



Virtual Infusion Services

Bringing cancer therapies closer to rural patients

Rural and underserved communities in South Dakota have limited access to immediate oncology expertise. It is not unusual for patients receiving care at Sanford Cancer Center in Sioux Falls, S.D., to travel more than 100 miles for office visits or infusions. Travel can prove difficult in this state, particularly during the winter months, when severe weather can force patients in rural areas to choose between skipping or delaying treatments and traveling in dangerous conditions.

Travel to large, tertiary care medical centers for infusion therapies can also be a significant financial burden, especially if lodging is necessary. Distance to care centers, the frequency of trips, a lack of public transportation, and associated travel costs can all be barriers to prescribed oncology care. The inability to access infusion services can lead to urgent health concerns that may require emergency treatment.

Although many rural facilities in South Dakota do have infusion centers that administer anti-cancer therapies, these centers are generally not directly overseen by an oncologist or oncology-trained advanced practice provider. Rather, local family practice or internal medicine physicians who are often unfamiliar with oncologic therapies oversee the administration of infusions.

Nurses in Sanford Cancer Center's rural infusion centers are oncology trained, but they typically have limited exposure to many of the complex treatment plans ordered by Sanford oncol-

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ogists. If nurses have questions about labs, treatment plans, or symptoms, they contact by phone the Sanford Cancer Center in Sioux Falls. Receptionists typically convey these messages to an oncology nurse, who in turn relays the question to an oncologist. The oncologist typically addresses messages between office visits and communicates answers to the nurse, who returns the call to the nurse at the rural site with the appropriate orders. This multilayered process can cause delays and frustration for both patients and the infusion nurses. Because the administration of anti-cancer

therapies is complex and carries the risk of adverse reactions if not done properly, oncologists in tertiary care centers often restrict off-site infusions, compelling patients to travel long distances to access complex treatments.

Telemedicine can be an effective method for providing expert medical care to patients living in rural communities. Virtual technologies already enable not only remote office visits but also expert care for patients in rural emergency rooms and intensive care units. A review of the current literature specific to the needs of oncology patients addresses the use of telemedicine for office visits, but there is no evidence of telehealth being used in rural infusion centers.¹

In 2015 Sanford Cancer Center launched its Virtual Infusion Project to determine whether an oncology-certified nurse practitioner (CNP) based in a tertiary care infusion center could provide safe, effective oversight to three rural infusion clinics by using telemedicine technology, a dedicated telephone line, and an electronic health record (EHR).^{2,3} The overwhelming success of the project proved that remote oversight by an oncology CNP is on par with that of an on-site oncology specialist. Subsequently, the leadership at Sanford Cancer Center extended the virtual infusion program beyond the project's time frame, and there are plans to expand telemedicine services to additional rural infusion centers within Sanford's network.

Virtual Infusion Comes to Rural South Dakota

Located in Sioux Falls, S.D., the Sanford Cancer Center Infusion Center is accredited by the Commission on Cancer and certified by the Quality Oncology Practice Initiative. The Virtual Infusion Project tested the feasibility of having a CNP oversee the operations of three of Sanford's rural infusion centers for a three-year period. (The project initially involved two rural infusion sites and later added a third.) The CNP provided direct and real-time support to the three sites through a dedicated telephone line, telemedicine equipment, and Sanford's EHR. Because the CNP is familiar with and followed practice guidelines and standards

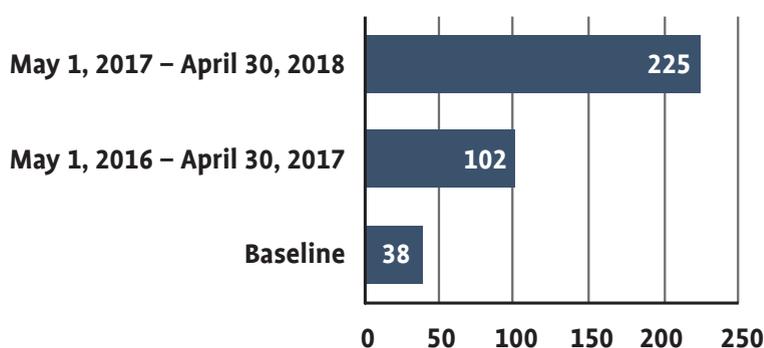
of care, private insurers, Medicare, and Medicaid covered patient treatment costs.

Sanford Vermillion Medical Center in Vermillion, S.D., is a one-chair infusion center located 63 miles south of Sanford's tertiary care center in Sioux Falls. The second site is the Douglas County Memorial Hospital, also a one-chair infusion center located 96 miles west of Sioux Falls in Armour, S.D. A third site, Sanford Worthington Medical Center in Worthington, Minn., was added at the end of the second year of the project after the center lost its medical oncologist. The Worthington site has four chairs and two beds and is located 63 miles east of Sioux Falls.

Prior to the project going live May 1, 2016, team members spent 12 months creating a seamless model of care delivery. They reviewed the policies and procedures of each of the three rural sites in the program, compared them to oncology best practices, and established a standard treatment approach.⁴ Providers from the Sanford Hematology and Oncology Department obtained telemedicine credentials to allow them to treat patients in each rural infusion center. Sanford's IT department purchased and installed telemedicine equipment in all three sites. The clinical team received telemedicine and oncology training before going live.

At the tertiary care site, telemedicine stations were strategically placed on the desks of two providers located near the infusion center. This convenient access increased the use of this treatment modality among the oncologists and CNPs at Sioux Falls. Telemedicine visits to Sanford's rural clinics increased from 38 visits during the year before the project to 102 visits by the end of the project's first year. The telemedicine visits included those made to the three rural sites included in the project as well as other rural sites within the Sanford system. Sanford's leadership subsequently budgeted more dollars for the project and purchased additional telemedicine equipment to place in each oncologist's office. During the second year of the project, 225 telemedicine visits were made (see Figure 1, below). The total number of telemedicine visits was across all Sanford facilities, including the three project sites.

Figure 1. Number of Telemedicine Visits at Sanford's Rural Clinics



Patient Volumes Increase Across Project Sites

During the 12 months prior to the Virtual Infusion Project going live, the project team collected baseline data in five areas:

1. Infusion volumes
2. Satisfaction surveys
3. Access to expert oncology care
4. Telemedicine visits
5. Safety data.

The Virtual Infusion Project started with two rural sites on May 1, 2016. Sanford Vermillion Medical Center treated six patients in the 12 months prior to the go-live date, accounting for 65 visits. Of those visits, 12 were for injections and 3 were for infusion therapy (three anti-cancer agents and two support medications). The remaining 50 visits were for continuous infusion anti-cancer therapy pump removal. All six patients had their pumps initiated at Sanford Cancer Center in Sioux Falls as part of their treatment plan; they reported to the Vermillion site for pump removal.

Douglas County Memorial Hospital in Armour, S.D., was the second rural site in the project. Many years ago, this site had administered anti-cancer therapies when it had on staff an outreach oncologist who held regular clinics at the facility. After that oncologist left, the clinic closed its infusion facility and had not treated any patients in the previous 12 months.

By the end of the second year of the project (as stated previously, year one of the project was spent prepping), Sanford Cancer Center had successfully transitioned 15 of its patients to the Vermillion site and 1 patient to the Armour site. These 16 patients accounted for 92 patient visits during one year at the two rural centers—27 more visits than in the previous year (see Table 1, below).

During the project’s second year the Vermillion and Armour sites offered patients complex therapies, which had not previously been administered at these locations. Specifically, the Vermillion

site administered eight anti-cancer therapies that Sanford had not previously permitted outside of its tertiary care center. Vermillion’s increased patient volume and the addition of complex treatments required the site to add a second chair to its infusion center.

A third site, Sanford Worthington Medical Center in Worthington, Minn., was added at the start of the project’s third year. The Worthington infusion center had lost its oncologist and was therefore a prime candidate for telemedicine. Although oncologists from Sanford’s Hematology and Oncology Department had agreed to provide outreach coverage to Worthington, they were only at the remote site one day per week.

Worthington’s infusion center saw 79 patients in the 12 months prior to its participation in the Virtual Infusion Project, accounting for 612 visits. Telemedicine services allowed Worthington to continue to provide complex anti-cancer therapies when visiting oncologists were not present. Under the program, Worthington also grew its patient volume. By the end of the Virtual Infusion Project, Worthington had 93 patients, accounting for 852 visits (Table 1, below).

From May 1, 2016, to April 30, 2018, Sanford Cancer Center transitioned 127 patients to one of the three rural infusion sites, compared to 85 patients before the project. This increased the number of infusion visits at the rural sites to 1,062, compared to 677 visits prior to the Virtual Infusion Project (Table 1, below).

Patient Demographics

We collected patient data throughout this project to capture the demographics of the population we served. The 16 patients we transitioned to virtual transfusion during the second year of the project were Caucasian. Four were age 65 and older, and the remaining 12 were adults ages 18 to 64. These individuals represented 8 counties, compared to the baseline of 10. The patients’ payer mix included 3 individuals covered by Medicare and 13 covered by third-party payers.

Table 1. Patient Volumes and Site Visits

Site	Baseline		May 1, 2016- April 30, 2017		May 1, 2017- April 30, 2018		Two-Year Totals Postimplementation	
	Patients	Visits	Patients	Visits	Patients	Visits	Patients	Visits
Armour	0	0	1	2	4	18	5	20
Vermillion	6	65	15	90	14	100	29	190
Worthington ^a	79	612	0	0	93	852	93	852
Totals	85	677	16	92	111	970	127	1,062

^aThe Worthington site was only operational the last year of the project (year three).

Demographics changed with the addition of the Worthington site in the final year of the project. Of the 111 patients we transitioned to the rural sites that year, 93 were Caucasian, 3 were Asian, 2 were African American, 1 was American Indian, and 12 were unknown. Sixty-three patients were age 65 and older, and the remaining 48 were adults ages 18 to 64. The patients' payer mix included 59 individuals covered by Medicare, 49 covered by third-party payers, and 3 covered by Medicaid. The project reached patients in 26 counties, 16 above the baseline of 10. The Vermillion site served patients in 9 counties in three states; the Armour site served patients in 3 counties; and the Worthington site served patients in 14 counties in two states.

Throughout the project, the triple-check system recommended by the American Society of Clinical Oncology and Oncology Nursing Society standards was followed. These checks included physicians writing the orders, nurses reviewing and releasing the orders, and pharmacy staff verifying the orders.

Patient and Clinician Satisfaction

The Virtual Infusion Project team created satisfaction surveys for the patients, physicians, CNPs, and nurses who participated in the telemedicine project. After several months of patient surveys consistently indicating 100 percent satisfaction in all categories, we discontinued the surveys. The project team acknowledged a potential for bias among patients in that the convenience of receiving treatment at a site closer to home may have superseded any other concern they may have had with the care they received. The team also observed that people in rural settings are close-knit. Nurses believed that they would have heard any concerns through word-of-mouth if patients had issues with their care.

Feedback from initial providers (i.e., physicians and CNPs) indicated problems connecting the virtual stethoscope during telemedicine visits. After additional one-on-one training on this equipment, providers indicated 100 percent satisfaction in all elements of the process. To avoid redundancy, providers requested that the surveys be discontinued in favor of promptly reporting of any issues to project leaders.

Safety Data

The rural infusion centers were able to safely administer treatments that had previously been restricted to the tertiary care setting. There were seven infusion reactions recorded in the two-year project period. In each case, the CNP communicated with the patient via telemedicine and gave appropriate orders, successfully managing the reaction and reversing the reported symptoms. The drugs were re-challenged, and each patient went on to receive his

or her prescribed treatments. There were no sentinel events or hospitalizations related to infusions or infusion reactions in the rural settings. There were five reported medication variances during the project related to workflow issues:

- A drug was administered before the most recent lab results were obtained. For the drug involved, darbepoetin, our policy was that a hemoglobin had to be checked within 30 days of administration. The hemoglobin that the nurse looked at prior to administration was obtained within the last 30 days and met parameters for treatment; however, she missed the fact that the patient had hemoglobin drawn earlier that day, which also met parameters. The Sanford Medication Safety Team (who was independent of the project) labeled the variance as an error that did not reach the patient.
- An equipment malfunction occurred that nurses were able to successfully troubleshoot.
- A treatment day was cancelled rather than deferred (caught by pharmacy), requiring the CNP to fix the treatment plan.
- A scheduled anti-cancer injectable was obtained using an override function versus releasing it from the treatment plan—a deviation from protocol.
- A lack of communication from the hospital at the time of a patient's discharge could have led to a missed dose had a nurse not caught it.

Throughout the project, the triple-check system recommended by the American Society of Clinical Oncology and Oncology Nursing Society standards was followed. These checks included physicians writing the orders, nurses reviewing and releasing the orders, and pharmacy staff verifying the orders. Variance reporting was encouraged as a mechanism through which to learn and was non-punitive. The Project Team Meeting had safety/variance reporting as a standing agenda item. These checks and balances put into place by the project team during the implementation phase were effective.

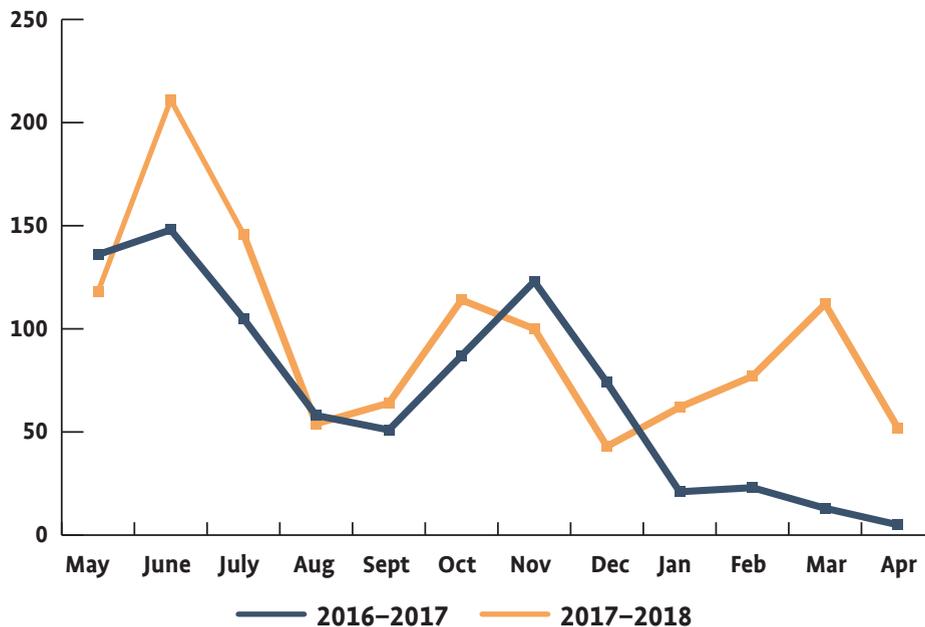
The CNP Role

The oncology CNP involved in the Virtual Infusion Project maintained a log of all interactions she had with the three rural sites. The rural infusion nurses contacted the CNP via a dedicated phone line most of the time; they also used the inbasket function of Sanford's EHR for questions that did not require immediate action. In some cases, they used both methods of communication.

The CNP's time spent consulting with the rural clinics, measured in minutes, ranged from providing an electronic signature (1 minute) to tracking down an oncologist to answer a complex patient question (50 minutes). In the two years the study was live, the CNP had 301 contacts with the rural infusion nurses, accounting for 2,037 minutes. These interactions addressed questions about different aspects of treatment plans, requests for lab reviews, reviews of vital signs or symptoms, and requests for help managing infusion reactions.

The number of interactions between the CNP and rural clinics increased from 117 during the second year of the project to 184 during the third year. This increase reflects the addition of the

Figure 2. CNP Interactions with Rural Infusion Nurses by Month



third site to the project and an overall increase of patients treated in all participating sites (Figure 2, above).

Clinical Trials

Early on, the virtual infusion team identified Sanford oncologists' commitment to enroll patients in clinical trials as a potential barrier to the project based on stringent requirements that dictate the setting of patient enrollment and treatment, which would preclude patients on a clinical trial from receiving infusion treatments outside of a tertiary care setting. Nurses from Sanford Research joined the team early in the project to look for ways to overcome the barriers. They identified Compass as a clinical trial that would be manageable in the rural setting. Compass (Community Oncology Use Molecular Profiling to Personalize the Approach to Specialized Cancer Treatment at Sanford) was a non-treatment trial. The trial allowed the project team to begin to develop the foundations of clinical research in the rural setting, including on-site research coordinators who would work with the oncologists to identify and consent patients. However, because the clinical trial did not involve actual treatment, the project team would not have to address the regulatory standards involved with study drugs. Sanford research team initiated the required regulatory work for Vermillion and Worthington late in year. Both sites identified research coordinators who completed training. Worthington opened for enrollment in March 2018; Vermillion opened in April 2018. The rural research coordinators enrolled two patients into Compass prior to project completion on April 30, 2018. The project team is hopeful that Sanford Research can

build upon this foundation and address other barriers that deter rural patients' enrollment in clinical trials.

Lessons Learned

Although most patients in the project were eager to receive their care closer to home, a few were concerned that care delivered via telemedicine would be substandard. The team proactively addressed this concern with a marketing plan called the Community Awareness Campaign. Printed materials conveyed the message, "High-quality care from an expert team is available at your local infusion center. Infusions are safely provided by oncology-trained nurses who receive virtual oversight by an expert oncology provider." Patients also received verbal assurance from members of the tertiary care team (i.e., physicians, infusion CNPs, infusion nurses, etc.). Although patients had the option of transferring their care back to the tertiary care center if they were dissatisfied with their care at the rural infusion site, this did not occur.

When implementing the Virtual Infusion Project, we had some difficulty identifying oncology patients in the rural areas we targeted. This was particularly difficult at the Armour site. The smallest of the project's rural sites, Armour serves a sparsely populated area. Despite the willingness of Sanford's oncologists to transition their patients from the tertiary care center in Sioux Falls to the Armour site, the physicians were unfamiliar with the Armour area and missed opportunities to recommend virtual services to local patients who could have benefited from them. Although the Community Awareness Campaign aimed to educate patients about the project and encourage them to ask their oncol-

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ogists about it, we were unable to significantly increase participation at the Armour site.

The Virtual Infusion Project also taught us the importance of giving nurses in our rural sites adequate access to the software used by our EHR. Unlike their counterparts in Sanford's tertiary infusion center, our rural infusion nurses had been limited to "read only" access to our EHR, which denied them the ability to verify patient treatment plans. This omission had financial repercussions when infusion nurses were unable to proactively identify treatment errors before medications were prepared. As a result, some treatments were cancelled, and medications were wasted.

Today, Sanford's rural nurses have clearances to check and verify individual patient orders in the EHR, allowing them to practice within the full scope of their license. These nurses later became part of a pilot project at Sanford to measure the impact of expanding EHR access. The data from the pilot will help determine future security clearances for all rural infusion nurses in the Sanford network.

Results and Conclusions

Oncology CNPs are well versed in the needs of oncology patients undergoing treatment. They review lab work, sign treatment plans, and manage side effects and infusion reactions. During our Virtual Infusion Project, the oncology CNP's virtual oversight of three rural infusion centers decreased infusion delays, lowered the number of treatment interruptions, and decreased emergency room visits due to infusion reactions. This enhanced efficiency reduced the number of queries to oncologists and subsequently lowered costs by avoiding potential emergency room visits and hospitalizations related to treatment.

The Virtual Infusion Project successfully demonstrated that—using an EHR, telemedicine equipment, and a dedicated telephone line—a CNP in a tertiary care infusion center can adequately provide direct oversight to patients receiving oncology treatments in rural infusion centers. The success of this project was largely made possible by a group effort that incorporated the respective expertise of each participant. Nurses, pharmacists, and managers at the tertiary and rural clinics who participated in the project met frequently to network and discuss project workflows. Together,

they brought a multidisciplinary approach to the project that created a seamless care delivery model.

By standardizing policies and procedures, following best practices in oncology and telemedicine, and developing a well-trained rural staff, project leaders ensured that patients could safely receive complex anti-cancer therapies closer to home. Convenient telemedicine access to oncology specialists increased the comfort level of the nurses in the rural clinics and the prescribing oncologists in Sioux Falls, who both felt more comfortable with transitioning complex anti-cancer treatments to rural clinics. As a result, patients and their families saved travel time and related costs by being treated in their own communities.

Indeed, travel time and expenses for patients significantly dropped under the telemedicine program. Collectively, patients and their families reduced their travel to medical appointments by 65,456 miles and 1,757 hours, translating to \$65,791 in costs savings (Table 2, right).

Looking Forward

Inspired by the Virtual Infusion Project's success, oncologists in Sanford's Hematology and Oncology Department have transitioned patient care to rural infusion settings wherever possible, further easing travel burdens for patients and their families in remote locations. Some nurses in the project's rural settings have expanded the project's impact. After project participation, several nurses in the three rural clinics decided to obtain their certification in oncology nursing, helping expand oncology expertise in areas where it is limited.

Virtual infusion has become an important component of Sanford's Oncology Program. The leaders of the Virtual Infusion Project plan to continue offering telemedicine services at the original three rural sites. The tertiary care center will continue providing CNP coverage to the clinics, and Sanford's leadership plans to expand the program to other rural infusion centers within its network.

However, for the long-term growth and sustainability of virtual infusion at Sanford's rural cancer clinics, it is unsustainable for the tertiary care center to absorb the costs of the program. Sanford's leadership has therefore put together a business plan that incorporates a monthly subscription fee for rural clinics based on their size and volume. Current rural infusion centers will choose whether to continue offering virtual infusion services. If a rural center opts out of the program, Sanford's Hematology and Oncology Department may choose to stop transitioning patients who require complex therapies to that site.

Both the American Society of Clinical Oncology and the Oncology Nursing Society have identified the need for oncology programs to design and test cost-effective patient care models that can provide quality oncology care and improve patient care outcomes while maintaining accountability for the care delivered. Sanford's Virtual Infusion Project accomplished this, and the best practices it identified will enhance additional telemedicine services as Sanford expands them throughout its network. 

Table 2. Travel Miles, Time, and Cost Savings^a

	Total Trips	Total Miles Saved	Total Time (Hours) Saved	Total Cost Savings
May 1, 2016- April 30, 2017	92	10,548	151	\$5,643
May 1, 2017- April 30, 2018	970	54,908	1,606	\$60,148
Totals	1,062	65,456	1,757	\$65,791

^aThe round-trip mileage from the patient's city address to Sioux Falls, minus the round-trip distance between their city address and the rural town (i.e. Armour) equaled miles saved. Miles saved divided by 70 mph, the average speed limit between interstate and highway travel, determined the travel time saved. Miles saved, multiplied by the IRS mileage rate, estimated the patient's travel costs savings.

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