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Impact of Telepharmacy Services as a Way to Increase Access to Asthma Care

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Abstract

Objective: To demonstrate that real-time, telepharmacy-based asthma educational services are feasible and support the efforts of local primary care prescribers to improve patient outcomes.

Methods: The lead investigator [a pharmacist, physician assistant and certified asthma educator] identified an independent community pharmacy with telehealth capabilities in a rural area with a high prevalence of asthma. Working with the pharmacy, an asthma education program was developed based on the National Asthma Education and Prevention Program guidelines. It consisted of three monthly education visits, with subsequent visits every three months for one year. The Asthma Control Test (ACT) was administered at baseline and at each visit to assess a patient's perception of asthma control.

Results: Eighteen of 20 patients (90%) with reversible airway disease completed all six visits in this year-long study. For the 18 patients, the mean ACT scores of 18 at baseline (initiation of intervention), did not meet the threshold for "well controlled" asthma. By the third educational visit (3 months), 16 patients met ACT criteria for well controlled asthma (mean score = 20), and

they maintained control for the remaining 9 month follow-up period ($ACT \geq 21$). Local prescribers authorized medication changes recommended by the asthma educator 20 times and also requested six direct consults with the asthma educator over the study period.

Conclusion: Using the local community pharmacy as a vehicle to deliver asthma education services by telepharmacy was utilized by local prescribers. The findings show this is an effective means to engage patients to gain and maintain asthma control.

Key words

Telehealth, Medically Underserved Area, Rural Health, Ambulatory Care

Introduction

The use of distance technology to help patients manage asthma is increasing. A recent Cochrane review reported that the use of remote face-to-face medical visits (telehealth) for asthma management did not adversely affect asthma control.¹ Several studies have shown, the utility of telehealth (includes both telemedicine and telepharmacy) to improve asthma outcomes.²⁻³ However, real world applications using strategies to implement these initiatives in particularly rural areas is lacking.

Rural areas of North Dakota (ND) face challenges in financing and delivering health care. Difficulties recruiting and retaining providers as well as reductions in third-party reimbursement limit access to health care services. Forty nine of ND's 53 counties contain medically underserved areas or populations.⁴ Over 9% of North Dakota residents travel 21 to 50 miles to access health care services.⁵

Collaboration and advanced technology are two cornerstones for rural health access. One example is the North Dakota Telepharmacy Project (NDTP), which has demonstrated that pharmacy services can be retained and restored in rural communities through the use of standardized, HIPAA-compliant, cost-effective telehealth technology.⁶ It provides pharmacy services by using audio and visual computer links to connect face-to-face in real time a licensed pharmacy technician and patient within rural communities with a pharmacist at a central site. The NDTP has led to the establishment of 56 remote telepharmacies serviced by 25 central locations, serving 80,000 rural residents.⁶

The challenge of accessing health care is especially problematic for ND residents diagnosed with asthma.⁷ Changes in temperature, winds, and flora/fauna lifecycles can trigger

breathing problems which are more pronounced for residents living in rural, agricultural areas.⁷ The choice of asthma, to study patient education delivered by telepharmacy, is optimal for four reasons. First, individuals living in rural agricultural areas are more likely to suffer from airway diseases and also experience reduced access to care.⁷ Second, the primary modes of asthma treatment are medicinal and educational.⁸ Third, asthma education can be delivered through telehealth technology without fundamental alterations.⁸⁻¹⁰ Fourth, the use of telepharmacy in the state suggests that patients are familiar with the technology, and may be amenable to receiving a broader array of health care services using the technology.¹¹

Rural Dickey County in North Dakota was chosen for this study due to its higher prevalence of patients reported current asthma (8.9%) compared to the state average (7.1%).¹² The closest allergy and pulmonary clinics are nearly 70 miles away, and across the state border in Aberdeen, South Dakota. The travel costs to see a specialist and lost wages from having to take time off from work create undue financial hardships and, by extension, health disparities in the county. Oakes, ND (population 1,856) is located in Dicky county is a pivotal point for primary care and acute care access and is the socio-economic center of the county (i.e., it has a school, a grocery store and a critical access hospital). A videoconferencing system was available in a community pharmacy in Oakes (previously attained through a NDTP grant), which provides patients with telepharmacy technology, and was an accessible and quality site at which to base the asthma education program.

The purpose of this study was to assess the feasibility of incorporating telepharmacy services within a community pharmacy to deliver asthma education services in a rural community. In doing so, the investigators will demonstrate whether real-time, telepharmacy-

based asthma educational program services are feasible, support the efforts of other local health providers, and improve patient outcomes.

Methods

Study enrollment and baseline measures

The remote site study coordinator obtained informed consent, screened for the presence of uncontrolled asthma via spirometry, administered validated surveys and documented inhaler techniques using the In-Check Dial™. The study lead investigator, a Certified Asthma Educator, verified informed consent and reviewed spirometry obtained from potential patients and based on the following criteria determined participant eligibility for study. Patients were included in the study if they were five years or older and demonstrated reversible lung disease, FEV1% (forced expiratory volume, measured as a percentage of predicted volume) change of at least 12% and 200ml change in pre-post FEV1 values, by spirometry. Over one year, the certified asthma educator provided face to face virtual visits with patients via telehealth technology.

The Oakes community pharmacy promoted the study as part of their normal local radio and newspaper advertising. They also convinced the local newspaper to feature the study as a front page article. Knowing that high school athletic events draw large amounts of people in the community, the study coordinator collaborated with the local high school to set up a table in a private room to aid in maintaining confidentiality at a basketball game to recruit and screen study participants.

The AE-C provided two lunch and learn meetings in Oakes, ND at the local pharmacy for prescribing primary care providers to educate them about the new asthma education service and

to encourage local providers to utilize the AE-C for any asthma related questions and to refer patients for education.

Because this is a pilot study, a small sample size was expected. Hence, emphasis was placed on summarizing trends in the data, rather than utilizing complex hypothesis tests and/or statistical inference. The Expert Review Panel-3 guidelines (<http://www.nhlbi.nih.gov/files/docs/guidelines/asthgdln.pdf>) were used to identify clinically appropriate assessments and evidence-based benchmarks for asthma control.⁸ The effectiveness of the asthma education intervention was assessed via the validated Asthma Control Test (ACT) and spirometry readings via a PC based KoKo™ spirometer using NHANES III predictive values for adults, Wang for pediatric patients and a low resistance one time use filter for accurate spirometry testing, were collected from patients at the beginning of each visit. The minimum total ACT score that identifies patients as having “well controlled” asthma is 20. Similarly, the minimum forced expiratory volume in one second (as percentage of predicted volume; FEV1%) value indicating that a patient has “well controlled” asthma is 80%.

Asthma Educational Program

A certified asthma educator (AE-C) who served as the lead investigator (Who is also a pharmacist and physician assistant), identified an independent community pharmacy with telepharmacy capabilities in a health provider shortage area within a county with a high prevalence of current asthma in order to determine the feasibility of delivering asthma education services to this area via real time audio/video counseling. A grant (obtained by the NDSU Department of Pharmacy Practice Seed Grant) provided the funding support to train one staff pharmacist at the community pharmacy to attend training through the American Lung

Association's Asthma Educator Institute, which included training on obtaining accurate spirometry based on American Thoracic Society guidelines for standardization of lung function testing, and complete the Social-Behavioral-Educational track from the Collaborative Institutional Training Initiative (CITI) program. Then, this community pharmacist served as the remote site study coordinator. All methods utilized in this study were approved by the North Dakota State University (NDSU) Institutional Review Board.

Working with the community pharmacy, the certified asthma educator, developed an asthma education program based on the National Asthma Education and Prevention Program guidelines and Thomas Plaut's book *One Minute Asthma*.¹³ All patients received the *One Minute Asthma* book and the graphics and concepts were emphasized from the book during the three educational sessions.

Patient education was delivered by the certified asthma educator through real time audio/video counseling using the telepharmacy equipment. The program consisted of three monthly education visits, with follow up visits every three months over the course of one year. The first educational visit addressed basic asthma facts, signs of asthma exacerbation, medication(s) roles as reliever and controller, medication technique assessment and with patient involvement, and a symptom based asthma action plan was developed. The second visit reviewed medication techniques and the patient's utilization of their asthma action plan, followed by an introduction to peak flow monitoring via the True Zone peak flow meter. The third education visit reviewed medication technique, peak flow readings and personal trigger identification. With the patient, a symptom and peak flow based asthma action plan was created that incorporated patient identified trigger minimization strategies. All education visits used

motivational interviewing techniques to promote patient self-management and decision support in order to impact disease control. The subsequent three follow-up visits consisted of reviewing inhaler technique and how the patient was utilizing their asthma action plan for monitoring disease, medication use and trigger minimization or avoidance.

Data analysis

The analysis gives primary emphasis to the number of patients whose asthma is well (or not well) controlled, as evidenced by counts of individuals whose ACT scores are 20 or higher (versus those below 20) and/or FEV1% scores of 80% or higher (versus those below 80%). The chi-square test of homogeneity, Fisher's exact test and McNemar's test are used to assess the relationship between the patient's asthma control and the timing of the visit. Failing to reject the null hypothesis of homogeneity (or no association) indicates that the typical asthma patient's level of control is unchanged despite program participation. Rejecting the null indicates a change in the typical patient's level of control throughout the program, which may indicate an effective (or negatively effective) intervention. The analysis is conducted both overall (tracking progress over the entirety of the program including all intermediate visits, using only the chi-square test of homogeneity) and sequentially (tracking progress between the initial visit and a specific time frame – say the second visit or the third visit). Because the sequential analyses are based on symmetric, two-by-two frequency tables, the Fisher's Exact test and McNemar test are used in addition to the chi-square test. In all cases, a five percent significance level is employed.

As an exploratory analysis, it is also informative to assess the magnitudes of patient ACT and FEV1% measures at a specific point in time. The design of the spirometry and ACT tests are such that, once patients' exhibit well-controlled asthma, additional gains are less pronounced

and less precisely captured in binary data characterizing control or lack of control. So, it is unlikely that statistically significant gains in asthma outcomes will occur over the study time frame once a patient achieves and maintains acceptable asthma control, especially in pilot studies generating very small sample sizes. Therefore, a decision was made to analyze each time frame (month 1, 6, 9, and 12 visits) separately for each time period. One-sample t-tests were used to assess mean differenced in patient outcomes at a given visit against established clinical benchmarks. The null hypothesis for ACT scores is that the (population) mean total ACT score is 20. Similarly, the null hypothesis for FEV1% scores is that the (population) mean FEV1% score is 80%. In all cases, two-sided hypothesis tests were performed and assessed at a five percent level. Each of the t-tests described above are also presented as two-sided, 95% confidence intervals to allow the reader an alternative (yet statistically equivalent) means to assess how the confidence intervals change (if at all) over the course of the 12 month program as patient ACT scores and spirometry results changed.

Results

Study completion

Thirty-eight individuals were screened for study inclusion. Twenty qualified for the study demonstrating reversible lung disease by spirometry. Eighteen patients completed the year-long study, leading to a study completion rate of 90%. This rate of completion demonstrates that delivery of the asthma educational service via live audio/video conferencing is feasible.

Patient Outcomes

Table 1 presents the number of patients who did, and did not, achieve asthma control based on their ACT score. Over the entirety of the study, the chi-square test of homogeneity indicates no

significant association between asthma control and the time frame, suggesting no significant increase in the number (and proportion) of patients with acceptable ACT scores. McNemar test results comparing the first visit to each subsequent visit (taken individually) fail to reject the null hypothesis, suggesting no substantial gains in asthma control. However, chi-square and Fisher's exact tests indicate that, when comparing the number (and proportion) of patients with "well controlled" asthma at visit one, to patients at their third visit (chi-square probability: 0.034; Fisher's exact test probability: 0.045), fifth visit (chi-square probability: 0.033; Fisher's exact test probability: 0.049) and sixth visit (chi-square probability: 0.018; Fisher's exact test probability: 0.041), respectively, there was a notable improvement in the number of patients with "well controlled" asthma. At the first visit, 11 of the 18 patients earned ACT scores below 20. By the sixth visit, this count had decreased to only 4 patients. Patients making their second and fourth visits did not score significantly better than patients at the first visit to the provider, indicating (but by no means proving) that gains in asthma control as measured by ACT scores may occur gradually over time.

Table 2 presents an analysis of the number (and proportion) of patients with (not well) controlled asthma as characterized by FEV1% scores. As evidenced cumulatively by the chi-square test of homogeneity, as well as across individual time frames (by the chi-square, McNemar and Fisher's exact tests), no significant changes in FEV1% scores occur over the study's time frame.

The magnitudes of patient ACT scores improved between the first visit and visit 6 (Table 1). After the second education visit, patient ACT scores remained at or above 20, indicative of "well controlled" asthma. During the first three educational visits, the two-sided, 95% confidence intervals for the total ACT scores averaged about 20, showing that a substantial

number of patients obtained total ACT scores below 20. That is, even though there is no statistical evidence to suggest these patients are significantly below the population mean of 20 (the cutoff for “well controlled” asthma), many patients are actually slightly below this cutoff. After the fourth visit (which occurred after approximately six months into the study), ACT scores stabilized and remained constant at 21. Moreover, for visits 4 through 6, the two-sided, 95% confidence intervals for the ACT scores identify 20 as the lower bound of the confidence interval. As a result, by visit 4, we are 95% confident that the mean patient has “well controlled” asthma, and that the majority of patients meet the threshold of 20.

Similarly, FEV1% scores increased during the first six months of the study (Table 2) and were maintained throughout the follow up portion of the study. For visit 1, the t-tests indicate that patient FEV1% values are significantly different from (and in this case, below) the 80% threshold for “well controlled” asthma. The results for the remaining three visits fail to reject the null hypothesis that the mean FEV1% is no different from 80%; the cutoff for “well controlled” asthma. Unlike the total ACT scores, however, the two-sided 95% confidence interval estimates for the 6, 9 and 12 month visits have 80% as the upper bound of the confidence interval estimate. Thus, while the statistical analysis indicates the reasonableness of the null hypothesis of “well controlled” asthma, clinicians may choose to interpret this result as a continued opportunity to work with these patients to improve their FEV1% values.

Qualitative findings also support the viewpoint that the local providers felt supported by the asthma educator. Local providers directly contacted the asthma educator on six separate occasions and authorized medication changes recommended by the asthma educator 20 times over the course of the study.

Discussion

The Chronic Care Model illustrates various patient and system components important to achieving desirable population health outcomes.¹⁴ Component enhancement, especially in regards to patient self-management and decision support, prompts community members to engage healthy practices.¹⁵ This pilot study was able to incorporate a remote asthma educator as part of the local provider team and deliver real-time education to patients with asthma via telemedicine technology. While gains in patient outcomes were quite small, the results reported in this study are consistent with other, related interventions.¹⁻³

The feasibility of providing, and subsequently sustaining, an intervention is always a concern when incorporating the intervention into an already busy medical or pharmacy practice. Prior to any patient recruitment efforts, a plan was devised to incorporate the asthma program as a front-end service instead of adding it to the pharmacy workflow. This allowed the staff pharmacist (who was trained as the study coordinator) to function like a case manager, leaving the education and interventions to the remote certified asthma educator. This allowed the staff pharmacist to provide more direct patient care activities, while minimizing the impact on her dispensing responsibilities. With declining reimbursement rates, pharmacy owners are looking for additional revenue sources, and asthma education is a viable opportunity.

The rural pharmacists were an important resource in the development of the study. One of the first interventions that was incorporated into the study was based on a pharmacist's feedback. Consistent with many rural areas in the U.S., the pharmacists noted that a substantial amount of variation exists in the health literacy of Dickey County residents. As a result, a decision was made to provide study patients with a book (written at the fourth grade level) called

“One Minute Asthma” by Thomas F. Plaut.¹³ This book uses simple, relevant pictures and incorporates a written asthma action plan, and thus can convey information appropriately to patients with a lower level of health literacy.

The independent community pharmacy had already established itself as a trusted medication resource to the local medical community, and was able to serve as a liaison between the certified asthma educator and local primary care providers (i.e., family practice physicians, nurse practitioners, physician assistants and less proficient physicians (in latest advances in asthma therapy) were more receptive to engaging with the asthma program in order to support their efforts in the management of patients with asthma. During the study period, primary care providers contacted the certified asthma educator for asthma related questions outside of the educational parameters of the study. Two recommendations were for pediatric dosing for corticosteroids for acute asthma exacerbations. Two were follow-up consultations with study participants post exacerbation. One contact was for assistance in obtaining controller medication via mail-order and one contact involved a monitoring question about Theophylline for a non-study patient. When asked, providers reflected on their experience and appreciated the expertise of the asthma educator and additional support she provided for their patients as evident by their request for guidance on a non-study patient.

When specialty medical services are delivered to rural areas, the specialist will typically designate up to one day a month to travel, often taking several hours, to the remote site to see patients. With this approach patients have to significantly adapt their schedules to meet with the specialist. Concomitantly, the telemedicine approach, which grants contact with the specialist within a matter of minutes, allows for multiple times and days per week to schedule with the

specialist. This allows for greater flexibility for rural patients, who may live some distance from the pharmacy and may need to complete a large number of tasks when they come to town.

Key impact factors

The success of this type of initiative, however, depends on a number of factors. The first factor is technology. It is vital to use a technology (such as the telepharmacy technology used in this study) that allows for flexible scheduling of appointments and real-time patient-asthma educator interaction.

The second factor is the location at which services are provided. In our pilot study, patients were able to access asthma education services at a remote site location where other local services (gas, groceries, and elementary/high schools) are located in order to increase convenience for participants.

Third, it is important to select an intervention site where it is possible to engage and educate local patients regarding the nature of services being provided in order to improve patient outcomes. The Asheville project in North Carolina showed that face-to-face meetings with in a community pharmacy setting between patients and specially trained pharmacists resulted in significant improvements in patient clinical, humanistic, and economic outcomes.¹⁶⁻¹⁸ Local community pharmacists are typically considered as trustworthy by the general public. Hence, using the local community pharmacy as a vehicle to market new services such as asthma education, along with traditional pharmacy services, may be an effective means to engage patients that might not otherwise seek out this type of care. This was demonstrated in this study where we achieved a 90% retention rate for study participants and improvement in their ACT scores while improving and maintaining lung function. Engaging patients also requires making

the new program convenient to use. For example, multiple patients reported that they found it convenient to pick up medication at the time of the education. Because they could combine the education with other important tasks (such as picking up refill medications at the local community pharmacy), it was easier for them to justify the time for the education.

Lastly, it is important to ensure that local health care providers are made aware of the initiative and engaged in the project. The more engaged other providers are in the initiative, the more likely they are to collaborate with the asthma educator to make appropriate changes to medications or other alterations to therapy that improve patient outcomes.

Limitations and Future Research

Despite the promising results reported above, our pilot study contains significant limitations. The primary impetus of the study was to promote access to health care services. Hence, a decision was made to include every eligible patient in this community intervention study. The consequence of this decision was that the study was observational in nature, rather than an experimental design study with well-defined control and test groups. Even so, the small patient population generated a small sample size which limited the use of advanced statistical analyses and made finding statistically significant gains in asthma control less likely to occur. Hence, all results are descriptive and preliminary in nature, and may be confounded by factors not controlled for in the statistical analyses.

The geographic size of the intended target population needs to be taken into consideration. Researchers anticipated more study participation based on higher county prevalence of asthma, marketing efforts and health provider referrals. Geography continued to play a role in the extent a potential participant was willing to travel to receive asthma education.

All participants lived within a 41 mile radius of the local community pharmacy which does not cover the entirety of Dickey County. The establishment of other remote sites in the county would have enabled the researchers to ensure that all patients in the county who met the study's inclusion criteria and desired (and needed) asthma education received appropriate care.

An additional limitation is the ability to bill insurance for educational services. Currently in North Dakota, as well as other states, a community pharmacy is not considered a designated site for patients to receive educational services via telepharmacy. Thus larger projects demonstrating the successful use of telepharmacy in community pharmacy settings are needed.

Conclusions

The successful control and improvement of asthma rates in a rural setting is highly dependent on community resources and adoption of chronic disease management practices. Formation of partnerships with rural communities to support and develop interventions (i.e., telepharmacy) can help to bridge gaps in health care organization and service delivery. Accessibility of an asthma educator, via telepharmacy, was a successful way to engage patients and health providers in a medically underserved community and to improve asthma control.

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Table 1. Average Asthma Control Test Scores of Telepharmacy Patients Over One Year

	Number of Patients	Asthma Control Test *	2-Sided P value	95% Confidence Range
Visit 1	18	18	0.23	16-21
Visit 2	17	20	0.77	18-22
Visit 3	16	21	0.58	19-23
Visit 4	17	21	0.18	20-23
Visit 5	19	21	0.05	20-23
Visit 6	18	21	0.22	20-23

* Patient results were compared to the validated Asthma Control Test cut off of ≥ 20 indicating control of symptoms.

Table 2. Average Lung Function of Telepharmacy Patients Over One Year

			2-Sided	95% Confidence
	Number of Patients	Forced Expiratory Volume in One Second Percentage of predicted (FEV1%)*	P value	Range
Month 1	20	74%.	0.02	69%-78%
Month 6	17	75%	0.07	71%-80%
Month 9	18	75%	0.07	71%-80%
Month 12	18	75%	0.07	71%-80%

*Patient results were compared to EPR-3 control chart where well controlled is defined as $\geq 80\%$.



Figure 1