

SUMMARY REPORT: 90-DAY PROJECT

High-Risk High-Cost

January 31, 2013

Executive Summary:

Among organizations that are responsible for the total cost of health care, it is not surprising that many have decided to focus on their high-risk, high-cost patients as a way to make a large impact. Given the intuitive appeal of this approach, there is concern that these organizations are gravitating to a solution without a strong understanding of the problem and the specific nature of their high-risk, high-cost population. Over the course of two 90-day cycles we have identified a few vital principles for managing this complex and dynamic subset of the population which should guide this type of work: identifying patients at risk for *future* cost, tethering interventions to ‘impactability’ in that specific population, potential interventions and redesign, and the cost effectiveness of those interventions. Through testing in the Triple Aim community during this wave of work, we have developed a four-step process for managing this complex group.

Additionally, many organizations struggle with a prerequisite to this process: the identification of their at-risk patients. To inform that effort, we have also surveyed the field of predictive modeling to report some of the commercial vendors as well as their levels of prediction, approaches to measurement, and implementation at the front lines.

I. Research and Development Team:

- John Whittington, MD
- Amelia Cline

II. Intent:

Building on the last 90 days of work as well as the ongoing work of the Triple Aim community, we intend to build a comprehensive approach to working on the management of the high-cost, high-needs population. Our goal is to help people make sense of how they should work with these patients. This population is attracting a lot of attention and our concern is that the medical community is jumping to a solution too quickly and without a complete understanding of the problem. We will develop an overall approach to working with a high-risk population.

III. Background:



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For many years organizations that are responsible for the cost of health care have been interested in doing a better job of managing the high-cost individuals. These individuals are commonly identified as the 5% of patients who account for 50% of the cost of health care. Actuaries have been thinking about risk and prediction for a long time from an insurance perspective and have been focused on this high-cost population. Health insurers are increasingly using predictive models to identify fraud and abuseⁱ. A good reference is *Health Risk Adjustment and Predictive Modeling* by Ian Duncan. Working with high-cost individuals is a seductive idea: just control their cost and you can make a huge impact on overall spending on health care. Yet we know this impact has been elusive for many organizations who have attempted to focus on this population. We need to think about this work carefully and take a very cost-effective approach.

During the last 90-day cycle on this topic we observed that the highest spenders in the US are often elderly and have one or more chronic conditions, with risk increasing for each additional chronic condition. This group is also likely to have functional limitations and need help with activities of daily living. Lastly, this group is not static. In 2009, only 38% of the top 5% of spenders remained in the high-spending group the following year. Based on 1997 data, nearly 15% of high-spenders died by January 1st of the next year. Thus, we know that without any change to the system nearly 60% of the high spenders each year will be new to that group. Predicting the group of high-cost patients can be very difficult, especially given the dynamic nature of the group, and any interventions must take into account the limitations of targeting a single year's high spendersⁱⁱ.

Our concern now is that people are too quickly gravitating to a program/solution without understanding the problem well enough. When looking back at last year's claims, you could break the population into three groups: low, medium and high-cost individuals. When looking forward you need to realize that next year's high-cost individuals will come out of all three groups. Future risk is where we need to keep our focus. The core of this work is to know who is at high risk for future high cost and to determine whether interventions can be designed that will impact their care in a cost-effective manner. So there are at least four issues in play: identification, impactability, potential interventions and cost effectiveness. When it comes to cost effectiveness you need to consider the potential savings along with the cost of the intervention. The approach that we are going to outline is to learn how to manage this population in a cost-effective way.

IV. Description of Work to Date:

- Support the Triple Aim learning community to push this work further.
- Understand the cutting edge of predictive modeling for high-cost patients.
- Develop an approach to working with high-risk, high-cost patients that could be used with sites and would support a seminar.



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During this 90-day cycle we reviewed previous work that an R&D team did on predictive modeling in Wave 6. We interviewed some individuals with expertise on predictive modeling along with reviewing select literature. We surveyed the field to understand more about commercial vendors who had predictive modeling skill. We developed a process to work on high-risk, high-cost patients that involves four steps. Triple Aim sites have successfully used this work in their own focus on high-risk, high-cost individuals.



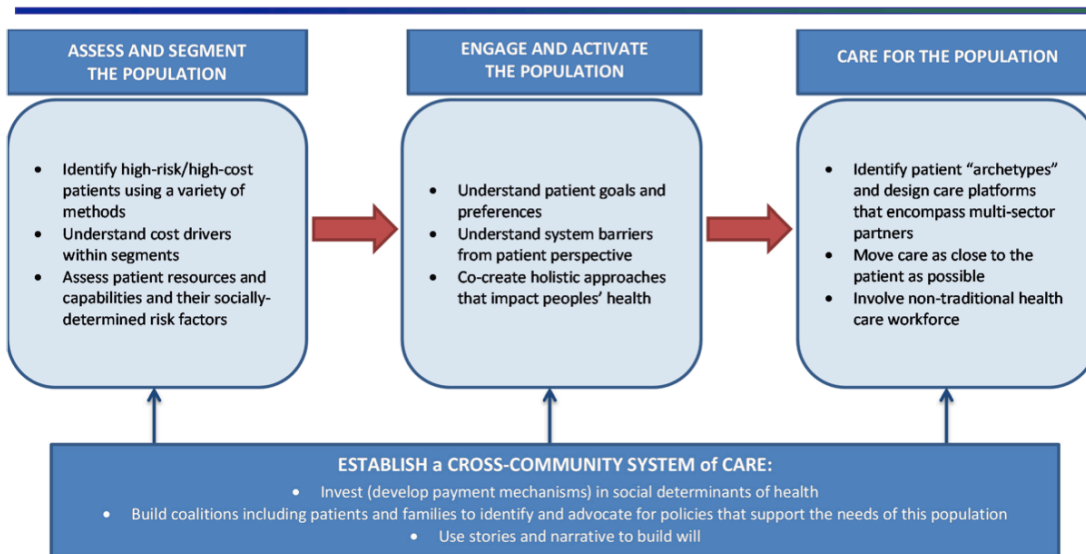
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V. Results of the 90-Day Scan:

During the past year we have been using the following model to work on managing high-cost, high-risk individuals in the Triple Aim collaborative community.

Change Ideas



Behind the model is a set of more detailed change concepts that we have been working with. Rather than explaining this model in detail we are going to discuss a 4-step process that will use this model.

Step One is to decide what the high-risk population is that you want to work with. You are going to use some case finding techniques to identify a population that you want to work with. You can use a predictive modeling algorithm or some screening criteria to find your population (i.e., everyone who spent more than \$50,000 or all newly diagnosed cancer patients) or ask clinicians who they think are high-risk. There are strengths and weakness to all methods.

A good review of the literature around predictive modeling was done by the King's Fund, in partnership with Health Dialog and New York University in 2005. They describe the three methods which are expanded in Appendix A as:

- 1) Threshold approach;
- 2) Clinical knowledge; and
- 3) Predictive modeling.



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To see their work: <http://www.kingsfund.org.uk/projects/predicting-and-reducing-re-admission-hospital>. One of their conclusions was that predictive modeling gave you the best chance to risk stratify the population for future costly events.

At the end of Step One you should have a population of individuals who you think will have high risk in the future that you want to consider working with. You should have an idea of the size of the total population of these patients.

Here is an example of selecting a population using the threshold approach:

Table One: From Care Oregon

Population Segment	# Members	% Members	Avg Total Paid Cost per Member/ 12 mos	% Paid Cost of Segment/ 12 mos	# ED visits	# IP Admits
No inpatient visits/ 6+ ED	81	3%	\$8,743	5%	786	0
1 Non-OB inpatient and 0-5 ED visits	97	4%	\$18,767	14%	147	97
2+ Non-OB inpatient OR 1 Non-OB inpatient AND 6+ ED visits	71	3%	\$59,440	32%	383	189

Remember you are trying to select patients who are at future risk for high cost. As we discussed in our earlier paper on high-risk, high-cost patients, many patients who have high cost this year will not be as costly next year. It is the simple idea of regression to the mean. You need to identify the individuals who will be at greatest risk in the next year.

With a predictive modeling tool you can give risk scores to individuals in the population and use those risk scores to stratify your population. In this way you can try to select individuals who are at high-risk. No matter how you select your population you will need to consider whether you can impact their outcome in a cost-effective manner with whatever interventions you devise.



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Table 2: Commercial and non-commercial tools that you can use for predictive modeling

Model	Developer/ Vendor	Data Sources	Risk of	Link
PARR ++, PARR1, PARR2	Health Dialog	<ul style="list-style-type: none"> • Patient Demographics • Hospital and ED utilization • Diagnostic data (ICD) --DCC-HCC • Community Characteristics 	Readmission in the next 12 months	Kings Fund , Nuffield Trust
Combined Predictive Model	Health Dialog; Kings Fund; John Billings, NYU	<ul style="list-style-type: none"> • Patient Demographics • Inpatient • Outpatient • A&E • GP data • Community Characteristics 	Emergency hospitalization in the next 12 months	Kings Fund , Nuffield Trust
Adjusted Clinical Groups (ACG)	Johns Hopkins	<ul style="list-style-type: none"> • Age • Gender • Diagnostic data (ICD) • Pharmacy data (NDC) 	Future hospitalization, high cost, or high pharmacy use	http://www.acg.jhsph.org/
Impact PRO	Optum (formerly Ingenix)	<ul style="list-style-type: none"> • Medical claims • Pharmacy claims • Additional modules: <ul style="list-style-type: none"> • Lab data • Pharm risk groups • Clinical indicators 	Risk of future cost, inpatient stay.	Optum Insight

Model	Developer/ Vendor	Data Sources	Risk of	Link
Risk Navigator Clinical	Elsevier/ MEDai	<ul style="list-style-type: none"> • Medical claims • Patient demographics • Lab data • HRA data • Episode treatment groups • Pharmacy data (NDC) Insurance type	Future cost, clinical risk (diabetes, comorbid cardiovascular, etc.)	MEDai
Clinical Risk Groups (CRG)	3M	<ul style="list-style-type: none"> • Age • Gender • Medical claims data (ICD) • Pharmacy data • Functional health status 	Future healthcare utilization and cost	3M
Diagnostic Cost Group-Hierarchical Coexisting Conditions (DCG-HCC)	Verisk Healthcare Inc. (formerly DxCG); developed at Boston University	<ul style="list-style-type: none"> • Age • Gender • Diagnostic data (ICD) 	Concurrent ‘expected’ spending, risk of future expenditures	VeriskHealth
Scottish Patients at Risk of Readmission and Admission (SPARRA)	Information Services Division, NHS National Services Scotland	<ul style="list-style-type: none"> • Pharmacy data • Hospital, ED, outpatient, and psychiatric utilization 	Admission, readmission in the next year	ISD Scotland

For more detail on predictive modeling see Appendix A.



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In table 3 you will see a list of high-cost individuals from one organization. These are individuals under 65. As you look at the data you will see terrific variation in cost at the individual level from year to year. Some high-cost individuals become low-cost and some low-cost become high-cost.



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Table 3 High-Cost Individuals as seen over time (partial table see Appendix B for full table)

Claimant #	Paid Medical 2009	Paid Medical 2010	Paid Medical 2011	Paid Medical 2012 (Through November)
1	\$550,502.00	\$75,185.00	\$282,155.00	\$1,529.00
2	\$237,266.00	\$76,702.00	\$0.00	\$0.00
3	\$234,765.00	\$0.00	\$0.00	\$0.00
4	\$186,464.00	\$1,938.00	\$2,691.00	\$0.00
5	\$178,360.00	\$0.00	\$0.00	\$0.00
6	\$169,233.00	\$7,542.00	\$1,735.00	\$3,575.00
7	\$153,968.00	\$8,465.00	\$6,299.00	\$67,725.00
8	\$150,041.00	\$39,430.00	\$100,113.00	\$79,604.00
9	\$148,572.00	\$0.00	\$0.00	\$0.00
10	\$143,280.00	\$905.00	\$380.00	\$1,864.00
11	\$135,407.00	\$43,328.00	\$3,131.00	\$0.00
12	\$128,299.00	\$1,282.00	\$1,443.00	\$309.00
13	\$114,780.00	\$14,204.00	\$126,622.00	-\$121,525.00
14	\$104,866.00	\$9,717.00	\$6,466.00	\$4,166.00

Step Two is the logical next step because you want to understand the needs of this population to see if you can develop cost-effective interventions that can make a difference. This goes back to the idea of impactability. Can we make a difference? There is seldom a case in healthcare where an improved design could not improve the care for the patient. However the issue is can we improve the care and do it in a cost-effective manner. Based on work from our last R and D cycle we know that people with multiple chronic diseases represent a high-cost group. Frail elderly would be another group that overlaps some with the first. Patients with significant disability are another group. Patients with mental health issues and chronic disease are another. There could also be special case groups like patients with chronic kidney disease that are moving to a stage where dialysis is neededⁱⁱⁱ.

So in order to produce a better understanding of the high-risk population that you have identified, look to the following to create this deeper view:

- 1) Using data systems
- 2) Using clinic personnel
- 3) Using patient interviews
- 4) Using third party data to understand personal behavioral and economic issues
- 5) Consider GIS mapping

A good practical step here would be to take a list of high-risk patients that you identified in step number 1 and interview clinicians to learn what they see as the big cost-driver issues. Secondly, go interview 10 of the patients to learn more from their perspective. And thirdly, continue to analyze whatever data you have to see if there are particular issues or trends that you see. This should lead to some ideas around the root cause of their problems and possible interventions that you might want to test.

Here is an example from a Triple Aim Community member who is working on high-risk, high-cost individuals

“We reviewed charts of patients with at least 4 ER visits and at least 2 hospitalizations and found that in middle age alcohol and substance abuse was a major contributor to health care use. Over 60 years, multiple chronic diseases became the major issue. Depression and other mental health issues are likely common but not well documented or screened for. Substance abuse was often not addressed during hospitalization.”

When interviewing potential high-risk individuals you may want to use a tool like the Harms 8 ([More information here](#)) which helps you look at the following dimensions: knowledge, resilience, health beliefs, stability, physical functioning, self confidence, reasoning, and social support. Another tool to consider is the Outcome Star: <http://www.outcomesstar.org.uk>.

The same Triple Aim organization that did chart review above also did a HARMS 8 survey with patients admitted to the hospital to generate new ideas for transitioning patients after discharge:

1. Refer patients with high risk for medication errors to public health nursing home visit to review meds & med management
2. Identify roles and gaps between different resources:
 - Behavioral health & substance abuse
 - CHR's
 - Medical social work
 - Environmental health & injury prevention



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- Utilization review
 - Counseling services
 - Aging programs
 - Pharmacy
 - PHN
3. Learn more about contract health transportation services
- Can a patient with children obtain rides to outpatient appointments? What transportation contract allows for this service?
 - Can a patient with behavior and physical limitations get a non-emergent ambulance transport? For what type of appointments?

The ideas listed above are not necessarily the solutions for your problems. They are just to demonstrate what you can learn when you start to understand your population better by using a tool like the HARMS 8 or Outcome Star.

The last comment to be made is that most predictive models use claim data as their main focus. This does not always get at the psycho-social issues and patient activation issues that are important. You can get at the psycho-social issues and patient activation issues by interviewing and potentially build that into a model for patient selection. Or you could purchase third party data on populations that can help you understand more about behavior and economic issues. For instance companies like Acxiom keep enormous data bases on consumer activity. They can segment the market into 70 different consumer segments. By using their data with your population you can learn a lot about their social and economic situation without having to get data from individuals.

By the end of step two you should have some ideas on root cause issues and potential interventions.

Step three is to test out some of your ideas with a few individuals. At IHI we have recommended an approach that we call 5x scale up. The idea is to start small and then scale up in increments of 5. The system issues in the table below are meant for illustration and not as a template to design from. Right now we want you to focus on working with just 5 individuals. The goal now is to get the work started and begin to learn your way through it. You have limited financial risk with any interventions that you do with 5 people versus huge potential cost when you work on the whole population.

Table 4: 5X Scale Up

Number of people	System issues to address
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5	<ol style="list-style-type: none"> 1. Form a team of volunteers 2. Find people through referrals
25	<ol style="list-style-type: none"> 1. Full time team 2. Redesign of practice 3. Cooperation of hospitals for data 4. Assess outcomes
125	<ol style="list-style-type: none"> 1. Grant funding for operations 2. Consistent population outcomes
625	<ol style="list-style-type: none"> 1. ?
3125	<ol style="list-style-type: none"> 1. ??
15,625	<ol style="list-style-type: none"> 1. ???

Specifically in this step you should co-create a care plan with 5 people (1 plan per person)

- Start with what matters to the person
- Include an identified family member or friend in planning discussion if preferred
- Identify the person's life and health goals together
- Identify the person's care preferences together
- If the goal is big, start by outlining steps and doing the first step

Here is a case study from Care Oregon to demonstrate this approach. Let's call the patient George (not his real name).

- 62 yr-old Caucasian man admitted to the hospital twice for complications related to CHF (Shortness of breath, tachycardia, and fluid volume overload). Also has diabetes, cognitive challenges, has been intermittently on O2.
- Lives alone in a single-room apartment, has daughters and an ex-wife who live in other states. Doesn't have a lot of social interaction but has two cats that he adores.
- Cardiology Nurse Practitioner (NP) refers him to our outreach worker upon discharge. NP goal: no 30-day readmission.
- Everywhere in his chart it is written that George is usually belligerent, uncooperative, non-compliant, and verbally abusive.

Now let's consider his resources and capabilities:

- Good Medicaid insurance coverage
- Committed care team with timely, reliable access
- Stable living situation
- State-sponsored caregiver who George trusts

And also his Socially Determined Risk Factors:

- Living in poverty
- Low health literacy
- Demonstrates challenging interpersonal behaviors (from care team perspective)
- Demonstrates inability to effectively advocate for himself
- Demonstrates difficulty with basic planning and problem solving (cognitive impairment?)

Now what matters to George?:

- Does not like to be hospitalized or referred to the ED
- Wants to live alone with his cats
- Likes to be able to get out of his apartment and "move around outside"
- Desires privacy and respect from care providers
- Wants to be in touch with daughters more frequently

And the system barriers for George:

- Care providers do not treat him with respect or offer him privacy.



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- Has not been able to get an appropriate wheelchair.
- Care providers in different settings (ED, Hospital) don't talk to one another.

Based on all of this, here is the plan that was used with George:

- With permission, go through George's cupboards and refrigerator to assess daily diet habits.
- Go grocery shopping with George and his caregiver; teach about sodium and fluid related to CHF and connect to his desire to stay out of the hospital.
- Role model advocacy with visiting care providers (home health, case worker) by setting up regular visiting times based on George's preferences; also requiring a phone call prior.
- Accompany George to medical appointments to provide care coordination and opportunity to role model "respectful" communication on both sides.
- Work with health plan and DME provider to replace wheelchair so that he can get out of his room.
- Teach George how to use Facebook to connect with daughters.

The goal in working with 5 individuals is to begin to understand opportunities and barriers within the system. At its most elemental level you are learning your way into the larger-scale design issues that you will face as you begin the next step. As you work with 5 you are not concerned with the cost-effective issues. You are just seeing if you can co-develop a plan with these 5 and execute the plan. The key is to learn with these individuals. You are going to attempt to learn at the individual level so that you can act for the system.

Step four is to take the learning from working with 5 individuals and see if you can scale it up to 25. At this point you are now going to have to think about larger system issues. If you haven't already done it, you should be deciding how many people are in this high-risk population that you will ultimately want to impact. Knowing this long-term goal is very important as you start to scale up.

In the previous R and D paper on high-risk individuals we discussed various care team designs that were being implemented to manage this population. We are not going to repeat that section here. Instead we are going to list the support elements that made up the various designs:

1. Community Health Workers
2. Case Managers who are often RN's
3. Pharmacy support
4. EMR as tool for communication and coordination
5. Primary Care
6. Retraining of any of the above
7. Community resources
8. Integration of the support team



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9. Co-development of the plan with the individual and family

Take the learning from working with 5 individuals and see if you can scale it up to 25 using these components and any others that you need. As you design for 25 think now about how cost-effective your design is. As you scale this system up will you be able to afford it for 125 or 625, etc. The tests you did with 5 are not the only source of knowledge as you go to scale. Look for other organizations that are working with similar populations and understand some of their strategies. Also look through the scientific literature to find other good examples.

Finally as you move past 25 to full-scale implementation you should think about bundles of interventions for specific types of patient within your high-risk group. How will you measure success? Because the population changes from year to year you should consider how much you are spending on the top 5% each year along with how much you are spending for the whole population and see if you can improve the spending for the 5% along with the total spending.

VII. Conclusions and Recommendations:

Because of the enormous concentration of spending associated with high-risk, high-cost individuals this subject continues to attract a lot of attention. As stated in the paper we think this subject is an important topic for us. We have two simple recommendations at this time:

1. Continue to work with Triple Aim sites to help them make progress on high-risk, high cost individuals.
2. Continue to recommend the creation of an IHI high-risk, high-cost public seminar.



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VIII: Appendices:

Appendix A: Predictive Modeling

Practically speaking, the first step to improving care and reducing cost for complex patients is identifying those patients. At a population level, many predictive methods rely on historical cost data to predict utilization in the future. At that population level, these methods are good predictors of the population in the future, but when we try to apply those techniques at an individual level, they are not as useful. As we saw during the last wave of research on high cost patients and the persistence of that classification, past spending alone is not always a strong predictor of future spending for an individual patient. Without any change to the system or the care provided to these patients, approximately 60% of high cost patients will move out of that group the next year. A predictive model based solely on past cost for each individual patient will fail to capture and thus provide additional support for the 60% of high cost patients each year who were lower cost the previous year.

A significant subset of these predictive models consists of those that look retrospectively to predict future costs, with varying success. Another use for these predictive methods is for predicting concurrent risk in a system. For example, a concurrent model risk could be mitigated if a patient is determined to be high risk for further complications, or seeking care in the wrong setting.

Impactability

We know, for example, that car accidents and other trauma are often very costly in terms of health care cost, but within the scope of our work there is not much of an impact that primary care, or the healthcare sector in general, can have on the rate or severity of car accidents. So our job is not just to find out who is costing the most, but who is the spending the most money that perhaps could be avoided or limited. Not unrelated to the impactability of an intervention is the resource use. For groups focusing their efforts on the top spenders in their system, they are making the assumption that this small group is unique both in the amount of money they spend as well as the opportunity to reduce costs. As detailed by Nichole Willy in IHI's 2008 90-day report on Predictive Modeling^{iv}, the break-even cost for this population can be very enticing.

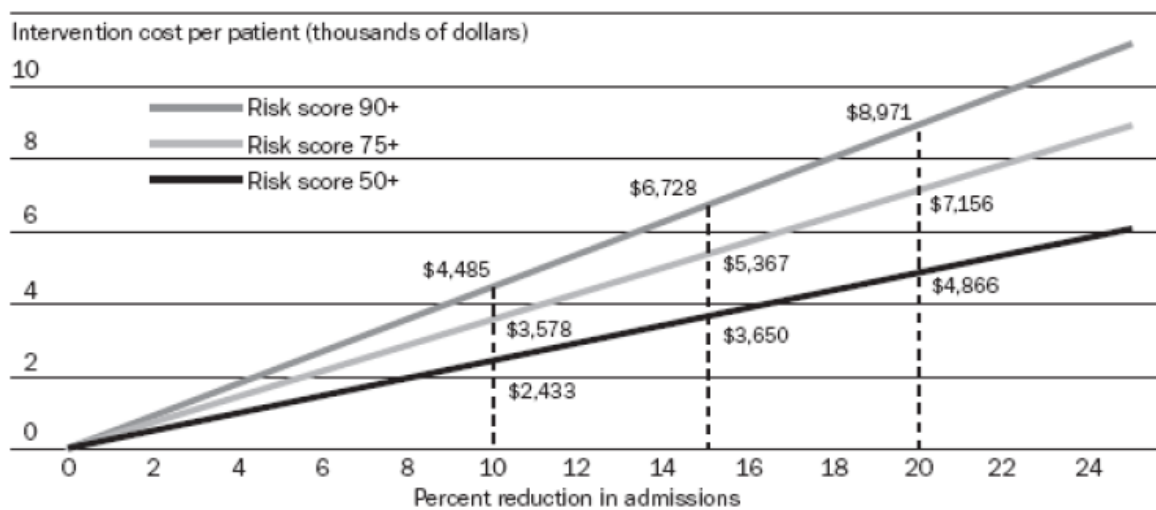
“The break-even cost refers to the amount of money that can be used per person to cover the cost of the interventions before the organization begins to lose money. [The figure below] is an example of the break-even cost for the Medicaid population in New York for an intervention period of 12 months^v. However this scenario is not unique. For resource intensive members, a large sum of money per person can be allowed to cover intervention costs before an organization begins to lose money.”



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Figure 3. Maximum Intervention Cost per Patient for Break-Even⁴



SOURCE: Values derived by the authors from analysis of Medicaid claims data.

However, the equation for break-even cost relies on spending being modifiable, either through better care to prevent future spending or deployment of resources to slow the cascade of spending. For example, let's say patient X has a history of heart failure, diabetes, substance abuse, and perhaps very little social support. Are they likely to be high cost? Yes. Are there care interventions we might be able to provide which could impact their health and their spending? Yes. But then we must tether that to the question: are those interventions cost effective? With that in mind, the answer is more complex.

Evaluating predictive power

A common way to measure the strength of a predictive model is to use the area under receiver operating characteristic curve (ROC curve), also called an area under curve (AUC). A ROC curve plots the sensitivity (true positive rate) on the y-axis versus 1-specificity (the false positive rate) on the x-axis. Roughly, the AUC is the probability from 0 to 1 that a randomly chosen subject is correctly categorized, where an area of 1 represents a perfect prediction.

Another common method for evaluating the predictive strength of a model is using an R-squared value or "coefficient of determination." This number, also with a value between 0 and 1, describes how well a regression line fits a set of data. Said differently, this measures what proportion of the variability in a data set that is accounted for in the statistical model.

A third method that is used to evaluate predictive models is positive predictive value (PPV). This is the proportion of positive test results that are true positives. In this case, the proportion of the identified high cost patients who are actually high cost in the future.

While they seem to be measuring a similar phenomenon, a high AUC is often accompanied by a relatively low R-squared value. When assessing models, it is not advisable to use any of these



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methods as the sole measure, but rather to use a two or more, especially when using it for stratification purposes^{vi}.



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Determining the Cutoff Point

In each of the three approaches outlined below, organizations will need to set a cutoff point in risk level. For example, in the threshold approach, the cutoff point is the threshold itself. Patients above that threshold will be included. In the more traditional predictive models, organizations must design their own cutoff point to narrow their population and isolate those who are high-risk. In 3M's CRG model, for example, each patient is placed into one of over 1000 risk groups. Organizations that choose to use this product will decide where the cutoff point is for their population and the programs they have to offer. One of the benefits of predictive modeling is the ability for each organization to adjust this cutoff point as a way to adjust the sensitivity and specificity of the method. If they have a lower cutoff point in risk scores, they will have a large pool of people and likely quite a few false positives – people who have been identified as high-risk, but who did not become high-cost. On the flip side, a higher cutoff point will give them a smaller pool of people who are more likely to be high-risk, high-cost - true positives. But since it is a smaller pool many of the high-risk, high-cost individuals who are below your cut point will be missed. Organizations will need to weigh the information they have about their available resources, the cost of interventions and the size and characteristics of the population and use them to set an appropriate cutoff point for the population they select.

An important thing to keep in mind when approaching predictive models is that they are designed to be only one of the first in a series of data points in determining the right levels of care or interventions for complex patients. If a patient is determined to fall on the riskier side of the cutoff point, they move to the next stage of the algorithm for determining who needs a particular intervention.

Data Inputs

In their literature search on predictive risk, Natasha Curry et al^{vii} categorized the types of inputs for predicting risk nicely into three general methods: clinical knowledge, the threshold approach, and predictive modeling.

Clinical Knowledge/Care Team Predictions

Generally speaking, this first method is not one that is software-based. The execution and venue varies widely, but in this type of prediction providers use their experience and background knowledge of the patient population to predict complex patients and determine those who could benefit from different resources. For example, the Visiting Nurse Service of New York relies on home health care providers to transfer information about special needs and complexity across patients entire care team. More formally, the PACE Center uses a comprehensive assessment to make a care plan that includes contextual factors and follow-up. They also rely on an interdisciplinary team to anticipate services that may be outside the scope of one individual provider's interaction with the patient. These are just two examples of organizations from work gathered by an internal IHI team working on workforce development in the care of patients enrolled in both Medicare and Medicaid. ^{viii} Another example, outside of that subset of complex



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patients, is the use of automatic trigger reminders in electronic medical records for clinicians to ask about non-clinical factors such as availability of caregivers, method of transportation, safe places to keep medication and medical information, etc. This approach to stratifying risk and services at the point of care, by clinicians, does have its limitations. As Curry et al point out, “clinicians may be able to identify patients who are currently high risk, but are less able to identify those who are going to become high risk in the future.”

Threshold Approach

Another category of input is best described as the “threshold approach.” This method uses a predetermined threshold to stratify a population by risk for high cost, readmission, etc. Common thresholds include: number of admissions in the last 12 months, age, and gender. A major benefit of this method is the ability to adjust the thresholds sensitivity and specificity based on a specific organizations need. If, from year to year, the available resources are different an organization could raise and lower their threshold accordingly. Similarly, thresholds could be to target a specific type of high-cost patient, for example those without social supports, to better fit the interventions and maximize impactibility.

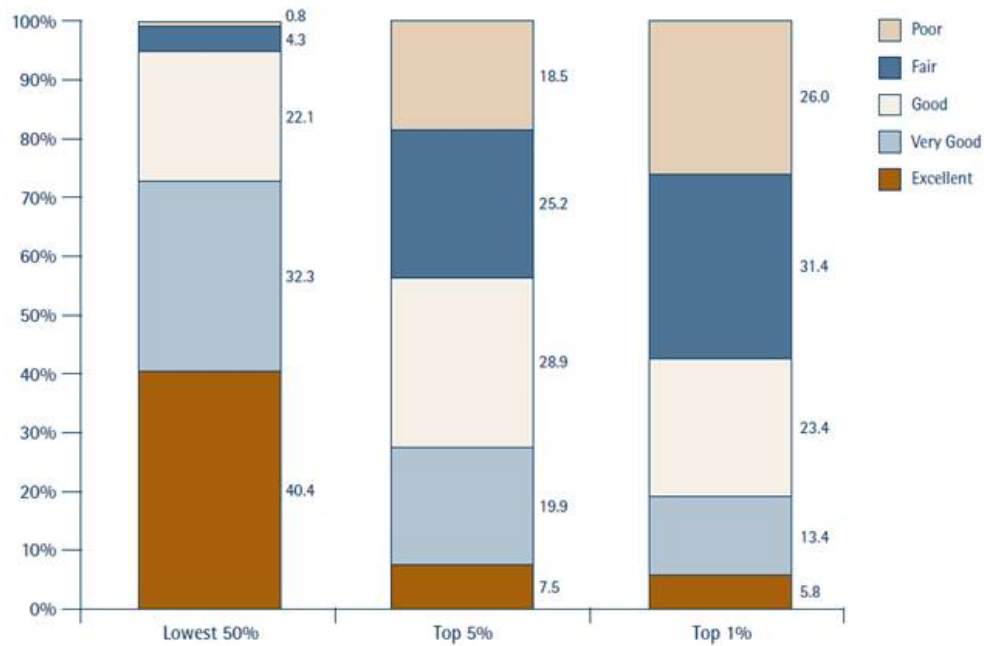
In most cases, these thresholds are set without a lot of background knowledge on the population as a whole, or the numbers and types of people who will fall above or below the threshold. This method is often chosen for its simplicity, but at a cost in exactness. That being said, there are some more sophisticated applications of the threshold approach which begin to straddle the line between that method and a traditional predictive model. The question “How is Your Health” has often been used at this level. The answer to this question, general self-rated health (GSRH), has been shown to be comparably predictive as Short form-12 (SF-12) and the Seattle index of Comorbidity in identifying patients who will be in the top quintile of expenditures. According to an analysis by DeSalvo et al, the AUC for predicting individuals in the top 20% was 0.79, 0.80 for the top 10%, and 0.82 for the top 5%. ^{ix} In fact, by crosslinking the claims and demographic portions of AHRQ’s MEPS data, researchers have shown the strong relationship between the answers to this simple question and spending at a population level.



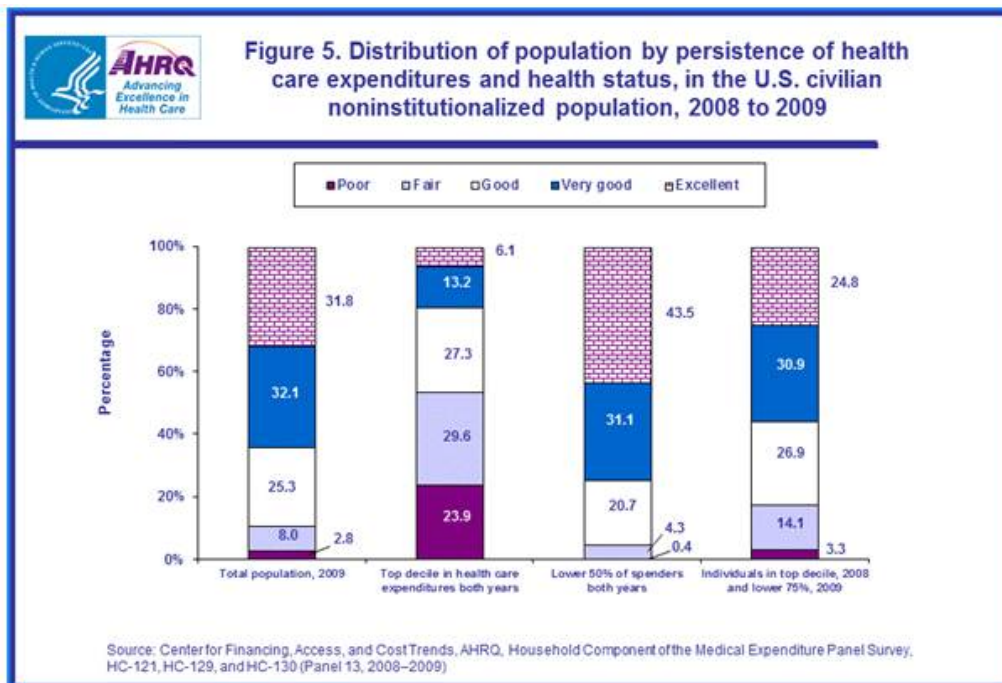
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FIGURE 4. HEALTH STATUS OF LOW VS. HIGH SPENDING GROUPS, 2009



NIHCM Foundation analysis of data from the 2009 Medical Expenditure Panel Survey.



Source: Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, HC-121, HC-129, and HC-130 (Panel 13, 2008-2009)

The appeal and simplicity of this method, however, is dulled somewhat by its predictive power. Some of the common, off-the-shelf, claims-based predictive models, DCG-HCC (more information in Table 2), has been shown to have better predictive power in terms of AUC (0.85 for top 10% of spenders versus 0.80 for GRSH) and in terms of r-squared (14.3% for DCG-HCC and 6.1% for GRSH). In fact, adding GRSH to DCG-HCC for a combined predictive model resulted in only modest improvement in AUC and r-squared values.^{ix}

Predictive Modeling/ Claims-Based Predictions

This third category of data input was described by Curry et al as ‘predictive modeling’, but for our purpose we will generalize those models which predict using past medical claims and utilization as their primary source of information. There are many software packages which have tried to predict future spending by slicing claims data in different ways, with different inputs. (See Table 2 for examples.)

Community Care of North Carolina (CCNC) is a public-private partnership to provide local medical homes for the enrollees in the states Medicaid and Children’s Health insurance program. In this program, local networks and primary care providers receive supplemental funding to support care coordination, management, and quality improvement initiatives for this specific population. For their predictive modeling needs they chose 3M’s clinical risk groups. This proprietary model takes past claims data, diagnostic patterns, intensity and assigns patients to one of over 1000 risk ‘buckets’ with levels of severity in each. Per Carlos Jackson, Direct of Program Evaluation and Interim Director of Analytics and Reporting, the majority of patients fall within the healthier categories; the most value lies in the strata of chronic conditions. These are sorted by how many a patient has and the severity level of each. For example, there is a specific CRG for patients with both hypertension and diabetes, and within that group there are six separate levels of severity. The organization uses those clinical risk groups in a few different ways. Firstly, each CRG has an average hospital utilization. From an organizational level, they are limited in the support they are able to provide. They maximize the “impactability” of their interventions by targeting those patients who spend will above or below the average for their CRG. Typically, this takes the form of a case manager or home visit. On the flip side, CCNC also uses the CRGs for program evaluation. They are able to stratify programs by risk group and evaluate the impact within specific groups. One such program, their transitional care program, does not show much success at the population level, but within a few specific CRGs, the impact has been shown to be drastic.

Lastly, there are claims-based predictive models that are able to incorporate data outside of claims into their predictive models. Social, lab, and clinical data are difficult, from a technological standpoint, to combine with claims data, but those who have been able to have shown improved predictive ability.

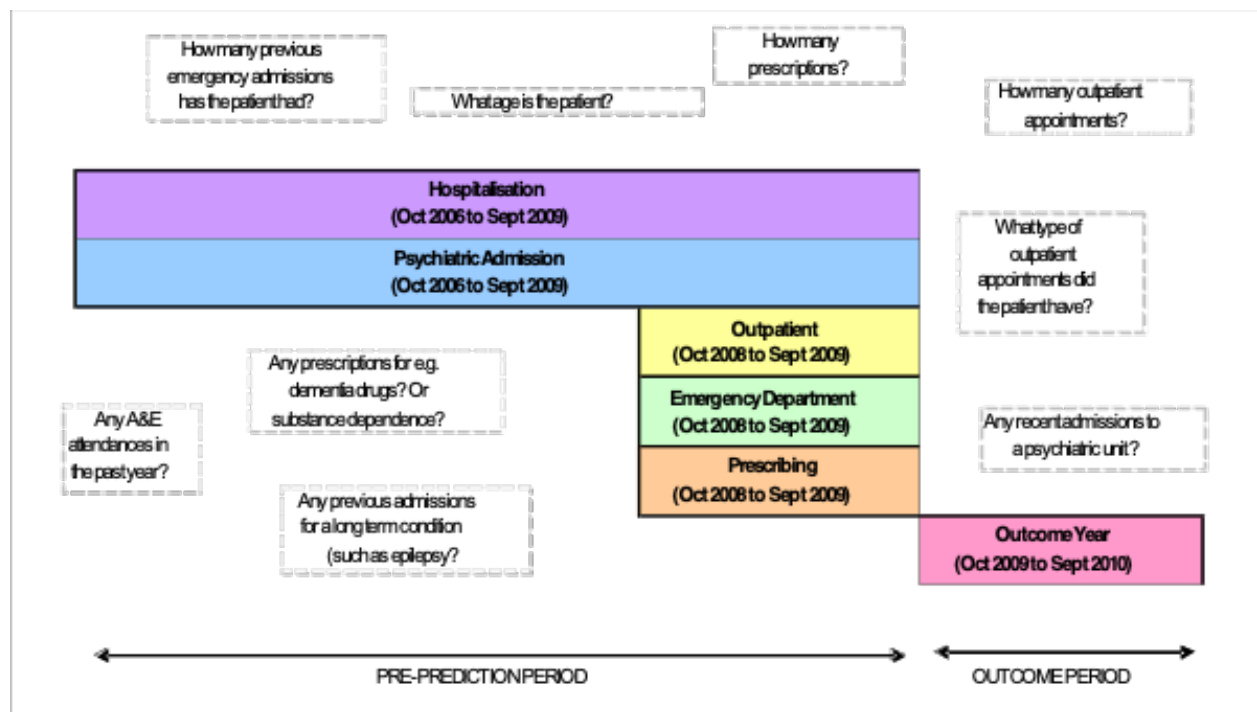


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The Scottish Patients at Risk of Readmission and Admission^x (SPARRA) model, described in Table 2, is intended to be used by multi-disciplinary teams across community health partnerships as a way to determine which patients would most benefit from a different level of care, specifically case and care management. See below for a diagram of data inputs used by the care team and the automated model to produce risk scores. Patient care lists and plans are reviewed at multi-disciplinary team meetings where anticipatory care plans (ACPs) are created. These are shared electronically with out of hours and ED services. The GPs are notified if their patient is determined to have a 65% or higher risk of an emergency room admission.

Their risk scores are used differently based on the intervention at hand. In the case of telehealth support in patients with COPD and heart failure, the team does not look at the patient with very high risk scores because they are likely more complex. Instead they target patients with lower scores, who are a bit further down the pyramid and are likely to benefit in a meaningful way from that particular level of support.



Appendix B

Table 3 High Cost Individuals as seen over time (full table of 79 individuals)

Claimant #	Paid Medical 2009	Paid Medical 2010	Paid Medical 2011	Paid Medical 2012 (Through November)
1	\$550,502.00	\$75,185.00	\$282,155.00	\$1,529.00
2	\$237,266.00	\$76,702.00	\$0.00	\$0.00
3	\$234,765.00	\$0.00	\$0.00	\$0.00
4	\$186,464.00	\$1,938.00	\$2,691.00	\$0.00
5	\$178,360.00	\$0.00	\$0.00	\$0.00
6	\$169,233.00	\$7,542.00	\$1,735.00	\$3,575.00
7	\$153,968.00	\$8,465.00	\$6,299.00	\$67,725.00
8	\$150,041.00	\$39,430.00	\$100,113.00	\$79,604.00
9	\$148,572.00	\$0.00	\$0.00	\$0.00
10	\$143,280.00	\$905.00	\$380.00	\$1,864.00
11	\$135,407.00	\$43,328.00	\$3,131.00	\$0.00
12	\$128,299.00	\$1,282.00	\$1,443.00	\$309.00
13	\$114,780.00	\$14,204.00	\$126,622.00	-\$121,525.00
14	\$104,866.00	\$9,717.00	\$6,466.00	\$4,166.00
15	\$87,853.99	\$1,303.00	\$2,995.00	\$147,876.00
16	\$62,620.77	\$104,985.00	\$26,605.00	\$33,013.00
17	\$49,944.74	\$64,311.00	\$111,920.00	\$93,088.00
18	\$47,161.32	\$146,175.00	\$84,838.00	\$223,809.00
19	\$46,912.59	\$25,219.00	\$116,267.00	\$0.00
20	\$38,075.84	\$119,196.00	\$8,177.00	\$13,859.00
21	\$23,727.08	\$295,711.00	\$158,584.00	\$7,446.00
22	\$20,986.99	\$338,261.00	\$39,848.00	\$13,107.00



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Claimant #	Paid Medical 2009	Paid Medical 2010	Paid Medical 2011	Paid Medical 2012 (Through November)
23	\$19,972.02	\$35,190.00	\$118,114.00	-\$308.00
24	\$17,964.88	\$180,289.00	\$5,965.00	\$235.00
25	\$17,433.22	\$161,079.00	\$78,019.00	\$11,035.00
26	\$16,403.11	\$5,294.00	\$6,044.00	\$229,826.00
27	\$14,561.59	\$299,581.00	\$4,511.00	\$0.00
28	\$13,577.91	\$6,319.00	\$21,024.00	\$111,573.00
29	\$13,130.97	\$2,627.00	\$341,172.00	\$3,562.00
30	\$9,119.86	\$134,389.00	\$1,374.00	\$1,517.00
31	\$8,871.60	\$95,411.00	\$110,093.00	\$0.00
32	\$8,810.58	\$2,121.00	\$8,071.00	\$105,368.00
33	\$8,717.57	\$23,422.00	\$29,820.00	\$161,156.00
34	\$7,998.61	\$68,267.00	\$35,494.00	\$103,852.00
35	\$7,145.49	\$10,045.00	\$166,717.00	\$9,323.00
36	\$6,198.04	\$126,243.00	\$600.00	\$0.00
37	\$5,911.77	\$20,850.00	\$86,394.00	\$151,101.00
38	\$5,889.03	\$106,139.00	\$9,009.00	\$0.00
39	\$5,448.47	\$933.00	\$10,466.00	\$167,325.00
40	\$5,349.78	\$83,557.00	\$221,445.00	\$0.00
41	\$5,235.96	\$57,815.00	\$103,082.00	\$81,252.00
42	\$5,013.92	\$132,987.00	\$38,858.00	\$2,530.00
43	\$4,899.28	\$8,310.00	\$223,569.00	\$20,692.00
44	\$4,577.05	\$3,285.00	\$298,896.00	\$13,798.00
45	\$4,422.55	\$102,097.00	\$11,766.00	\$1,459.00
46	\$4,379.87	\$196,018.00	-\$418.00	-\$2,384.00



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Claimant #	Paid Medical 2009	Paid Medical 2010	Paid Medical 2011	Paid Medical 2012 (Through November)
47	\$3,353.12	\$321.00	\$33,915.00	\$109,143.00
48	\$3,316.83	\$153,469.00	\$2,439.00	\$687.00
49	\$3,286.78	\$212,975.00	\$39,737.00	\$2,989.00
50	\$3,238.84	\$4,708.00	\$4,621.00	\$100,006.00
51	\$3,142.39	\$2,144.00	\$1,982.00	\$206,792.00
52	\$3,084.56	\$3,496.00	\$217,516.00	\$1,131.00
53	\$2,720.84	\$108,438.00	\$59,206.00	\$2,795.00
54	\$2,618.55	\$33,005.00	\$5,433.00	\$149,350.00
55	\$2,481.23	\$918.00	\$21,300.00	\$196,618.00
56	\$2,198.43	\$4,208.00	\$198,898.00	\$1,810.00
57	\$2,155.60	\$5,400.00	\$81,407.00	\$266,980.00
58	\$1,813.42	\$110,798.00	\$0.00	\$0.00
59	\$1,742.52	\$997.00	\$4,491.00	\$339,491.00
60	\$1,723.52	\$196,727.00	\$42,673.00	\$7,137.00
61	\$1,472.84	\$109,253.00	\$6,614.00	\$0.00
62	\$1,346.99	\$23,733.00	\$144,359.00	\$13,720.00
63	\$952.98	\$19,161.00	\$27,195.00	\$112,633.00
64	\$932.79	\$3,915.00	\$178,211.00	\$15,577.00
65	\$891.35	\$101.00	\$196,464.00	\$7.00
66	\$491.08	\$670.00	\$3,490.00	\$273,911.00
67	\$382.32	\$72,729.00	\$117,229.00	\$104,675.00
68	\$286.00	\$45,795.00	\$143,521.00	\$66,969.00
69	\$248.31	\$5,230.00	\$5,955.00	\$134,017.00
70	\$226.80	\$0.00	\$167,538.00	\$5,673.00



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Claimant #	Paid Medical 2009	Paid Medical 2010	Paid Medical 2011	Paid Medical 2012 (Through November)
71	\$0.00	\$0.00	\$0.00	\$1,053,988.00
72	\$0.00	\$65,063.00	\$127,088.00	\$245,582.00
73	\$0.00	\$0.00	\$0.00	\$115,268.00
74	\$0.00	\$0.00	\$68,028.00	\$104,039.00
75	\$0.00	\$7,592.00	\$19,571.00	\$102,865.00
76	\$0.00	\$2,453.00	\$12,291.00	\$100,334.00
77	\$0.00	\$54,898.00	\$672,479.00	\$40,320.00
78	\$0.00	\$250,327.00	\$19,316.00	\$0.00
79	\$0.00	\$282,307.00	\$4,873.00	\$0.00

Appendix C

Overview of different interventions

This document is divided into seven types of innovative interventions to improve care for high-risk, high costs patients:

- 1) Care management interventions
 - Care Management Plus (Intermountain Healthcare)
 - Center for Health Care Solutions (CHCS) Rethinking Care Program
 - Guided Care Model
- 2) Community-based interventions
 - Camden Coalition of Healthcare Providers
 - Community Benefit / Community Development Financial Institutions
 - Community Solutions
- 3) Patient navigation interventions
 - Geisinger Health System's ProvenHealth Navigator Program
 - Health Choices Health Connections
- 4) Primary-care focused interventions
 - Grand-Aides
 - Group Health Cooperative
 - Southcentral Foundation
- 5) Care transitions
 - Care Transitions Intervention
 - Transitional Care Model
- 6) Provider-led health plans
 - Capital Health Plan
 - CareMore Connect Special Needs Plan
 - Care Oregon



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- Commonwealth Care Alliance
 - Community Care of North Carolina
 - HealthCare Partners Medical Group
 - SCAN Health Plan
 - Visiting Nurse Service of New York (VNSNY) CHOICE
- 7) Elderly-specific models
- Evercare model
 - Geriatric Resources for the Assessment and Care of Elders (GRACE)
 - Program for All-Inclusive Care of the Elderly (PACE)
 - PeaceHealth Senior Health and Wellness Program
- 8) Failed Interventions
- Medicare Disease Management and Care Coordination Demonstration Programs

Care Management Interventions

Care Management Plus (Intermountain Healthcare)

Description: RN care manager placed in primary care practices. Care managers schedule office and home visits, phone calls and other services as needed

Results: Participants had higher odds of having diabetes controlled and reduced odds of mortality, all-cause admission and of being admitted for an ambulatory-sensitive condition.

Cost/ROI: **Total return on investment = \$18,303/clinic;** Savings to society from reduced utilization = \$230,000/clinic.

Center for Health Care Solutions (CHCS) Rethinking Care Program

CHCS partnered with four states (CO, WA, NY and PA) to pilot test new care management approaches to improve quality and reduce costs for high-need, high-cost Medicare beneficiaries.

- *Colorado:* working with two health plans to provide enhanced care management.
- *New York State Chronic Illness Demonstration Project:* implementing six regional demonstration projects to improve care for high-need, high-cost Medicaid fee-for-service beneficiaries by improving quality, ensuring appropriate use of services, improving clinical outcomes and reducing cost of care. Preliminary data indicates a 45% reduction in hospital admissions and a 15% reduction in ER visits over two years.
- *Pennsylvania SMI Innovations Project:* testing two regional pilot projects to integrate physical and behavioral health services for adults with serious mental illness and physical comorbidities.
- *King's County Care Partners:* intensive care management and coordination for adults with chronic physical needs and mental illness or substance abuse issues. Participants were more likely to have increased access to care, lower inpatient medical costs, fewer unplanned admissions and fewer deaths.

Guided Care Model

Description: RNs are trained in care management of complex patients through home visits, phone calls and primary care office visits. RNs teach patients and families self-management skills, including early identification of worsening symptoms.

Results: Participants had a 24% reduction in total hospital inpatient days, 15% fewer ER visits and 37% decrease in skilled nursing facility days.

Cost/ROI: Annual net Medicare savings of \$1364 per patient and \$75,000 per Guided Care nurse in a practice (no ROI data).

Community-Based Interventions

Camden Coalition of Healthcare Providers

Description: Collaborative, community-based effort to improve the health of residents of Camden, NJ. Stakeholders include hospitals, health care providers, businesses and consumer groups. They are



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running a Medicaid ACO and run several programs: Care Management Program; Health Information Exchange; Camden Citywide Diabetes Collaborative; Camden Guidance, Preservation and Support (GPS) Program; Pregnancy and Parenting Partners; and New Jersey Medication Access Partnership. Results: Care management program participants show decreased ED and hospital utilization, improvement in diabetes self-management and improvement in clinical measures. Cost/ROI: no cost data.

Community Benefit / Community Development Financial Institutions (Federal Reserve)

The Federal Reserve Bank of San Francisco (the Fed) has a robust community development investment program. The focus of much of the community development financing has been on addressing social determinants of health, including education, housing, urban planning, employment and transportation. The Department of the Treasury has a Community Development Financial Institutions Fund (CDFI), which invests in community development financial institutions that provide loans, investments, financial services and technical assistance to underserved populations and communities.

Community Solutions

Community Solutions is a nonprofit organization dedicated to strengthening communities to end homelessness by building partnerships, sharing innovations and connecting vulnerable people to homes and support. While not directly focused on improving health and health care, Community Solutions works with an extremely disadvantaged, high-need population. They help communities mobilize partners to connect vulnerable individuals to health, employment and other social services they need to succeed and costs far less than shelters and hospitals, which are frequent responses to homelessness. They work with local leaders and service agencies to plan community-wide improvements to strengthen neighborhoods while supporting vulnerable residents; integrate housing with health, mental health and other services; and assist individuals with getting the necessary government benefits to stay in their homes and out of ERs, hospitals and jails. They also convene local leaders, non-profits, businesses and public agencies to create a network to strengthen communities.

Patient Navigation Interventions

Geisinger Health System's ProvenHealth Navigator (PHN) Program

Description: 5 components: 1) patient-centered primary care with a PCP-led care team; 2) integrated population management by a case manager; 3) medical neighborhood including SNFs, EDs, hospitals, home health and community resources; 4) quality outcomes and 5) value-based reimbursement with value-based incentive payments for providers.

Results: Positive outcomes for diabetes care and reduced Medicaid admissions and readmissions among PHN sites.

Cost/ROI: 7.1% cumulative cost savings between 2006 and 2010. Estimated \$3.7 million net savings from the PCMH model implementation and a return on investment of greater than 2 to 1.

Health Choices Health Connections

Description: Capitated behavioral “carve-out” that provides care to adult Medicaid and Medicaid-Medicare eligible individuals with complex medical and behavioral needs (the top 20% of individuals with high utilization of behavioral health services). Wellness Recovery Teams (WRT) consisting of trained and certified patient navigators are assigned to the high risk patients. The primary responsibilities of the navigator include coordinating behavioral and physical health care, providing patient support and enabling patient self-activation. They provide services at three support levels: PH/BH case management; administration support; and behavioral health support. Navigators are



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supported by case managers, who provide navigators with information at the plan level such as notices of hospitalizations and recommendations of referral services.

Results: The program resulted in a decrease in ED visits but no significant decrease in mental health hospitalizations or 30-day readmissions

Cost/ROI: no cost data.

Primary-care focused interventions

Grand-Aides

Description: A Grand-Aide is a lay-person who has been trained with a specified curriculum in medical care to be an extender for a nurse, nurse practitioner or a physician. The Grand-Aide must be a certified nurse Aide or Medical Assistant and functions under that state certification. Grand-Aides has five goals: 1) "Decongest" EDs, clinics and hospitals of people who could be cared for at home; 2) Increase access to care providers for primary chronic care and to leverage the Grand-Aides to free providers' time accordingly; 3) Educate patients in preventative and self-care; 4) Make care more affordable; and 5) Create jobs and improve the lives of adults who want to give back to their community. Grand-Aides work on primary care and transitional/chronic care.

Results: Grand-Aides and their supervisors averted 62 percent of drop-in visits at one clinic and would have eliminated 74 percent of emergency department visits at a clinic in another state.

Cost/ROI: Grand-Aides cost \$15-20 per call/visit (Medicaid payments for clinic visit are \$56-\$200; ED visits \$175-425). **Grand-Aides calculated the net savings per Grand-Aide at \$81,297, which is a ROI of 2.01.**

Group Health Cooperative

Description: Risk assesses its population age 65+ based on functional status (severity of illness) rather than a specific illness. A primary-care-based RN leads a multidisciplinary team which works on medication management, fall prevention, exercise, care of incontinence and depression, and other care management interventions. GHC also created a PCMH pilot, which was very successful.

Results: GHC showed a 29% reduction in ER visits and 11% reduction in ambulatory sensitive care admissions.

Cost/ROI: Additional investment in primary care of \$16 per patient per year was associated with offsetting cost reductions, with the net result being no overall increase in total costs for pilot clinic patients (the total net cost trend was a savings of \$17 per patient per year, which was not statistically significant).

Southcentral Foundation

Description: The core of Southcentral's model (called the Nuka Model of Care) is its primary care clinics, which provide a full spectrum of primary care services. Patients are served by a primary care team, composed of a physician, medical assistant, nurse (who focuses on care coordination) and an administrative assistant who provides case management support. Specialists and other providers are also assigned to primary care teams. Southcentral is extraordinarily patient-focused – the organization refers to patients as customer-owners – and they define the needs, goals and values that direct the system's focus.

Results: 75% decrease in hospital admissions, 71% decrease in hospital days per 1000, and a 36% decrease in outpatient visits. Urgent care and ED visits dropped by more than 40% from 1999 to 2001. Primary care and specialist visits have decreased while phone and email interactions with clinical staff have increased. Patient and employee satisfaction are very high (>90%) and, in 2011, SCF won a Baldrige National Quality Award.

Cost/ROI: no cost data



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Care Transitions

Care Transitions Intervention

Description: The Care Transitions Intervention (CTI) seeks to improve the ability of patients, caregivers and providers to effectively manage transitions between care settings. CTI assists patients and their caregivers in cultivating self-management skills and uses “Transition coaches” to support patients and caregivers in facilitating information sharing across care settings and coach patients and caregivers via visits and phone calls prior to a change in care setting. Coaches are trained and patients/caregivers are educated in four key areas: medication self-management, a personal health record, follow-up care, and indications of a worsening condition.

Results: The CTI has been implemented in many settings with positive results; an RCT found that intervention patients had lower 30-day and 90-day rehospitalization rates and lower rehospitalization rates for the same condition as the index hospitalization at 90 and 180 days compared to control group patients.

Cost/ROI: Return on investment has been calculated for different clinics implementing the CTI. One clinic in the Bronx calculated the intervention costs per transition coordinator at \$86,953 and the cost reduction for the facility from the intervention at \$145,440 for a return on investment of 1.67. The above-mentioned RCT found that mean hospital costs were lower for intervention patients than for control patients at 180 days.

Transitional Care Model

Description: Comprehensive discharge planning and home follow-up by advanced practice nurses, including several in-hospital visits, at least two home visits after discharge, further home visits as needed, at least weekly phone calls, and easy telephone access to the advanced practice nurses.

Results: Intervention patients had significantly lower total hospital readmission rates than control patients within 30 and 90 days after the initial hospital discharge and lower rehospitalization for the same diagnosis as the initial hospitalization at 180 days. A follow-up RCT found a significant reduction in readmissions within 90 days and a highly significant reduction in readmissions for the same diagnoses at 180 days.

Cost/ROI: Intervention patients had significantly lower hospital costs at 90 and 180 days. (no ROI data)

Provider-led health plans

Capital Health Plan

Description: The health plan’s Center for Chronic Care (a high-risk clinic) is designed for the 1 percent of the health plan’s enrollees who accounted for 25 percent of expenditures. Patients choosing the Center leave their established physician. The Center led by a geriatrician working with two RNs and one clerical staff person who care for about 300 patients. This team works with patients to create a care plan that is updated regularly. The Center offers same day access, with visits as long as needed.

Results: Clinical outcomes and patient quality of life scores improved compared with scores on admission to the Center. Hospital admissions and emergency department visits were substantially lower for Center for Chronic Care patients compared with patients cared for by traditional primary care.

Cost/ROI: total costs were reduced among patients cared for at the Center (no ROI data)

CareMore Connect Special Needs Plan



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Description: The CareMore model provides early intervention to avoid more costly complications and to improve outcomes. The CareMore model relies on “extensivists”, who are contracted or employed physicians who coordinate care for each patient. The extensivist is responsible for overseeing the patient’s entire course of care and for communicating with all members of the care team. Use of information technology is an essential component of the CareMore model, including tools ranging from wireless scales to an electronic health record (EHR) system. The CareMore model relies on an interdisciplinary team to provide care for the patient. Within this interdisciplinary team, the extensivist serves as the central care coordinator, providing oversight of the patient’s care team and interfacing with the patient’s PCP, the CareMore Care Center, case managers, specialists, and home-based service providers.

Results: no published results

Cost/ROI: no cost data

Care Oregon

Description: CareOregon is a non-profit health plan serving approximately 155,000 Medicare and Medicaid beneficiaries in Oregon. CareOregon’s provider network includes primary care clinics, providers, hospitals, specialist clinics and providers, FQHCs, public health organizations and rural health clinics. CareOregon’s Community Care Team workers are based in clinics, ERs and in the community to connect members with primary care providers, families and social agencies to help overcome barriers to health. CareOregon is a Coordinated Care Organization (CCO). CareOregon implemented two innovative programs for low-income individuals: CareSupport and Primary Care Renewal.

Results: CareSupport reduced hospitalizations by 43% (compared with an 11% increase among members with CareSupport).

Cost/ROI: Their Quality Enhancing Initiative (QEI) showed \$5,897,487 in savings, which is a 12.21 benefit-cost ratio. CareSupport saved between \$5,000 and \$20,000 per high-risk member between 2004 and 2005 and the overall return on investment in CareSupport during that time was \$5.9 million. In 2007, CareOregon calculated a \$7,309,966 savings for the 1,445 complex members served by the CareSupport program. Taking into account the yearly cost of the program, this amounts to a 1:4.22 return on investment.

Commonwealth Care Alliance

Description: The Commonwealth Care Alliance (CCA) is a Boston-based nonprofit health plan and delivery system which focuses on coordinating medical care, social support services, and daily living needs for Medicare and Medicaid enrollees. Commonwealth Care Alliance operates two health plans, Commonwealth Care Connection and Senior Care Options Plan (SCP). CCA has flexible payment arrangements which allow coverage of non-traditional items deemed necessary for medically and socially complex patients. Provider contracts with CCA are frequently written to allow providers sufficient freedom to provide patients with these non-traditional services without notifying or seeking approval from CCA. They also have a robust provider network and a unique provider reimbursement system wherein CCA contracts with provider sites through two types of payment arrangements. Core care model concepts include: 1) enhanced primary care services; integrated care coordination and management; 3) personal care services; and 4) mobility services.

Results: Participants showed improvements in chronic disease management, shorter hospital stays, reduced hospital admissions and ED visits and lower costs and length of stay.

Cost/ROI: Although primary care costs (including care management services) are higher than average, CCA saves money by reducing use of hospital and nursing home services.

Community Care of North Carolina (CCNC)



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Description: CCNC built a partnership between Medicaid, primary care physicians, and other local health care providers to achieve quality, utilization, and cost objectives in the management of care for Medicaid recipients across North Carolina. Within the CCNC program, approximately 1,200 primary care practices across North Carolina manage the care of about 750,000 Medicaid patients, roughly 80% of the state Medicaid population, or almost 10% of the North Carolina population. The CCNC program has created community health networks organized and operated by community physicians, hospitals, health departments, and departments of social services. A statewide infrastructure, which helps to coordinate and support the 14 individual networks provides direct financial assistance in proportion to the number of patients in the network. CCNC has successfully combined the following key features on a large scale: (1) linking patients to a medical home, (2) engaging practices in quality improvement efforts, (3) case managing high-risk patients, (4) planning interventions and measuring success using quality data, and (5) providing a statewide structure but retaining control at a regional level.

Results: Outcomes to date include improved outcomes for children with asthma and diabetes indicators (HbA1c, blood pressure and LDL) that are well below the NCQA threshold.

Cost/ROI: The estimated annual savings for Medicaid was \$160 million. (no ROI data)

HealthCare Partners Medical Group

Description: HealthCare Partners Medical Group is a large medical group and independent practice association based in California that is forming an ACO through the Pioneer ACO program. They use data and integrated services to keep patients at the lowest appropriate level of care and to devote resources to caring for the sickest patients through reducing unnecessary spending on healthier patients. Their primary focus is continuity of care, supported by an EHR system and direct communication between providers. HealthCare Partners implemented two interventions targeting high-need patients at risk of hospitalization, opening five Comprehensive Care Centers. In these centers, multidisciplinary care teams for patients recently discharged or for patients with chronic conditions such as congestive heart failure or COPD. Patients were also visited by Homecare Teams, composed of physicians, social workers and case managers

Results: They have low hospital use and readmission rates, which are about one-third and half of the national average, respectively.

Cost/ROI: Patients in the high-risk program showed a 20% decrease in hospital use, which was associated with \$2 million in annual savings for every 1,000 members. They showed a positive ROI for their COPD management program, which progressively increased over five years (from 1.42 to 19.95 by year 5).

SCAN Health Plan

Description: The SCAN Health Plan is a Medicare Advantage HMO serving over 100,000 Medicare beneficiaries. SCAN has implemented a variety of programs for complex patients including RN care management in primary care, the Care Transitions Intervention, home care, and a high-risk clinic. The high-risk clinic targets very complex patients and provides a multidisciplinary team of physician, nurse practitioner, RN, medical assistant and social worker for 325 patients. Patients are offered the choice of remaining with their regular primary care physician and additionally receiving the high-risk clinic services or transferring all care to the high-risk clinic.

Results: The number of hospital bed days per 1,000 patients decreased markedly following the implementation of these programs.

Cost/ROI: no cost data

Visiting Nurse Service of New York (VNSNY) CHOICE



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Description: Visiting Nurse Service of New York (VNSNY) CHOICE program is a managed care organization serving adult residents of New York City who are eligible for Medicare, Medicaid, or both programs. The main objectives of the CHOICE care model are: to improve access to appropriate care, to help patients navigate a complex health care system, and to shift the focus of care from the institution to the home and community for elderly and frail Medicare and Medicaid eligible beneficiaries with multiple chronic conditions. In support of this goal a specially trained nurse care manager is assigned to each member to coordinate services from a multi-disciplinary team including physicians, nurses, rehabilitation therapists, nutritionists, social workers, family caregivers, and community service workers. The core components of CHOICE are: 1) continuous care management to support both medical and community service needs; 2) comprehensive assessments and specialized care plans; 3) Information technology to facilitate decision-making, communication and monitoring; and 4) collaborative relationships with hospitals, PCPs and community care and service providers.

Results: Decreased hospital admissions (54%), 30-day readmissions (24%) and ED visits (27%). VNSNY CHOICE managed long-term care members' report they are satisfied with the care management, compared to 88 percent of members in all MLTC plans in New York State.

Cost/ROI: no cost/ROI data

Elderly-specific models

Evercare Model

Description: The goal is to prevent high-cost episodes such as hospitalizations and ER visits among nursing home residents. Evercare employs NPs who serve as a liaison between the resident's primary care physician and nursing home staff. The NPs create a care plan in collaboration with the patient and care team that accounts for the resident's preferences and wishes, provides care and monitoring; coordinates and integrates different aspects of care and communicates with the family and care team.

Results: There was a 45% reduction in hospitalizations and a 50% reduction in ED visits among nursing home residents whose care was managed by ECM compared to a control group of nursing home residents. ECM was also associated with improved patient and provider satisfaction.

Cost/ROI: Estimated hospital cost savings per NP per year of \$103,000.

Geriatric Resources for the Assessment and Care of Elders (GRACE)

Description: GRACE enrolled low-income seniors with multiple diagnoses, 25 percent of whom were at high-risk for hospitalization.

Results: At two years, the use of the emergency department was significantly lower in the group receiving the GRACE intervention compared with the usual care group, but hospital admission rates were not significantly different between the two groups. However, the subgroup defined at the start of the study as having a high-risk of hospitalization was found to have a significantly lower hospitalization rate compared with high-risk usual care patients.

Cost/ROI: no cost data

Program for All-Inclusive Care of the Elderly (PACE)

Description: PACE provides comprehensive long term services and supports to Medicaid and Medicare enrollees. An interdisciplinary team of health professionals provides individuals with



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coordinated care. Most participants receive care at home rather than receive care in a nursing home. Financing for the program is capped, which allows providers to deliver all services participants need rather than limit them to those reimbursable under Medicare and Medicaid fee-for-service plans. Care and services include: Adult day care that offers nursing; physical, occupational and recreational therapies; meals; nutritional counseling; social work and personal care; Medical care provided by a PACE physician familiar with the history, needs and preferences of each participant; Home health care and personal care; All necessary prescription drugs; Social services; Medical specialists such as audiology, dentistry, optometry, podiatry, and speech therapy; Respite care; and Hospital and nursing home care.

Results: Evidence suggests that PACE participation is associated with a reduction in hospitalizations, lower rates of nursing home admissions, shorter hospital stays, lower mortality rates and better self-reported health and quality of life outcomes compared to individuals not participating in PACE.

Costs: Costs for PACE participants are 16-38% lower than regular Medicare costs for a frail elderly population and 5-15% lower than regular Medicaid costs for the same group.

PeaceHealth Senior Health and Wellness Program- Oregon

Description: The PeaceHealth Medical Group in Oregon utilizes RN or social worker care managers, each supporting 7 to 8 physicians. Each care manager has a caseload of 80 to 100 active patients. Care managers do home visits, see patients in the practices, and interact with them by telephone. The care managers have acted as the eyes and ears for primary care physicians, learning when patients are worsening before it is too late. The Senior Health and Wellness Center has geriatricians, nurse practitioners, a social worker care manager and multidisciplinary team.

Results: Compared with traditional primary care patients receiving care management and with primary care patients without care management, Senior Health and Wellness Center patients, who are more complex, have better health-related quality of life despite the fact that virtually all declined in physical function. The Senior Health and Wellness Center is an example of a high-risk clinic.

Cost/ROI: no cost data

Failed Interventions

Medicare Disease Management and Care Coordination Demonstration Programs

Description: Over the past decade, Medicare conducted six major demonstrations to test different approaches to disease management and care coordination, with a total of 34 programs participating. The programs hoped to reduce Medicare spending by reducing hospital admissions by maintaining or improving beneficiaries' health.

Results: A CBO analysis found that, on average, the 34 programs had no effect on hospital admissions or regular Medicare expenditures (expenditures before accounting for the interventions' fees). While there was considerable variation in the programs' effects (programs in which care managers directly interacted with physicians and patients were more likely to reduce admissions than those without the in-person interaction).

Cost: After accounting for the fees that Medicare paid the programs, Medicare spending was either unchanged or was higher in nearly all of the programs.

*We have a more detailed assessment that can be provided on request



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ⁱ Medicare and Medicaid: Savings Opportunities from Health Care Modernization. UnitedHealth Center for Health Reform & Modernization. Working Paper 9. January 2013. http://www.unitedhealthgroup.com/hrm/UNH_WorkingPaper9.pdf

ⁱⁱ Whittington, John; Cline, Amelia. Complex Patients and Primary Care, IHI R and D Report. October 31, 2012

ⁱⁱⁱ Berger A, Edelsberg J, Inglese GW, Bhattacharyya SK, Oster G. Am Cost comparison of peritoneal dialysis versus hemodialysis in end-stage renal disease. J Manag Care. 2009 Aug;15(8):509-18.

^{iv} Willy, N; Whittington J, Martin, L. Predictive Modeling. IHI Summary Report: 90-Day Project. January 31, 2008.

^v Billings J, Mijanovich T. Improving the management of care for high-cost Medicaid patients. Health Affairs (Millwood). 2007 Nov/Dec;26(6): 1643-1655.

^{vi} Cook, Nancy R. "Use and misuse of the receiver operating characteristic curve in risk prediction." *Circulation* 115.7 (2007): 928-935.

^{vii} Curry, N; et al. Predictive risk Project: Literature Review. June 2005. http://www.kingsfund.org.uk/sites/files/kf/field/field_document/predictive-risk-literature-review-june2005.pdf

^{viii} IHI's Workforce Development How-to-Guide for the Lewin/Dual Eligables. 2012.

^{ix} DeSalvo KB, et al. Health care expenditure prediction with a single item, self-rated health measure. Med Care. 2009 Apr;47(4):440-7.

^x <http://www.isdscotland.org/Health-Topics/Health-and-Social-Community-Care/SPARRA/>



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