gap between problem and desired states, or if there is no champion to spread its support, the innovation is likely to be discontinued during this stage (Rogers, 2003).

Methods

This was a quality improvement Doctor of Nursing Practice (DNP) project which involved implementation of an electronic form in a free clinic. This project was approved by the Arizona State University Institutional Review Board and did not involve direct patient interaction.

Population and Setting

The project took place in a free clinic in Southern Arizona. 14 free clinic volunteer providers were involved in the project, including nine medical doctors (MDs), four family nurse practitioners (NPs) and one physician assistant (PA) (see Appendix C). All interactions between the project team and clinic volunteers were held virtually due to COVID-19 restrictions.

Project Description

An electronic form task force team (EFTFT) was developed on October 13, 2020. This team consisted of the project lead, medical director, executive director, FNP volunteer, clinic manager and data manager. All members of the EFTFT signed consent forms prior to participation. This team held multiple virtual meetings throughout the month of October to discuss clinic workflow and determine what information was necessary to capture on the electronic form. After a suitable prototype was developed per EFTFT standards, the electronic form was created using a HIPAA compliant online form builder (JotForms). Prior to trialing the electronic form, clinic providers were encouraged to complete a health information technology awareness survey (see Appendix D). The first version of the electronic form was trialed on October 22, 2020. Volunteer providers interested in trialing the electronic form signed consent forms prior to participation. Between October 22, 2020 and December 17, 2021, the EFTFT met weekly to discuss provider suggestions and workflow concerns. Multiple form versions were piloted. The data manager volunteer was present at the clinic during hours of operation to support providers with electronic form use. On January 6, 2021, the final version of the electronic form was implemented in the clinic.

Providers had the option of utilizing the original paper appointment summary form, or the new electronic appointment summary form (see Appendix E, Figures E1 and E2). Prior to

utilizing the electronic form, providers were required to complete a consent form. Between January 6, 2021 and February 6, 2021, 306 appointment summary forms (110 electronic and 196 paper) were completed.

Data Collection

All electronic form data were stored on the password protected, HIPAA-compliant JotForms database. All exported electronic form data were de-identified prior to transferring from the database. All paper form data were stored on the clinic's password protected database and were deidentified prior to exporting.

Instrumentation

A modified version of the Information Technology in Primary Care Practice questionnaire (perceived ease of use $\alpha = 0.83$, perceived usefulness $\alpha = 0.92$) was utilized to determine technology awareness and readiness among providers prior to utilizing the electronic form (see Appendix E) (Dixon & Dixon, 1994). Overall awareness scores were determined based on responses to questions involving interest in future use of technology, perceived ease of use, perceived usefulness and overall attitudes toward technology.

Appointment Summary Forms

Both paper and electronic appointment summary forms were utilized to collect clinic-related data (primary diagnoses, labs ordered, referrals made, etc.). HIPAA-compliant electronic forms were accessible to providers via shareable weblink on any electronic device with a web browser. Data from paper forms was inputted into the clinic's database (password protected excel spreadsheet) while electronic-form data was automatically submitted to the JotForms database. All data was deidentified and exported from each database. Form completeness scores were calculated for each form submission based on the following ten data fields (fields present

on both the paper and electronic forms): provider, visit type, type of appointment, patient gender, patient age, blood pressure, limitations to patient compliance, primary diagnosis, level of service and referral. Each field that contained data counted for one point, with a maximum completeness score of 10.

Budget

No funding was required for this project. The JotForms online form builder offered a free HIPAA-compliant subscription to healthcare providers during the COVID-19 pandemic and all required technology was either present at the clinic or provided by clinic volunteers.

Results

Completeness Scores

Intellectus Statistics software was utilized to analyze collected data. Welch's t-test was used instead of a Student's t-test to compare completeness scores between electronic and paper forms (E=110, P=196), as it is more reliable when two samples have unequal variances and unequal sample sizes (Ruxton, 2006). The result of the two-tailed independent samples *t*-test was significant based on an alpha value of 0.05, $t(276.67) = 10.77$, $p < .001$, indicating the null hypothesis can be rejected. This finding suggests the mean completeness score was significantly different between electronic and paper forms (E=9.7, P=8.5) (see Appendix F, Figures F1 and F2).

Information Technology Awareness

Though only four providers were willing to complete the modified Information Technology in Primary Care Practice questionnaire prior to implementation, provider age was inversely related to awareness score (see Appendix F, Figure F3). Electronic form utilization

increased from 10 to 56% from the first trial in October 2020 to the end of the final month-long implementation in February 2021 (see Appendix F, Figure F4).

Level of Service

Electronic forms were associated with no missing level of service entries, while paper forms were missing 30% of level of service entries (see Appendix F, Figure F5 and Figure F6).

Impact & Sustainability

Electronic form utilization has the potential to increase completeness of clinically related data. More complete clinic data is beneficial for providers, patients and the community. More complete data may lead to increased quality of care and decreased costs associated with unnecessary procedures and avoidable emergency room visits. More complete data may also allow the clinic to apply for additional funding opportunities. Utilization of the electronic form has the potential to lead to more complete and structured data sets, allowing clinic volunteers to easily analyze and present data to current and potential donors. Electronic form use is straightforward and will allow volunteers with little experience in data collection and management to assist the clinic with monthly analysis and annual reports. The JotForms account is HIPAA-compliant and easily maintained from any electronic device with a web browser. While the JotForms application was free during the project implementation period, the service will eventually cost around $30 per month.

Discussion

Electronic form utilization increased completeness of data in a free clinic. Form utilization rates among providers steadily increased, suggesting an increase in information technology awareness. Project findings were presented to the executive director and clinic

president on April 7, 2021. The clinic will continue to utilize the electronic form and plans to transition to an EHR in the near future.

Limitations

This was a single-site project, meaning the electronic form was only implemented in one free clinic. Additionally, the majority of volunteer providers that participated in the project were Caucasian male MDs with a mean age of 65. Technology avoidance may have been more prevalent in this group due mean age of providers. While it would have been ideal to transition the clinic from a paper charting system to an EHR, the clinic was not interested in this intervention prior to electronic form implementation. Moreover, only four providers participated in the modified Information Technology in Primary Care Practice questionnaire. A larger sample size is needed to determine technology awareness and readiness in this population.

Barriers/Challenges

COVID-19

This project occurred during a global pandemic. COVID-19 related restrictions prohibited the project lead from carrying out any project-related duties on site. All interactions between clinic staff were held virtually or via phone or email. Implementing new technology and information systems requires constant physical presence. Lack of physical presence made it extremely difficult for the project lead to participate in the clinic's change process, likely contributing to poor facilitating conditions and increased technology avoidance (Venkatesh et al., 2003).

Technology Avoidance

Some clinic staff members were extremely resistant to utilization of any type of technology. These staff members were adamant about continuing to use non-electronic data

collection methods. Most provider volunteers that preferred to utilize paper forms and charts reported that they had awful experiences with EHRs and other health information technology. These providers felt like technology impeded on their ability to establish and maintain a relationship with the patient. Technology avoidant providers also felt like utilization of technology would not in any way improve quality of care. Though some providers opposed the electronic form in the beginning of the project, open and consistent communication seemed to improve attitudes toward technology use toward the end of the implementation period.

Lack of Support from Key Stakeholders

As social influence contributes to adoption of new technology, lack of support from the medical director made it difficult to implement the electronic form (Venkatesh et al., 2003). Many versions of the electronic form were trialed before the medical director agreed to implementation. Providers supported the medical director and remained resistant to implementation of the electronic form.

Volunteers/Turnover

Free clinics are constantly accepting varied levels of assistance from credentialed and non-credentialed volunteers. Schedules are erratic and it is difficult to contact volunteers. It is burdensome to carry out change processes in this type of environment, especially without physical presence.

Resources and Technology

Free clinics rely on grant funding and private donations for financial support. Health information technology is not usually the primary focus in free clinics, often resulting in outdated machinery. The free clinic was able to provide some laptops and tablets, however providers often preferred to use their own electronic devices to access the electronic form. Some

providers reported that the laptops were “slow” and that they found it “difficult to click through the form”.

Previous Findings

This quality improvement project supports previous research related to positive impact of health information technology utilization in underserved and under-resourced settings (Olayiwola et al., 2016; Smeenge et al., 2016; Syzdykova, 2017). Additionally, the inverse relationship between provider age and technology avoidance is supported by technology theory (UTAUT) (Venketesh et al., 2003). Lastly, project findings are in-line with user-centered design (UCD) studies, which support testing electronic tools in healthcare settings in real time (Chokshi & Mann, 2018). Electronic forms were trialed in the clinic, giving providers the opportunity to participate in the development of a useful and supportive tool.

Future Implications

Despite challenging barriers, utilization of health information technology improved data quality in a free clinic. The previously reported outcomes may be useful for free clinics struggling to capture complete data in under-resourced settings. Project findings warrant future investigation of the relationship between quality of free clinic data, information management systems, provider willingness to utilize technology and funding opportunities in free clinics. It may also be beneficial to explore technology acceptance theories and consider expanding such theories to incorporate technology implementation in under-resourced settings.

References

Arizona Alliance for Community Health Centers. (2020). *What is a community health center?* https://www.aachc.org/communityhealthcenters/

Arizona Department of Health Services. (2017). *Arizona designation mapper*. https://www.azdhs.gov/prevention/health-systems-development/shortage-designation/designation-mapper/index.php

Chokshi, S. K., & Mann, D. M. (2018). Innovating from within: A process model for user-centered digital development in academic medical centers. *JMIR Human Factors*, *5*(4), e11048. https://doi.org/10.2196/11048

Clinica Amistad. (2018). Agency financial report: Fiscal year 2018. https://www.clinicaamistad.org/uploads/6/3/0/5/63052577/clinica_2017-18_annual_report.pdf

Dixon, D. R., & Dixon, B. J. (1994). Adoption of information technology enabled innovations by primary care physicians: Model and questionnaire development. *Proceedings of the Annual Symposium on Computer Application in Medical Care* (p. 631). American Medical Informatics Association.

Flanagan, M., Militello, E., Rattray, L., Cottingham, G., & Frankel, N. (2019). The thrill is gone: Burdensome electronic documentation takes its toll on physicians' time and attention. *Journal of General Internal Medicine, 34*(7), 1096-1097. https://doi.org/10.1007/s11606-019-04898-8

Frogner, B., Wu, X., Park, J., & Pittman, P. (2017). The association of electronic health record adoption with staffing mix in community health centers. *Health Services Research, 52*(1), 407-421. https://doi.org/10.1111/1475-6773.12648

Khan, J. S., Jibb, L. A., Busse, J. W., Gilron, I., Choi, S., Paul, J. E., ... & Devereaux, P. J. (2019). Electronic versus traditional data collection: A multicenter randomized controlled perioperative pain trial. *Canadian Journal of Pain*, *3*(2), 16-25. https://doi.org/10.1080/24740527.2019.1587584

Konerman, M. A., Thomson, M., Gray, K., Moore, M., Choxi, H., Seif, E., & Lok, A. S. (2017). Impact of an electronic health record alert in primary care on increasing hepatitis c screening and curative treatment for baby boomers. *Hepatology*, *66*(6), 1805-1813. https://doi.org/10.1002/hep.29362

Kruse, G. R., Hays, H., Orav, E. J., Palan, M., & Sequist, T. D. (2017). Meaningful use of the Indian Health Service electronic health record. *Health Services Research*, *52*(4), 1349-1363. https://doi.org/10.1111/1475-6773.12531

Laitman, B. M., Mosley, G., Thomas, D. C., & Meah, Y. S. (2017). How well does a student-run free clinic care for diabetic patients? *Journal of Student-Run Clinics*, *3*(1), 1-9. https://studentrunfreeclinics.org/journalsrc.org/index.php/jsrc/article/view/37

Lyles, C. R., Tieu, L., Sarkar, U., Kiyoi, S., Sadasivaiah, S., Hoskote, M., ... & Schillinger, D. (2019). A randomized trial to train vulnerable primary care patients to use a patient portal. *The Journal of the American Board of Family Medicine*, *32*(2), 248-258. http://dx.doi.org/10.3122/jabfm.2019.02.180263

Melnyk, B. M., & Fineout-Overholt, E. (2005). Rapid critical appraisal of randomized controlled trials (RCTs): an essential skill for evidence-based practice (EBP). *Pediatric Nursing*, *31*(1), 50-2. https://www.ncbi.nlm.nih.gov/pubmed/15794325

Meng-Han, T., Xirasagar, S., Carroll, S., Bryan, C. S., Gallagher, P. J., Davis, K., & Jauch, E. C. (2018). Reducing high-users' visits to the emergency department by a primary care

intervention for the uninsured: A retrospective study. *Inquiry: The Journal of Health Care Organization, Provision, and Financing*, 55(1), 1-12. http://dx.doi.org/10.1177/0046958018763917

The National Association of Free & Charitable Clinics. (2020). *Education corner.* https://www.nafcclinics.org/content/education-corner

O'Malley, A., Draper, K., Gourevitch, R., Cross, D., & Scholle, S. (2015). Electronic health records and support for primary care teamwork. *Journal of the American Medical Informatics Association: JAMIA, 22*(2), 426-434. https://doi.org/10.1093/jamia/ocu029

Office of Disease Prevention and Health Promotion. (2014). *Access to health services.* https://www.healthypeople.gov/2020/topics-objectives/topic/Access-to-Health-Services/objectives

Office of Disease Prevention and Health Promotion. (2020). *Healthy people 2030 framework.* https://www.healthypeople.gov/2020/About-Healthy-People/Development-Healthy-People-2030/Framework

Office of the National Coordinator for Health Information Technology. (2013). *Are there penalties for providers who don't switch to electronic health records (EHR)?* https://www.healthit.gov/faq/are-there-penalties-providers-who-dont-switch-electronic-health-records-ehr

Office of the National Coordinator for Health Information Technology. (2017). *Quick stats*. https://dashboard.healthit.gov/quickstats/quickstats.php

Olayiwola, J. N., Anderson, D., Jepeal, N., Aseltine, R., Pickett, C., Yan, J., & Zlateva, I. (2016). Electronic consultations to improve the primary care-specialty care interface for

cardiology in the medically underserved: a cluster-randomized controlled trial. *The Annals of Family Medicine, 14*(2), 133-140. https://doi.org/10.1370/afm.1869

Patel, A., & Cadet, V. E. (2017). Free clinic educational interventions for patients with chronic disease. *Journal of Compassionate Health Care*, *4*(1), 11. https://doi.org/10.1186/s40639-017-0039-x

Regan, E. A., & Wang, J. (2015). Realizing the value of EHR systems critical success factors. *Health Economics and Healthcare Reform: Breakthroughs in Research and Practice* 3(1), 56-76. https://scholarworks.wmich.edu/cgi/viewcontent.cgi?article=1043&context=ichita_transactions

Rogers, M. E. (2003). Diffusion of innovations (5th ed.). Free Press. https://ebookcentral-proquest-com.ezproxy1.lib.asu.edu/lib/asulib-ebooks/detail.action?docID=4935198

Ruxton, G. D. (2006). The unequal variance t-test is an underused alternative to Student's t-test and the Mann-Whitney U test. *Behavioral Ecology, 17*(4), 688-690.

Ryu, B., Kim, N., Heo, E., Yoo, S., Lee, K., Hwang, H., ... & Jung, S. Y. (2017). Impact of an electronic health record-integrated personal health record on patient participation in health care: Development and randomized controlled trial of MyHealthKeeper. *Journal of Medical Internet Research*, *19*(12), e401. http://doi.org/10.2196/jmir.8867

Smeenge, D., Larson, B., Chadwell, M., & Binienda, J. (2016). Recommended medical record practices for student-run free clinics. *Journal of Student-Run Clinics*, *2*(2). https://studentrunfreeclinics.org/journalsrc.org/index.php/jsrc/article/view/21

Staziaki, P. V., Kim, P., Vadvala, H. V., & Ghoshhajra, B. B. (2016). Medical registry data collection efficiency: A crossover study comparing web-based electronic data capture and

a standard spreadsheet. *Journal of Medical Internet Research*, *18*(6), e141. https://doi.org/10.2196/jmir.5576

Syzdykova, A. (2017). Open-source electronic health record systems for low-resource settings: Systematic review. *Journal of Medical Internet Research., 19*(11), 17-17. https://doi.org/10.2196/medinform.8131

Tenney, D., & Sheikh, N. (2019). Development of a strategic roadmap framework for nonprofit organizations: Literature review. *2019 Portland International Conference on Management of Engineering and Technology (PICMET),* 1-11. https://doi.org/10.23919/PICMET.2019.8893887

Umar, S., & Hassan, S. (2019). Encouraging the collection of performance data in nonprofit organizations: The importance of organizational support for learning. *Public Performance & Management Review, 42*(5), 1062-1084. https://doi.org/10.1080/15309576.2018.1481118

U.S. Department of Health and Human Services. (2017). *2017 Poverty guidelines*. https://aspe.hhs.gov/2017-poverty-guidelines

Vanderwielen, L., Vanderbilt, A., Crossman, S., Mayer, S., Enurah, A., Gordon, S., & Bradner, M. (2015). Health disparities and underserved populations: A potential solution, medical school partnerships with free clinics to improve curriculum. *Medical Education Online, 20*(1), 27535. https://dx.doi.org/10.3402%2Fmeo.v20.27535

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478. https://doi.org/10.2307/30036540

World Health Organization. (2019). WHO guideline: recommendations on digital interventions for health system strengthening. Geneva: World Health Organization; 2019. License: CC BY-NC-SA 3.0

Young, R., Burge, S., Kumar, K., Wilson, J., & Ortiz, D. (2018). A time-motion study of primary care physicians' work in the electronic health record era. *Family Medicine*, *50*(2), 91-99. https://doi.org/10.22454/FamMed.2018.184803

Zeleke, A. A., Worku, A. G., Demissie, A., Otto-Sobotka, F., Wilken, M., Lipprandt, M., ... & Röhrig, R. (2019). Evaluation of electronic and paper-pen data capturing tools for data quality in a public health survey in a health and demographic surveillance site, Ethiopia: Randomized controlled crossover health care information technology evaluation. *JMIR mHealth and uHealth*, *7*(2), e10995. https://doi.org/10.2196/10995

Zhou, H., & Ye, S. (2019). Legitimacy, worthiness, and social network: An empirical study of the key factors influencing crowdfunding outcomes for nonprofit projects. *International Journal of Voluntary and Nonprofit Organizations*, *30*(4), 849-864. https://doi-org.ezproxy1.lib.asu.edu/10.1007/s11266-018-0004-0

Appendix A

Evaluation and Synthesis Tables

Table A1

Evaluation Table

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Frogner et al. (2017). The association of electronic health record adoption with staffing mix in community health centers. **Funding**: Cooperative Agreement for a Regional Center for Health Workforce from the Health Resources and Services **Bias**: None reported **Country**:	Productivity Paradox Theory	**Design:** Longitudinal cohort study **Purpose:** Assess how medical staffing mix changed over time in association with the adoption of EHRs in CHCs	**N:** 722 CHCs **CG:** 110 **EG:** 612 **Setting**: Community health centers within the 50 states and Washington, DC. **Inclusion Criteria:** -CHCs in operation across the entire study period -CHCs within the 50 United States or	**IV1:** EHR adoption **IV2**: No EHR adoption **DV1:** Staffing mix- NP/PA **DV2:** Staffing mix- RN **DV3:** Staffing mix- Other	Readiness for Meaningful Use and HIT and Patient Centered Medical Home Recognition Survey- no information regarding validity available for this survey	Fractional multinomial logit (fmlogit) model, two-sample t-test	Staffing mix- NP/PA (p = .004) Staffing mix- RN (p = .004) Staffing mix- Other (p = .065) *CHCs that had an EHR had a significantly ($p < .05$, $p < .01$, and $p < .001$) higher proportion of other medical staff	**LOE:** II **Strengths:** Explores EHR use in underserved population, supports idea that change in staffing results from EHR adoption. **Weaknesses:** Observational-association v cause, does not assess quality of care **Conclusions:** CHCs with EHRs have different staffing arrangements of their medical staff than CHCs without EHRs. Supports the hypothesis that EHR adoption in CHCs allowed for greater flexibility among staff types. **Feasibility/Applicability to pt. population:** Applicable to

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
U.S. **Affiliations**: -The George Washington University -National Association of Community Health Centers			District of Columbia -Information available on the key variables consistently over the study period -Have an identifiable year of EHR adoption **Sample Demographics:** Female: 58% 19-64 y.o.: 66% Hispanic: 25% White: 54% Uninsured: 43% 100% or below poverty level: 50%					patient population- underserved patients as well as setting- under resourced clinic. As the free clinic depends on non-credentialed volunteers it is important to consider that EHR adoption was associated with an increase in support staff in this study. This suggests that support staff is necessary to adopt an EHR- VERY important to consider before attempting to switch from paper charts to EHR.
Khan et al. (2019). Electronic versus traditional data collection: A multicenter randomized	Health Behavior Theory, Technology Acceptance Model	**Design:** RCT **Purpose:** Characterize the impact of an EDC method on data quality, patient protocol	**N:** 78 **EG:** 38 EDC **CG:** 40 (traditional data capture) **Setting**: Population	**IV1:** EDC **IV2:** Traditional data collection **DV:** Impact on data quality	Short-Form McGill Pain Questionnaire 2 (α = 0.64-0.74)	T test, fisher's exact test, SPSS	EDC group had a significant increase in the total number of queries (4.92 [SD = 4.67]	**LOE:** I **Strengths:** High level of evidence, controlled exploration of EDC v PPDC, **Weaknesses:** open-label study- this could introduce

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
controlled perioperative pain trial. **Funding**: -Physicians Services Incorporated (grant number R14-30) -an Innovation grant received from McMaster University, Hamilton, Ontario **Bias**: Noe reported **Country**: Canada **Affiliations**: McMaster University		adherence, patient and research assistant satisfaction, and resource when compared to traditional data collection methods (i.e., paper-based diaries and verbally using the telephone)	Health Research Institute at McMaster University in Ontario. **Inclusion Criteria:** Patients included in the PLAN (Pregabalin and Lidocaine in breast cancer surgery to Alter Neuropathic Pain) pilot trial at Juravinski Hospital in Hamilton, Ontario, and Sunnybrook Health Sciences Centre in Toronto. **Sample Demographics:** European ethnicity (92%), married (81%), had completed	**DV2:** Patient adherence to protocol **DV3:** Patient/research assistant satisfaction **EDC:** Use of electronic forms to collect data	Brief Pain Inventory (α = 0.84-0.94)		vs. 1.88 [SD = 1.51]; $P < 0.001$) and queries requiring intervention (3.42 [SD = 3.63] vs. 1.23 [SD=1.29]; $P < 0.001$) There were no differences between the two data collection groups in patient-reported compliance (P value for difference ranged from 0.15 to 0.97 There were no differences in patient satisfaction scores	bias. Results may not be generalizable to all EDC systems. "Underpowered", needed ~31 queries per patient and only had 25. **Conclusions:** Study suggests that EDC systems can significantly reduce the amount of time needed to collect study data. **Feasibility/Applicability to pt. population:** Useful information, not necessarily relating to an EHR, but an EDC system (which may be more of what the free clinic is looking for). This is a high level study that encourages use of EDC over pen and paper data collection. This research does not specifically involve a low-resourced clinic or underserved patient population, however the data collection information is still valuable.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
			college or university (40%), and were engaged in full-time employment (55%) Mean age: 52				between the electronic data capture group (81.9 [SD = 28.6]) and traditional data collection group (85.5 [SD = 22.1];	
Konerman et al. (2017). Impact of an electronic health record alert in primary care on increasing hepatitis c screening and curative treatment for baby boomers **Funding**: -National Institutes of Health. Grant Number: T32DK062708 -American Association for	Health Behavior Theory, Technology Acceptance Model	**Design:** Case Controlled Trial **Purpose:** Assess the impact of an EHR–based prompt (BPA) on hepatitis C screening rates in baby boomers in primary care.	**N:** 105,492 **CG:** 52,660 **EG:**52,832 **Setting**: three clinic sites associated with the University of Michigan (general medicine, family medicine, and medicine/pediatrics) **Inclusion Criteria:** -Born between 1945 and 1965,	**IV:** BPA **DV:** hep C screening rates	Abbott RealTime HCV Test Specificity/sensitivity: ~99% Siemens ADVIA Centaur Immunoassay Specificity: 96% Sensitivity: 90%	Descriptive and bivariate analyses	Anti-HCV was ordered in only 4.6% of eligible visits and 7.6% of eligible patients compared to 47% and 72% in the 12-month post-BPA period ($P < 0.001$).	**LOE:** II **Strengths:** Suggests use of screening tools could promote positive patient outcomes. BPA design could easily be implemented in other Epic-based systems or adapted for other EHRs. **Weaknesses:** homogenous patient population with potentially lower risk of HCV infection **Conclusions:** Hep C screening rates increased 5X to 72% during the 1-year period after implementation of the EHR-based BPA. The success of this screening intervention is a direct result of the ease of the

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
the Study of Liver Disease's - Advanced/Transplant Hepatology Fellowship **Bias**: Potential conflict of interest: Dr. Lok received grants from Bristol-Myers Squibb and Gilead. Supported by the National Institutes of Health (T32DK062708 training grant) and the American Association for the Study of Liver Disease's Advanced/Transplant Hepatology Fellowship (to M.A.K.).			-Lacked a prior diagnosis of HCV infection -Lacked prior documented anti-HCV testing **Sample Demographics:** Caucasian: 27% African American: 34% 50-59 y.o.: 28.5% 60-70 y.o.: 28.5% Female: 26%					EHR design, which was constructed based on the needs of PCPs **Feasibility/Applicability to pt. population:** Applicable to patient population. Av age is ~55y.o. at the free clinic. Many patients have chronic complex underlying conditions and an EHR with BPA may improve suggested screening rates in this population.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Country: U.S. **Affiliations**: University of Michigan								
Lyles et al. (2019). A randomized trial to train vulnerable primary care patients to use a patient portal. **Funding**: - Agency for Healthcare Research and Quality – National Library of Medicine– National Institutes of Health. **Bias**: None reported **Country**: U.S.	Health Belief Model Technology Acceptance Model	**Design:** RCT **Purpose:** Evaluate the impact of implementing different modes of training on subsequent portal use rates.	**N:** 93 **CG:** 44 **EG:** 49 **Setting**: Zuckerberg San Francisco General Hospital and 1 community-based clinic **Inclusion Criteria:** -Access to the internet **Exclusion Criteria:** - Cognitive or visual impairment, severe mental health conditions.	**IV1:** In-person tutorial with a trained research assistant **IV2**: Online tutorial **DV1:** Change in EHR portal use. **DV2:** Change in perception of ability to use portal	eHealth Literacy Scale (α=. 94)	Paired t-tests, McNemar's test, Stata 14.2	-Rates of portal signup and logon were over twice as high: 20% in the trial compared with 8% in usual care for initiating portal sign-up process (P<.001), and 21% in the trial compared with 9% in usual care for portal logins (P<.001). - Ability to use the Web site 63% to 78% (P< .03). increase in the eHealth	**LOE:** I **Strengths:** Highest level of evidence, focus on EHR use within vulnerable population **Weaknesses:** Small sample size, self-reported health literacy **Conclusions:** Online video-based portal training resulted in moderate use of the portal in subsequent month Suggests a need for more computer/digital literacy training and support. **Feasibility/Applicability to pt. population:** It is helpful to understand EHR portal use in vulnerable populations, directly applicable to pt population. It will be important to consider training/education in this population, along with barriers

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Affiliations: Zuckerberg San Francisco General Hospital			- Individuals without email addresses **Sample Demographics:** Mean age: 54 y.o. Nonwhite: 64% Female: 52% Limited English proficiency: 25%				literacy scale over time (14.4 to 16.2, P < .001).	that may persist after providing education.
Olayiwola et al. (2016). Electronic consultations to improve the primary care-specialty care interface for cardiology in the medically underserved: a cluster-randomized controlled trial. **Funding**: Funding received from the Connecticut	Health Belief Model	**Design:** Cluster-RCT **Purpose:** To test efficacy and effectiveness of electronic consults in reducing wait times and improving access to specialty care (cardiology) in an underserved population.	**Clinicians:** **N:** 36 **n:** 17 (EG) **n:** 19 (CG) **Attrition:** 3 Clinicians dropped out **Patients:** **N**:590 **n:** 229 (EG) **n:** 361 (CG) **Setting**: Community Health Center, Inc. (CHCI) in Connecticut. Patient-centered medical home.	**IV:** Type of referral (electronic consultation v. traditional) **DV:** Time to consultation with cardiologist **DV2:** Completion rate of referrals to cardiologists **DV3:** Number of face-to-face visits	Number of referrals recorded in the clinic	Cox proportional hazards model, Analysis of adverse events and emergency departmentv isits	e-consult=less time between referral placement and consult with cardiologist. Median time to consultation 5 days (e-consultation) v. 29 days (traditional referral) 28 e-consultations	**LOE:** I **Strengths:** Highest level of evidence-RCT. Relevant patient population with focus on electronic health record-related intervention. **Weaknesses:** Only focused on one specialty, results relied on chart review (which may have missing data), small sample size suggests low generalizability. **Conclusions:** e-consult increases access to specialty care for underserved population and possibly

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Health Foundation **Bias**: Funder did not participate in creation, conduct, or analysis of study. **Country**: U.S.			Provide care to underserved/uninsured. **Sample Demographics:** No significant differences between EG and CG. **Patients**: Mean age: 52 Female: 52% African American: 17% Caucasian: 41% Hispanic: 30% Uninsured: 14% **Clinician Type**: NP/PA: 35%(EG) v 26% (CG) Family Medicine: 47% (EG) v 68% (CG) Internal Medicine: 18%(EG) v 5%	**Electronic consultation-** Referral sent via EHR, communication via electronic messaging. **Traditional referral-** Referral sent via fax/or scan without electronic communication function.			not completed v. 62 traditional referalls not completed 66% of e-consult group did not require face-to-face meeting EG cardiologist consult (Exponentiated coefficient 1.45, ~1.5 times more likely, 95% confidence interval p=.019) Traditional consult group had higher emergency department visits.	reduces emergency department visits. **Feasibility/Applicability to pt. population:** Very applicable to patient population-25% uninsured and 35% Hispanic. Clinic was not a nonprofit institution, though was a patient-centered medical home serving vulnerable patient populations (minorities and uninsured). This type of institution is not necessarily low-resourced (unlike a NPO). This study did not discuss effectiveness of EHRs in free clinics, however did report efficacy of a major EHR function in an underserved population.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
			(CG) **Inclusion Criteria:** Primary care clinician (NP, MD, PA) caring for adult patients at CHCI primary care center, working 30 hours per week.					
Ryu et al. (2017). Impact of an electronic health record-integrated personal health record on patient participation in health care: Development and randomized controlled trial of MyHealthKeeper. **Funding**:	Health Belief Model Technology Acceptance Model	**Design:** RCT **Purpose:** Demonstrate development of an EHR-tethered PHR app named MyHealthKeeper and to study the effectiveness of a PHR data-driven clinical intervention.	**N:** 80 **CG:** 29 **EG:** 51 **Attrition**: 7 from EG, 5 from CG **Setting**: Seoul National University Bundang Hospital Outpatient clinic **Inclusion Criteria:**	**IV:** PHR use on mobile app **DV1:** Change in weight **DV2:** Change in BMI **DV3**: Change in triglycerides	PHR app	chi-square, paired t test, SPSS	-Weight (mean 1.4 kg, 95% CI 0.9-1.9; *P*<.001) -BMI (mean 0.4 kg/m^2, 95% CI 0.3-0.6; *P*=.000) -triglycerides (mean 2.6 mmol/L, 95% CI 17.6-75.8; *P*=.002)	**LOE:** I **Strengths:** Highest level of evidence, improve on conventional EHRs and incorporate functionality frequently used in a clinical setting **Weaknesses:** Short clinical trial period, small sample size, retrospectively registered (questionable validity?) **Conclusions:** Result of the trial showed that PHR use correlated with changes in body weight and clinical parameters.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
-Grant from the Korea Health Technology R&D Project through the Korea Health Industry Development Institute, -Grant from Ministry of Health & Welfare Republic of Korea (grant number: HI14C3213 - Funded by the Ministry of Trade, Industry & Energy (MOTIE, Korea). **Bias**: None reported **Country**: Korea **Affiliations**: Seoul National University			- Patients who provided prior consent to complying with self-management - Patients without acute diseases -Patients with a BMI of over 23 **Exclusion Criteria:** -Patients who would not be able to use a mobile app and a wearable device -Pregnant patients **Sample Demographics:** Male: 68% Married: 75% College deg: 74%					**Feasibility/Applicability to pt. population:** No directly applicable to patient population, as majority are college grads in this study. Still, though, interesting to note that a smartphone app was successfully connected to the EHR and improved outcomes. Patients at the free clinic have access to a smartphone, suggesting a system like this is a possibility. This could also potentially improve access to care for these patients.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Bundang Hospital								
Staziaki et al. (2016). Medical registry data collection efficiency: A crossover study comparing web-based electronic data capture and a standard spreadsheet. **Funding**: No report **Bias**: No report **Country**: U.S. **Affiliations**: -Massachusetts General Hospital, Department of Radiology -Harvard Medical School,	Technology Acceptance Model	**Design:** Crossover **Purpose:** assess the efficiency of an EDC solution compared with a standard spreadsheet regarding time to collect data and data accuracy.	**N:** 6710 data entries **CG:** 3,355 **EG:** 3,355 **Setting**: Harvard Medical School associated Emergency Department coronary Computed Tomography Angiography (CTA) registry **Inclusion Criteria:** Patients of ED CTA registry	**IV1:** EDC **IV2:** Computer spreadsheet data collection **DV1:** Time to collect data **DV2:** Data accuracy **EDC:** Use of electronic forms to collect data **Spreadsheet Data Collection:** Entering data into spreadsheets on Microsoft Excel	Research Electronic Data Capture (REDCap) Microsoft Excel	Paired t-test	*Mean data collection time*: EDC in minutes was 6.2±2.3, while using a spreadsheet was 8.0±2.0 (P <.001) *Data accuracy:* No significant relationship	**LOE:** I **Strengths:** High level of evidence, controlled exploration of EDC v excel spreadsheet. **Weaknesses:** Small dataset. Low generalizability, results specific to type of clinical setting. **Conclusions:** EDC saves more than 3 workdays of data collection compared to excel data entry. **Feasibility/Applicability to pt. population:** While the population of focus was not relevant in this study, the comparison of data collection processes is extremely relevant to the PICOT question. The free clinic of focus currently records data using spreadsheets and is very hesitant to incorporate an EHR into practice—The REDCap is "an EDC tool that is HIPAA-

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Boston, MA, United States								compliant,… noncommercial, and secure. It has an intuitive user-friendly interface for data entry, allowing researchers to create secure online forms with very large numbers and several types of variables and does not require any technical skillset to implement" (Staziaki et al., 2016, p. 5). A tool like the REDCap may be a solution for the free clinic, as it would be a way to "electronically monitor" data without utilizing an EHR. Also, it may be user friendly for volunteers.
Umar et al. (2019). Encouraging the collection of performance data in nonprofit organizations: The importance of organizational support for learning.	Organizational Support Theory Adaptive Learning Behavior	**Design:** Survey **Purpose:** Examine the relationship between support for employee learning/development activities and performance data collection in New York	**N:** 154 No EG or CG-mixed method research-survey w/ quantitative analysis 26 of 72 NPOs (affiliated with UWGCR) agreed to participate in	**IV:** organizational support for learning **DV1:** Performance Data Collection **DV2:** Organizational Goal Clarity **DV3:**	**1.**Organizational Support for Learning Survey (6 pt. Likert Scale)-(α=0.86), **2.**Organizational Goal Clarity (6 pt. Likert Scale)-(α=0.73)	PCA, Bartlett method, Varimax rotation, compatibility principle, OLS regression analysis, ICC coefficients	Higher support for learning has a positive relationship with performance data collection, though degree of relationship depends on	**LOE:** III **Strengths:** Relevant exploration of nonprofit organizations and data collection, encouraging support for learning/goal setting for successful performance data collection. **Weaknesses:** Survey study-increased likelihood for response bias. Small sample

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Funding: Authors received no financial support for the research, authorship, &/or publication of this article. **Bias**: Affiliation with the United Way of the Greater Capital Region (UWGCR) **Country**: U.S.		nonprofit organizations	survey study- 36% response rate. 170 Questionnaires sent to 26 NPOs, 154 returned (91% response rate) **Setting**: 26 NPOs in New York **Sample Demographics:** Male- 27% Female-73% White-79% Black- 12% Hispanic-5% Other-4% Mean Age- 43 y.o. Clerical/Support staff- 14% Professional/technical workers- 28% Mid-level managers- 37% Senior Executive- 21% Mean Length of	Evaluation Capacity **DV4:** Work Demands **Organizational Support-** the degree to which individuals believe their efforts, contributions, and well-being are valued by their employer.	**3.** Evaluation Capacity (4 pt. Likert Scale)- (α=0.89) **4.** Employee Work Demands (6 pt. Likert Scale) (α = 0.82) **1.** Performance Data Collection Survey (5 pt. FQ Scale)- (α = 0.81)	ICC1(organizational support for learning)- 0.73 ICC2-0.82 ICC3-0.89 ICC4-0.86 ICC1 (performance data collection)- 0.81	resources and clarity of goals. Goal clarity and performance data collection:(r= 0.47, p<0.05) Support for learning and performance data collection: (r=0.42, p<0.05) Higher evaluation capacity more likely to collect performance data (r=0.31) though not statistically significant (p>0.10) No relationship between work	size, non-randomized, limited to NPOs of UWGCR Foundation in New York- low generalizability. 90% confidence intervals used instead of 95% confidence intervals due to small sample size (low validity). **Conclusions:** Performance data collection is influenced by support for learning and clear goal setting in 26 NPOs affiliated with UWGCR in New York. Further studies are needed to produce more useful and generalizable results for NPOs. **Feasibility/Applicability to pt. population:** While this study examines performance data collection in NPOs, it is not specifically focused on healthcare related NPOs. The suggested relationship between support for learning and data collection is relevant, however not highly valid or generalizable; mildly helpful in guiding exploration of PICOT question.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
			Employment- 7 y.o.				demands and performance data collection (r=-0.07, p>0.10)	
Young et al. (2018). A time-motion study of primary care physicians' work in the electronic health record era. **Funding**: -Texas Academy of Family Physicians Foundation -Grant received from the National Center for Advancing Translational Sciences and National Institutes of Health **Bias**:	Technology Acceptance Model Actor-Network Theory (ANT)	**Design:** Cross-Sectional, Observational **Purpose:** Update measures of the time primary care physicians require to care for ambulatory patients in clinics, specifically measuring how much time was spent working in the EHR and to determine the other patient, physician, and visit characteristics associated with these time measures.	**N:** 982 (clinic visits-- 982 patients and 982 physicians) **Setting**: clinics of 10 family medicine residency programs that are members of the RRNeT **Sample Demographics:** *Patients*- 20% >65 y.o. 55% Hispanic 61% Female 41% HTN 28% DM 28% HLD *Providers*- 49% Male average years of	**IV1:** Patient Factors **IV2:** Physician/ Medical Decision-making Factors **IV3:** Clinic/System Factors **DV:** Hours spent using EHR	National Ambulatory Medical Care Survey (NAMCS) Specificity: .90-.99 Sensitivity: .12-.84	SPSS, T-Tests, ANOVA	<u>Patient Factors</u>: New patient- P = .004 Serious mental illness- P = .014 Patient has different language/culture than physician- P=.034 <u>Physician/Medical Decision-Making Factors:</u> Physician is a resident and met with faculty- P<.001	**LOE:** III **Strengths:** Good exploration of time providers spend using EHR in primary care. Data collection process straightforward. **Weaknesses:** Because this was observational in nature, Hawthorne effect should be considered. Also, one of the authors is an owner of a company that will be creating an EHR in the future- could be conflict of interest. **Conclusions:** Increased physician time spent on EHR since last completed study (29% of visit compared to 54%). Some patient, physician, and visit characteristics were found to affect time spent on the EHR.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Author Young is the sole owner of Sentire, LLC, which is developing a new documentation, coding, and billing system for primary care. **Country**: U.S. Affiliations: -Residency Research Network of Texas (RRNeT)			experience: 7.1 **Inclusion Criteria:** Family med physician at RRNeT clinic				Number of labs ordered- P <.001 Physician is Hispanic/Latino- P .008 Physician is a 2nd year resident- P=.012 Number of new medications prescribed- P-.027 <u>Clinic/system factors:</u> Patient is cared for by 1 or more providers- P<.001 Mean (SD): 2.9 (3.8) minutes working in the chart prior to entering the room -16.5 (9.2) minutes of	**Feasibility/Applicability to pt. population:** Though this study was not completed in a free clinic, the patient population was 55% Hispanic. It is important to discuss time spent using the EHR and factors that my increase usage/decrease face time with patients; some of the physicians in the clinic of focus are concerned with adopting an EHR because it will take "time away from their patients". This study seems to suggest that certain factors may increase EHR time, however would be more applicable if carried out in a free clinic or NPO.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
							face-to-face time not working in the EHR -2.0 (2.1) minutes working in the EHR in the room -7.5 (7.5) minutes of non-face time (mostly EHR time), -6.9 minutes (7.6) of EHR work outside of normal clinic operational hours	
Zeleke et al. (2019). Evaluation of electronic and paper-pen data capturing tools for data quality in a public health survey in a health and demographic surveillance site,	Health Behavior Theory	**Design:** RCT **Purpose:** Compare data quality parameters in the data collected using mobile electronic and standard paper-	**N:** 2497 respondents' data **n:** 1246 PPDC **n:** 1251 EDC **Attrition**: 5 EDC removed **CG:** 1246 **EG:** 1251	**IV1:** PPDC **IV2:** EDC **DV:** Error Rate	System Usability Scale (α=0.85)	SPSS, R, ordinal logistics mixed regression model	*PPDC:* 41.9% had 1 or more errors P=.003 EDC: 30.9% had 1 or more errors P=.003	**LOE:** I **Strengths:** High level of evidence, controlled exploration of EDC v PPDC, relevant setting (under resourced) **Weaknesses:** Interviewers were used, increased risk for interviewer bias.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Analysis	Findings	Decision for Use
Ethiopia: Randomized controlled crossover health care information technology evaluation. **Funding**: -University of Gondar -Deutscher Akademischer Austauschdienst **Bias**: Noe reported **Country**: Ethiopia. **Affiliations**: -University of Oldenburg -University of Gondar		based data capture tools.	**Setting**: The Dabat Research Center in Northwest Ethiopia. Run by the University of Gondar's College of Medicine and Health Sciences. **Inclusion Criteria:** 6 towns were selected for specific research based on accessibility of internet coverage and electric power supply in the town or nearby towns.	**EDC:** Use of electronic forms to collect data **PPDC**: Use of pen and paper to collect data				**Conclusions:** EDC outperformed pen-and-paper systems across each data quality parameter for DHS in Ethiopia. Data collected using tablet computers were more likely to have fewer errors compared with the conventional paper questionnaire. **Feasibility/Applicability to pt. population:** Great exploration of open source technology (OS) in an under resourced setting! Promising findings in an RCT- this heavily supports need for intervention in the free clinic. EDC will produce fewer errors and ultimately better outcomes.

Key: ANOVA- Analysis of Variance test; **BMI**: body mass index; **BPA**- Best Practice Advisory; **CG**- control group; **CHC**- Community health center; **CI** – confidence interval; **CSS** – cross-sectional study; **DV**-dependent variable; **EDC**- electronic data capture; **EG** – experimental group; **EDC** -Electronic Data Capture; **EHR**- electronic health record; **hr**- hour; **ICC-** interclass correlation; **IV**- independent variable; **MD** – medical doctor; **mn**- months; **N**-number of studies (if SR) or participants in study; **n**- number of participants (if SR) or number of participants in subset; **NP**: nurse practitioner; **NPO**- Nonprofit Organization; **OLS**- ordinary least squares; **PA**: physician's assistant**; PCA-** principal components analysis; **PHR**-Personal Health Record; **PPDC**- Pen and paper data capture; **Pt.**- Point; **RCT** – randomized control trial; **SD –** standard deviation; **SLC** – student-led clinic; **SR-** systematic review;; **wk**- weeks; **y.o.** – years-old; α - Cronbach's alpha value

Table A2

Synthesis Table

Study Overview										
	1	2	3	4	**5**	6	7	8	9	10
Author	Frogner et al.	Khan et al.	Konerman et al.	Lyles et al.	Olayiwola et al.	Ryu et al.	Staziaki et al.	Umar et al.	Young et al.	Zeleke et al.
Year	2017	2019	2017	2019	2016	2017	2016	2019	2018	2019
Design/Level of Evidence	LCS/II	RCT/I	CCT/II	RCT/I	RCT/1	RCT/I	Crossover/I	Survey/III	Cross-Sectional/III	RCT/I
Sample Size	722	78	105,492	93	590	80	6,710	154	982	2,497
Country	U.S.	Canada	U.S.	U.S.	U.S.	Korea	U.S.	U.S.	U.S.	Ethiopia
Study Characteristics										
Demographics										
Age	66% 19-64	Mean age: 52	57% 50-70	Mean age: 54	Mean age: 52	Mean age: 40	N/A	Mean age: 43	20% > 65	N/A
Gender	58% Female		26% Female	52% Female	52% Female	31% Female	N/A	73% female	61% Female	N/A
African American			34%	29%	17%		N/A			N/A
Hispanic	25%			12%	30%		N/A		55%	N/A
Caucasian	54%	92%	27%	36%	41%		N/A	79%		N/A
% Uninsured	43%		0		14%		N/A			N/A
Setting										
CHC	X				X					
RI		X					X			X
PC			X	X		X			X	

CCT- case control trial; **CDM**- chronic disease management; **CHC**- community health clinic; **EDC**- electronic data capture; **EVPD**-electronic versus paper data; **IPC**- interprofessional collaboration; **IT**- information technology; **LCS**- longitudinal cohort study; **NPO**- nonprofit organization; **OSL**- organizational support for learning; **PC**- primary care; **PDC**- paper data collection; **PDCP**- provider data collection preference; **PPO**- positive patient outcomes; **RI**- research institute; **TSDC**- time spent on data collection; **UPP**- underserved patient population; **URS**- under resourced setting; ↑ ↓- inversely related; ↑- positive correlation; ↓- negative correlation; *- clinically significant; ≠- not clinically significant

NPO								X		
Focus										
EHR	X		X	X	X	X			X	
EDC		X					X			X
EVPD	X	X					X			X
IPC	X							X		
CDM			X		X	X			X	
Barriers to Care			X	X	X	X				
UPP	X			X	X					
URS	X				X					X
PDCP	X								X	
Independent Variables										
EHR Use	X		X	X	X	X				
PDC		X					X			X
EDC		X					X	□		X
IT Education				X						
OSL								X		
Patient Factors						□			X	
Findings										
Dependent Variables										
Data Quality										

CCT- case control trial; **CDM**- chronic disease management; **CHC**- community health clinic; **EDC**- electronic data capture; **EVPD**-electronic versus paper data; **IPC-** interprofessional collaboration; **IT**- information technology; **LCS**- longitudinal cohort study; **NPO**- nonprofit organization; **OSL**- organizational support for learning; **PC**- primary care; **PDC**- paper data collection; **PDCP**- provider data collection preference; **PPO**- positive patient outcomes; **RI**- research institute; **TSDC**- time spent on data collection; **UPP**- underserved patient population; **URS**- under resourced setting; ↑ ↓- inversely related; ↑- positive correlation; ↓- negative correlation; *- clinically significant; ≠- not clinically significant

		↓ PDC * ↑ EDC *	↑ *				≠	↑ *		↓ PDC * ↑ EDC *
TSDC							↑ PDC * ↑ ↓ EDC *		↑ *	↑ PDC * ↑ ↓ EDC *
Patient Satisfaction		≠								
Patient Adherence		≠								
Staffing Mix-NP/PA	↑ ↓ *					□		□	□	
Staffing Mix-RN	↑ ↓ *									
Staffing Mix-Other	↑ *									
Quality of Care			↑ *		↑ *					
Health Literacy				↑ *						
PPO						↑ *				

CCT- case control trial; **CDM**- chronic disease management; **CHC**- community health clinic; **EDC**- electronic data capture; **EVPD**-electronic versus paper data; **IPC-** interprofessional collaboration; **IT**- information technology; **LCS**- longitudinal cohort study; **NPO**- nonprofit organization; **OSL**- organizational support for learning; **PC**- primary care; **PDC**- paper data collection; **PDCP**- provider data collection preference; **PPO**- positive patient outcomes; **RI**- research institute; **TSDC**- time spent on data collection; **UPP**- underserved patient population; **URS**- under resourced setting; ↑ ↓- inversely related; ↑- positive correlation; ↓- negative correlation; *- clinically significant; ≠- not clinically significant

Appendix B

Models and Frameworks

Figure 1

The Unified Theory of Acceptance and Use of Technology

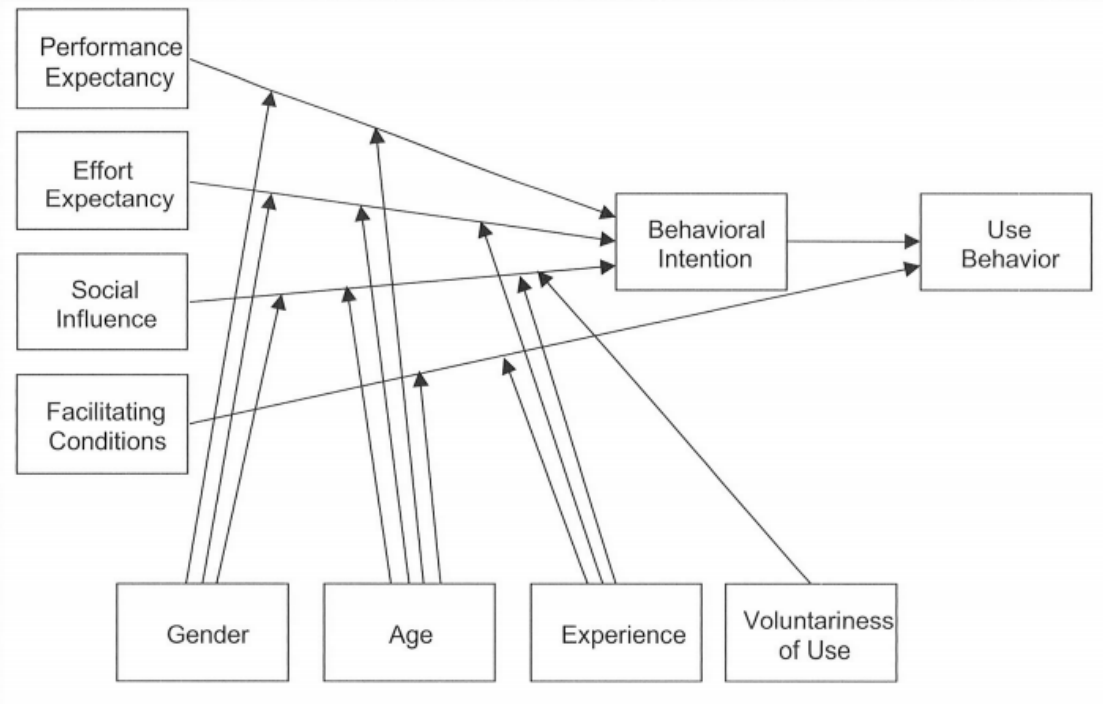
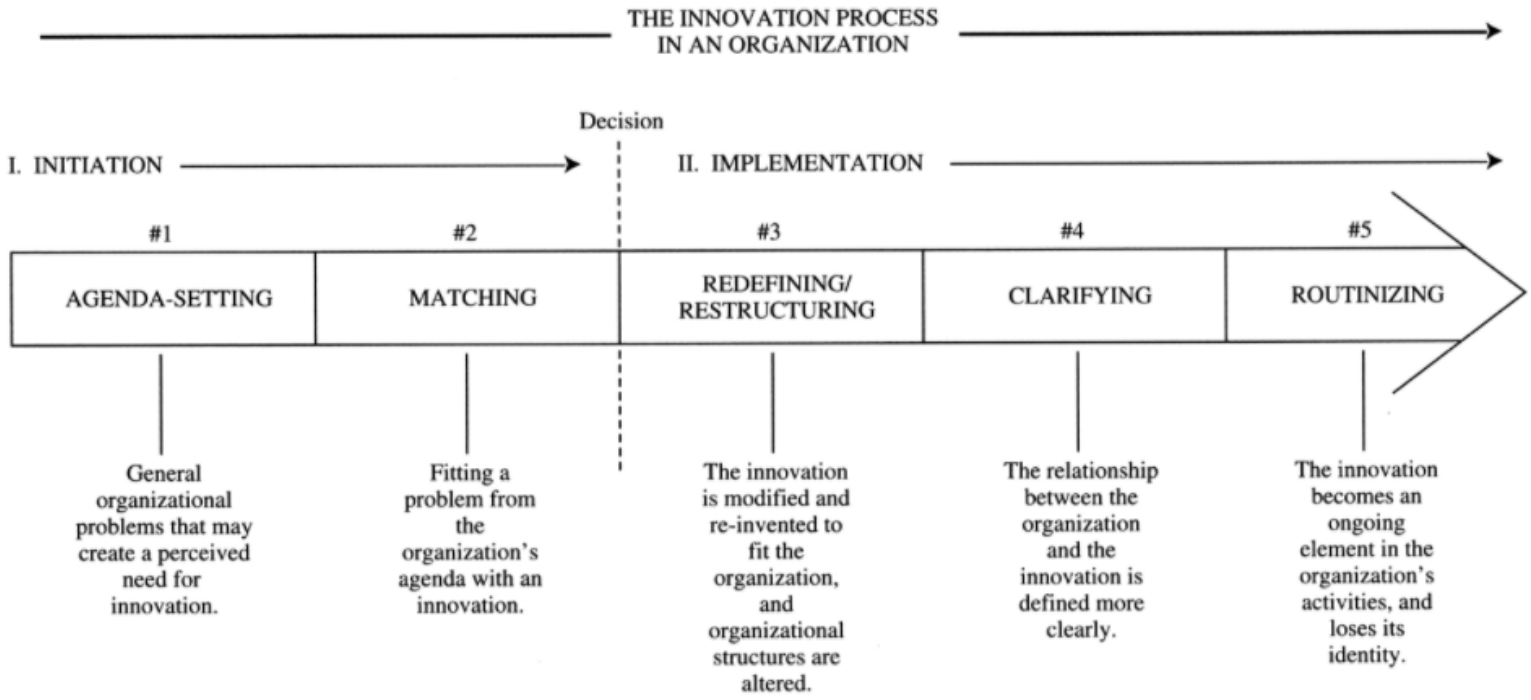


Figure 2

Diffusion of Innovations Model



Appendix C

Provider Demographics

Table 1

Frequency Table

Variable	*n*	%
Gender		
F	7	50.00
M	7	50.00
Missing	0	0.00
Provider_Type		
PA	1	7.14
MD	9	64.29
FNP	4	28.57
Missing	0	0.00
Race		
Caucasian	12	85.71
Other	1	7.14
Hispanic	1	7.14
Missing	0	0.00

Note. Due to rounding errors, percentages may not equal 100%.

Variable	*M*	*SD*	*n*	SE_M	Min	Max	Skewness	Kurtosis
Age	58.79	14.36	14	3.84	35.00	87.00	0.03	-0.46

Appendix D

Modified Information Technology in Primary Care Practice Survey

Please tell us a bit about yourself so we can better analyze the collected data. Please remember that this will be kept in strict confidence.

Are you:

- ○ Male
- ○ Female

What is your year of birth?

(XXXX)

If you are a prescriber, what year did you graduate from medical/professional school?

(XXXX)

Select your title:

- ○ MD
- ○ DO
- ○ PA
- ○ NP
- ○ Other

Information Technology in Primary Care Practice

(c. 1999 David R. Dixon)

a. Please indicate how often you personally use the following information technologies at Clinica Amistad.

b. Please indicate how interested you are in using each of the items at Clinica Amistad.

1a. CURRENT USAGE: Practice Management (electronic scheduling) *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

1b. INTEREST IN FUTURE USE: Practice Management (electronic scheduling) *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

2a. CURRENT USAGE: Email *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

2b. INTEREST IN FUTURE USE: Email *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

3a. CURRENT USAGE: Electronic Patient Records *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

3b. INTEREST IN FUTURE USE: Electronic Patient Records *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

4a. CURRENT USAGE: Internet *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

4b. INTEREST IN FUTURE USE: Internet *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

5a. CURRENT USAGE: Decision Support (guidelines, protocols) *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

5b. INTEREST IN FUTURE USE: Decision Support (guidelines, protocols) *

	1	2	3	4	5	
Never	○	○	○	○	○	Frequently

Part II

Please indicate if you agree or disagree with the following statements (considering your practice at Clínica Amistad):

1. I expect to use computers in my medical practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

2. I am interested in using computers in my practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

3. Physicians will be able to work more quickly by using computers. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

4. Computers will allow physicians to practice more effectively. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

5. Practicing medicine will be made easier with computers. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

6. Overall physicians will be able to reach the correct diagnosis more frequently by using computers. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

7. My colleagues accept computer use in medical practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

8. Using a computer in practice would conflict with guidelines concerning acceptable medical practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

9. It is a personal priority to use computers in my practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

10. It is a priority of my clinic to use computers in medical practices. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

11. I expect to see a favorable change in the way my practice operates with computer use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

12. It is easy to learn new computer applications. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

13. Overall, computers are easy to use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

14. It will be easy to change the way my practice operates to accommodate computer use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

15. I will be able to change patient outcomes with computer use. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

16. My patients are comfortable with computer use in medical practice. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

17. Help will be easily accessible if I have problems with technology. *

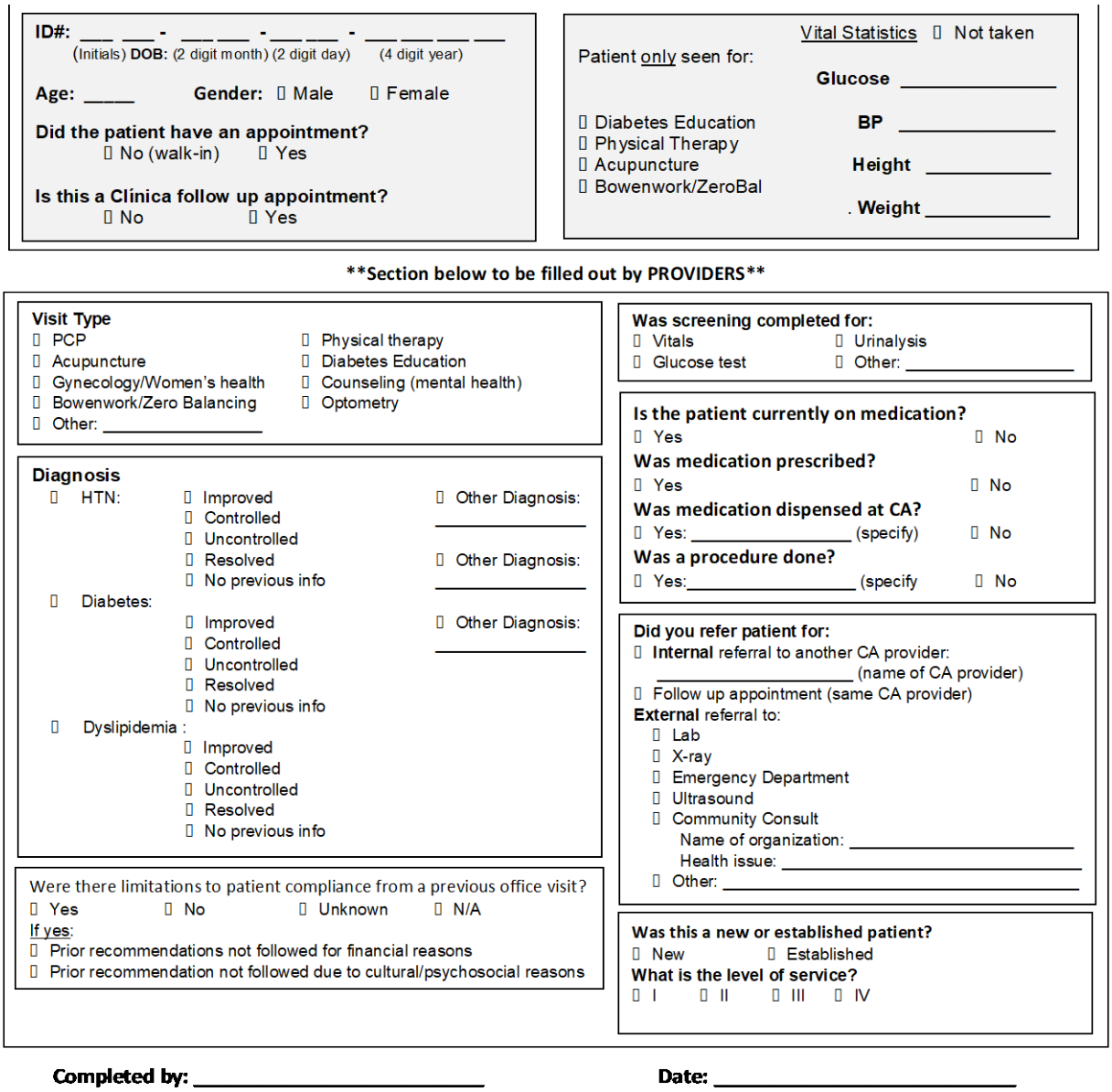
	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Appendix E

Appointment Summary Forms

Figure 1

Paper Appointment Summary Form



ID#: ___ ___ - ___ ___ - ___ ___ - ___ ___ ___ ___
(Initials) DOB: (2 digit month) (2 digit day) (4 digit year)

Age: _____ Gender: ☐ Male ☐ Female

Did the patient have an appointment?
☐ No (walk-in) ☐ Yes

Is this a Clínica follow up appointment?
☐ No ☐ Yes

Patient only seen for:
☐ Diabetes Education
☐ Physical Therapy
☐ Acupuncture
☐ Bowenwork/ZeroBal

Vital Statistics ☐ Not taken
Glucose _____
BP _____
Height _____
Weight _____

Section below to be filled out by PROVIDERS

Visit Type
☐ PCP
☐ Acupuncture
☐ Gynecology/Women's health
☐ Bowenwork/Zero Balancing
☐ Other: _____
☐ Physical therapy
☐ Diabetes Education
☐ Counseling (mental health)
☐ Optometry

Diagnosis
☐ HTN: ☐ Improved ☐ Controlled ☐ Uncontrolled ☐ Resolved ☐ No previous info
☐ Other Diagnosis: _____
☐ Other Diagnosis: _____
☐ Diabetes: ☐ Improved ☐ Controlled ☐ Uncontrolled ☐ Resolved ☐ No previous info
☐ Other Diagnosis: _____
☐ Dyslipidemia : ☐ Improved ☐ Controlled ☐ Uncontrolled ☐ Resolved ☐ No previous info

Were there limitations to patient compliance from a previous office visit?
☐ Yes ☐ No ☐ Unknown ☐ N/A
If yes:
☐ Prior recommendations not followed for financial reasons
☐ Prior recommendation not followed due to cultural/psychosocial reasons

Was screening completed for:
☐ Vitals ☐ Urinalysis
☐ Glucose test ☐ Other: _____

Is the patient currently on medication?
☐ Yes ☐ No
Was medication prescribed?
☐ Yes ☐ No
Was medication dispensed at CA?
☐ Yes: _____ (specify) ☐ No
Was a procedure done?
☐ Yes:_____ (specify ☐ No

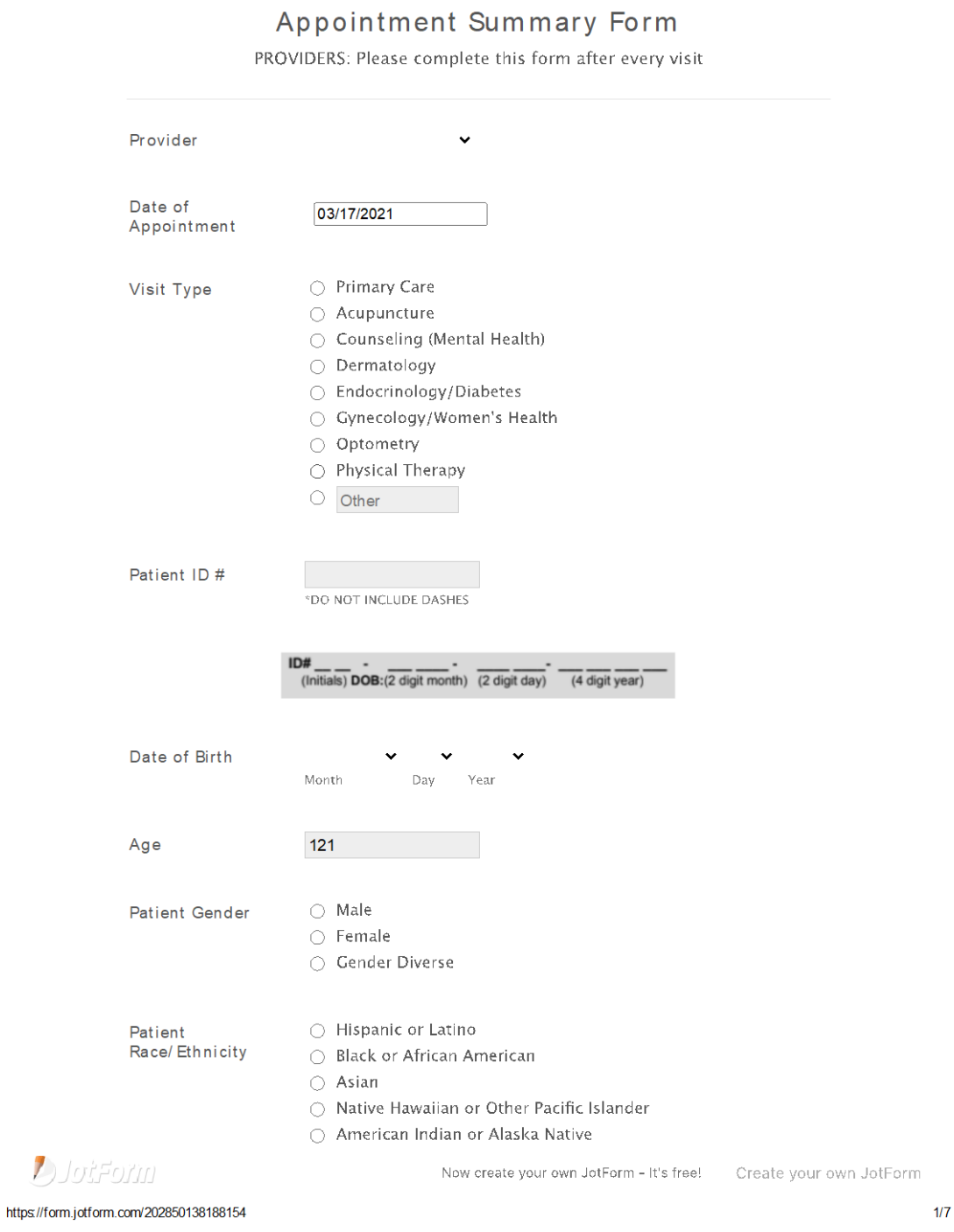
Did you refer patient for:
☐ **Internal** referral to another CA provider:
_____ (name of CA provider)
☐ Follow up appointment (same CA provider)
External referral to:
☐ Lab
☐ X-ray
☐ Emergency Department
☐ Ultrasound
☐ Community Consult
Name of organization: _____
Health issue: _____
☐ Other: _____

Was this a new or established patient?
☐ New ☐ Established
What is the level of service?
☐ I ☐ II ☐ III ☐ IV

Completed by: _____ Date: _____

Figure 2

Electronic Form



Appointment Summary Form

PROVIDERS: Please complete this form after every visit

Provider

Date of Appointment 03/17/2021

Visit Type
- Primary Care
- Acupuncture
- Counseling (Mental Health)
- Dermatology
- Endocrinology/Diabetes
- Gynecology/Women's Health
- Optometry
- Physical Therapy
- Other

Patient ID #

*DO NOT INCLUDE DASHES

ID# __ __ - ___ ___ - ___ ___ - ___ ___ ___ ___
(Initials) DOB:(2 digit month) (2 digit day) (4 digit year)

Date of Birth
Month Day Year

Age 121

Patient Gender
- Male
- Female
- Gender Diverse

Patient Race/ Ethnicity
- Hispanic or Latino
- Black or African American
- Asian
- Native Hawaiian or Other Pacific Islander
- American Indian or Alaska Native

Type of Appointment
- ○ Walk-in
- ○ Scheduled

Blood glucose: ex: 23

Blood Pressure:

Limitations to patient compliance due to:
- ☐ Financial barriers
- ☐ Cultural barriers
- ☐ Psychosocial barriers
- ☐ No limitations to compliance

Select primary diagnosis for this visit:

If OTHER selected for primary diagnosis, list here:

If secondary diagnosis, list here:

If tertiary diagnosis, list here:

Click here ONLY if patient has HYPERTENSION

HYPERTENSION

Is the hypertension well controlled
- ○ Yes
- ○ No

Blood pressure today is:

- ○ less than 120/ less than 80
- ○ (120–130) / (< 80)
- ○ (131–139) / (80–89)
- ○ (140–179) / (90–119)
- ○ (180 or greater) / (120 or greater)
- ○ Other

If the patient is diagnosed with hypertension and BP is >140/90- what was the intervention?

- ☐ Non-pharmacological interventions, continue to monitor
- ☐ Initiated pharmacological treatment
- ☐ Increased dose of current pharmacological treatment
- ☐ Administered medication in the clinic
- ☐ Continue current plan of care, no new interventions at this time
- ☐ Other

Click here ONLY if patient has DIABETES MELLITUS TYPE II

DIABETES MELLITUS TYPE II

What was the patient's blood sugar today?

- ○ <70
- ○ 70–100
- ○ 101–200
- ○ 201–300
- ○ 301–400
- ○ >400

Has the patient had an A1C completed in the past 3 months?

- ○ Yes
- ○ No
- ○ Unknown

What is most recent A1C?

- ○ < 7%
- ○ 7–9%
- ○ 10–12%
- ○ >12 %
- ○ Unknown

Is DMII well controlled (A1C <

- ○ Yes
- ○ No

If DMII is NOT well controlled, or A1C is unknown, what was/ were the intervention(s)? (select all that apply):

- [ ] Lifestyle Modifications
- [ ] Initiated oral pharmacological treatment
- [ ] Initiated treatment with insulin
- [ ] Gave insulin in the clinic
- [ ] Foot exam performed/Foot care education provided
- [ ] Encouraged daily use of gluccometer
- [ ] Referred to diabetic specialist for further evaluation/education
- [ ] Referred to Optometry/Ophthalmology
- [ ] A1C ordered
- [ ] BMP ordered
- [ ] Lipid Panel ordered
- [ ] Continue current plan of care, no new interventions at this time
- [ ] Other

Does the resident have pre-diabetes? (A1c 5.7-6.4)?

- ○ Yes
- ○ No
- ○ Unknown

Associated Complications: (Select all that apply)

- [ ] Retinopathy
- [ ] Nephropathy
- [ ] Nueropathy

Click here ONLY if patient has DYSLIPIDEMIA

DYSLIPIDEMIA

Has a lipid panel been collected in the past year?

- ○ Yes
- ○ No
- ○ Unknown

Is dyslipidemia well controlled (LDL 100 or less & TGs 200 or less)?

- ○ Yes
- ○ No
- ○ Unknown

If dyslipidemia is NOT well controlled, what interventions

- [ ] Lifestyle modifications (diet/exercise, smoking cessation, etc)
- [ ] Blood pressure management

today? (select all that apply):

- [ ] Lipid panel ordered
- [ ] Continue current plan of care, no new interventions at this time
- [ ] Other

Labs/ Diagnostics/ Referral

Labs/ Diagnostics Ordered (select all that apply):

- [ ] A1C
- [ ] BMP
- [ ] CMP
- [ ] CBC
- [ ] CBC w/ Diff
- [ ] Lipid Panel
- [ ] Urinalysis
- [ ] Ultrasound
- [ ] X-ray
- [ ] Electrocardiogram (EKG)
- [ ] N/A
- [ ] Other

Follow-up appointment scheduled? *

- ( ) Yes
- ( ) No

Referral? *

- ( ) Other Provider at Clínica Amistad
- ( ) Emergency Department
- ( ) Community Consult
- ( ) None

If referred to another provider at CLÍNICA AMISTAD, please provide name and specialty here:

If referred to a

please provide reason for referral and name of organization here:

Level of Care

Level of Service *

Please select

Please select

See charts below to determine level of service:

NEW PATIENT VISIT

CPT Code	99201	99202	99203	99204
Required Key Components *(3/3 required)				
History and Exam				
• *Problem-Focused*	X			
• *Expanded Problem-Focused*		X		
• *Detailed*			X	
• *Comprehensive*				X
Medical Decision Making (complexity)				
• *Straightforward*	X	X		
• *Low*			X	
• *Moderate*				X
• *High*				
Contributory Factors				
Presenting Problem (Severity)				
• *Self-Limited or Minor*	X			
• *Low to Moderate*		X		
• *Moderate*			X	
• *Moderate to High*				X
Counseling				
Coordination of Care				
Typical Face-to-Face Time (Minutes)	10	20	30	45

ESTABLISHED PATIENT VISIT

CPT Code	99211	99212	99213	99214
Required Key Components **(2/3 required)				
History and Exam				
• *Problem-Focused*	N/A	X		
• *Expanded Problem-Focused*			X	
• *Detailed*				X
• *Comprehensive*				
Medical Decision Making (complexity)				
• *Straightforward*	N/A	X		
• *Low*			X	
• *Moderate*				X
• *High*				
Contributory Factors				
Presenting Problem (Severity)				
• *Minimal*	X			
• *Self-Limited or Minor*		X		
• *Low to Moderate*			X	
• *Moderate to High*				X

Any additional notes?

Submit

Appendix F

Results

Figure 1

Completeness Score Table

	E		P				
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
Total_Data_Quality_Score	9.66	0.51	8.51	1.33	10.77	< .001	1.14

Note. N = 306. Degrees of Freedom for the *t*-statistic = 276.67. *d* represents Cohen's *d*.

Figure 2

Completeness Score Graph

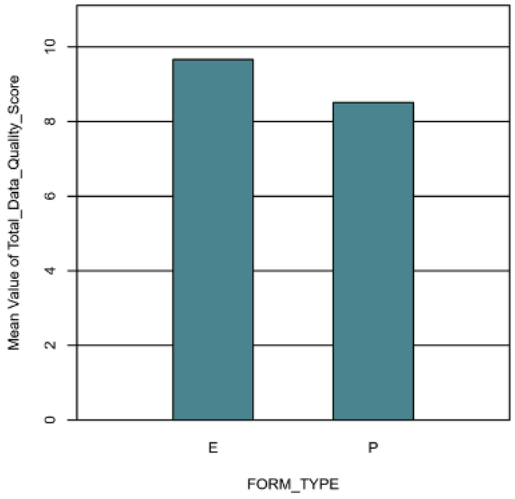


Figure 3

Provider Age V. IT Awareness Score

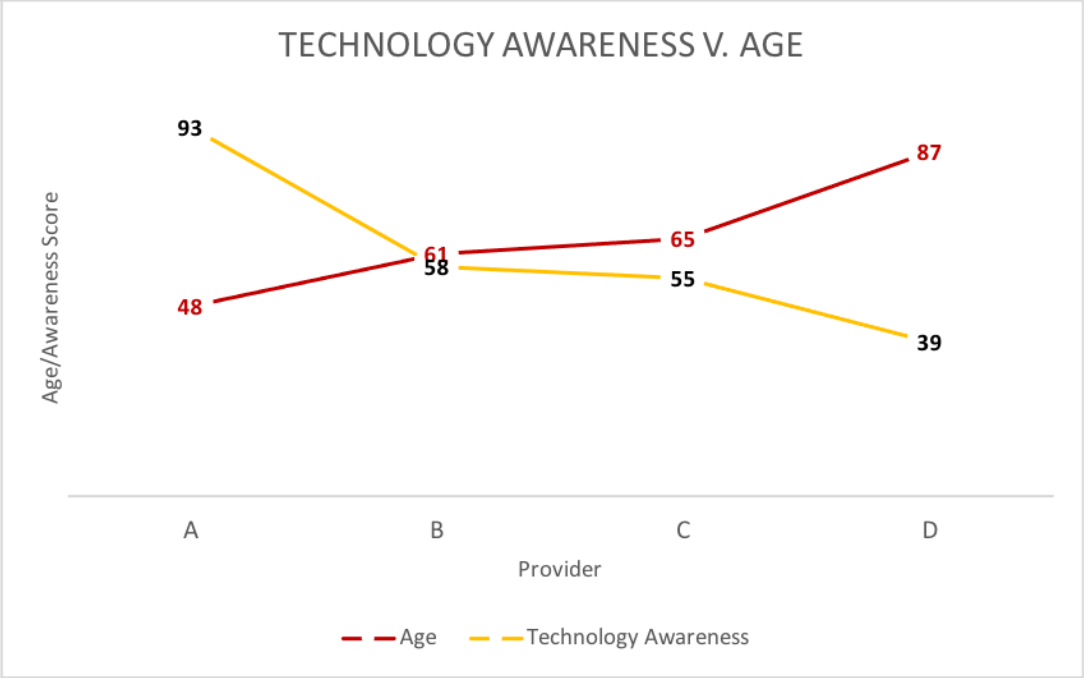


Figure 4

Electronic Form Utilization

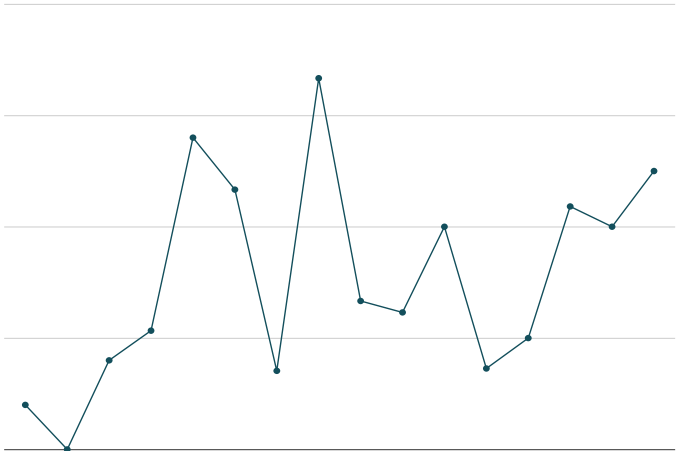


Figure 5

LOS Entries- Paper form V. Electronic Form