Increasing Arteriovenous Fistulas (AVF) Within Network #15
Intermountain End-Stage Renal Disease Network, Inc.
ESRD Network #15

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Abstract

In 2002, the Intermountain End-Stage Renal Disease Network, Inc., Network #15, initiated a quality improvement project, "Increasing Arteriovenous Fistulas Within Network #15." The primary objective of this project was to maximize the placement of Arteriovenous Fistula (AVF) within the adult in-center hemodialysis population in Network #15. A closely related objective was to ensure that policies and procedures were in place at each facility to encourage placement and maintenance of fistulae once they had been placed. Based on the facility-specific percent of adult patients reported to have a fistula in January 2001, eight facilities were selected to participate in the project. Approximately 100 project partners (facility staff, nephrologists and surgeons) collaborated in an effort to improve AVF rates for both incident and prevalent patients. The interventions for this project were multi-faceted and included: face-to-face meetings with project partners, dissemination of a NKF-DOQI Summary Paper on Vascular Access, video materials and written information for patient and staff use, post-operative "Fistula Care Packages," educational meetings and data feedback reports to facility staff, nephrologists and surgeons. Of the seven indicators selected for this project, the predicted improvement was met in four. Overall improvement was noted in six of the seven process/outcome measures. A statistically significant ($p=0.05$) improvement was noted in the rate of fistulas used for treatment for prevalent (all) hemodialysis patients. This rate increased by about one-third from baseline to re-measurement.

Introduction and Objectives

At the end of 2000 nearly 300,000 individuals in the U.S. were relying on a vascular access to receive life saving hemodialysis treatment. A hemodialysis patient's vascular access is his/her lifeline. The need for hemodialysis patients to have a well-functioning, low-maintenance hemodialysis access is widely acknowledged. Not only do multiple access failures result in poor health, frequent hospitalizations and disruptions in the lives of ESRD patients, but access problems can also disrupt the workflow in a dialysis unit. This disruption may affect the schedules of many patients for an entire day. The 2000 United States Renal Data System (USRDS) Annual Report states that vascular access problems are the most common reason for hospitalization in ESRD patients. Every time a patient has an access complication, surgical schedules, radiology schedules, nephrologists' and surgeons' schedules also are affected.

An ideal vascular access would deliver a blood flow rate that is high enough to provide optimum dialysis, last a long time, and have a low rate of complications. Unfortunately, the perfect hemodialysis access does not yet exist. Although no type of access in current use satisfies all of these criteria, AVFs come the closest. AVFs are reported to have fewer complications than either grafts or catheters, to have the best five-year patency rates and to have lower rates of infection.

The 1997 National Kidney Foundation Dialysis Outcomes Quality Initiatives (NKF-DOQI) Clinical Practice Guidelines for Vascular Access were developed to promote implementation of evidence-based clinical practice guidelines. These guidelines provide dialysis and surgical professionals with recommendations for optimal clinical practices, thereby improving the quality of patient care, and positively influencing patient outcomes (NKF, 1997).

The NKF-DOQI Vascular Access Workgroup members concluded that the access type that comes closest to the ideal access is an AVF (NKF, 1997). Multiple published studies have shown that the AVF has superior 4-5 year patency rates and requires the fewest interventions compared to grafts and catheters (Churchill, Taylor, Cook, et

al, 1992; Mehta, 1991). Concomitant studies have also shown lower annual surgical and hospitalization costs associated with the use of AVFs versus grafts (Feldman, Held, Hutchinson et al, 1993; Hakim & Himmelfarb, 1998). At least one study that looked at the correlates for patients who required multiple vascular accesses during their time on dialysis found that the odds of having four or more accesses was greatest in patients who had either catheters or grafts (Rodriguez, Lopez, Montse, et al, 1999). Finally, a recent study of infectious complications of hemodialysis access reveals that AVFs have the lowest risk of infection, catheters the highest, and grafts intermediate (Nassar & Ayus, 2001). These authors have also recommended increasing the placement of AVFs. The NKF-DOQI Practice Guidelines Workgroup recommended 50% of all new patients received an AVF, and that the overall AVF prevalence rate be 40%. By meeting these national goals, the NKF-DOQI Workgroup notes that quality of life and overall outcomes for hemodialysis patients could be improved.

The 2000 USRDS Annual Report describes significant geographic variation in the ratio of native AVFs to AV grafts and permanent central venous catheters, with the Northeast and Northwest areas of the U.S. achieving the highest fistula rates. Individual dialysis units with patient demographics similar to the general ESRD population have reported AVF rates up to 97.9% (Nguyen, Griffith, Robinson, 2001). The fistula rate for the Network #15 Native American population is 43.4%, which is higher than the overall rate for five of our six states and higher than the Network as a whole. Where marked variation occurs there is an opportunity for improvement. The "Increasing Arteriovenous Fistulas (AVFs) Within Network #15" project aimed to achieve improved use of AVFs to decrease this variation.

The objectives chosen for this project were based on the NKF-DOQI Clinical Practice Guidelines for Vascular Access: Update 2000, and are listed in Table 1.

Table 1. Increasing Fistula Project Objectives

Process Objectives	To ensure that facilities had a policy to address the initial access placement, including: patient history and physical exam prior to placement, diagnostic evaluation prior to placement, order of preference for access and order of preference for access location,
	To ensure that facilities had current vascular access management protocols in place including a protocol for the management of new or fragile fistulas, stenosis monitoring, fistula development, preservation and maintenance, a clamp protocol, dressing management, and patient education protocols,
	To assess whether a vascular access coordinator (defined as an individual with designated responsibility for tracking patients' accesses, developing and implementing policies, protocols, etc.) was identified for each facility,
	To increase the proportion of surgeons placing $\geq$ 50% AVF for intervention facilities.
Outcome Objectives	To increase the rate of incident patients $\geq$ 18 years of age that begin in-center hemodialysis using a fistula,
	To increase the rate of prevalent pts $\geq$ 18 years of age dialyzing at an in-center hemodialysis facility with a fistula,
	To improve incident fistula rates to at least 50%, and prevalent fistula rates to at least 40% in the eight project facilities.

Methods

Because of the intensive nature of the intervention, and to conserve both staff and fiscal resources, eight (8) project facilities located in a single metropolitan area were chosen to participate in the Network #15 Increasing Fistulas project. To be considered for this project, facilities needed to be located in the Denver metropolitan area, and had to have demonstrated a prevalent fistula rate lower than the Colorado aggregate fistula rate during a January 2001 data collection. The project group included 25% of the state's facilities. From these 8 facilities, multidisciplinary teams consisting of facility staff, nephrologists and surgeons were asked to collaborate in an effort to improve AVF rates for both incident (patients on dialysis for < 91 days) and prevalent patients (all patients in the facility). This resulted in approximately 100 project partners.

The interventions for this project were multi-faceted. Facilities selected for project participation were first asked to complete a root cause analysis and to submit a complete list of vascular access surgeons and nephrologists who provided care for patients at their facilities. After compiling contact information for this group, a letter of introduction and an executive summary of the project were sent to each project partner in March of 2002. In addition to the letter of introduction, nephrologists were asked to contact individually surgeons who provide care for their patients about the project. Face-to-face meetings were then scheduled with each facility, as well as with each individual/group of nephrologists and surgeons that the facility staff identified as providing care to the patients in their facility. To ensure maximum awareness of and participation in the project, meetings were scheduled at the convenience of the project partners.
The project partner visits took place in April and May of 2002. The following agenda was completed during the on-site visits:

- PowerPoint presentation to review the Quality Improvement Project as well a state-specific and national comparison of fistula data.
- Discussions of reasons that fistulas are not being placed (review of root cause analysis completed previously by facilities).
- Change packets were introduced consisting of a NKF-DOQI Summary Paper on Vascular Access, written information for patient and staff use, video materials, and "Fistula Care Packages" containing post-operative and exercise information for patients, as well as a tourniquet and "squeezy kidney".
- Discussion of the plan for monthly reporting (e.g., reporting frequency, due dates, expectations).
- Project partners were asked to schedule multidisciplinary meetings to identify specific Quality Improvement activities that could be implemented to increase fistula rates, and to discuss which of the contents of the Change Packet could be used or modified in order to assist with this process.

Additional Interventions:

- Three educational meetings were conducted for project partners:
  - "*Back to the Basics: Increasing the use of AV Fistulas in Hemodialysis Patients,*" by Vo Nguyen, MD on May 23, 2002.
  - "*A Multidisciplinary Access Program,*" by Lawrence Spergel, MD (corporate sponsorship) on September 24, 2002.
  - " *Mastering the Buttonhole Technique,*" by Kay Briegel, RN on October 15, 2002.
- Monthly data submission to the Network. Access data for all new (incident) in-center hemodialysis patients who were 18 years of age or older and on dialysis for > than 90 days but < 120 days, as well as fistula prevalence data were collected.
- Monthly facility-specific, surgeon-specific and aggregate trend data were compiled by the Network #15 staff and reported back (blinded) to all project partners. Project newsletters accompanied the data and contained project updates and timely information regarding access placement and management.

Additional Activities:

- Follow-up data collection was completed in February 2003.
- Validation of 100% of the incident patient data reported was completed in February 2003.

- Intervention Evaluation was distributed to project partners in February 2003 along with an access-tracking template utilizing MS Excel. This program computes access rates and generates graphs, which allows the facility to continue to track access rates and surgeon-specific data, as well as access complication information.

The quality indicators chosen for the project are listed in Table 2.

Table 2. Increasing Fistula Project Quality Indicators

Process Measures	***Indicator***		***Project Goal***
	Numerator	***Denominator***	
Vascular access *placement* policy present at intervention facility	# of facilities with a vascular access *placement* policy at baseline and follow-up	# of facilities in the project throughout the time period	The proportion of facilities in the intervention group, which have a vascular access placement policy to **increase by 20 percentage points**
Vascular access *management* policy present at intervention facility	# of facilities with a vascular access management protocol at baseline and follow-up	Number of facilities in the project throughout the time period	**60%** will have a management policy following intervention
Vascular access coordinator utilized at intervention facility	# of facilities with a vascular access coordinator at baseline and follow-up	Number of facilities in the project in the time period	**40%** will have a designated access coordinator following intervention
Proportion of surgeons placing $\geq$ 50% AVF in intervention facility	Number of surgeons whose AVF rate equals or exceeds 50% of all accesses placed at baseline and follow-up	Number of surgeons performing vascular access procedures during the time period	Proportion of surgeons in the intervention group who place $\geq$ 50% fistulas will **increase by 10 percentage points**
Outcome Measures	***Indicator***		***Project Goal***
	Numerator	***Denominator***	
Rate of incident patients, $\geq$ 18 years of age starting in-center hemodialysis at an intervention facility using a fistula	Number of patients in the denominator with an AVF *used* at the first hemodialysis treatment in the study period	Number of patients initiating hemodialysis for the first time in the time period	Patients beginning dialysis using a fistula in the intervention population will **increase by 5 percentage points**

Outcome Measures (cont.)	*Indicator*		*Project Goal*
	Numerator	*Denominator*	
Rate of incident patients ≥ 18 years of age starting in-center hemodialysis at an intervention facility with a fistula created as their first permanent access (may be dialyzing with a catheter as a bridge to a maturing fistula	The number of patients in the denominator in whom an AVF is constructed as their first permanent access	Number of patients initiating hemodialysis for the first time in the time period	The proportion of patients for whom a fistula is created as their first permanent access in the intervention population will **increase by 5 percentage points**
Rate of prevalent patients ≥ 18 years of age dialyzing at the in-center hemodialysis facility who are dialyzing *using* a fistula for dialysis.	The number of patients in the denominator who dialyze utilizing an AVF	The total number of prevalent patients dialyzing at the facility	The rate of prevalent patients ≥ 18 years of age dialyzing with a fistula will **increase by 5 percentage points.**

Data for process and outcome measures were reported to the Network on data collection forms and entered into Microsoft Excel spreadsheets for tracking and analysis. Proportions were computed in the spreadsheets and 95% confidence intervals were computed. (Fleiss, 1982)

Results

Forty-three accesses were placed in incident patients during the 3-month baseline period (October-December 2001) and thirty-eight during the 3-month re-measurement period (August-October 2002). At the beginning of the project, the facilities had identified the surgeons to whom they refer their patients for access placement. Accesses placed by other or unknown surgeons were grouped together and are not included in the surgeon-specific results, but are included in all other relevant rates calculated in the project. At baseline, twelve of the seventeen (70.6%) surgeons identified by the facilities placed fistulas for 50% or more of their accesses in patients at the intervention facilities. These seventeen surgeons placed a total of 34 accesses for the intervention facilities during the baseline period. During the re-measurement period, 20 accesses were attributed to eight specific surgeons. Seven of these surgeons (87.5%) placed fistulas for 50% or more of their accesses in patients in the intervention facilities. During the baseline period, between 1 and 5 accesses were placed by each surgeon reported; during re-measurement, only one or two accesses were placed by each surgeon, except for one who placed seven accesses.

Table 3. Rate of Incident Patients Using a Fistula

Time Period	# Patients Using AVF at 1st HD Treatment	# Patients Initiating HD for the First Time	Rate of Fistula Use (%)	95% Confidence Interval
Baseline (Oct-Dec 2001)	5	43	11.6	(4.4 – 25.9)
Re-measurement (Aug-Oct 2002)	9	38	23.7	(12.0 – 40.6)

The rate of fistula *use* for first hemodialysis treatment of patients new to dialysis (incident patients) doubled from baseline to re-measurement. At re-measurement, nearly one-quarter of the incident patients were using a fistula for their first dialysis treatment.

Table 4. Rate of Incident Patients with a Fistula Placed as First Permanent Access				
Time Period	# Patients with AVF Placed	# Patients Initiating HD for the First Time	Rate of Fistula Placement (%)	95% Confidence Interval
Baseline (Oct-Dec 2001)	23	43	53.5	(37.8 – 68.5)
Re-measurement (Aug-Oct 2002)	21	38	55.3	(38.5 – 71.0)

The rate of fistula *placement* for first permanent access for patients new to dialysis (incident patients) was essentially the same at baseline and re-measurement. More than half of the incident patients had a fistula placed for their first permanent access.

Table 5. Rate of Prevalent Patients Using a Fistula				
Time Period	# Patients Using AVF for Treatment	Total # of Patients	Rate of Fistula Use (%)	95% Confidence Interval
Baseline (Dec 2001)	176	605	29.1	(25.5 – 32.9)
Re-measurement (Aug-Oct 2002)	733	1904	38.5	(36.3 – 40.7)

The rate of fistula *use* for treatment of all hemodialysis patients (prevalent patients) increased by about one-third from baseline to re-measurement. The difference in the rates at baseline and re-measurement for fistula use in all patients was statistically significant ($p<0.05$). At re-measurement, nearly 40% of patients were using a fistula for dialysis treatment, almost reaching the NKF-DOQI goal.

Validation was completed on all of the data reported. Network Quality Improvement staff visited each facility and reviewed patient records and determined, for prevalent patients, that:

- Number of patients matched 100%.
- Number of patients dialyzing with a fistula matched 100%.

For incident patients there was less concurrence, but concurrence was still high. Identification of the surgeon who placed the access was the most difficult item to validate. For nearly 8% of patients, documentation was unavailable to validate the surgeon. In the facility with the lowest validation rate just under two-thirds could be validated by Network staff.

Table 6. Validation of data for incident patients				
Indicator	% Matched	% Disagreed	% Unable to Validate	Range Matched
1st permanent access type	88.5	7.1	4.4	80.0 – 100.0
Type of access used for first treatment	91.2	4.4	4.4	84.6 – 100.0
Surgeon who placed access	86.8	5.5	7.7	65.7 – 96.6

Conclusions

Current literature was not helpful to anticipate a level of change; thus, estimates for rates of improvement were made at the beginning of the project and were based on baseline data collected within Network #15 for other projects. This project was successful in effecting four of the seven indicators selected.

***Process measure 1*:** There were no facilities with a policy to address initial access placement at baseline nor at follow-up. Although sample policies and procedures for access placement were provided in the change packet, the facility staff members completing the facility-specific survey at the end of the project were not aware if such policies had been developed.

Process measure 2: There was an increase from 3 to 4 (37.5% to 50.0%) in the number of facilities with a vascular access management protocol. In addition, the protocols contained more elements at re-measurement than at baseline. At baseline, they had 3-4 of the desired elements; at re-measurement, they had 4-8 elements.

Process measure 3: There was an increase from 1 (12.5%) facility with a vascular access coordinator at baseline to 6 (75.0%) at re-measurement. The facility staff reported on their follow-up facility-specific survey that a Vascular Access Coordinator position has been approved for all facilities. The Vascular Access Coordinator will be responsible for tracking and trending access data as well as ensure that patients without permanent accesses and/or access complications are referred to surgeons or radiologists appropriately.

Process measure 4: The objective of increasing proportion of surgeons with an AVF placement rate >50% by 10 percentage points was met; this proportion increased from 70.6% to 87.5%.

Outcome measure 1: A predicted increase of 5 percentage points in the proportion of incident patients using AVF at first treatment was exceeded. The increase was from 12% to 24%, a total of 12 percentage points. (Table 3).

Outcome measure 2: The anticipated improvement of 5 percentage points in the proportion of incident patients for whom AVF was the first permanent access was not met. The increase was 1.8 percentage points from baseline to re-measurement (Table 4). However, at both baseline and re-measurement, the rate of fistulas placed exceeded the national goal of 50% fistula placement.

Outcome measure 3: Note in this project "prevalent patients" equaled *all* patients. The anticipated increase of 5 percentage points in the proportion of prevalent patients using AVF was exceeded. The rate increased by 9.4 percentage points, from 29.1% to 38.5% (Table 5). At 38.5%, the NKF-DOQI goal of 40% is almost met.

Facilities provided additional data regarding fistula prevalence (fistulas placed but not necessarily in use, all patients), which indicated a consistent improvement in fistula rates from January 2002 to December 2002, with one facility doubling its baseline rate. Fistula prevalence ranged from 24to35% in January 2002 and improved to 39 to 48% in December 2003.

A facility-specific survey was completed at baseline and re-measurement in order to describe the handling of vascular accesses at each of the eight project facilities. The results of the survey are included in the above Process Measure Results section (process measures 1-3).

At the conclusion of the project, facility personnel, nephrologists and surgeons were also asked to complete an evaluation form, rating each element of the project's educational materials:

- Nephrologist/Surgeon Communication Fax Form
- Vascular Access Placement Policy
- Vascular Access Management Protocol
- Vascular Access Coordinator Job Description
- Fistula Care Package
- Power Point "Best Access Procedures from the Dialysis Units Viewpoint"

- Power Point "Fistulas for Dialysis Acess: The Challenge of Preservation, Creation, Maturation and Cannulation"
- Staff Education Video: "Access Management: The Native AV Fistula"
- Staff Education Video: "Introduction to Cannulation: Steps to Optimal Cannulation"
- Patient Education Video: "Vascular Access for Hemodialysis"
- Vascular Access Project Listserv
- Vascular Access Team Concept

We did not receive as many responses to the evaluation as we had hoped: seven facilities did complete the evaluation, but the eighth had a new facility administrator who was not familiar with the project materials and no one at the facility could answer the questions. Only four nephrologists and five surgeons responded.

The element rated the highest was the Fistula Care Package: the majority of facilities, nephrologists and surgeons gave it a high rating and wrote positive comments about it. Many respondents did not rate a number of the materials, saying they the materials were "lost" or were never shared with staff. However, those who did rate the materials liked the two staff education videos and made positive comments about their usefulness. There were both positive and negative sentiments expressed about the Nephrologist/Surgeon Communication Fax and the Vascular Access Team Concept. For example, one surgeon said that the Nephrologist/Surgeon Communication Fax Form "helps clarify concisely what team members are thinking and for the record" and another called it "condescending." About the Vascular Access Team Concept, one surgeon said "I don't think it exists!" while a facility reviewer commented that nurses from the surgeons office visited the dialysis facility and a dialysis nurse was going to visit the surgeon's office. At least two facilities commented that they did not feel like they were "part of the team."

Although the current project was successful in meeting most of the outcome and process objectives, there were barriers to achieving even greater success with this project. Among the barriers identified are:

- Inconsistent contact people for the project. During the project, 6 of 8 facility administrators changed (sometimes multiple times), surgeons were added in the later stages of the project, one nephrologist left, multiple staff members who had been involved in the project at the start were no longer the "contact" people at the end of the project. Because of the staff turnover at the facility level it was difficult to involve patient care staff in the project. Many of the staff members contacted at the end of the project were unaware of the intervention materials.
- Based on personal communication with the project partners, nephrologist/surgeon commitment varied throughout the project. Management commitment and organization communication, as well as staff/physician participation are extremely important to superior performance. To be successful in an endeavor such as this it is essential that the key people responsible for access placement (the nephrologists and the surgeons) be active participants in the project. This was not always the case as reported by some project partners.
- An additional educational offering with a surgical focus was considered. The project partners were contacted regarding their interest. Due to the general lack of interest expressed by the majority of the surgical partners and the financial commitment this offering would require, this educational offering was not pursued.
- During the data validation process, documentation of vascular access location, type, placement date and the name of the placing surgeon were located on a single "vascular access" form in two of the eight facilities. Although a "vascular access" form was available in all eight of the facilities, it was not consistently utilized. In order to find the information, an extensive search of the medical record was necessary in the majority of cases.

As with many projects of this nature, this project had its limitations and in reviewing the project results, these limitations should be kept in mind:

- Many of the surgical partners provide services for patients receiving care at facilities not involved in this project. When fistula rates were reported during this project, the surgical partners did not receive "the full picture" as the reports contained information only on those patients dialyzing at the project facilities.
- This project was conducted within the metropolitan area in which the Network office is located. This was done due to the intensive nature of the interventions and the face-to-face detailing. This specific approach will not be practical for a location remote to the Network office.
- The dialysis facility staffing inconsistencies provided additional challenges to the implementation of the dialysis facility-specific educational components of this project. Resource materials, which were delivered during the face-to-face meetings to the original administrative representative, were reported not to be available to the new administrator or facility staff.
- Some project partners reported a lack of teamwork. This lack of teamwork was also evident during the initial face-to-face meetings. In reviewing the root-cause analysis documents, a number of the partners indicated that the problem was with another discipline, not them.
- This was the first time the surgical community was invited to participate in a quality improvement project at this level. The surgical partners are not familiar with the Network's role, responsibilities or expertise. Scheduling the initial face-to-face meetings and making contact with the surgeons who needed to be involved in the project was extremely challenging. Hundreds of phone calls and many weeks of time were spent coordinating these appointments.
- Although not a limiting factor in this project, since reference data were available within the Network from prior projects, it is essential that baseline data be reviewed in order to focus on the appropriate indicators for the project.

Additional Comments

- Prior to the beginning of the project one of the participating facilities was already involved in a long-standing quality improvement effort aimed to increase fistulas for their patients and had made significant improvements.
- One of the dialysis corporations involved in the project will be starting to monitor fistula and graft performance with the Transonic device in March 2003.

To make the project more effective if it were to be implemented again, several changes should be considered.

- To foster teamwork and to remain focused on the project, all project partners (facility staff, nephrologists and surgeons) should meet periodically to discuss the project at hand. As previously noted although face-to-face meetings with the project partners were effective, it was very difficult to coordinate appointments to get all project partners together at the same time. If dates for follow-up meetings were set at the beginning of the project, people would be more likely to attend. Though it is preferable to have a "team effort" when involved with a project such as this, it is evident that it was not essential as improvements were made when the facilities worked independently from the surgeons and nephrologists.
- In order to ensure continued focus on the project in the event that facilities have staff turnover, facilities should be required to submit monthly progress reports detailing quality improvement activities.
- The data burden for this project, though not large for the facilities (range 0 to 6 patients/month) was very time-consuming at the Network level. This involved monthly data collection, compilation of the results, revision of the tracking system, and dissemination of the information to all facilities, nephrologists and surgeons involved in the project. At the beginning of the project facilities were not always punctual in submitting data by the due date necessitating multiple follow-up phone calls to obtain the information. In addition, data that were submitted was not always complete when it was received. This caused delays in the distribution of the data to the project partners. The development of the electronic data tracking system should help to facilitate data collection for future projects by allowing for the electronic submission of the data to the Network and potentially to other project partners.

The efforts of the surgeons and the nephrologists to increase fistula rates for both incident and prevalent hemodialysis patients should be recognized. Without their interest and expertise this project would not have been possible. To quote one of the surgeons during a visit at the beginning of the project, "All you need to do is tell us what needs to be done and we'll take care of it." Indeed they did.

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