Introduction

Federally Qualified Health Centers (FQHCs) were created to address shortcomings of the American health system by providing accessible quality patient care to medically underserved areas. Community Health Centers (CHCs) have implemented collaborative community public health measures to attack common problems at their root and cost-effective measures to decrease overhead, leading to marked improvements in healthcare systems. These processes are admirable, ongoing, but could benefit from the inclusion of the exploration of telehealth's role in improving access to care not currently provided by FQHCs.

Dermatology serves as an fantastic probe for telemedicine due to the highly visual nature of dermatologic diagnostics coupled with the tremendous patient load incurred from skin issues at community health centers. A 2001 study showed that approximately one-third of all primary care visits were for dermatologic issues (1). Furthermore, general practitioners often misdiagnosed patients with dermatology problems (1). These misdiagnoses resulted in repeat visits, delayed care, missed time from work, extra travel time, and increased cost of care for the patient and the health care system. Referrals and consults incur extra costs, excessive (often prohibitive) travel, and increased need for administration, which adds to already disproportionate operational costs. The benefit of teledermatology is the potential to address many of these inefficiencies with technology already present at CHCs.

Background

[redacted] is a Federally Qualified Community Health Center (FQHC) with a superb track record of providing effective and affordable care by bringing the needed elements of health care together for the community. [redacted] PhD, President and CEO of [redacted],

founded [redacted] as a social work project and realized the drastic need for care. Innovation, collaboration, and hard work have led to 21 locations being opened over 40 years. Furthermore, they have dentistry, optometry, and podiatry. The needs of the community are noticed and [redacted] executive team works effectively with local organization and colleges to meet their needs. One traditionally difficult need to meet is that of specialty care.

Reliable access to specialty care by patients seen at FQHCs has been a problem for as long as they have existed. Problems for the patient include money, transportation, and time. Problems for the facilities include contracts with local hospitals, specialists, and government funds. These needs can be met with innovative strategies founded in the early 20th century if coupled with current everyday digital devices.

Telemedicine is nothing new. A Dutch physician performed the first use of telemedicine in 1905 when electrocardiograms were carried by horseback. In the 1920's, the first radiologic consults took place from ships for people who were on secluded islands. In the 1950's the first radiographic images were transmitted in the United States. Today all sorts of telehealth services are rendered. More recent uses have been for telepsychology, teleopthalmology, and teledermatology.

The standards used for success have been those from which [redacted] could greatly benefit. Patient satisfactions, provider satisfactions (2,3), wait time for appointments, and cost of care have all been improved by the implementation of the aforementioned telehealth applications (2). Furthermore, telehealth may provide an answer to the looming loss of [redacted].

[redacted] is a pivotal healthcare program, set up by the [redacted] County Health District (dba University Health System) to provide health care to indigent [redacted] County residents. Those who can document county residence, financial need, and a source of monthly income are eligible

to enroll; U.S. citizenship is not required. Members receive ambulatory and hospital care, preventive services, and formulary medications. The assistance allows patients to visit their local community health center and grants them the financial flexibility to access specialty care. If [redacted] can find ways to improve efficiency they may be able to entice [redacted] to stay. Telehealth has the ability to do just that.

So why are telehealth services not ubiquitous amongst healthcare systems? The reasons are numerous but the main one is, like most shortcomings for competent entities, a lack of knowledge. The main purpose of this study is to begin a necessary conversation about telehealth's applicability to community health centers' as it pertains to their ability to provide access to quality specialty care by assessing the value teledermatology could bring to [redacted].

There are many questions that must be addressed prior to assessing the costs and efficiency of teledermatology for [redacted]. For instance: what, exactly, is telehealth? Three different forms of telehealth exist:

1. Store-and-Forward Telehealth (SFT): objective data is digitized, stored on a server, and sent the to a specialist for assessment.
2. Live-Interactive (LI): consults via web-based communications.
3. Hybrid: SFT and LI may be combined.

There are numerous benefits and problems with each method. The problems with LI are the synchronization of times and potential added cost due to extended time with the dermatologist. The SFT method, with secure messaging, would allow for delayed feedback, but the asynchronous nature allows for more flexibility and lessens interaction time with the dermatologist allowing for minimal costs of care. The hybrid method would potentially cut-down on time with LI visits because data, such as a history and images, will have already been taken.

The hybrid method would allow feedback to providers and patients as new, overlooked information arose but does not address the problem of synchronization. The SFT method will be the method used for this study.

The following questions are those relevant to any new medical intervention.

1. Is the practice diagnostically accurate and will it improve upon the diagnostic accuracies from the agencies currently in place?

The answers are yes and yes. According to studies done by the NIH, the diagnostic accuracy for skin disorders by a primary care provider range from 30% - 57%. The diagnostic accuracy of a dermatologist ranges from 93%-100%. The diagnostic agreement amongst teledermatologists and clinical dermatologists were comparable to the agreement amongst clinical dermatologists (4). The diagnostic accuracy and impact of teledermatology are both well within the desired realm of quality care.

2. **Will teledermatology improve upon clinical outcomes?**

A 2014 study shows the clinical outcomes of teledermatology to have the same clinical outcome course as traditional dermatologic visits (5). Furthermore, according to a review by Medical, teledermatologists changed the diagnosis of the referring physician 60%-80% of the time (6). It is fairly safe to assume teledermatology would be of great benefit to the patient.

There are many idealized situations in which innovations would improve clinical outcomes for patient care, but they must be fiscally feasible. Online reviews vary widely as to whether or not teledermatology is a sustainable practice. This study is a preliminary evaluation of

the temporal and monetary costs to [redacted], leading to further investigations and, if beneficial, the implementation of telehealth services.

Methods

All data from [redacted] pertains to the time frame Jan 1, 2014 – Jun 30, 2014.

Next Gen EHR was used to identify dermatology issues by ICD-9 codes. The codes used were: 213, 221, 222, 237, 215, 202, 232, 694, 172, 238, 697, 173, 693, 239, 685, 703, 702, 214, 700, 681, 695, 228, 701, 705, 216, 707, 684, 698, 680, 708, 686, 704, 709, 696, 690, 706, 691, 682, 692. *All skin conditions of the foot seen by podiatrist [redacted] and by dermatologically inclined family medicine doctor [redacted]Usatine were deleted from the data.

The data was then hand-sorted to elucidate the number of patients with repeat visits resulting in an ICD-9 code for a dermatology diagnosis (see Table 1., Appendix A).

The total number of referrals for the given time frame (695) as well as administrative time required to complete a referral (see Table 2., Appendix A) was obtained from administrative personnel.

The total cost per patient to [redacted] ($72.00) was obtained as an estimate from administrative personnel.

The cost of teledermatology and dermatology referrals was obtained from a research paper and came to $38.00 and $93.09, respectively (7).

Time dermatologists spend on a clinic visit and time spent on a SFT dermatology referral was obtained from a research paper and came to 24.4 min vs 7.2 min, respectively (7).

Results

The study provides a cautiously optimistic outlook on the applicability of teledermatology at [redacted]. Per year, teledermatology could save roughly $70,000.00, while increasing access to care with the requirement of an additional 80 hrs of administrative work. Chart 1 shows that the proportion of dermatologic visits for [redacted] are quite small compared to the national average (see Graph 1., Appendix-A). Still, Table 1 demonstrates a potentially positive effect when comparing SFT dermatology to the traditional referral system. A reduction in time spent on the administrative aspect of teledermatology operations can be seen in Table 2. In addition, Table 2 shows a potentially dramatic increase in the productivity for dermatologists. Altogether, this study appears to demonstrate, by using teledermatology, Telehealth may be more an asset for [redacted] than a detriment.

Discussion

- <u>What has this project shown?</u>

Telemedicine has proven to be an effective means of delivering quality care across geographically disparate areas. The ability to increase access to specialty services by decreasing costs, wait time, and travel is in concordance with FQHC goals. The practice of telemedicine has been around for over a century and the advancement of technologies enables its implementation to be nearly seamless and it appears to be fiscally feasible.

All too often the economic bottom-line, a necessary but cumbersome aspect of medicine, complicates health care delivery models. It is not enough to show that a practice would benefit patients; sustainability must be proven. The practice of SFT has been implemented in California

with great success, but the environment is much different than that of Texas. Even without support from insurance reimbursements, this simple study of SFT's impacts upon [redacted] show promise.

The potential benefits elucidated by this data analysis project could equate to greater procurement of funding and support from local funders of access to specialty care. Furthermore, the primary care provider would be provided with invaluable learning opportunities that could potentially decrease the need for dermatology referrals.

- What are the limitations of this project?

The use of ICD-9 codes:

The problem with using ICD-9 codes is the possibility that the patient encounter was not for the sole purpose of addressing a dermatologic issue, however, this may not be all that detrimental to the conclusions generated from the data gathered. The concern is the cost of care may be shared with an additional problem, leading to an overestimation of money saved. In addition, the provider may have coded the dermatologic issue even though it is being properly controlled; obfuscating what entails a repeat visit for a dermatologic issue. A problem that biases estimates in the opposite direction is patients who visit and tack on dermatologic issues as an additional concern that the clinician does not code. In addition, some providers already utilize informal SFT methods for dermatologic issues, potentially decreasing the number of referrals. Hard data shows 1/3 – 1/4 of all primary care visits entail some dermatologic issues and [redacted] is well below these numbers.

There is also an underestimation of the number of repeat visits since this study looks at an isolated period of time. There are undoubtedly patients from the time period before the 6-month window who have repeat visits within it that were not recorded. Likewise, there are patients

within the time frame that have repeat visits that extend beyond or, will extend beyond, that were not recorded. Additionally, the number of follow-ups after a teledermatology visit may not quite be the 1007 used to assess cost of care, potentially decreasing direct costs to [redacted] by avoiding more than just repeat visits > 1.

Another problem with this study is to assume all patients would have their needs met with a teledermatology visit. This is where triage would play a role. A study on teledermatology for the triage of melanomas revealed that 51% of these patients were able to avoid a clinical dermatology visit (5). This does not negate the problem but shows there are additional innovations to be had in the field of telemedicine. Again, further studies that drill down into the specifics for diseases and teledermatology must be conducted in order to assess its applicability.

There are many other limitations with this study that must be addressed by further investigation. The specifics of dermatologic diagnostic and therapeutic efficacy of primary care providers should be studied. The true number of dermatologic patients and those requiring excessive visits due to improper treatment should be elucidated as well. Problems beyond my knowledge must be addressed and, again, further studies must be conducted in order to determine if telemedicine can help improve an already efficient system.

- <u>Recommendations moving forward</u>

There are philanthropic agents that would be willing to participate in a study, if properly approached with a well-designed project. For instance, Dr[redacted] could be utilized in studies. By enlisting one of [redacted] sites to send all dermatologic cases via SFT methods to Dr. [redacted], while tracking patient outcomes, monies, and time, [redacted] could gain a deeper understanding of teledermatology's potential. A pilot could evaluate teledermatology for specific diseases and their outcomes to address some of the most prevalent and pressing issues [redacted]

faces. Again, this study used teledermatology to flesh out the benefits of telehealth. Other studies could expand beyond dermatology, using telepsychology, for example. The data gathered will be useful moving forward as U.S. healthcare systems continue their rapid evolution.

After a thorough cost-benefit analysis for [redacted] and other closely involved entities, the data could be used for grant procurement, and policy adjustments. California has set the stage for telehealth practices, as have many other states. Some may attribute this to the liberal nature of their governments, explaining, Texas is always behind on programs of this sort. If telemedicine saves money and time while improving access to much needed fields of care, this message should satisfy the majority of parties involved, helping to fuel the change [redacted] has been perpetuating for the past 40 years.

*** A link to a California teledermatology practice guide from 2013: http://www.caltrc.org/wp-content/uploads/2013/10/teledermatology_practice_guide_2_pdf.pdf

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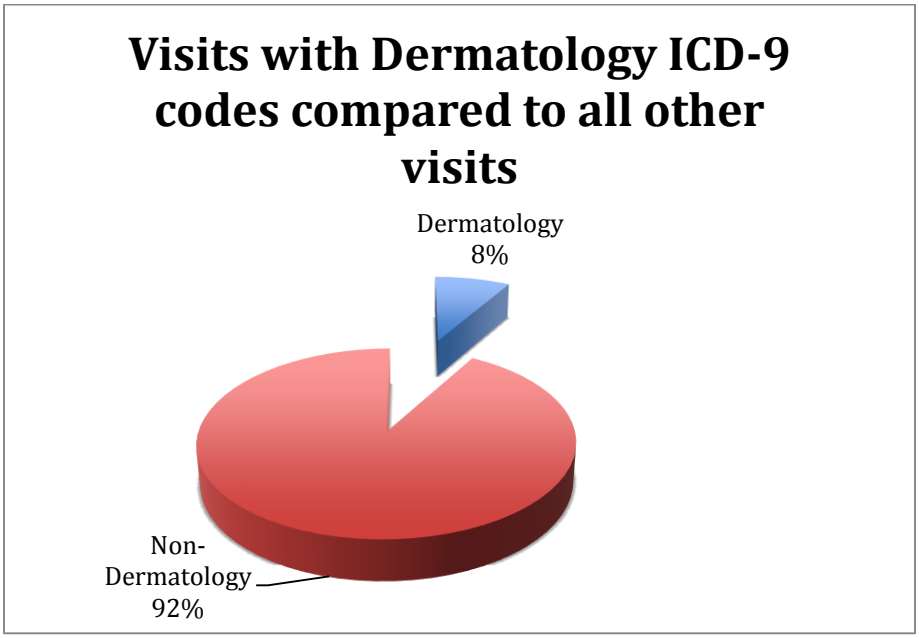
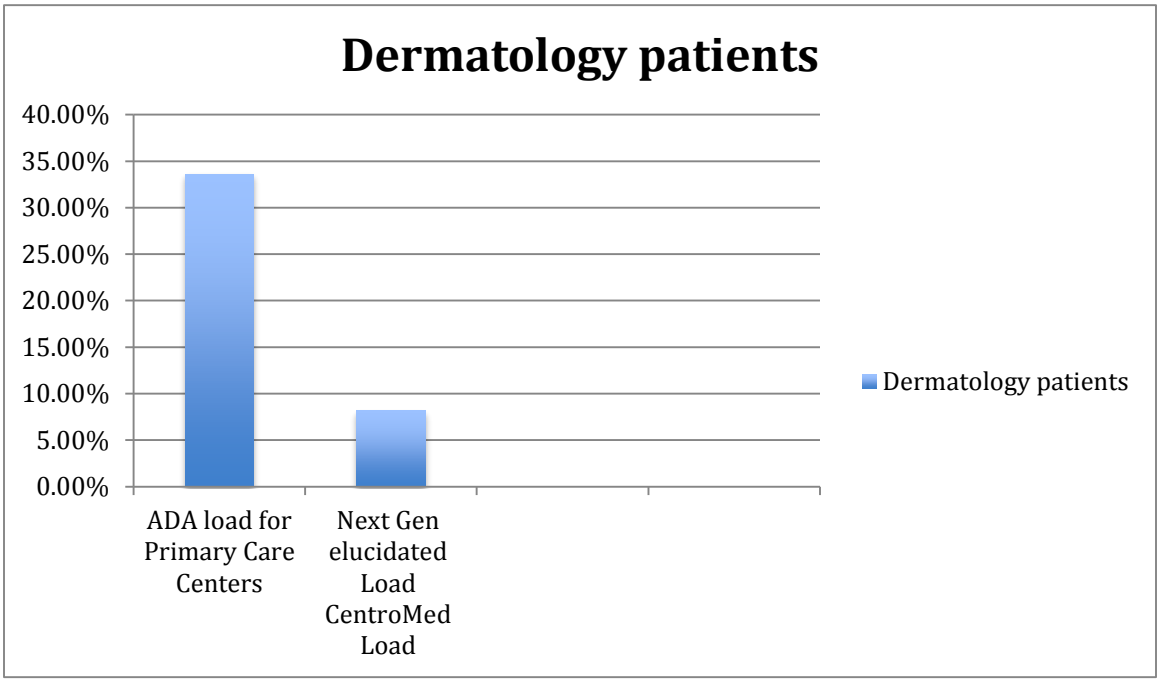
Chart 1.



Dermatology Vists = 8,116
Total Visits = 93,339

8,116/93,339 = 8.17 x 100% = 8.17%

Chart 2.



*ADA = American Dermatology Association

Table 1.

Monetary Costs	Number	Cost ($72.00/visit, *$93.09/clinical dermatology visit)	Cost if teledermatology used ($38.00/patient [7])
Patient's with repeat visits resulting in ICD-9 coding	1,007	N/A	$38,266.00
Repeat visits resulting in ICD-9 coding	1495	$107,640.00	One f/u visit for continuity of care = $0.00
Repeat visits > 1 resulting in ICD-9 coding	488	$35,136.00	Third visit avoided -$35,136.00
Referrals	695	*$64,697.55	($26,410.00 - $64,697.00) = -$38,287.55
		Total Financial Cost	-$35,157.55

Column 3, Row 3: *1495 visits x $72.00/visit =* $107,640.00
Column 3, Row 4: *488 visits x $72.00/visit =* $35,136.00
Column 3, Row 5: *695 referrals (result in dermatology clinical visit) x $93.09/dermatology clinical visit [7] =* $64,697.55
Column 4, Row 2: *1007 patients x $38.00/patient =* $38,266.00
Column 4, Row 3: *Cost of follow-up (f/u) is in Column 3, Row 3 and is being counted as neutral since it will not be avoided and is a part of normal operations, thus its impact on the finances of this situation from what is normal =* $0.00.
Column 4, Row 4: *Teledermatology has potential to eliminate third visit for dermatologic issue resulting in cost of a repeat visit > 1 savings, (-) Column 3, Row 4 =* -$35,136
Column 4, Row 5: *Cost of teledermatology visit for the 695 referrals = 695 patients x $38.00/patient = $26,410.00, and would result in a savings of the cost to see those 695 patients in the dermatology clinic, amounting to (-) Column 3, Row 5: -$64,697.55. $26,410 + (-) $64,697.55 =* -$38,287.55
Column 4, Row 6: *Column 4, Rows 2-4 added = $38,266.00 + $0.00 + (-)$35,136.00 + (-)$38,287.55 =* (-)$35,157.55.

Table 2.

Temporal Cost	Number	Time dermatologist spends on clinic visit (24.4 min/patient [7])	Time dermatologist spends on SFT consult (7.2 min/patient [7])	Administrative time spent on traditional dermatology referral (80% of referrals require ~ 52.5 min, 20% require 17.5 min)	Administrative Time spent for SFT operations (20 min per patient and referral [7])
Patients	1007	N/A	7,250.4 min	N/A	20,140
Referrals	695	16,958 min	(5,004 min – 16,958 min) = -11,954 min	31,620 min	(13,900 min - 31,620 min) = -17,720 min
		Time spent by Dermatologist if utilizing SFT	**-4,703.6 min**	**Administrative Time Spent if using SFT for dermatology**	**2,420 min**

Column 3, Row 3: *659 referrals (which result in dermatology clinical visit) x 24.4 min/visit =* 16,958 min.
Column 4, Row 2: *1007 patients x 7.2 min/patient =* 7,250.4 min
Column 4, Row 3: *Time if referrals were handled with SFT methods = 695 x 7.2 min = 5,004 min; time saved by not having 695 clinic visits = (-) 16,958 min; Total time if SFT dermatology were used instead of referrals then = time needed for teledermatology visit – time saved from avoiding in-clinic visits = 5,004 min – 16,958 min =* -11,954 min.
Column 4, Row 4: *Column 4, Row 2 + Column 4, Row 3 = 7,250.4 min + (-) 11,954 min =* - 4,703.6 min.
Column 5, Row 3: *Time for 695 referrals, if 80% referrals take 45min-60 min to complete and the other 20 take 15min-20min to complete = (695 x 80% x (45+60)/2) + (695 x 20% x (15+20)/2) =* 31,620 min.
Column 6, Row 2: *20 min of admin time per SFT completion of referral/patient x 1007 patients =* 20,140 min
Column 6, Row 3: *20 min of admin time per SFT completion of referral/patient x 695 referrals (which essentially = patients) = 13,900min; the time saved from avoiding traditional referral completion = Column 5, Row 3 = 31,620 min; total time for SFT completion of 695 referrals then = time spent on the 695 patient referrals - Column 5, Row 3 = 13,900 min – 31,620 min =* -17,720 min.
Column 6, Row 4: *Column 6, Row 2 + Column 6, Row 3 = 20,140 min + (-)17,720 min =* 2,420 min.