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Engaging Rural Providers About the Potential of Low-Earth Orbit Internet Satellite Supported Rural Telehealth Programs

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Abstract

This paper describes a DNP project that was designed to address the issue of rural mental telehealth implementation barriers. One of the main barriers to rural telehealth programs has been a technical infrastructure incapable of adequately hosting the telehealth programs; something often referred to as the rural telehealth conundrum. Low-Earth orbit (LEO) internet technology has emerged as a way to solve the rural telehealth conundrum by offering an improved rural technical infrastructure. An integrated review was completed based on the following PICOT question: In rural providers, how does an educational outreach compared to no educational outreach affect provider adoption of new technologies? The evidence showed educational sessions as efficacious in enhancing provider buy-in for new technologies. Lewin's Change Theory served as the project's framework. The project planned to offer rural providers education sessions that cover how to implement LEO-supported telehealth programs, the technology's capabilities, and reimbursement requirements. It measured the providers' knowledge and interest before and after the educational outreach. It aimed to improve provider knowledge, interest, and overall buy-in. The project was guided by a gap analysis, GANTT chart, SWOT analysis, work breakdown structure, budget, and communication matrix.
Data analysis for the project utilized the SPSS program to conduct dependent t-tests, Cohen's d, Cronbach's alpha, and a post hoc power analysis. Ethical considerations were navigated using the ANA Code of Ethics and Jesuit values. Statistically significant results were found in pre versus post knowledge test and interest survey scores with improvements in both. Limitations were identified around provider attendance concerns and having a sufficient study population. Attendance incentives, partner outreach, and offering virtual sessions were utilized as potential ways to mitigate the limitations. Overall, LEO technology appears to be an ideal option for

overcoming short-term and long-term implementation barriers to rural telehealth. Education will be critical to provider buy-in.

Problem Description

Around 25% of Americans live in rural areas, whereas only 10% of the nation's physicians practice in these areas (Drake, Zhang, Chaiyachati, & Polsky, 2019). Not only is there a difficulty in finding provider coverage, but rural areas also often lack access to an efficient technological infrastructure (Gajarawala & Pelkowski, 2021). While the urban areas have access to high-speed fiber-optic internet, the rural areas throughout the country are mainly limited to slower, geo-synchronous satellite internet access, making it difficult to provide the needed technical support for telehealth initiatives (Patel, Huskamp, Busch, & Mehrotra, 2020). This is where the rural-telehealth conundrum emerges. Telehealth would allow non-rural providers to see rural patients and expand access to care for these populations, but the rural technological infrastructure often struggles to support telehealth interventions (Gajarawala & Pelkowski, 2021). While urban telehealth expansion occurred rapidly during the COVID-19 pandemic, the rural technical infrastructure could not support a similar rural development (Meyer et al., 2020).

Background

Telehealth has long been discussed as one way to decrease the disparity of access to care often experienced by remote or rural patient populations (Meyer et al., 2020). The technological infrastructure requirements are often cited as the main burden to rural telehealth implementation, even in the wake of the COVID-19 surge in telehealth implementation (Meyer et al., 2020). While the urban areas have access to high-speed fiber-optic internet, the rural areas throughout the country are still mostly limited to slower, geo-synchronous internet access, making it difficult to provide the needed technical support for telehealth initiatives (Patel, Huskamp, Busch, & Mehrotra, 2020). Emerging technologies such as affordable low-Earth orbit (LEO) satellite internet may answer how rural telehealth implementation can be achieved in a widespread and

efficient manner (LC, 2020). This project examined the role of low-Earth orbit (LEO) internet satellite-supported telehealth programs as a potential solution to the traditional technology infrastructure and cost implementation hurdles that rural telehealth programs have traditionally faced. It focused on the effectiveness of education about the technology in increasing the technology adoption by rural providers.

Available Knowledge

An integrated review of the literature was conducted to examine research findings regarding the following PICOT question: In rural providers, how does an educational outreach compared to no educational outreach affect provider adoption of new technologies? The CINAHL, Cochrane, PsycINFO, PubMed, and SCOPUS databases were used to conduct the review. An evidence table from the integrated review can be found in Appendix A. All articles included in the integrated review were analyzed using the Johns Hopkins Research and Non-Research Quality Appraisal Tool. The table lists the articles from the highest level of evidence to the lowest level of evidence.

The available evidence points to a clear case for the efficacy of educational outreach to improve provider buy-in for new technology. Iversen & Ma (2022) found that education programs significantly increased provider adoption of new health technology programs. The study specifically found that, “factors that raise benefits and reduce costs have encouraged adoption” within the educational outreach. High adoption was typically seen when the change came with high financial rewards (Iversen & Ma, 2022). A systematic review by Alfaro et al. (2021) found that providing educational context was critical for technology adoption across several industries. This indicates that rural providers will respond best to an educational program that addresses how the new technology can be applied rurally. A systematic review by

Varabvova, Blankart, Greer, & Schreyögg (2017) found that environmental determinants were noted to be very impactful within a "strategic-institutional system" focus, which emphasizes the importance of the environmental context for long-term decision making involved with large-scale innovation adoption efforts. Ramsey et. al, (2016) indicated that two major perceived barriers by healthcare workers to technological adoption is overall budget and patient population size. As rural medical practices typically have smaller budgets and patient populations, any educational outreach will need to demonstrate how LEO effectively overcomes these perceived barriers. Burkoski et al. (2021) found that exposure to technology was a better predictor for adoption than generational associations within the nursing field. The study found that older and more experienced nurses were just as likely as their younger and less-experienced coworkers to adopt new technology if they were exposed equally to education about the latest technology. Clipper (2020) found that a lack of adequate access to reliable internet and hosting platforms left some communities unable to take advantage of the surge in telehealth offerings during the COVID-19 pandemic. Overcoming the internet reliability issue has been one of the main barriers to rural telehealth expansion and rural provider buy-in to adoption of the technology. Sadoughi, Ali, & Erfannia (2020) found that technology needed to be readily accessible before implementation efforts were undertaken, which indicates that LEO technology is now available at a level where it could be successfully implemented. Phillips (2019) found that competency assessment post-education was critical for determining the success or failure of a technological education adoption effort. Dyb, Bernsten, & Kyam (2021) found that healthcare providers no longer resist technology adoption efforts for philosophical reasons but almost exclusively for pragmatic reasons. Any adoption efforts directed at healthcare providers must focus on specifically addressing pragmatic barriers to implementation to increase the overall chance of provider buy-in (Dym, Bernsten, & Kyam, 2021).

Context

Three main stakeholders were identified as critical to the project. They are management/financial decision-makers of HMOs, medical providers that could provide telehealth, and the patients and families (DeHart et al., 2022). Buy-in from all three groups was noted to be critical for successfully implementing an LEO-supported rural telehealth program targeting rural patients. The financial backing of healthcare organizations' executive decision-makers would be necessary to get the programs started. Without their initial sign-off, any implementation efforts would be impossible to pursue. Medical providers had to be trained to utilize the technology necessary to host the appointments efficiently. The patients and their families would also need to buy into the nature of virtual visits and participate fully in the treatment modality (DeHart et al., 2022).

Rationale

The project used a framework developed from Lewin's Change Theory to identify how to assess the three stages of change for a practice change within the tele-mental health field. This framework was chosen because it addressed the process of change, something that the project encouraged in the realm of integration of technology into rural healthcare. The theory addressed the change process by breaking it down into three unique stages. The three stages are the unfreezing stage, the movement stage, and refreezing stage (Lewin, 1951). The unfreezing stage looks to introduce the change and encourage adoption. This is usually done by promoting positive pressure towards the change and restraining resistance to the change. These efforts are directed at stakeholders involved in the change process. The movement stage is when there is an attempt to have the change begin to be seen as the norm. The refreezing stage is when the newly implemented change becomes a habit and reaches general acceptance (Lewin, 1951).

Project Aims

The project sought to improve rural provider buy-in for participating in LEO-supported rural telehealth programs by implementing educational sessions about the technology. It attempted to accomplish this by increasing provider knowledge and interest following the education sessions. By Fall 2022, the project developed, implemented, and evaluated a LEO-based mental telehealth educational toolkit for the medical providers at the assigned rural clinical location assigned for the summer term. Goals: An overall score increase of over 50% on the pre/post-assessment that assessed the providers' knowledge in terms of (1.) how to implement a LEO-based telehealth program, (2.) the technology's overall capabilities, and (3.) telehealth reimbursement requirements.

Intervention

The project's intervention consisted of an educational outreach to rural providers about the capabilities of LEO-internet-supported mental telehealth opportunities in the rural environment. As the project's theoretical framework indicated, the project aimed to pursue a change in practice regarding increased use of LEO-internet-supported telehealth programs in the rural setting. An educational outreach aimed at rural providers about LEO-internet and its capabilities within the rural telehealth realm was how the project aimed to achieve an expanded utilization. The educational toolkit covered LEO-telehealth implementation, the overall capabilities of the technology, and telehealth reimbursement requirements. Provider knowledge was measured using a pre and post-test. Provider interest was measured using an interest survey questionnaire before and after the educational session. The test and the questionnaire were recorded using Qualtrics. This test and interest survey were used to determine if the educational

outreach was successful in creating greater knowledge of and interest in LEO-internet telehealth programs within the rural provider population.

Gap Analysis

A gap analysis was completed as part of the project. It found that continued reliance on geo-synchronous satellite internet would make any rapid expansion of rural telehealth programs unlikely (Gajarawala & Pelkowski, 2021). It was found that videoconferencing in a clinical setting required heavy data usage (Gajarawala & Pelkowski, 2021). Geo-synchronous providers reduced service speeds if a customer used more than their allotted data per month (HughesNet, 2022). Slower internet speeds made it difficult to host the patient-provider video encounters and made it difficult to operate a successful telehealth program (DeHart et al., 2022). Starlink, a low-Earth orbit satellite internet provider, appeared to hold the answer to the rural-telehealth conundrum. Its constellation strategy would allow it to reliably service these rural areas by the end of 2022 with internet metrics comparable to major urban areas (Starlink, 2022). Another selling point for Starlink was the lack of data caps on the monthly service meaning it had controlled costs associated with consistent service (Starlink, 2022). The gap analysis can be viewed in Appendix B.

GANTT Summary

A GANTT chart was created for the project that lays out all the necessary tasks that must be completed. The GANTT chart starts with the project's genesis in 2019 and ended in 2022, when the project has been finish finished. The project's tasks were laid out in sequential order, along with the DNP course in which they are scheduled to be completed. The chart served as a visual cue to ensure the project was kept on task and adhered to the proposed timeline as closely as possible. The project's critical path directed the project schedule to conclude in December of

2022, with any delay to a rural placement in June of 2022 being the main threat to deviation from the critical path. This deviation would have caused a delay in the project by having to postpone the education sessions. This delay did not occur.

The overall project has benefited from being organized around the critical path. Starting in August of 2019, the project's PICOT question was developed. In early 2020, the integrated review was completed and written up. In late 2020, the project's framework was developed from Lewin's Change Theory. The project implementation design and the educational toolkit were completed in September of 2021. The project finalized approaches to potential partners and the interest survey and knowledge test in Spring 2022. There was a slight delay in conducting the education sessions in Summer 2022 due to some scheduling issues, but the education sessions were able to be held in Fall 2022. The data analysis and final project write-up and presentation were completed by December 2022 per university protocol. The project's GANTT chart can be reviewed in Appendix C.

SWOT Summary

A SWOT analysis (Appendix D) identified both strengths and areas of concern within the project. This analysis focused on both the internal organizational and external/macro levels. The internal organizational level analysis identified the project's strengths and weaknesses within the clinic system. The external/macro-level analysis identified opportunities and threats to the project outside the clinic system. The information obtained from the overall SWOT analysis helped to inform decisions on the project's implementation process.

The internal analysis of strengths identified several things within the organization that would help the project to succeed in its aim. The main strength of the project was that it educated the system's providers on how to capitalize on the early adoption of the new technology.

Financial incentives were present for providers and organizations that positioned themselves to be drivers of an expanded rural telehealth ecosystem. Increasing patient volumes and reimbursement criteria were covered within the education session to demonstrate the potential opportunity. The organization also were shown that they would benefit from the technology bringing a lower monthly cost for the internet (Starlink, 2022).

The internal analysis of weaknesses identified several things within the organization that potentially could have made the project less likely to succeed in its aim. The main weakness was the associated cost of implementing the new technology. The organization would have to navigate funding any LEO-supported program. Those costs included employee training for a telehealth program, the cost of the LEO-internet satellite dish, and the monthly cost of the LEO-internet service.

The external analysis identified several things outside entities may have been able to bring as opportunities that made the project more likely to succeed. Patients were likely to appreciate the expanded options in pursuing their care if a reliable telehealth program was instituted. Providers may be easier to recruit in the future if they are presented with the opportunity to participate in delivering care via a telehealth program. The overall reimbursement rates as set by the CMS Physician Fee Schedule remained high, even as access to traditional care had expanded during the later stages of the pandemic (CMS, 2022).

The external analysis identified several outside factors that may have threatened the project's success. The project was focused on LEO-internet, a new technology that did not have an established performance track record. The LEO-internet constellations were being actively built and were not operating to their full capability. This could have presented access issues in some geographic areas (LC, 2020; Starlink, 2022). While the telehealth reimbursement rates

remained high with the current CMS Physician Fee Schedule at that time, there was no guarantee that reimbursement rates would remain high post-pandemic (CMS, 2021).

Work Breakdown Structure Summary

A work breakdown structure (WBS) was developed for the project. The WBS broke the project into five phases: Initiation, Planning, Execution, Control, and Closeout. Each phase represented a key completion milestone of the project. Stages were further broken down into required tasks. The breakdown can be found in a table in Appendix E.

The Initiation phase can be broken down into four tasks. The first task was the selection of rural mental health disparities and potential telehealth solutions as the project's topic. The next step consisted of developing a PICOT question based on the topic. Following the development of the PICOT question, a literature review was completed based on the PICOT question. Finally, the last task of the initiation phase used the literature review findings to develop a scholarly manuscript.

The Planning phase follows the initiation phase, and it too consists of four tasks. It is where the project currently stands. The first task is to identify rural clinics and health professional organizations to partner with on the project. The next step is to build the educational PowerPoint. The third task is building the pre/post-test and provider interest survey. The final task for the phase is to complete a prospectus and obtain approval to implement the project.

The Execution phase consists of five tasks, the first being coordinating the dates of the education sessions with the project's partners. Next, advertising was initiated to increase turnout at the education sessions. The education sessions were then be held. Immediately following the education sessions, the data from the tests and surveys was collected via the Qualtrics forms. The data was then logged so that it could then be used for the statistical analysis.

The Control phase consists of three tasks. A two-tailed t-test determined statistical significance in the pre-versus-post change in test scores. Next, a two-tailed t-test determined statistical significance in the pre-versus-post overall provider shift interest. A Cohen's d was calculated in SPSS to determine effect size. Cronbach's alpha was calculated using SPSS to determine the reliability of the interest survey. Lastly, a post hoc power analysis was conducted to determine the power of the study.

The Closeout phase was the termination phase of the project and consisted of four tasks. The first task called for debriefing the project's partners and seeking their feedback on how they thought the project went. A presentation was then completed that summarized the project in its entirety and its findings. This presentation was then presented to the DNP Committee for final sign-off on the project. The last task was writing personal thank you letters to the project's partners and the USF faculty that were involved with the project.

Budget

A preliminary budget was created for the project. This budget can be seen in table format in Appendix F. The projected total cost of the project was $2,200.00. The costs consisted of food catering, door prizes, worked hours, advertising, and transportation. At the end of the project, the actual costs differed from this preliminary budget. A finalized budget can also be seen in table format in Appendix F. The total amount spent on the project ended up at $1,750.00. Much of the savings in terms of planned expenses in the preliminary budget versus actual expenses in the finalized budget were associated with a smaller study sample population than what was planned for.

Communication Plan Summary

A communication matrix was developed for the project. The matrix laid out the strategy for communicating with different key stakeholders. This helped guide those working on the project on how to maximize their communication efforts to get the best return for their efforts. It also kept everyone working on the project on the same page in terms of where communication efforts needed to occur to keep the project on track. For example, while the project focused on educating rural providers, there needed to be a maintained focus on communicating the project's needs to the financial decision-makers. Without their buy-in, even the education efforts of the project would have likely stalled out. Patients and their families needed to be kept aware of potential opportunities the project might provide. This became a lower priority when the project's scoped was narrowed towards the first priority being organizational and provider buy-in. Clinic staff needed to be monitored to ensure the project is not disruptive to the clinic's workflow. The communication matrix can be reviewed in Appendix G.

Proposed Outcome Measures

Provider knowledge was assessed with the pre/post-assessment. The pre/post-assessment was administered as a Qualtrics form. The data generated from the change seen in pre versus post-test scores was then analyzed. The provider's interest was assessed with a Qualtrics questionnaire before and after the education session. As stated before, a major goal of the project was to improve the providers' knowledge scores by at least 50% in all three categories following the educational outreach and see an increase in overall interest. Increased provider knowledge and interest was associated with an increased likelihood that the providers would be more willing to participate in LEO-supported telehealth programs following the educational outreach.

Statistical Analysis

The data entered into SPSS software was collected from the Qualtrics forms that the test and interest survey used. All data was anonymized to ensure participant privacy. A one-tailed dependent t-test was utilized to determine if there was a statistically significant difference in the providers' pre versus post scores for both the knowledge and interest data. The dependent t-test for each data set was conducted using the SPSS software. An alpha level of less than 0.05 was used to determine statistical significance for the dependent t-tests. A Cohen's d was calculated in SPSS to determine effect size. A significant effect size of around 0.8 was the goal of the project to demonstrate that the educational intervention has a practical significance in increasing rural providers knowledge of and interest in LEO-supported telehealth programs. A Cronbach's alpha was calculated using SPSS to determine the reliability of the interest survey. Lastly, a post hoc power analysis was conducted to determine the power of the study. A data table with the results of the study is included as Appendix H.

Ethical Considerations

This project had an ethical framework guided by a commitment to Jesuit and nursing values found within the American Nurses Association Code of Ethics (ANA, 2015). Two key Jesuit beliefs are Cura Personalis and a commitment to be people for others (USFCA, 2022). Cura Personalis calls for the care of the total person, and the project aimed to honor this value by ensuring rural patients have access to mental health services. The idea of being people for others is a commitment to serve those that are underserved, mistreated, or looked down upon. Rural patients are currently very underserved, and this project aimed to improve their access to mental health services.

A provision of the ANA COE that presented itself at the core of this project's intent was Provision 8, that states, "The nurse collaborates with other health professionals and the public to

protect human rights, promote health diplomacy, and reduce health disparities (ANA, 2015)." Access to healthcare resources should be increased to reduce overall health disparities. This requires that changes be made to ensure the rural population has access to mental health services. The project aimed to achieve this expanded access to care by educating rural providers on a new technology that could expand access. Another provision of the ANA COE that guided this project was Provision 9. ANA COE (2015) Provision 9 states, "The profession of nursing, collectively through its professional organizations, must articulate nursing values, maintain the profession's integrity, and integrate principles of social justice into nursing and health policy." This provision informed the project's design in ensuring that the collected data remained confidential. The privacy of the project's participants had to be guaranteed. The disclosure of the project's HRSA funding was also tied to adherence to this provision, which ensured that the project and its finding were presented honestly and ethically.

Results

The results of the study were statistically significant for both the knowledge assessment and the interest survey. The t-test results can be found in the data table in Appendix H. The average score difference between the pre-test and the post-test was a mean improvement of 44%. The average score difference between the pre-survey and post interest survey was a mean improvement of 3.36 points on the 7-point Likert scale in favor of adopting LEO telehealth in the rural setting.

Discussion

Summary

The overall results of the study were generally mixed in terms of meeting the project's aims. The results on their face seem to be in alignment with the project's aims of increasing rural

provider knowledge of and interest in LEO telehealth options, but the statistical analysis brought forth several concerns. Only provider knowledge increase about LEO was the project aim that was supported following the statistical analysis. These concerns will be addressed in detail below. Overall, the project indicated a need to be reworked to include a larger overall population sample in order for the results to be taken seriously after inferential statistical analysis.

Interpretation

The pre-vs-post test for the knowledge scores were statistically significant ($p = .00146$). The overall increase in mean score of 44% fell just under the target goal of an average of 50% increase, however it was indicative of a major overall improvement of provider knowledge. The Cohen ‘s *d* came out to be 3.111. This was indicative of a very large effect size. The 44% mean improvement fell about three standard deviations to the right of the pre-test mean. This effect size finding needs to be treated cautiously as the overall study sample population was under 50. It was however in alignment with the overall increase in knowledge scores from the pre-test to the post-test.

The pre-vs-post survey of provider interest change in mean scores were statistically significant ($p = .00005$). The overall increase in mean score of 3.36 points on the 7-point Likert scale showed a large increase in provider interest following the education sessions as compared to before it. The Cohen ‘s *d* came out to be 11.200. This was indicative of a very large effect size. Once again, this effect size finding needs to be treated cautiously as the overall study sample population was under 50. It was however in alignment with the overall increase in level of interest from the pre-survey to the post-survey.

There was also a noteworthy area of concern within the results of the statistical analysis of the survey results. The Cronbach alpha of 0.31250 indicates that the interest survey should not

be seen as a reliable survey tool. This lack of reliability calls into question the overall findings of the interest increase that the survey found. Any conclusions drawn from the survey's findings needs to be taken cautiously in terms of reliability. Upon further review of the survey, the author felt it was highly likely that more than one latent variable was tested for within the survey, hence the unreliable Cronbach alpha. The study survey should be redesigned in any subsequent studies to ensure a more reliable survey tool is utilized with a focus on ensuring only one latent variable is being monitored for. The observed power of the study in terms of the knowledge assessment's t-test was only 0.74. This falls under the study's stated goal of ensuring a power of 0.8. Once again, the study's small sample population is likely a major contributing factor to this issue. Interestingly, the observed power of the interest survey was 1.0. This is a very high power. However, any results of the interest survey must be taken into consideration acknowledging the fact that the survey tool used was overall unreliable.

Limitations

Two potential implementation barriers for the project were provider attendance at the education sessions and the ability to reach a large enough rural provider population to generate sufficient data. The first barrier revolved around getting providers aware of the education session to come and check it out. One way to encourage attendance was to have a prize drawing for the attendees to thank them for taking the time to go to the session, as well as food being provided at all the education sessions. Another option was to work with the sponsoring organizations to help adjust schedules to allow for coverage while providers attend. Providers were surprisingly willing to attend without much incentive. However, the second predicted barrier was recognized in the difficulty in reaching enough rural providers for sufficient data to be gathered. The population sample included in the study was extremely small at only five participants. Partnering

with one rural clinic was probably not sufficient. A solution to this could have been working with medical professional organizations that serve rural providers and seeking to establish a partnership with them. However, attempts at outreach to such organizations were not fruitful. Virtual sessions were offered as another possible solution and were also not as fruitful in sample size increase as hoped for. These potential solutions tried to allow the project to reach enough rural providers to have a sufficient study population. It is important to note that even with these attempts, the study population remained small. Any subsequent studies must attempt to increase the overall sample size.

Conclusion

With the current momentum behind the implementation of telehealth programs due to the pandemic, telehealth implementation, in general, is far easier than even just a few years ago (Spaulding & Smith, 2021). With LEO-supported options now emerging in the rural United States, this appears an opportune time for healthcare systems to focus on rural telehealth expansion. Current CMS reimbursement rates further incentivize telehealth implementation at the time of this project. Rural telehealth will be more feasible with the support of low-Earth orbit (LEO) satellite internet. Many of the current metrics for speed and reliability demonstrate a clear advantage for LEO satellite internet over the currently available geo-synchronous orbit satellite internet (LC, 2020). Starlink, the first LEO satellite internet provider to come online, is cheaper per month than all currently available geo-synchronous satellite internet providers (Starlink, 2022; HughesNet, 2022). The rapid implementation of LEO satellite internet to rural clinics should provide a cost-effective and efficient technical support structure for rapid rural telehealth implementation in the near-term, and LEO technology appears to be the long-term solution to the

rural telehealth conundrum. Provider education will be critical in increasing buy-in to allow these short-term and long-term possibilities to be fully realized.

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Appendix A

Evaluation Table

Purpose of Article or Review	Conceptual Framework	Design / Method	Sample / Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Level of Evidence (Critical Appraisal Score) / Worth to Practice / Strengths and Weaknesses / Feasibility / Conclusion(s) / Recommendation(s) /
APA Citation: Alfaro, S. D., Balantrapu, T., Chaurey, R., Goicoechea, A., & Verhoogen, E. (2021). Interventions to promote technology adoption in firms: A systematic review. *Campbell Systematic Reviews*, *17*(4), 1–36. https://doi.org/10.1002/cl2.1181								
Examine efficacy of education for encouraging technology adoption	Diffusion of Innovations, Lewin's Change Theory	Systematic Review	80 studies met inclusion criteria	SE for all included studies were calculated	1,108 regression coefficients analyzed	Regression coefficients	Context must be included in any technology adoption effort	Level I, A quality Adequate inclusion criteria, sufficient studies for analysis, bias assessed for, conclusions logically flow from review question, the finding emphasized the importance of education and positive financial benefits in promoting new technology adoption

Definition of abbreviations: SE: Standard error

APA Citation: Sadoughi, F., Ali, O., & Erfannia, L. (2020). Evaluating the factors that influence cloud technology adoption—comparative case analysis of health and non-health sectors: A systematic review. *Health Informatics Journal*, *26*(2), 1363–1391. https://doi.org/10.1177/1460458219879340								
Examine factors that determine the success or failure of technology adoption	Diffusion of Innovations, Lewin's Change Theory	Systematic Review	47 studies met inclusion criteria	Research inclusion criteria reviewed in detail within the planning, execution, and reporting stages	Technology-Organization-Environment (TOE) framework applied for analysis	Framework analysis	Consistent resource availability must be included in any technology adoption effort	Level III, A quality Adequate inclusion criteria, sufficient studies for analysis, future research directions suggested, conclusions logically flow from review question, the finding emphasized the importance of sustained technology availability in the areas in which it will be first implemented

Definition of abbreviations: N/A: Not applicable

APA Citation: Varabyova, Y., Blankart, C. R., Greer, A. L., & Schreyögg, J. (2017). The determinants of medical technology adoption in different decisional systems: A systematic literature review. *Health Policy*, *121*(3), 230–242. https://doi.org/10.1016/j.healthpol.2017.01.005								
Examine factors that determine the success or failure of technology adoption	Diffusion of Innovations, Lewin's Change Theory	Systematic Review	65 studies met inclusion criteria	Research inclusion criteria reviewed in detail within the	Decision-making systems Determinants framework applied for	Framework analysis	"Environmental determinants are so important in the strategic-institutional	Level III, A quality Adequate inclusion criteria, sufficient studies for analysis, future research directions suggested, conclusions logically flow from review question, the finding emphasized the importance of

				planning, execution, and reporting stages	analysis		system confirms the importance of the environmental context to long-term decision making involved into the adoption of large-scale innovations."	sustained technology availability in the areas in which it will be first implemented

Definition of abbreviations: N/A: Not applicable

APA Citation: Burkoski, V., Yoon, J., Hutchinson, D., Hall, T. N. T., Solomon, S., & Collins, B. E. (2019). Generational Differences in Hospital Technology Adoption: A Cross-Sectional Study. *Nursing Leadership (1910-622X), 32*, 87–97. http://dx.doi.org/10.12927/cjnl.2019.25812								
Examine generational trends in nursing related to adoption of new technology	Diffusion of Innovations, Lewin's Change Theory	Cross-Sectional Study	N=63, nurses	IV1: Exposure to technology IV2: Length of employment DV1: CTD skill score	IV1: Multiple regression IV2: Multiple regression DV1: CTD score scale 0-5	Multiple regression	IV1: (β = 0.054, p = 0.021) IV2: (β = 0.06, p = 0.011) DV1: 3.74 avg out of 5 (SD = 0.75)	Level III, A quality Equal exposure to new technology and education on new technology was a better adoption predictor than generational trends, statistically significant beta coefficients demonstrating noted trends

Definition of abbreviations: IV: Independent variable, DV: Dependent variable, SD: Standard deviation CDT: Clinical technological device

APA Citation:

Iversen, T., & Ma, C. A. (2022). Technology adoption by primary care physicians. *Health Economics*, *31*(3), 443–465. https://doi.org/10.1002/hec.4447

Examined the technology adoption rates and trends in primary care physicians	Lewin's Change Theory	Cross-Sectional Study	N=4,100, Rural Norwegian primary care providers	IV1: Education IV2: Peer adoption rate IV3: Access to Fee 109 rate DV1: Billing for technological service	IV1: Regression model IV2: Regression model IV3: Regression model DV1: # of Providers billing	Fixed-effect models, reg. models	IV1: (β = 0.947, $p < 0.001$) IV2: (β = 0.920, $p < 0.001$) IV3: (β = 0.066, $p < 0.05$) DV1: 3,333 (SD:725)	Level III, A quality Education and peer adoption were two strong predictors for increased technology adoption by primary care physicians, economic factors are another key driver of adoption, statistically significant beta coefficients demonstrating noted trends

Definition of abbreviations: IV: Independent variable, DV: Dependent variable, SD: Standard deviation, Reg: Regression

APA Citation:

Ramsey, A., Lord, S., Torrey, J., Marsch, L., & Lardiere, M. (2016). Paving the Way to Successful Implementation: Identifying Key Barriers to Use of Technology-Based Therapeutic Tools for Behavioral Health Care. *Journal of Behavioral Health Services & Research*, *43*(1), 54–70. https://doi.org/10.1007/s11414-014-9436-5

Examined the technology adoption rates and trends in primary care physicians	Lewin's Change Theory	Qualitative Analysis single study	N=260 medical providers	IV1: Budget IV2: Size of patient population IV3: Geographic location DV1: Reported barriers	IV1: ANOVA IV2: ANOVA IV3: ANOVA DV1: 1-6 scale of perceived barrier effect	ANOVA, reg. models	IV1: M=2.08; SD=1.12 F(1, 217)=5.379, P=0.021 IV2: M=2.08; SD=1.08 F(1, 236)=9.234 P=0.003 IV3: M=1.91; SD=1.01 F(1, 200)=1.0 P≥0.05 DV1: Mean=1.87 SD=0.98	Level III, A quality Overall budget and population size are major determinants of technology adoption within the medical field, whereas geographic location did not have a statistically significant role as a potential barrier

Definition of abbreviations: IV: Independent variable, DV: Dependent variable, SD: Standard deviation, Reg: Regression

APA Citation:

Dyb, K., Berntsen, G. R., & Kvam, L. (2021). Adopt, adapt, or abandon technology-supported person-centered care initiatives: healthcare providers' beliefs matter. *BMC Health Services Research, 21*(1), 1–13. https://doi.org/10.1186/s12913-021-06262-1

Examined the role of healthcare providers' beliefs on technology and its influence on	Lewin's Change Theory	Qualitative Study	N=36 healthcare providers	N/A, Non-research	N/A, Non-research	N/A, Non-research	Used qualitative analysis through the NASSS framework to come to the conclusion that healthcare	Level III, A quality Analysis framework explained, transparent process, bias accounted for, methodologic verification occurred, research conclusions matched the thematic conclusions,

adoption rates							providers no longer resist technology adoption efforts for philosophical reasons but almost exclusively for pragmatic reasons. Any adoption efforts directed at healthcare providers must focus on addressing pragmatic barriers to implementation.	

Definition of abbreviations: NASSS: Non-adoption, abandonment, and challenges to the scale-up, spread, and sustainability

APA Citation:

Clipper, B. (2020). The Influence of the COVID-19 Pandemic on Technology: Adoption in Health Care. *Nurse Leader*, *18*(5), 500–503.

https://doi.org/10.1016/j.mnl.2020.06.008

Implementation strategies for technology adoption, including telehealth	Lewin's Change Theory	Expert Opinion	N/A, Non-research	N/A, Non-research	N/A, Non-research	N/A, Non-research	N/A, Non-research	Level IV, A quality Offered an expert opinion about internet reliability being a key factor in telehealth implementation going forward, and having feasible internet will be critical in gaining rural provider buy-in for telehealth, written within the last five years

Definition of abbreviations: N/A: Not applicable

APA Citation:
Phillips, J. (2019). Complex Medical Technology: Strategies for Selection, Education and Competency Assessment, and Adoption. *AACN Advanced Critical Care*, *30*(1), 48–59. https://doi.org/10.4037/aacnacc2019957

Implementation strategies for technology adoption, including telehealth	Lewin's Change Theory	Expert Opinion	N/A, Non-research	N/A, Non-research	N/A, Non-research	N/A, Non-research	N/A, Non-research	Level IV, A quality Offered an expert opinion about the imperative nature of education and competency assessment when implementing new technology in healthcare, despite pushback from executives that this is considered "unproductive time" for medical staff

Definition of abbreviations: N/A: Not applicable

Appendix B

Gap Analysis

Gap Analysis		
Area under consideration: Rural Health Clinics and Telehealth		
Desired State	**Current State**	**Action Steps**
Robust access to mental health providers	Access to care disparity	Expand access through telehealth
Strong rural telehealth programs	Geo-synchronous internet insufficient to support rural telehealth	Educate providers about using LEO
Provider support for telehealth	Rural telehealth conundrum has been problematic for years	Use education to show difference between LEO and geo-synchronous
Fully supported videoconferencing	Geo-synchronous unable to support extended videoconferencing	Switch internet from geo-synchronous to LEO
Cheaper monthly internet costs	Geo-synchronous internet is more expensive than LEO internet	Switch internet from geo-synchronous to LEO
Increase telehealth reimbursement	Rural telehealth programs underutilized compared to need	Educate providers on reimbursement requirements
Enhanced reputation within the local community	Issues providing services and access to specialists throughout the rural setting	Increase access to specialists by partnering with urban specialists via a LEO-supported telehealth program

Appendix C

GANTT Chart

		2019												2020											
units	Class	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Spring																							
		Spring																							
						Summer																			
	Start								Fall																
8	7001, 7002, 705A								PICOT Question																
10	7003, 7006, 7007, 705B													Lit. Review											
	NP Core													Spring											
7	7004, 7009, 7100																	Summer							
8	706, 707, 7008																				Framework				
	NP Core																				Fall				

		2021												2022											
units	**Class**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9	7210, 7220, 790P, 791P	Design Project																							
		Spring																							
7	763, 749A, 792P					Manuscript/ Build Toolkit																			
6	747, 748								Fall																
	NP Core								Fall																
9	758, 760, 7005													Spring											
														Spring											
7	768, 778, 749B																	Conduct Sessions							
7	789, 795P, 7290																				Data Analysis				
	End																				Presentation				

Appendix D

SWOT Analysis

	Favorable/Helpful	Unfavorable/Harmful
Internal	**Strengths** • Cheaper internet all-around at the clinics • Provide increased patient volume • Establishes new reimbursement revenues	**Weaknesses** • Upfront cost for LEO satellite dish • Staff training requirements/costs • Having to transition to a new internet provider (contracts)
External	**Opportunities** • Better technology infrastructure is a selling point to outside mental health providers looking to potentially partner • Expands number of available mental health providers to partner with by removing the need to relocate • Increase reputation in the community by expanding patient access • CMS telehealth reimbursement rates remain high so far as the pandemic abates	**Threats** • LEO technology not yet available in all rural areas as the constellations are built • LEO internet is in its infancy without a performance track record • Potential reduction of reimbursement post-pandemic

Appendix E

Work Breakdown Structure

Level 1	Level 2	Level 3
Engaging Rural Providers About the Potential of Low-Earth Orbit internet Satellite Supported Rural Telehealth Programs	1.1 Initiation	1.1.1 Identify Topic 1.1.2 Develop PICOT Question 1.1.3 Conduct Literature Review 1.1.4 Develop Manuscript
	1.2 Planning	1.2.1 Identify and Connect with Partner Agencies/Organizations 1.2.2 Build Education Presentation 1.2.3 Design Data Collection Tools (Pre/Post-Test and Survey) 1.2.4 Develop Prospectus
	1.3 Execution	1.3.1 Organize Schedule with Partners 1.3.2 Advertise Education Sessions 1.3.3 Deliver Education Sessions 1.3.4 Collect Data 1.3.5 Record Data
	1.4 Control	1.4.1 Run Two-Tailed T-Test on Education Improvements 1.4.2 Run Two-Tailed T-Test on Likert Scale Changes 1.4.3 Determine Statistical Significance and Determine Power of Study
	1.5 Closeout	1.5.1 Debrief Partners and Seek Feedback 1.5.2 Create Presentation about Project 1.5.3 Present Presentation before DNP Committee 1.5.4 Send Out Thank You Letters to Partners and Involved Faculty

Appendix F

Proposed Budget

Project Budget

Total

$2,200.00

Item	Cost
Catering	$300.00
Door Prizes	$150.00
Worked Hours	$1,500.00
Advertising	$50.00
Transportation	$200.00

Actual Budget

Project Budget

Total

$1,750.00

Item	Cost
Catering	$0.00
Door Prizes	$0.00

Worked Hours	$1,500.00
Advertising	$50.00
Transportation	$200.00

Appendix G

Communication Matrix

Level of Power ↑		
	Keep Satisfied **High Power, Low Interest**	**Manage Closely** **High Power, High Interest**
	• HMO Management	• Rural Providers
	Monitor **Low Power, Low Interest**	**Keep Informed** **Low Power, High Interest**
	• Clinic Staff	• Patients • Patient Families
	Level of Interest →	

Appendix H

Data Table

	dF	T-value	P-value	Cohen's *d*	Power
Pre vs. Post Assessment	4	6.487446	p = .00146	3.111	0.743
Pre vs. Post Interest Survey	4	15.734642	P = .00005	11.200	1.0
	Cronbach's alpha				
Interest Survey	0.31250				