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Evaluation of Medicare Care Management for High Cost Beneficiaries (CMHCB) Demonstration: VillageHealth's Key to Better Health (KTBH)

Final Report

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RTI INTERNATIONAL

EVALUATION OF MEDICARE CARE MANAGEMENT FOR HIGH COST BENEFICIARIES (CMHCB) DEMONSTRATION: VILLAGEHEALTH'S KEY TO BETTER HEALTH (KTBH)

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EXECUTIVE SUMMARY

The purpose of this report is to present the findings from RTI International's evaluation of VillageHealth's (VH) Key to Better Health (KTBH) Medicare Care Management for High Cost Beneficiaries (CMHCB) demonstration program. The principal objective of this demonstration is to test a pay-for-performance contracting model and new intervention strategies for Medicare fee-for-service (FFS) beneficiaries, who are high cost and/or who have complex chronic conditions, with the goals of reducing future costs, improving quality of care and quality of life, and improving beneficiary and provider satisfaction. The desired outcomes include a reduction in unnecessary emergency room visits and hospitalizations, improvement in evidence-based care, and avoidance of acute exacerbations and complications. In addition, this demonstration provided the opportunity to evaluate the success of the "fee at risk" contracting model, a relatively new pay-for-performance model, for CMS. This model provided the KTBH program with flexibility in its operations and strong incentives to keep evolving toward the outreach and intervention strategies that are the most effective in improving population-based outcomes.

The overall design of the CMHCB demonstration follows an intent-to-treat (ITT) model, and like the other care management organizations (CMOs), the KTBH program was held at risk for its monthly management fees based on the performance of the full population of eligible beneficiaries assigned to its intervention group and as compared with all eligible beneficiaries assigned to its comparison group. Beneficiary participation in the CMHCB demonstration was voluntary and did not change the scope, duration, or amount of Medicare FFS benefits received. All Medicare FFS benefits continued to be covered, administered, and paid for by the traditional Medicare FFS program. Beneficiaries did not pay any charge to receive CMHCB program services.

Our evaluation focuses upon three broad domains of inquiry:

- Implementation. To what extent was KTBH able to implement its program?
- Reach. How well did KTBH engage its intended audiences?
- Effectiveness. To what degree did KTBH improve beneficiary and provider satisfaction, improve functioning and health behaviors, improve clinical quality and health outcomes, and achieve targeted cost savings?

Organizing the evaluation into these areas focuses our work on CMS' policy needs as it considers the future of population-based care management programs or other interventions in Medicare structured as pay-for-performance initiatives. We use both qualitative and quantitative research methods to address a comprehensive set of research questions within these three broad domains of inquiry.

E.1 Scope of Implementation

VH launched its KTBH CMHCB demonstration program November 1, 2005. VH worked with its CMS project officer and analysts from Actuarial Research Corporation (ARC) to develop a methodology for selecting the starting population for the KTBH CMHCB program.

Beneficiaries had to meet the following four inclusion criteria for eligibility in the KTBH CMHCB demonstration program:

- Medicare fee-for-service beneficiaries, who have a primary residence in Queens, Suffolk, or Nassau county New York;
- High costs based on Medicare claims from 2004 (i.e., $5,000 or more);
- High risk for future health care utilization (i.e., Hierarchical Condition Code > 1.7); and
- Diagnosis of chronic kidney disease (CKD) as evidenced by at least one claim with a diagnosis from a list of 27 ICD-9 diagnosis codes indicative of CKD.

Beneficiaries were excluded if they had one of the following exclusion criteria for eligibility in the KTBH CMHCB demonstration program:

- Met the specific VH diagnostic criteria for exclusion, generally identifying patients with hemophilia, HIV, cancer, or currently on dialysis;
- reached end-stage renal disease or had received dialysis or a kidney transplant prior to the launch date of the program, November 1, 2005.
- elected the Medicare hospice benefit, enrolled in a commercial Medicare Advantage plan, did not have both Part A and Part B Medicare coverage, had Medicare as a secondary payer, or did not have a phone number from a search of the Social Security Administration's contact information database.

The remaining beneficiaries were randomly assigned to the intervention and comparison groups at a ratio of 5 to 2. The final original population was composed of 4,996 intervention beneficiaries and 2,000 comparison beneficiaries.

A refresh population of 2,385 intervention beneficiaries and 956 comparison group beneficiaries was received by the KTBH program in November 2006. The basic criteria for selection of the intervention and comparison refresh populations were similar to the criteria used to select the initial populations with one noted exception. VH requested that beneficiaries who were institutionalized during March 2006 and May 2006 be excluded from the refresh population.

Of the KTBH's original intervention group beneficiaries, 47% verbally consented to participate in the CMHCB demonstration at some point during the intervention period, 33% refused to participate, and 21% were not contacted or were unable to be located. Of the refresh intervention beneficiaries, 45% consented to participate at some point during the 24-month period. The percent that refused to participate went up slightly (37%), the percent that were not contacted or were unable to be contacted decreased slightly to 19%. The KTBH program ended October 31, 2008 or 36 months after initiation of the original population and 24 months after the start of the refresh population.

VH negotiated a two-step fee structure with CMS; $100 per-member per-month (PMPM) for all beneficiaries who did not opt out during the 6-month outreach period and a $225 PMPM payment for active participants during the remaining 30 months of the demonstration. VH derived its fee structure based on the assumption that it would actively manage 2,400 (i.e., 40%) of beneficiaries from the intervention group and absorb costs for ongoing educational mailings to the whole population from the fees paid for active participants. Further, VH's fee strategy was based on a literal interpretation of participation, i.e., only patients who agree to actively participate by receiving care support services via telephone and/or home visits from nursing staff are defined as program participants. Lower risk individuals who agreed to receive periodic educational mailings are classified as non-participants in terms of program fees collected. For the refresh cohort, a fee was paid for the refresh beneficiaries only if they became participants. The net savings requirements for the KTBH program are 5% for the original cohort and 2.5% for the refresh cohort.

E.2 Overview of the KTBH CMHCB Demonstration Program

The core of the intervention was one-on-one nurse care manager support provided via telephone and/or in-person visits complemented by support from the KTBH program pharmacist, social worker, and dietician and access to a 24-hour hotline. Participants received any or all of these services during the demonstration program, depending on their needs throughout the period. Nurse care managers engaged in the following core activities to support program participants:

- Conducted initial and continuous risk evaluation of participant medical and psychosocial needs, such as laboratory tests or access to eldercare for a spouse.

- Coordinated care through the development of a care plan that summarized participant needs and outlined action plans to ensure that issues were addressed in a timely way. In addition, care managers recommended referral to a nephrologist as appropriate for participants who reached stage IV CKD.

- Educated participants about slowing the progression of renal disease, the benefits of early referral to a nephrologist, management of comorbid conditions, and treatment options for renal disease such as preparation for renal replacement therapy. Care managers had access to a comprehensive library of educational materials to support their efforts to inform patients.

- Coordinated medication therapy management, which included patient education about medications, discussion of issues of compliance with medication regimens, and identification of inappropriate drug regimens (duplication, etc.).

- Monitored participant status during each interaction either by telephone or in-person visit to detect changes in health status, psychosocial needs, and medical therapy, so that care plans could be adjusted to continually address issues pertinent to each participant. Care managers collected and recorded patient laboratory results obtained from patient self-report or supplied by a physician partner to monitor patient status.

This comprehensive set of services was provided to each participant using a buddy system, i.e., a team of two care managers composed of an IntelliCare nurse, who interacted with participants via telephone, and a field-based nurse, who communicated with participants both in-person and via phone. Supplemental assistance from a pharmacist, dietician, and social worker was provided as needed.

Medication Therapy Management. Many of the beneficiaries eligible for the KTBH program take a large number of prescription medications. Therefore, VH hired a full-time pharmacist to conduct medication reviews; inform providers about medication-related problems; and provide education about medications to participants, KTBH care managers, and community providers.

Dietician support. The KTBH program target population had a high prevalence of comorbid conditions, such as diabetes and HF that required compliance with prescribed dietary regimens. However, these beneficiaries did not have consistent access to support from a dietician, and their doctors often did not have the training or the time to provide this service. Therefore, VH hired a dietician located in San Antonio, Texas, who had worked for VH since 2000, to provide nutritional support and guidance to KTBH program participants.

Social Support. VH hired a social worker shortly after implementation to assist KTBH program participants with psychosocial issues such as obtaining support for depression, understanding insurance benefits, and transportation issues. Working in Philadelphia, Pennsylvania, she interacted with participants via telephone to determine their needs and discuss resources that may be available to help.

Telemonitoring support. VH also provided a Cardiocom telemonitoring scale to participants with HF who had been hospitalized or were at high risk of an acute event based on relative risk score and nursing judgment. Participants used the scale that has a platform on the bottom to weigh themselves daily and answer a series of questions about their health status and current symptoms using a key pad on the device's pedestal. VH worked with Cardiocom to customize questions asked for the KTBH program, and the software used branching tree logic, so depending on symptoms reported, the questions asked of each participant differed.

24-hour hotline. KTBH program participants could call VH at any time of day to request assistance. During the day, participants could call their care manager directly, who received calls via cell phone. Calls received after 8pm were answered by triage care managers, who handled urgent concerns, and offered callers the opportunity to leave a message for one of their care managers. An IntelliCare nurse generally followed up with each participant the day after an after-hours call was received.

Using information gleaned from its early experience with the program, KTBH made a series of changes and enhancements to its operations as reported to us at our second site visit.

Addition of Enclara services for end-of-life care. In October 2007, KTBH began partnering with Enclara, a firm that specializes in end-of-life planning and preparation for hospice referral. Enclara performed either telephonic or in-person support. Enclara also helped

patients with advanced care planning and prepared the family and the beneficiary for hospice evaluation.

Motivational interviewing. In October 2007, KTBH began partnering with Motivational Interviewing Network of Trainers (MINT) at the Oregon Health and Sciences University to learn the technique of motivational interviewing (MI).

Change in clinical focus. KTBH program staff reported at the second site visit that they had expanded the clinical focus of the program to include identifying and treating the comorbid conditions of CKD—HF, hypertension, cardiovascular disease, and diabetes mellitus. Several factors precipitated this expansion in clinical focus. First, KTBH staff report that it was difficult to obtain laboratory values and thus it is difficult to stage kidney disease. Furthermore, claims analyses showed that most KTBH participants with CKD were in Stage 3 and therefore were not at immediate risk of renal replacement therapy. KTBH staff believed that if the KTBH program focused on these comorbid conditions, the progression of CKD should slow.

Focus 5. The KTBH staff believed that their approach to managing participants with CKD should focus on those things that drive morbidity and hospitalizations. They therefore developed the "Focus 5" approach to identify those things on which they should concentrate, which would establish more frequent contact with participants, and ultimately decrease morbidity and hospitalization rates. These 5 factors include (1) CKD and vascular access, (2) medication therapy management, (3) fluid/metabolic monitoring, (4) immunizations/wounds/infections, and (5) advanced care planning.

Late Stage Intervention Program (LSIP). KTBH developed a new program called the Late Stage Intervention Program (LSIP) that targeted members with Stage 4 and 5 CKD, who were followed by the nephrology partners. The first session was a home visit with a KTBH nurse, who provided education regarding CKD, which focused on protection of the kidneys, treatment options, and vascular access education. A personal history and medical review were also done at this time. Then, ongoing support included timely vessel mapping and placement of a fistula when a beneficiary's glomerular filtration rate (GFR) fell to less than 30. Follow-up of these patients was monthly to support education, access planning, and monitor laboratory values, and treat anemia. Sometimes, referrals were also made by the KTBH nurses to a registered dietitian.

E.3 Key Findings

In this section, we present key findings based upon the 36 months of KTBH operations with its original population and 24 months with its refresh population. Our findings are based on the experience of approximately 7,500 ill Medicare beneficiaries with chronic kidney disease (CKD) assigned to an intervention or a comparison group. Six key findings on participation, intensity of engagement in the KTBH program, beneficiary satisfaction and experience with care, clinical quality, health outcomes, and financial outcomes have important policy implications for CMS and future disease management or care coordination efforts among Medicare fee-for-service (FFS) beneficiaries.

Key Finding #1: Several vulnerable subpopulations of Medicare FFS beneficiaries were less likely to agree to participate in the KTBH demonstration program.

Of all KTBH intervention beneficiaries, 46% verbally consented to participate in the CMHCB demonstration at some point during the intervention period. For the KTBH program, we find that participants from the original population were healthier and younger than beneficiaries who never participated. The very old (85 years of age and older), Medicaid enrollees, institutionalized beneficiaries, those that died, and those with higher prospective and concurrent HCC scores were less likely to be participants. In the multivariate regression analysis, the same baseline health status characteristics (e.g., prospective HCC risk score, PBPM costs, and Charlson comorbidity indices) had no impact on the likelihood of participation after controlling for baseline demographics and demonstration period health status. Beneficiaries with medium and high concurrent HCC scores were more likely to be participants. This suggests that the KTBH program was unable to engage the historically sicker Medicare beneficiaries but did make some inroads with engaging those with acute clinical deterioration as measured by the concurrent HCC score after controlling for baseline health status through the prospective HCC score. The results for the refresh population were similar to the original population, with one noted difference: higher baseline Charlson comorbidity scores were positive predictors of participation. These differences suggest that the KTBH program was more successful gaining participation during the last 2 years of the demonstration from sicker and more costly beneficiaries as their program matured.

Key Finding #2: As the KTBH program matured, KTBH staff was more successful targeting for intervention beneficiaries at high risk of hospitalization or who had been hospitalized.

A cornerstone of the KTBH's program was health coaching interactions with care manager nurses. Nearly every participating beneficiary received at least one call or in-person visit from a care manager in the last 18 months of the demonstration and over 60% received more than 20 contacts during this same time period. Telephone contact was the most dominant form of contact. In our multivariate regression modeling of likelihood of being in a high contact versus low contact group for the original population, we found that beneficiary characteristics, baseline characteristics, and demonstration period acute care utilization were not indicators of being in the high contact category. A high concurrent HCC score, or health status measured during the first 6 months of the demonstration period, was found to be a positive predictor of being in the high contact group indicating that the KTBH staff made contact with beneficiaries that had progressive health issues. Among the refresh population, there was evidence that KTBH staff made a focused effort to contact beneficiaries who were at high risk of hospitalization or who had been hospitalized during the demonstration period. Acute care utilization was a strong predictor of more contacts. These findings suggest that the KTBH program was successful in contacting the refresh beneficiaries who were at high risk of hospitalization or who had been hospitalized.

Key Finding #3: The KTBH program did not substantially improve beneficiary reported experience with care, level of physical activity, and self-reported physical health.

The beneficiary survey was designed to obtain assessments directly from beneficiaries about key outcomes of beneficiary experience of care, self-management, and physical and mental function. We asked beneficiaries about the extent to which their health care providers helped them to cope with their chronic condition. We supplemented this item with questions related to two key components of the KTBH CMHCB intervention: helpfulness of discussions with their health care team and quality of communication with their health care team. In addition, the survey instrument collected information about beneficiary self-care frequency and self-efficacy related to medications, diet, and exercise and Clinician and Group Adult Primary Care Ambulatory Consumer Assessments of Health Plans Survey (CAHPS®) measures of communication with health care providers. Last, the survey instrument included four physical and mental health functioning measures.

The KTBH demonstration program employs strategies to improve quality of care for high cost Medicare beneficiaries while reducing costs by empowering Medicare beneficiaries to better manage their care. KTBH program staff hypothesized that lifestyle changes and better communication with providers will mitigate acute flare-ups in the chronic conditions. Experiencing better health, beneficiaries should also be more satisfied that their health care providers are effectively helping them to cope with their chronic medical conditions. Among the 19 outcomes covered by the survey, the KTBH program demonstrated one positive intervention effect that resulted in the decrease of the depression symptoms, and one negative intervention effect on discussing treatment choices within the self-management survey domain

Key Finding #4: KTBH had no positive intervention effects on six quality of care process measures.

We have defined quality improvement for this evaluation as an increase in the rate of receipt of claims-derived, evidence-based process-of-care measures. We selected three measures appropriate for different populations of elderly beneficiaries: influenza vaccine for all beneficiaries; low-density lipoprotein cholesterol (LDL-C) testing for beneficiaries with diabetes or ischemic vascular disease (IVD); and rate of annual HbA1c testing for beneficiaries with diabetes. We also create two ESRD-related measures: rate of progression to ESRD and rate of fistula/graft placement prior to initiation of dialysis among beneficiaries who progress to ESRD. Of the six measures, there were no statistically significant differences in the rate of receipt of evidence-based care between the intervention and comparison original and refresh populations.

Over the course of the demonstration, the KTBH program had expected to increase rates of adherence to evidence-based care. However, during the last year of its demonstration program, we observe lower or very similar rates of adherence to the selected measures among its intervention beneficiaries relative to the comparison group beneficiaries for all measures. We also observe between roughly one-fourth to one-third of intervention beneficiaries in both the original and refresh populations were not compliant during the last year of the KTBH demonstration program despite focused efforts by KTBH staff to encourage beneficiaries to become compliant with evidence-based care. These findings suggest that improving or sustaining

adherence to guideline concordant care in a cohort of ill Medicare FFS beneficiaries was more challenging than originally envisioned.

Key Finding #5: The KTBH program did not reduce acute care utilization as measured by rate of hospitalization, ER visits, or 90-day readmissions nor did the KTBH program have any success reducing mortality or increasing the use of the Medicare hospice benefit.

During the course of the KTBH demonstration, we observed increasing rates of all-cause and ACSC hospitalizations, ER visits, and 90-day readmissions in both the intervention and comparison groups and for both the original and refresh populations. We observed no statistically significant differential rates of hospitalizations, ER visits, or 90-day readmission—either all-cause or for ambulatory care sensitive conditions—during the demonstration period relative to the baseline period for either the original or refresh populations. These findings are disappointing given the evidence that the KTBH staff made an effort to contact beneficiaries who were at high risk of hospitalization or who had been hospitalized during the demonstration period. Acute care utilization was a strong predictor of more contacts.

Further, we found no differential rate of mortality between the intervention and comparison original and refresh populations. The only statistically significant finding was within the refresh population and their use of the Medicare hospice benefit; the median number of days of hospice use was 14 days longer in the comparison group than in the intervention group.

Key Finding #6: Medicare cost growth in the intervention group was not different from the rate of growth in the comparison group.

No statistically significant savings were found for the intervention in either the original or refresh populations. Per beneficiary per month (PBPM) costs rose $111 slower in the original intervention group (4.4% of comparison costs), but savings needed to exceed $163 to be considered statistically significant. The KTBH program's average monthly fee was $90 for the original population. The KTBH program may have performed slightly better with its refresh sample because intervention costs increased $142 less than in the comparison group. This difference, however, was still insignificant, as savings needed to be $224 to be considered statistically significant.

Because the KTBH program's intervention and comparison groups were randomly determined, no material imbalances were found across many cost, severity, and other patient characteristics in the base period. Consequently, any slight differences that did exist in the subsequent base year had little effect on our final conclusion of no significant savings. Responding to KTBH's request, CMS staff selected a very costly, complex set of Medicare beneficiaries for their intervention and comparison groups. Mean per beneficiary per month base year claims costs (weighted by fraction of time eligible for the intervention) were approximately $1,800 in both groups, a figure considerably higher than in the general Medicare population. As a result, the comparison group exhibited both rapidly rising costs during the intervention period as well as extreme regression-to-the-mean effects.

E.4 Conclusion

Based on extensive qualitative and quantitative analysis of performance, we find that the KTBH program had no success improving key processes of care or beneficiary experience with care, self-management, or functional status, reducing acute care utilization or reducing mortality, or increasing use of the Medicare hospice benefit. Although PBPM costs rose slower in the original and refresh intervention groups relative to the comparison groups, statistically significant savings were not achieved. The lack of program savings to offset monthly management fees and lack of any impact on other outcomes cannot justify the KTBH model for chronically ill Medicare fee-for-service beneficiaries with CKD on cost effectiveness grounds.

What might explain the lack of success in the KTBH demonstration program? One explanation may be the targeting of beneficiaries at greatest risk of intensive, costly, service use (as distinct from the need for general care management). Responding to the KTBH program's request, CMS selected a very costly, complex set of Medicare beneficiaries for their intervention and comparison groups. Mean per beneficiary per month base year claims costs (weighted by fraction of time eligible for the intervention) were approximately $1,800 in both groups, a figure considerably higher than in the general Medicare population.

The KTBH program's lack of success is not surprising in light of the extreme regression-to-the-mean (RtoM) behavior that we observed among their selected beneficiaries. The KTBH staff focused on those most likely to be major users of acute care services or who had been hospitalized. Yet, many of these beneficiaries experienced declines in use and costs regardless of the intervention, as evidenced in the comparison group. The large increases in demonstration period costs in otherwise less costly beneficiaries in the base period suggests that the intervention staff should have targeted those at highest risk of increasing costs. In fact, the greater is the potential for regression-to-the-mean, the greater the effort is required to identify lower cost, lower utilizing beneficiaries to avoid expensive hospitalizations in the near future.

A second explanation may be their recruitment strategy. Given the KTBH program's high monthly management fee ($225 per month) and the population-based financial risk feature of this demonstration, engagement of less than 50% of the intervention population required the KTBH program to have been extremely successful in reducing costs associated with the participating beneficiaries. The KTBH program was not successful in reducing hospitalizations during the demonstration period. The lack of substantive improvements in acute care utilization broadly across their intervention population translated into limited financial savings. And, their targeting strategy was costly. Each contact cost was roughly $262 ($16.9 million in total fees divided by 64,423 contacts) or over twice the national average payment for a face-to-face office visit with an established patient with the ***highest level of complexity*** under the Medicare Fee Schedule[1].

And, a third explanation may be the model of intervention itself. Prior evaluations of Medicare care management programs that were primarily telephonic have not demonstrated savings sufficient to cover fees one-half the size of the KTBH program's fee. A cornerstone of

[1] National non-facility price of $124.79 for HCPCS code 99215 for 2009.

the KTBH's program was health coaching interactions with care manager nurses. Nearly every fully participating beneficiary during the last 18 months of the program received at least one call or in-person visit from a care manager and over 60% received more than 20 contacts during this same time period. This is a relatively high contact rate compared to other care management programs that we have evaluated. However, communicating by telephone with elderly and disabled patients is complicated by the relatively high frequency of cognitive impairments, and the most dominant form of contact was telephonic.

Furthermore, the nurse care managers were not part of the beneficiaries' primary health care teams, hindering their ability to directly interact with the beneficiaries' primary providers, either primary care physician or nephrologist, and effectively help facilitate changes in medical care plans to mitigate deterioration in health status. The care manager served only as an adjunct to the patients' primary physicians with a stated goal of facilitating the relationship between the patient and his or her community-based provider with a focus on CKD or other chronic issues. Although the KTBH program established partnerships with a number of nephrologists in their targeted geographic area, the total number of participating beneficiaries being treated by the partners was small. Thus, the care managers had to interact with a large number of community-based providers with whom they had little or no prior relationship. During our site visits, the care managers cited several challenges working with theses physicians, most notably, obtaining detailed clinical and laboratory data to clinically stage the beneficiaries' CKD status, and concern voiced by the community-based providers that their patients would be "stolen" by the partner nephrologists. Thus, the care managers had to implement a "shared care plan" with community-based physicians and specialists that were not fully supportive of the KTBH program. Lastly, by complementing, not substituting, for the primary care physician, the nurse care managers were not directly determining whether a patient was admitted to a hospital or what service intensity the beneficiaries would receive during the demonstration period.

CHAPTER 1
INTRODUCTION TO THE MEDICARE CARE MANAGEMENT FOR HIGH COST BENEFICIARIES (CMHCB) DEMONSTRATION AND VILLAGEHEALTH'S KEY TO BETTER HEALTH (KTBH) PROGRAM

1.1 Background on the CMHCB Demonstration and Evaluation

The purpose of this report is to present the findings from RTI International's evaluation of Village Health's (VH) Key to Better Health (KTBH) Care Management for High Cost Beneficiaries (CMHCB) demonstration program. On July 6, 2005, the Centers for Medicare & Medicaid Services (CMS) announced the selection of six care management organizations (CMOs) to operate programs in the CMHCB demonstration:

1. The Health Buddy Consortium (HBC), comprised of Health Hero Network, the American Medical Group Association, Bend Memorial Clinic, and Wenatchee Valley Medical Center

2. Care Level Management (CLM)

3. Massachusetts General Hospital and Massachusetts General Physicians Organization (MGH)

4. Montefiore Medical Center (MMC)

5. VillageHealth and its Key to Better Health program (KTBH)

6. Texas Tech University Health Sciences Center (TTUHSC) and its Texas Senior Trails (TST) program

These programs offer a variety of models, including "support programs for healthcare coordination, physician and nurse home visits, use of in-home monitoring devices, provider office electronic medical records, self-care and caregiver support, education and outreach, behavioral health care management, and transportation services" (CMS, 2005).

The principal objective of this demonstration is to test a pay-for-performance contracting model and new intervention strategies for Medicare fee-for-service (FFS) beneficiaries, who are high cost and/or who have complex chronic conditions, with the goals of reducing future costs, improving quality of care and quality of life, and improving beneficiary and provider satisfaction. The desired outcomes include a reduction in unnecessary emergency room visits and hospitalizations, improvement in evidence-based care, and avoidance of acute exacerbations and complications. In addition, this demonstration provides the opportunity to evaluate the success of the "fee at risk" contracting model, a relatively new pay-for-performance model, for CMS. This model provides the CMOs with flexibility in their operations and strong incentives to keep evolving toward the outreach and intervention strategies that are the most effective in improving population outcomes.

The overall design of the CMHCB demonstration follows an intent-to-treat (ITT) model, and the CMOs are held at risk for their monthly management fees based on the performance of

the full population of eligible beneficiaries assigned to their intervention group and as compared with all eligible beneficiaries assigned to their comparison group. Beneficiary participation in the CMHCB demonstration is voluntary and does not change the scope, duration, or amount of Medicare FFS benefits received. All Medicare FFS benefits continue to be covered, administered, and paid for by the traditional Medicare FFS program. Beneficiaries do not pay any charge to receive CMHCB program services.

The CMOs receive from CMS a monthly administrative fee per participant, contingent on intervention group savings in Medicare payments being equal to fees paid to the CMO plus an additional 5% savings safety margin calculated as a percentage of its comparison group's Medicare payments. CMS developed the CMHCB initiative with considerable administrative risk as an incentive to reach assigned beneficiaries and their providers and to improve care management. To retain all of their accrued fees, the CMOs have to reduce average monthly payments by the proportion of their comparison groups' Medicare program payments that the fee comprises. In addition, to insure that savings estimates were not simply the result of random variation in estimates of claims costs, CMS required an additional 5% in savings (net savings). If the CMOs are able to achieve net savings beyond the 5% safety margin, there is also a shared savings provision with CMS according to the following percentages:

1. Savings in the 0%-5% range will be paid 100% to CMS.

2. Savings in the >5%-10% range will be paid 100% to CMO.

3. Savings in the >10%-20% range will be shared equally between CMO (50%) and CMS (50%).

4. Savings of >20% will be shared between CMO (70%) and CMS (30%).

One year after the launch of each demonstration program, CMS offered all CMOs the option of supplementing their intervention and comparison populations with additional beneficiaries to offset the impact of attrition primarily due to death. This group of beneficiaries is referred to as the "refresh" population. The CMOs are at financial risk for fees received for their refresh populations plus an additional 2.5% savings.

We use the chronic care model developed by Wagner (1998) as the conceptual foundation for our evaluation because the CMHCB programs are generally provider-based care models. This chronic care model is designed to address systematic deficiencies and provides a standard framework that the area of chronic care management lacks. The model identifies six elements of a delivery system that lead to improved care for individuals with chronic conditions: the community, the health system, self-management support, delivery system design, decision support, and clinical information systems (Glasgow et al., 2001; Wagner, 2002; Wagner et al., 2001). According to the model, patients are better able to actively take part in their own care and interact productively with providers when these components are developed, leading to improved functional and clinical outcomes. Our evaluation focuses upon three broad domains of inquiry:

1. *Implementation.* To what extent were the CMOs able to implement their programs?

2. *Reach.* How well did the CMOs engage their intended audiences?

3. *Effectiveness.* To what degree were the CMOs able to improve beneficiary and provider satisfaction, improve functioning and health behaviors, improve clinical quality and health outcomes, and achieve targeted cost savings?

Organizing the evaluation into these areas focuses our work on CMS' policy needs as it considers the future of population-based care management programs or other interventions in Medicare structured as pay-for-performance initiatives. We use both qualitative and quantitative research methods to address a comprehensive set of research questions within these three broad domains of inquiry.

RTI International was hired by CMS to be the evaluator of the CMHCB demonstration and has previously conducted and reported to CMS findings from site visits to each CMO and a beneficiary survey of each CMO's intervention and comparison populations. In general, we made two rounds of site visits to each CMO to observe program start-up and to assess CMO implementation over time. The first round of site visits was conducted at the close of the outreach period for each program, and the second round of site visits was conducted approximately 2 years later. For each site visit, data were collected through telephone interviews, in-person interviews, and secondary sources, including program monitoring reports. Two RTI evaluation team members participated in 1- to 2-day on-site visits at each CMO location.

The first site visit focused on learning about CMHCB program start-up; examining the elements of the CMHCB programs; determining the nature of the CMOs' relationship with physicians in each community; learning about ways the CMOs manage costs, quality, and beneficiary utilization of care; and obtaining information on the types of services that comprise the intervention offered. The second site visit focused on engagement of the refresh population, program evolution, program monitoring/outcomes, and implementation experience/lessons learned. During the site visits, RTI met with a small number of physicians to develop an overall impression of satisfaction and experiences with the CMHCB programs. The primary objectives of the interviews were to (1) assess physicians' awareness of the CMHCB program and (2) gauge their perceptions of the effectiveness of these programs.

RTI also conducted an assessment of beneficiary satisfaction with the CMHCB program and whether the program improved knowledge and self-management skills that led to behavioral change and improved health status among intervention beneficiaries. Program success for each of four beneficiary survey domains, satisfaction, care experience, self-management, and physical and mental health functioning, was evaluated by surveying intervention and comparison beneficiaries once at Month 20 of the intervention period. KTBH's survey was conducted between June 11, 2007 and October 10, 2007. Surveying was conducted with beneficiaries from the original populations. No surveying was conducted with beneficiaries from any of the refresh populations. The findings from the beneficiary surveys were reported to CMS in RTI's third annual report (Smith et al., 2008).

This final report presents evaluation findings based on the full 36 months of the KTBH CMHCB program operations with its original population and 24 months with its refresh population. We start by reporting on the degree to which KTBH was able to engage its intervention populations. We measure degree of engagement in two ways: (1) participation rates and characteristics of participants; and (2) number and nature of contacts between KTBH and

participating beneficiaries from encounter data provided to RTI from KTBH. We then report findings related to the effectiveness of KTBH to improve beneficiary and provider satisfaction, improve functioning and health behaviors, improve clinical quality and health outcomes, and achieve targeted cost savings.

1.2 KTBH's CMHCB Demonstration Program Design Features

1.2.1 KTBH Organizational Characteristics

VillageHealth (VH; formerly RMS) was formed in 1996 as part of Baxter, a global medical products and services company with expertise in medical devices, pharmaceuticals and biotechnology. In 1997, VH signed its first contract to provide chronic kidney disease (CKD) care management services to Humana, which continues to be VH's largest client today. In 2002, DaVita, Inc. acquired VH, which operates the renal disease management program as a wholly owned subsidiary. The largest independent provider of dialysis services in the United States, DaVita, Inc., bought VH rather than developing its own disease management service line. DaVita, Inc. is a publicly traded company with $3 billion in annual revenue, 65% of which is obtained through contracts with Medicare and Medicaid. DaVita, Inc. provides support to almost 100,000 dialysis patients within approximately 1,250 dialysis centers in 41 states and the District of Columbia, with a staff of 28,000 teammates.

Headquartered in Vernon Hills, Illinois, near the offices of its previous owner, Baxter, VH is the largest renal disease management organization (DMO) in the country. VH was the first renal DMO to receive full National Committee for Quality Assurance accreditation in 2002, which was recently renewed for an additional 3 years. VH's staff of 178 full-time employees provides advanced care management programs in more than 25 markets throughout the U.S. DaVita also operates a Medicare Advantage Special Needs Plan in California, which is also the CMS ESRD Disease Management Demonstration Project. In addition, DaVita is collaborating with Evercare's Medicare Advantage Special Needs Plan / CMS ESRD Demonstration Project in Georgia and Arizona, as a result of DaVita's recent acquisition of Gambro, another provider of dialysis services.

The CMHCB demonstration serves as an important opportunity for VH to expand its government business, as well as learn about better ways to provide support for Medicare beneficiaries with CKD, a vulnerable population receiving less than optimal care from the currently fragmented health care system. VH employs a rigorous process of continuous quality improvement to ensure that lessons learned are applied to improve ongoing operations. VH has enlisted the support of several partners to meet the needs of the high-cost Medicare beneficiaries served by the CMHCB program.

VH developed the "Key to Better Health" (KTBH) program to serve Medicare fee-for-service beneficiaries with CKD eligible for the CMHCB demonstration in Suffolk, Nassau, and Queens, New York. The KTBH program draws on the core elements of VH's other disease management offerings, with adaptations to meet the needs of the older, sicker population eligible for the CMHCB demonstration program. The core of the VH disease management program is ongoing support from a team of telephone- and field-based nurse care managers/health coaches, supplemented by assistance from a pharmacist, social worker, and dietician on the program team.

The clinical team works to identify patients at risk for hospitalization, identify and provide support and education for the management of comorbid conditions (e.g., diabetes, hypertension, anemia, and bone disease), help beneficiaries obtain treatment to slow the progression of CKD, and prepare for timely initiation of renal replacement therapy. The goals of the KTBH program are to decrease risk of "crashing" into dialysis, reduce the number of patients who progress to end-stage renal disease (ESRD), and avoid or delay preventable hospitalizations. "Crashing" into dialysis refers to a patient going into renal failure, requiring the urgent initiation of renal replacement therapy with a catheter typically conducted in the emergency department of a hospital. This emergency procedure carries significant costs at the time of the crash, as well as during the following period of ESRD due to increased prevalence of complications and increased risk of infection from catheters compared with access provided by fistulas.

VH's key partners include 6 nephrology practices employing approximately 40 nephrologists that are part of Metro Renal IPA, an independent practice association of approximately 115 nephrologists. VH's key service providers/subcontractors include the following: (1) IntelliCare**,** a large network of medical call centers, provides telephonic nurse care manager support for VH's KTBH program; (2) Cardiocom supplies the KTBH program participants who have congestive heart failure with telemonitoring devices to manage early symptoms of complications and disease progression; and (3) Empire Blue Cross/Blue Shield, the Medicare fiscal intermediary for the New York area, provides VH with Medicare claims data on a monthly basis.

1.2.2 Market Characteristics

VH selected Suffolk, Nassau, and Queens, New York, as its target region for the CMHCB program. This section provides a summary of the main factors that motivated VH to choose this region for its launch of the KTBH program.

VH selected Suffolk and Nassau counties because they have a dense population of Medicare beneficiaries. Queens, New York, was added to the target area during initial negotiations with CMS and collaboration with ARC to ensure that there were a sufficient number of beneficiaries eligible for the program and to populate an intervention and comparison group for the CMHCB demonstration.

The ESRD population is growing in this urban area, according to census data reviewed by VH. VH also has a significant presence in the area, including dialysis centers that were acquired from Gambro and an existing contract to provide disease management services for Empire Blue Cross Blue Shield. As a result, VH had a regional medical director in the area to oversee these operations. Further, Metro Renal IPA offered the opportunity to work with a strong physician partner in the area

1.2.3 KTBH Intervention and Comparison Populations

VH worked with its CMS project officer and analysts from Actuarial Research Corporation (ARC) to develop a methodology for selecting the starting population for the KTBH CMHCB program. Beneficiaries had to meet the following four inclusion criteria for eligibility in the KTBH CMHCB demonstration program:

- Medicare fee-for-service beneficiaries, who have a primary residence in Queens, Suffolk, or Nassau county New York;
- High costs based on Medicare claims from 2004 (i.e., $5,000 or more);
- High risk for future health care utilization (i.e., Hierarchical Condition Code > 1.7); and
- Diagnosis of chronic kidney disease (CKD) as evidenced by at least one claim with a diagnosis from a list of 27 ICD-9 diagnosis codes indicative of CKD.

Beneficiaries were excluded if they had one of the following exclusion criteria for eligibility in the KTBH CMHCB demonstration program:

- Met the specific VH diagnostic criteria for exclusion, generally identifying patients with hemophilia, HIV, cancer, or currently on dialysis;
- reached end-stage renal disease or had received dialysis or a kidney transplant prior to the launch date of the program, November 1, 2005.
- elected the Medicare hospice benefit, enrolled in a commercial Medicare Advantage plan, did not have both Part A and Part B Medicare coverage, had Medicare as a secondary payer, or did not have a phone number from a search of the Social Security Administration's contact information database.

The remaining beneficiaries were randomly assigned to the intervention and comparison groups at a ratio of 5 to 2. The final original population was composed of 4,996 intervention beneficiaries and 2,000 comparison beneficiaries.

The CMHCB demonstration program was designed using an intent to treat model, which means that the CMOs are held accountable for outcomes across the full intervention population, not just those who agree to participate. This model provides CMOs with flexibility in their operations and strong incentives to keep evolving toward outreach and intervention strategies that are most effective in improving population outcomes. Once individuals were assigned to either the intervention or comparison group, they remained in their assigned group for all days in which they were eligible. Eligibility for the KTBH program and hence membership in either the intervention or comparison group was lost for any period(s) during which the beneficiary:

- enrolled in an MA plan,
- lost eligibility for Medicare Part A or B,
- got a new primary payer (i.e., Medicare becomes the secondary payer),
- moved out of the KTBH program service area,
- elected the hospice benefit, or
- died.

Refresh population—VH worked with its CMS project officer and analysts from ARC to develop a methodology identifying the refresh populations for the intervention and comparison groups. A refresh population of 2,385 intervention beneficiaries and 956 comparison group beneficiaries was received by the KTBH program in November 2006. The basic criteria for selection of the intervention and comparison refresh populations were similar to the criteria used to select the initial populations with one noted exception. VH requested that beneficiaries who were institutionalized during March 2006 and May 2006 be excluded from the refresh population.

1.2.4 KTBH Operations

VH launched its KTBH CMHCB demonstration program November 1, 2005. VH negotiated a two-step fee structure with CMS; $100 per-member per-month (PMPM) for all beneficiaries who did not opt out during the 6-month outreach period and a $225 PMPM payment for active participants during the remaining 30 months of the demonstration. VH derived its fee structure based on the assumption that it would actively manage 2,400 (i.e., 40%) of beneficiaries from the intervention group and absorb costs for ongoing educational mailings to the whole population from the fees paid for active participants. Further, VH's fee strategy was based on a literal interpretation of participation, i.e., only patients who agree to actively participate by receiving care support services via telephone and/or home visits from nursing staff are defined as program participants. Lower risk individuals who agreed to receive periodic educational mailings are classified as non-participants in terms of program fees collected. For the refresh cohort, a fee was paid for the refresh beneficiaries only if they became participants.

Participation continued until a beneficiary became ineligible for the CMHCB program or opted out of services provided by the KTBH program. Participants could drop out of the program at any time and begin participation again at any time, as long as they were eligible. Beneficiaries who declined participation could be re-contacted by the KTBH program after a sentinel event, such as a hospitalization or an emergency room visit.

1.2.5 Overview of the KTBH CMHCB Demonstration Program

RTI conducted two site visits to the KTBH program office in Freeport, NY. The first site visit was conducted 8 months after the launch of their CMHCB demonstration program. The site visit, one of several evaluation components, was designed to focus on implementation: understanding the services offered by the KTBH program and reporting early experiences with program implementation and engagement of eligible beneficiaries, providers, and CMS. The second site visit, 27 months into the demonstration, focused on KTBH staff's impressions and interpretation of its 27-month experience in working on the demonstration program, The protocol to conduct the follow-up interviews included a range of questions related to

- Program implementation,
- Program monitoring/outcomes to date, and
- Implementation experience/lessons learned to date.

The description of KTBH's CMHCB demonstration program and its activities in this report reflects KTBH's impressions and interpretation of its experience and does not necessarily reflect RTI's or CMS' perspective on these issues. First, we describe the continuum of services provided to KTBH program participants and physicians, as well as the clinical protocols/analytic tools to support the KTBH nurse care managers and other health professionals who deliver these services. Second, we discuss program changes and enhancement activities that occurred as the program evolved.

Overview of intervention. The core of the intervention was one-on-one nurse care manager support provided via telephone and/or in-person visits complemented by support from the KTBH program pharmacist, social worker, and dietician and access to a 24-hour hotline. Participants with heart failure (HF) also had the opportunity to receive a Cardiocom telemonitoring scale that transmitted information about an individual's weight and health status to the KTBH program on a daily basis to monitor changes that indicated the development of an acute exacerbation of the condition. Participants received any or all of these services during the demonstration program, depending on their needs throughout the period.

Nurse care managers engaged in the following core activities to support program participants:

- Conducted initial and continuous risk evaluation of participant medical and psychosocial needs, such as laboratory tests or access to eldercare for a spouse.

- Coordinated care through the development of a care plan that summarized participant needs and outlined action plans to ensure that issues were addressed in a timely way. For example, care managers made efforts to be aware of sentinel events that occurred, such as hospitalizations, so that they could provide support for coordination of post-discharge care needs of participants. In addition, care managers recommended referral to a nephrologist as appropriate for participants who reached stage IV CKD.

- Educated participants about slowing the progression of renal disease, the benefits of early referral to a nephrologist, management of comorbid conditions, and treatment options for renal disease such as preparation for renal replacement therapy. Care managers had access to a comprehensive library of educational materials to support their efforts to inform patients.

- Coordinated medication therapy management, which included patient education about medications, discussion of issues of compliance with medication regimens, and identification of inappropriate drug regimens (duplication, etc.). The KTBH program pharmacist provided additional support for medication management.

- Monitored participant status during each interaction either by telephone or in-person visit to detect changes in health status, psychosocial needs, and medical therapy, so that care plans could be adjusted to continually address issues pertinent to each participant. Care managers routinely collected and recorded

patient laboratory results obtained from patient self-report or supplied by a physician partner to monitor patient status.

This comprehensive set of services was provided to each participant using a buddy system, i.e., a team of two care managers composed of an IntelliCare nurse, who interacted with participants via telephone, and a field-based nurse, who communicated with participants both in-person and via phone. Initially, IntelliCare nurses conducted a baseline evaluation with each participant and provided care management support to beneficiaries who were at lower risk for acute health events or hospitalization. KTBH nurse care managers provided care management support for beneficiaries assessed to be at high risk for an acute event or who required in-person support. The dyad of care managers assigned to each participant jointly assessed whether care management should be provided by telephone or in person throughout the project period. The buddy system was implemented in June 2006, when the telephonic IntelliCare nurses and KTBH nurses had an in-person meeting to learn about each other's roles.

Medication Therapy Management. Many of the beneficiaries eligible for the KTBH program take a large number of prescription medications and may supplement their treatment regimens with over-the-counter drugs and herbal therapies. However, since beneficiaries often receive prescriptions from a variety of providers, they are at risk for receiving duplicate medications, over- or under-treatment, or adverse drug interactions. Further, many of the medications used have side effects that may impact health status and functioning, particularly among people with CKD. Therefore, VH hired a full-time pharmacist to conduct medication reviews; inform providers about medication-related problems; and provide education about medications to participants, KTBH care managers, and community providers. For example, the pharmacist presented in-depth information about a specific drug each week to clinical staff during routine meetings. The pharmacist was supported in these efforts by KTBH nursing staff and an expert consultant.

Dietician support. The KTBH program target population had a high prevalence of comorbid conditions, such as diabetes and HF that required compliance with prescribed dietary regimens. However, these beneficiaries did not have consistent access to support from a dietician, and their doctors often did not have the training or the time to provide this service. Therefore, VH hired a dietician located in San Antonio, Texas, who had worked for VH since 2000, to provide nutritional support and guidance to KTBH program participants. KTBH care managers referred participants to the dietician on an as-needed basis, and the dietician provided telephonic support and sent educational materials to participants to help them understand the importance of dietary guidelines and information about how to comply with these recommendations. The dietician could also provide education to nursing staff about issues related to nutrition.

Social work support. VH hired a social worker shortly after implementation to assist KTBH program participants with psychosocial issues such as obtaining support for depression, understanding insurance benefits, and transportation issues. Working in Philadelphia, Pennsylvania, she interacted with participants via telephone to determine their needs and discuss resources that may be available to help. She encountered many questions about the Medicare Part D benefit and older patients interested in receiving home health services. Three-way calls

that included both the participant and Medicare (or any other agency) were helpful to connect participants with needed resources.

Telemonitoring support. VH also provided a Cardiocom telemonitoring scale to participants with HF who had been hospitalized or were at high risk based on relative risk score and nursing judgment. Participants used the scale that has a platform on the bottom to weigh themselves daily and answer a series of questions about their health status and current symptoms using a key pad on the device's pedestal. VH worked with Cardiocom to customize questions asked for the KTBH program, and the software used branching tree logic, so depending on symptoms reported, the questions asked of each participant differed.

As of the first site visit, approximately 25 devices were operational in participant homes, and an additional 15 devices had been shipped. VH planned to deploy a total of 450 devices during the KTBH program and proactively provided the devices to individuals at risk for acute events rather than only persons who had recent hospitalizations. The only challenge anticipated by Cardiocom staff was long-term participant compliance with using the device, based on their experience with other populations.

24-hour hotline. KTBH program participants could call VH at any time of day to request assistance. During the day, participants could call their care manager directly, who received calls via cell phone. Calls received after 8pm were answered by triage care managers, who handled urgent concerns, and offered callers the opportunity to leave a message for one of their care managers. An IntelliCare nurse generally followed up with each participant the day after an after-hours call was received.

Non-clinical support. VH introduced one non-clinical personnel to the KTBH program staff to serve as a health services assistant (HSA). Participants who did not require clinical attention would receive calls from the HSA on a routine basis in order to help patients stay connected to the program without incurring the costs associated with clinical personnel. The HAS also supported KTBH nurses by performing laboratory data entry, sending out equipment, working with providers to get data, and sending provider reports to update them on their patients' status.

Notable Program Modifications. Using information gleaned from its early experience with the program, KTBH made a series of changes and enhancements to its operations as reported to us at our second site visit. The most notable changes to the program content and delivery process included:

- The selection and engagement of the refresh population,
- The addition of Enclara services,
- The use of motivational interviewing,
- A change in clinical focus,
- The creation of "Focus 5," i.e., five things that drive morbidity and hospitalizations,

- The implementation of the Late-Stage Intervention Program (LSIP), and
- A change in Cardiocom monitoring services.

Refresh Population. A refresh population of 2,385 intervention beneficiaries was received in November 2006. The basic criteria for selection of the intervention and comparison refresh populations were similar to the criteria used to select the initial populations with one noted exception. VH requested that beneficiaries who were institutionalized during March 2006 and May 2006 be excluded from the refresh population. The process used to engage the refresh population was also modified compared to the process for the original population. In the earlier process, beneficiaries were called by five nurses employed by IntelliCare, a network of medical call centers, according to an algorithm developed by VH using the 2004 Medicare claims data for the eligible population and a combination of three factors, beneficiaries receiving care from a nephrologist, presence of diabetes, and an elevated HCC risk score. For the refresh population, beneficiaries were stratified only by the HCC relative risk score. Cardiocom nurses contacted beneficiaries with heart failure and with high and medium HCC risk scores. The Intellicare nurses called all other beneficiaries starting with those with medium HCC risk scores.

Addition of Enclara services for end-of-life care. In October 2007, KTBH began partnering with Enclara, a firm that specializes in end-of-life planning and preparation for hospice referral. Village Health Nurses (VHN) referred participants to Enclara who were in declining health (based on signs of wasting, increased hospital or emergency department visits, and weight loss). Enclara performed either telephonic or in-person support and reported the outcome of the intervention to the KTBH team. Enclara also helped patients with advanced care planning and prepared the family and the beneficiary for hospice evaluation. The KTBH team had weekly team calls with Enclara to review patient-specific issues. For the KTBH program, all of the Enclara nurses had extensive experience in end-of-life issues, and Enclara hired a social worker with end-of-life experience.

Motivational interviewing. In October 2007, KTBH began partnering with Motivational Interviewing Network of Trainers (MINT) at the Oregon Health and Sciences University to learn the technique of motivational interviewing (MI). MI was defined by KTBH personnel as "a skillful, clinical style for eliciting from patients their own good motivations for making behavior changes in the interest of their health. The spirit of MI is collaborative, evocative, and honoring patient autonomy." In-person group learning sessions were attended by all KTBH personnel in October 2007. Ongoing group and individual sessions were made available to improve MI skills. KTBH program staff reported that beneficiaries had intrinsic motivation for making behavior changes towards improving their health. In other words, the motivation to change was elicited from the beneficiary. Through MI, the nurses and social workers worked to enhance the beneficiaries' intrinsic motivation.

Change in clinical focus. KTBH program staff reported at the second site visit that they had expanded the clinical focus of the program to also include identifying and treating the comorbid conditions of CKD—heart failure (HF), hypertension (HTN), cardiovascular disease (CVD), and diabetes mellitus (DM). Several factors precipitated this expansion in clinical focus. First, KTBH staff report that it was difficult to obtain laboratory values and thus it was difficult to stage kidney disease. Furthermore, claims analyses showed that most KTBH participants with

CKD were in Stage 3 (although claims data have not proven to be an accurate methodology to stage patients) and therefore were not at immediate risk of renal replacement therapy. KTBH staff believed that if the KTBH program focused on these comorbid conditions, the progression of CKD should slow.

Focus 5. The KTBH staff believed that their approach to managing participants with CKD should focus on those things that drive morbidity and hospitalizations. They therefore developed the "Focus 5" approach to identify those things on which they should focus, which would establish more frequent contact with participants, and ultimately decrease morbidity and hospitalization rates. These 5 factors include (1) CKD and vascular access, (2) medication therapy management, (3) fluid/metabolic monitoring, (4) immunizations/wounds/infections, and (5) advanced care planning.

Late Stage Intervention Program. KTBH developed a new program called the Late Stage Intervention Program that targeted members with Stage 4 and 5 CKD, who were followed by the nephrology partners. The first session was a home visit with a KTBH nurse, who provided education regarding CKD, which focused on protection of the kidneys, treatment options, and vascular access education. A personal history and medical review were also done at this time. Then, ongoing support included timely vessel mapping and placement of a fistula when a beneficiary's glomerular filtration rate (GFR) fell to less than 30. Follow-up of these patients was monthly to support education, access planning, and monitor laboratory values, and treat anemia. Sometimes, referrals were also made by the KTBH nurses to a registered dietitian.

Change in Cardiocom monitoring. At the time of RTI's first site visit, KTBH nurses monitored beneficiaries on the Cardiocom scale. In November 2007, the program began using Cardiocom nurses, rather than KTBH nurses, to perform the monitoring, because the KTBH staff felt that Cardiocom staff had greater expertise in the use of the software. KTBH staff felt that this change improved the tracking of or possible prevention of hospitalizations of beneficiaries with the scale.

1.3 Organization of Report

In ***Chapter 2***, we provide an overview of our evaluation design and a description of the data and methods used to conduct our analyses. ***Chapter 3*** contains a summary of our previously reported assessment of beneficiary satisfaction, self-management, and functioning at the midpoint of the KTBH CMHCB demonstration period and provider satisfaction with the KTBH CMHCB program culled from interviews with physicians during the site visit. In ***Chapter 4***, we provide the results of our analyses of participation levels in the KTBH program and level of intervention with participating beneficiaries (i.e., the number of in-person visits and/or telephonic contacts). In ***Chapters 5 and 6***, we provide the results of our analyses of changes in clinical quality of care and health outcomes, respectively. ***Chapter 7*** presents our analyses of financial outcomes. We conclude with an overall summary of key findings and a discussion of the policy implications of these findings for future Medicare care management initiatives. Supplements to ***Chapters 2, 4, and 7*** are available from the CMS Project Officer upon request.

CHAPTER 2
EVALUATION DESIGN AND DATA

2.1 Overview of Evaluation Design

2.1.1 Gaps in Quality of Care for Chronically Ill

Medicare beneficiaries with multiple progressive chronic diseases are a large and costly subgroup of the Medicare population. The Congressional Budget Office (CBO) estimated that in 2001 high-cost beneficiaries (i.e., those in the top 25% of spending) accounted for 85% of annual Medicare expenditures (CBO, 2005). Three categories of high-cost users—beneficiaries who had multiple chronic conditions, were hospitalized, or had high total costs—were identified by CBO for study of persistence of Medicare expenditures over time. Beneficiaries that were selected based upon hospitalization or being in the high total cost groups had baseline expenditures that were four times as high as expenditures for a reference group. Beneficiaries selected based upon presence of multiple comorbid conditions had baseline expenditures that were roughly twice as high as expenditures for a reference group. Subsequent years of costs remained higher for all three cohorts than the reference group; however, total expenditures declined the most for those beneficiaries who were identified as high cost due to a hospitalization followed by beneficiaries who had had high total costs in the base year. Subsequent costs were virtually unchanged for beneficiaries with multiple chronic conditions.

Further, these beneficiaries currently must navigate a health care system that has been structured and financed to manage their acute, rather than chronic, health problems. When older patients seek medical care, their problems are typically treated in discrete settings rather than managed in a holistic fashion (Anderson, 2002; Todd and Nash, 2001). Because Medicare beneficiaries have multiple conditions, see a variety of providers, and often receive conflicting advice from them, there is concern that there is a significant gap between what is appropriate care for these patients and the care that they actually receive (Jencks, Huff, and Cuerdon, 2003; McGlynn et al., 2003). The CMHCB demonstration has been designed to address current failings of the health care system for chronically ill Medicare fee-for-service (FFS) beneficiaries.

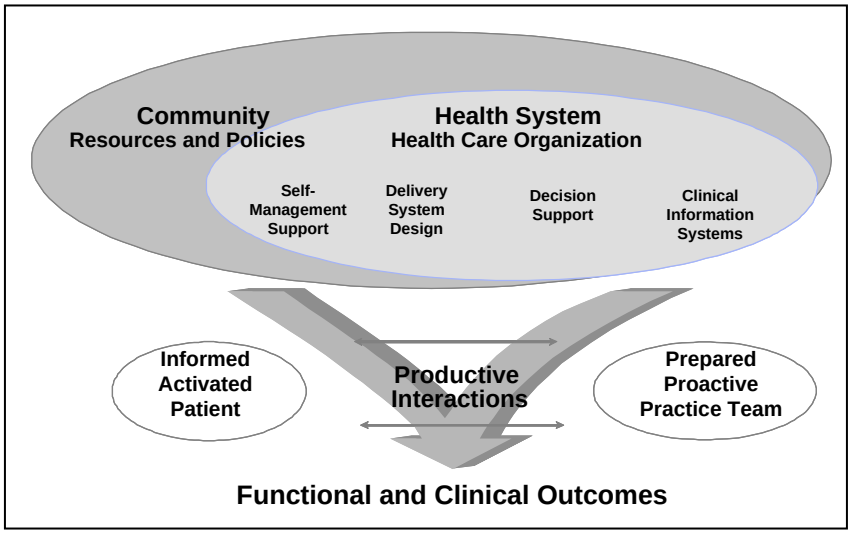
2.1.2 Emerging Approaches to Chronic Care

The Chronic Care Model—The concept of chronic care management as a patient-centered and cost-effective approach to managing chronic illness has been evolving for years. The Chronic Care Model (CCM), developed by Wagner (1998), has become a familiar approach to chronic illness care (***Figure 2-1***). This model is designed to address systematic deficiencies and offers a conceptual foundation for improving chronic illness care. The model identifies six elements of a delivery system that lead to improved care for individuals with chronic conditions (Glasgow et al., 2001; Wagner, 2002; Wagner et al., 2001):

- the community,
- the health system,
- self-management support,

- delivery system design,
- decision support, and
- clinical information systems.

Figure 2-1
Chronic Care Model



SOURCE: Wagner (1998). Reprinted with permission.

According to the model, patients are better able to actively take part in their own care and interact productively with providers when these components are developed, leading to improved functional and clinical outcomes.

Disease management and case management—The two most common approaches to coordinating care for people with chronic conditions are disease management and intensive case management programs (Medicare Payment Advisory Commission [MedPAC], 2004). Disease management programs teach patients to manage their chronic conditions and are often provided on a broader scale than case management programs. Services provided under a disease management program may include health promotion activities, patient education, use of clinical practice guidelines, telephone monitoring, use of home monitoring equipment, registries for providers, and access to drugs and treatments. Most disease management programs target persons with specific medical conditions but then take the responsibility for managing all of their additional chronic conditions. Case management programs typically involve fewer people than disease management programs (Vladek, 2001). Case management programs also tend to be more intensive and individualized, requiring the coordination of both medical and social support services for high-risk individuals. Typically, disease management programs are used with intensive case management for high-risk individuals who have multiple chronic conditions and complex medical management situations.

The empirical research on the effectiveness of disease management and case management approaches is mixed. Some studies have shown support for the clinical improvements and cost-effectiveness of disease management programs (Lorig, 1999; Norris et al., 2002; Plocher and Wilson, 2002; Centers for Disease Control and Prevention [CDC], 2002). Other programs, such as the CMS case management demonstration programs in the early 1990s, which required physician consent for patient participation, resulted in increased beneficiary satisfaction but failed to achieve any improvement in health outcomes, patient self-care management, or cost savings (Schore, Brown, and Cheh, 1999). In 2002, CMS selected 15 demonstration programs of varying sizes and intervention strategies as part of the Medicare Coordinated Care Demonstration (MCCD). None of the 15 programs produced any statistical savings in Medicare outlays on services relative to the comparison group, and two had higher costs (Peikes et al., 2009).[2] There were a few, scattered quality of care improvement effects. Two programs did show some promise in reducing hospitalizations and costs, suggesting that care coordination might at least be cost neutral. A major reason given for the lack of success in both Medicare savings and better health outcomes is attributed to the absence of a true transitional care model in which patients were enrolled during their hospitalizations. Studies have shown that approach to significantly reduce admissions within 30/60 days post-discharge, when patients are at high risk of being readmitted (Coleman et al., 2006; Naylor et al., 1999; Rich et al., 1995).

2.1.3 Conceptual Framework and CMHCB Demonstration Approaches

The care management organizations (CMOs) awarded contracts under this CMS initiative offered approaches that blend features of the chronic care management, disease management, and case management models. Their approaches relied, albeit to varying degrees, on engaging both physicians and beneficiaries and supporting the care processes with additional systems and staff. They proposed to improve chronic illness care by providing the resources and support directly to beneficiaries through their relationships with insurers, physicians, and communities in their efforts. The CMOs also planned to use all available information about beneficiaries to tailor their interventions across the spectrum of diseases that the participants exhibited.

Although each of the CMOs has unique program characteristics, all have some common features. These features include educating beneficiaries and their families on improving self-management skills, teaching beneficiaries how to respond to adverse symptoms and problems, providing care plans and goals, ongoing monitoring of beneficiary health status and progress, and providing a range of resources and support for self-management. Features of the CMHCB programs include:

- *Individualized assessment*. Several CMOs use proprietary algorithms to calculate a risk score or risk scores, while others depend on judgment of clinical staff. The scores are used to customize interventions to the participants' needs.

- *Education and skills*. A key step in improving self-management is educating beneficiaries and their families about their illnesses, how to react to symptoms,

[2] These findings were based on regressions controlling for age, gender, race, disabled/aged entitlement, Medicaid coverage, and whether beneficiaries used skilled nursing facility (SNF) or hospital services prior to the demonstration.

and what lifestyle changes to make. All of the CMOs provide a range of educational resources.

- *Medication management and support.* All of the CMO programs include efforts to optimize the medication regimens of participating beneficiaries. Some monitor compliance, some facilitate access to low-cost pharmaceuticals, and others offer face-to-face meetings with pharmacists.

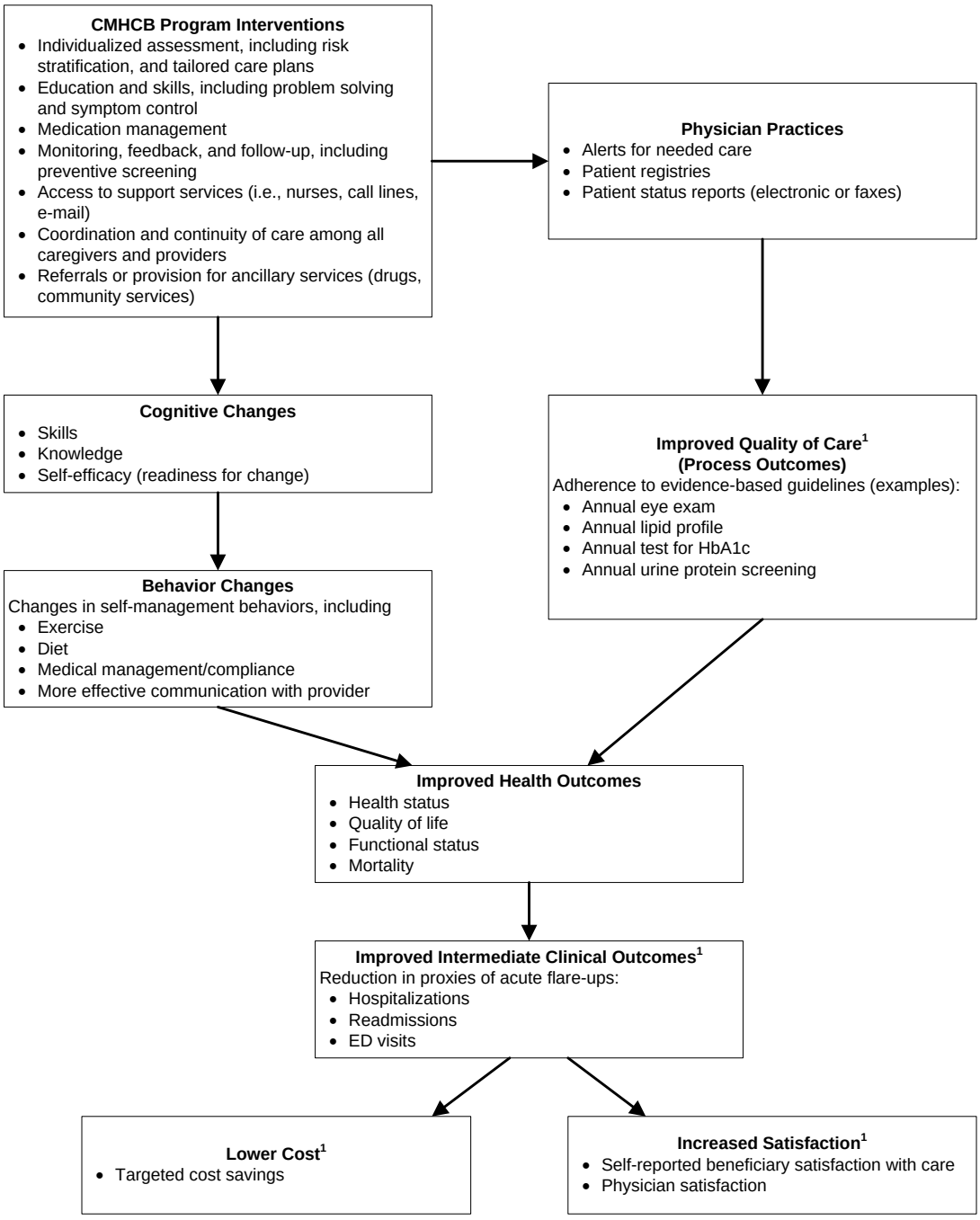
- *Monitoring, feedback, and follow-up.* Activities in this domain include ongoing biomonitoring of beneficiaries by placing scales or other equipment in their homes or by having the beneficiaries self-report their weights, blood sugars, or other measures. When data on preventive services, screenings, or recommended tests are available, the programs remind beneficiaries and/or their doctors to have them done. Flu shots are just one example.

- *Coordination and continuity of care.* One hallmark of the care management model is that it uses data from all available sources to disseminate information to providers and caregivers involved with a beneficiary's care. A limited number of the CMOs have care managers directly embedded in the physician practices, allowing for day-to-day and face-to-face interactions. Several CMOs also have direct communication with physicians via a shared electronic medical record. However, the majority of CMOs must engage physicians or physician practices more indirectly through telephone and fax communication.

- *Referrals or provision for community-based ancillary services.* Not all of a participant's needs are provided directly by the CMOs. All CMOs have recognized the need for transportation, low-cost prescriptions, or other services typically provided by community service organizations (e.g., social workers, dieticians). The CMOs developed relationships with other service providers and programs and helped selected beneficiaries receive these services through their participation in the CMHCB program.

Figure 2-2 presents RTI's conceptual framework for the overall CMHCB demonstration evaluation. It synthesizes the common features of the CMHCB demonstration implemented interventions and the broad areas of assessment within our evaluation design. The CMHCB demonstration programs employ strategies to improve quality of care while reducing costs by empowering Medicare beneficiaries to better manage their care. The programs do so in three ways: (1) by enhancing beneficiaries' knowledge of their chronic condition through educational and coaching interventions, (2) by improving beneficiaries' communication with their care providers, and (3) by improving beneficiaries' self-management skills. Successful interventions should alter beneficiaries' use of medications, eating habits, and exercise and should allow beneficiaries to interact more effectively with their primary health care providers. All of the CMHCB demonstration programs hypothesized that lifestyle changes and better communication with providers as well as improved adherence to evidence-based quality of care should improve health and functional status, which will mitigate acute flare-ups in chronic conditions, thereby reducing hospital admissions and readmissions and the use of other costly health services such as emergency rooms and visits to specialists. Experiencing better health and less acute care

Figure 2-2
Conceptual framework for the CMHCB programs



NOTE: CMHCB = Care Management for High Cost Beneficiaries; CMO = Care Management Organization; ED = emergency department.

SOURCE: RTI conceptual framework for the Medicare Care Management for High Cost Beneficiaries evaluation. Portions of this model are adapted from other sources, including the Chronic Care Model and the disease management model described in CBO (2004).

utilization, beneficiaries should also be more satisfied that their health care providers are effectively helping them cope with their chronic medical conditions, and providers should be more satisfied with the outcomes of care for their chronically ill Medicare FFS beneficiaries.

In this report, we present our findings with respect to the degree to which the KTBH program was able to engage its randomized intervention population and achieve four outcomes. ***Table 2-1*** presents a summary of research questions and data sources, organized by three evaluation domains: Reach, Implementation, and Effectiveness. The KTBH program implementation experience was is reported in Chapter 1.

Table 2-1
Evaluation research questions and data sources

Research questions	Site visits	CMO data	Claims	Survey
IMPLEMENTATION: To what extent was VillageHealth able to implement its KTBH program?				
1. To what extent were specific program features implemented as planned? What changes were made to make implementation more effective? How was implementation related to organizational characteristics of the KTBH program?	Yes	Yes	No	No
2. What were the roles of physicians, the community, the family, and other clinical caregivers? What was learned about how to provide this support effectively?	Yes	No	No	No
3. To what extent did the KTBH program engage physicians and physician practices in their programs?	Yes	No	No	No
REACH: How well did the KTBH program engage its intended audiences?	No	No	Yes	No
1. Were there systematic baseline differences in demographic characteristics and disease burden between the intervention and comparison group beneficiaries at the start of the demonstration?				
2. How many individuals did the KTBH program engage, and what were the characteristics of the participants versus nonparticipants (in terms of baseline clinical measures, demographics, and health status)?	No	Yes	Yes	No
3. What beneficiary characteristics predict participation in the KTBH program?	No	Yes	Yes	No
4. To what extent were the intended audiences exposed to the KTBH programmatic interventions? To what extent did participants engage in the various features of the program?	No	Yes	No	Yes
5. What beneficiary characteristics predict a high level of KTBH demonstration intervention versus a low level of intervention?	No	Yes	Yes	No
EFFECTIVENESS: To what degree was the KTBH program able to improve beneficiary and provider satisfaction, improve functioning and health behaviors, improve clinical quality and health outcomes, and achieve targeted cost savings?				
Satisfaction outcomes				
1. Did the KTBH program lead beneficiaries to be more satisfied with their ability to cope with their chronic conditions than beneficiaries in the comparison group?	No	No	No	Yes
2. How satisfied were physicians with the KTBH program intervention?	Yes	No	No	No

(continued)

Table 2-1 (continued)
Evaluation research questions and data sources

Research questions	Site visits	CMO data	Claims	Survey
Functioning and health behaviors				
1. Did the program improve knowledge and self-management skills?	No	No	No	Yes
2. Did the KTBH program result in greater engagement in health behaviors?	No	No	No	Yes
3. Did the KTBH program result in better physical and mental functioning and quality of life than would otherwise be expected?	No	No	No	Yes
Quality of care and health outcomes				
1. Did the KTBH demonstration program improve quality of care, as measured by improvement in the rates of beneficiaries receiving guideline concordant care?	No	No	Yes	No
2. Did the KTBH program improve intermediate health outcomes by reducing acute hospitalizations, readmissions, and ER utilization?	No	No	Yes	No
3. Did the KTBH program improve health outcomes by decreasing mortality?	No	No	Yes	No
Financial and utilization outcomes				
1. What were the Medicare costs per beneficiary per month (PBPM) in the base year versus the first 36 or 24 months of the demonstration for the intervention and the comparison groups?	No	No	Yes	No
2. What were the levels and trends in PBPM costs for intervention group participants and nonparticipants? Did nonparticipation, alone, materially reduce the intervention's overall cost savings?	No	No	Yes	No
3. How variable were PBPM costs in this high cost, high risk, population? What was the minimal detectable savings rate given the variability in beneficiary PBPM costs?	No	No	Yes	No
4. How did Medicare savings for the 36- or 24-month period compare with the fees that were paid out? How close was the KTBH program in meeting budget neutrality?	No	No	Yes	No
5. How balanced were the intervention and comparison group samples prior to the demonstration's start date? How important were any differences to the estimate of savings?	No	No	Yes	No
6. Did the intervention have a differential effect on high cost and high risk beneficiaries?	No	No	Yes	No
7. What evidence exists for regression-to-the-mean in Medicare costs for beneficiaries in the intervention and comparison groups?	No	No	Yes	No

NOTE:CMO = care management organization; KTBH = VillageHealth's Key to Better Health; CMS = Centers for Medicare & Medicaid Services; CMHCB = Care Management for High Cost Beneficiaries; ER = emergency room; PBPM = per beneficiary per month.

2.1.4 General Analytic Approach

The CMHCB initiative is what is commonly called a "community intervention trial" (Piantadosi, 1997). It is a "community" in the sense of being population based for a prespecified geographic area. It is "experimental" because it tests different CMHCB program interventions in different areas. It is a "trial" that employs randomization (or selection of a comparison population) following an "intent-to-treat" (ITT) model. The initiative is unusual because it employs a "pre-randomized" scheme, wherein CMS assigns eligible beneficiaries to an intervention or comparison stratum before gaining their consent to participate. In fact, comparison beneficiaries are not contacted at all. Further, beneficiaries opting out of the intervention are assigned to the intervention group, even though they will receive no CMO services. These refusals are included in the same stratum as those receiving care coordination services on an ITT basis.

Beneficiaries who become ineligible during the demonstration program are removed from the intervention and comparison groups for the total number of days following loss of eligibility for purposes of assessing cost savings and quality, outcomes, and satisfaction improvement. A beneficiary's eligibility status for the CMHCB program may change multiple times during the 3-year demonstration. For example, an eligible beneficiary may switch to a Medicare Advantage program during the second year and switch back to FFS during the third year. Our evaluation includes all months in which a beneficiary is eligible for the initiative, and we accounted for differential periods of eligibility in the analysis.

Further, the CMOs differentially engaged and interacted more with beneficiaries for whom they believe their programs will result in the greatest benefit, either in terms of health outcomes or cost savings. Thus, not all intervention beneficiaries participated nor did all beneficiaries receive the same level of intervention. In fact, some participants received very few services.

The CMHCB programs reflect a dynamic process of system change leading to behavioral change leading to improved clinical outcomes, and the type of experimental design within this demonstration calls for a pre/post, intervention/comparison analytic approach—sometimes referred to as a difference-in-differences approach—to provide maximum analytic flexibility. The strategy will be used to construct estimates of all performance outcomes of each demonstration program.

Our proposed model specification to explain any particular outcome variable, Y_{t+1}, measured during the intervention program follow-up period:

$$Y_{t+1} = \alpha + \beta_1 I + \beta_2 Y_t + \beta_3 I \bullet Y_t + \beta_4 X + \varepsilon \qquad (2.1)$$

where

α = the intercept term, or reference group;

I = 0,1 intervention indicator;

Y_t= the outcome measured during a base or predemonstration period;

X = a vector of beneficiary covariates; and

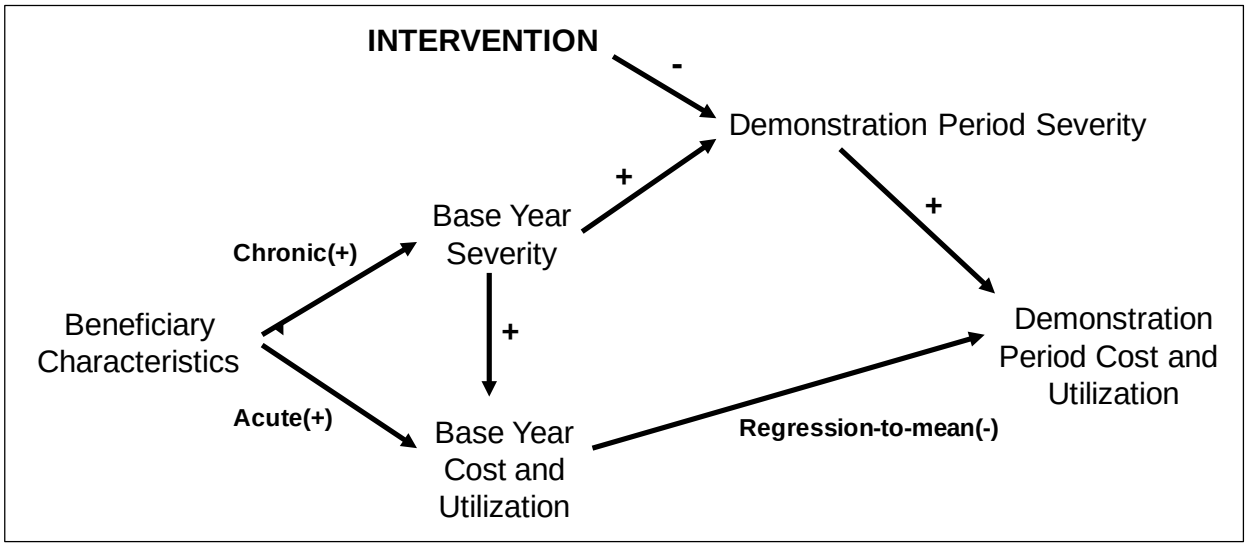
ε = a regression error term.

This model uses three sets of variables in analysis of covariance (ANCOVA) format to capture differences between intervention and comparison beneficiaries. The coefficient provides a test of the difference between the intervention group and comparison group in the base period for a particular outcome variable. (The reference comparison group mean value is in the α intercept.) If preprogram random assignment is successful, will be approximately zero before controlling for beneficiary-specific (X) factors. The β_2 coefficient tests for temporal changes between pre- and post-demonstration outcomes, while the β_3 interaction coefficient tests whether the intervention group's performance profile differs over time from the comparison group's performance. The vector of β_4 coefficients controls for beneficiary-specific covariates influencing individual differences in the dependent variable of interest. Including covariates should set the estimated equal to 0, if selection of a comparable comparison population is contravened in some way. Program effects during the demonstration are reflected in the interaction coefficients. The null hypothesis is that the coefficient for β_3 is zero, implying no CMHCB program impact. Estimates that are significant at the 95% confidence level imply distinct program effects. The model may also be expanded to conduct analyses across beneficiary subpopulations and CMHCB intervention characteristics.

Because we will be analyzing change over time, it is important to consider the likely trajectory in our outcome measures as a function of beneficiary characteristics at baseline. ***Figure 2-3*** displays an alternative conceptualization of how the CMHCB intervention could alter the expected demonstration period outcomes of interest. At baseline, beneficiaries were selected for the demonstration because of higher baseline risk scores as well as high baseline expenditures as a proxy for clinical severity. These beneficiaries also have a multiplicity of other health care issues—chronic and acute—leading to high baseline costs and acute care utilization. The bottom half of ***Figure 2-3*** displays the statistical phenomenon observed in cohort studies of regression-to-the-mean. Beneficiaries with high costs and utilization are likely to regress toward average levels in a subsequent period and vice versa. Because we start with beneficiaries with high costs and utilization, our expectation is that there would be significant negative regression to the mean; thus, we would observe lower costs and utilization in the demonstration period absent an intervention effect.

Prior research has shown that physical health status declines rather substantially over time for elderly populations, and in particular, for chronically ill elderly populations (Ware 1996). The top half of ***Figure 2-3*** displays the expected positive relationship between base year

Figure 2-3
Conceptualization of influence of beneficiary baseline health status and cost and utilization patterns on CMHCB demonstration period acute care utilization and costs



and demonstration period severity and the positive relationship between increasing severity of illness and medical costs and utilization during the demonstration period absent an intervention effect. The CMHCB demonstration is aimed at improving or preventing further deterioration in health and functional status. Thus, our expectation is that the CMHCB program intervention would have a negative or moderating influence on growing patient severity during the demonstration period, thereby reducing the expected positive relationship between demonstration period severity and costs and utilization.

2.2 Participation, Clinical Quality and Health Outcomes, and Financial Outcomes Data and Analytic Variables

This section provides a description of the data used to evaluate participation in and the effectiveness of the KTBH CMHCB demonstration program. As noted in Chapter 1, we also conducted a survey of KTBH CMHCB demonstration beneficiaries to assess their satisfaction with the CMHCB program and semi-structured interviews with a small number of physicians to assess their awareness of and satisfaction with the CMHCB program. The data used to make those assessments are described in ***Chapter 3***.

2.2.1 Data

We used six types of data for our evaluation analyses related to participation, clinical quality and health outcomes, and financial outcomes. Specifically, we used the following data sources:

- *Participant status files*. We received participant status files from ARC. The participant status information originates from the KTBH program and was submitted to ARC. This file was updated quarterly and logged status changes among the intervention groups by the KTBH program. Participation status was able to be determined on a monthly basis using three monthly indicators on a

given quarterly file, and we used these indicators to determine the participation decision of the original and refresh intervention beneficiaries during each month of the demonstration.

- *Finder file*. RTI used this file, produced by ARC, to identify the group into which each KTBH program beneficiary was randomized—intervention or comparison—for both the original and refresh populations.

- *Enrollment Data Base (EDB) daily eligibility files.*

— ARC provided RTI with an EDB file for the KTBH program comprised of all randomized original and refresh beneficiaries. RTI used this file to determine daily eligibility based on the KTBH program eligibility criteria (***Table 2-2***). The EDB file, in conjunction with the eligibility criteria, allowed us to identify beneficiaries as eligible or ineligible for each day of the intervention period and retrospectively for each day one-year prior to the KTBH program launch date. We used the files to identify days of eligibility during the 12-month baseline period and the intervention periods of the demonstration and to select claims data during periods of eligibility in both the baseline and intervention periods. *Only beneficiaries who had at least 1 day of eligibility in the baseline and the demonstration periods are included in our evaluation.*

— RTI conducted an EDB extract to obtain demographic characteristics at the time of randomization (October 3, 2005) for KTBH's original population.

— RTI conducted an EDB extract to obtain demographic characteristics at the time of randomization (October 1, 2006) for KTBH's refresh population.

- *Medicare claims data produced by ARC*. In keeping with the financial reconciliation, CMS requested that RTI use the ARC claims files for all analyses. Monthly, ARC receives claims data from a CMS prospective claims tap, and on a quarterly basis creates netted claims files. As of each quarter's processing, ARC updates prior quarterly netted claims files with claims data processed after the prior cutoff dates. These files contain the claims experience for original and refresh intervention and comparison beneficiaries during the 12 months prior to the KTBH program start date and claims with processing dates that span the full intervention period and 9 months thereafter (or claims run out).

- *CMO beneficiary intervention data files*. Quarterly, the KTBH program sent RTI beneficiary-level intervention files that contained summary counts of intervention activities, such as the total number of contacts to specific entities (i.e., participants, nephrologists, health plans, facilities) detailed by who the contact was from (i.e., providers, social workers, health service coordinators). In April 2010, the KTBH program provided more detailed information on the type of contact (in-person, telephonic) and contactee (patient/caregiver, physician, facility) for May 2007 through October 31, 2008. More detailed information on the contents of these files is in ***Chapter 4***.

- *FU Long Term Indicator (LTI) file*. Information in this file is obtained from the Minimum Data Set (MDS) of nursing home assessments and contains data on which Medicare beneficiaries are residents of nursing homes. We use this file to determine institutionalization status during the original and refresh intervention periods for the participation analysis.

Table 2-2
Criteria used for determining daily eligibility during the KTBH program

Ineligibility reasons	Description
Death	Ineligible beginning on day following date of death.
Hospice	Ineligible on hospice coverage start date. Eligible on day following hospice coverage end date.
MA plan	Ineligible on day of MA plan enrollment when GHO contract number does not equal the contract number for the KTBH program. Eligible on day following MA plan disenrollment.
Medicare secondary payer	Ineligible on day Medicare becomes secondary payer for working-aged beneficiary with an employer group health plan (primary payer code A) or for working disabled beneficiary (primary payer code G). Eligible on day following Medicare secondary payer end date.
Residence	Ineligible on residence change date indicating that a beneficiary has moved out of the service area determined by state code or state and county codes. Eligible on subsequent residence change date indicating that a beneficiary has moved into the service area determined by state code or state and county codes.
Part A/Part B enrollment	Eligible on day Part A/Part B coverage begins/resumes. Ineligible on day after Part A/Part B coverage ends.

NOTES: KTBH = VillageHealth's Key to Better Health; ESRD = end-stage renal disease; MA = Medicare Advantage; GHO = Group Health Organization.

Table 2-3 contains the KTBH program's evaluation start and end dates, both baseline and intervention periods, for the original and refresh populations.

Table 2-3
Analysis periods used in the KTBH CMHCB demonstration analysis of performance

Intervention period start date	Intervention period final end date	Intervention period months of intervention data	Baseline period start date	Baseline period end date
Original Population				
11/1/05	10/31/08	36	11/1/04	10/31/05
Refresh Population				
11/1/06	10/31/08	24	11/1/05	10/31/06

NOTES: CMHCB = Care Management for High Cost Beneficiaries; KTBH = VillageHealth's Key to Better Health.

2.2.2 Analytic Variables

To conduct our participation, clinical quality and health outcomes, and financial analyses, we constructed nine sets of analytic variables from the aforementioned files.

1) ***Demographic Characteristics and Eligibility***. Age, gender, race, Medicare status (aged-in versus disabled), and urban residence were obtained from the EDB and determined as of the date of randomization, October 3, 2005 for the original population and the refresh randomization date (October 1, 2006) for the refresh population. Medicaid enrollment was determined at any time during the baseline period and was also determined using the EDB.

   Daily eligibility variables were used to create analytic variables representing the fraction of the baseline and demonstration period that the intervention and comparison beneficiaries were CMHCB program eligible. These eligibility fractions were created based on the time period of the analysis. For example, the baseline eligibility fraction is constructed using the number of eligible days divided by 365. For the full intervention period, the denominator is adjusted based on the number of days that the KTBH program was active in the demonstration. The numerator is the number of days the beneficiary is eligible during that time period. The KTBH program participated in the demonstration for the full 36 months, so the number of days in the denominator for each original population beneficiary in the KTBH program is 1,096 (KTBH end date minus KTBH start date + 1). If a beneficiary died 420 days into the intervention period, the eligibility fraction for the participation analysis would be 420 divided by 1,096, or 0.383.

2) ***Institutionalized Status.*** Four binary indicators of institutionalization were created for both the original and refresh populations:

- Whether a beneficiary was in a nursing home for any one or more months of the initial 6 months of the demonstration period using the FU LTI file. This measure of institutionalization is used in all but the financial analyses.

- Whether a beneficiary had any baseline long-term-care (LTC) hospital costs in the baseline year. LTC hospitals are identified if the last four digits of the provider ID ranged from 2000 to 2299.

- Whether a beneficiary had any baseline skilled nursing facility (SNF) costs.

- Whether a beneficiary had any baseline nursing home services. These claims were identified if the Current Procedural Terminology (CPT) codes ranged from 99304 to 99340 or the location of service ranged from 31 to 33. An indicator for nursing home services was only created if there were two or more encounters during 2 consecutive months 3 months prior to the intervention period.

3) Hierarchical Condition Category (HCC) Risk Scores. Two HCC scores are used in this evaluation:

- A *prospective HCC score* calculated by RTI for a 12-month period prior to the *start* of the demonstration program using the 2006 CMS-HCC risk-adjustment payment model for both the original and refresh populations.

- A *concurrent HCC score* calculated by RTI for the first 6 months of the intervention period for both the original and refresh populations. In contrast to the predictive model, which uses a prior year's worth of claims data to generate a predicted HCC score, the concurrent model produces an HCC score based upon the current period's claims experience. Furthermore, we restrict the model to only 6 months of data. In RTI's experience, 80% of the HCC score is determined by 6 months of claims. Thus, we inflated the concurrent HCC score by 1.25 to approximate a score that otherwise would be calculated on a full year's data. The concurrent model used in this project is a 2004 model that was calibrated to the CMS Physician Group Practice (PGP) demonstration population. This is a FFS population that used services, rather than the entire FFS population used for payment purposes. This is a reasonable reference population because all CMHCB demonstration populations were also required to have used services to be selected for randomization.

4) Health Status. We constructed three sets of analytic variables to reflect health status prior to and during the demonstration:

- *Charlson index.* We constructed the Charlson comorbidity index using claims data from the inpatient, outpatient, physician, and home health claims files. We created an index for the year prior to the start of the demonstration program. ***Supplement 2A*** contains the SAS code used to create this index.

- *Comorbid conditions.* RTI reviewed the frequency of diagnoses associated with evaluation and management (E&M) visits for the full study population in the year

prior to the demonstration program to identify frequently occurring comorbid conditions: heart failure; coronary artery disease; other respiratory disease; diabetes without complications; diabetes with complications; essential hypertension; valve disorders; cardiomyopathy; acute and chronic renal disease; renal failure; peripheral vascular disease; lipid metabolism disorders; cardiac dysrhythmias and conduction disorders; dementias; strokes; chest pain; urinary tract infection; anemia; malaise and fatigue (including chronic fatigue syndrome); dizziness, syncope, and convulsions; disorders of joint; and hypothyroidism. This list is also inclusive of the top 11 groups of comorbidities that were provided to RTI by the KTBH program. Beneficiaries were identified as having a comorbid condition if they had one inpatient claim with the clinical condition as the principal diagnosis or had two or more physician or outpatient department (OPD) claims for an E&M service (CPT codes 99201-99429) with an appropriate principal or secondary diagnosis. The physician and/or OPD claims had to have occurred on different days. The diagnosis codes used to identify these clinical conditions are in ***Supplement 2A***.

- *Ambulatory Care Sensitive Conditions (ACSCs).* We constructed variables to indicate the presence of an ACSC in the year prior to the demonstration and during the demonstration, using the primary diagnosis on a claim. ACSCs include heart failure, diabetes, asthma, cellulitis, chronic obstructive pulmonary disease (COPD) and chronic bronchitis, dehydration, bacterial pneumonia, septicemia, ischemic stroke, and urinary tract infection (UTI). The diagnosis codes used to identify these conditions are found in ***Supplement 2A***.

5) Utilization. We constructed three sets of utilization variables for this evaluation as proxies for intermediate clinical outcomes. These sets of variables were also constructed for the following principal diagnoses: all-cause and the 10 ACSCs, using the primary diagnosis (from the header portion of the claim) for claim types inpatient and outpatient:

- the number of acute hospitalizations,
- 90-day readmissions, and
- emergency room visits, including observation bed stays.

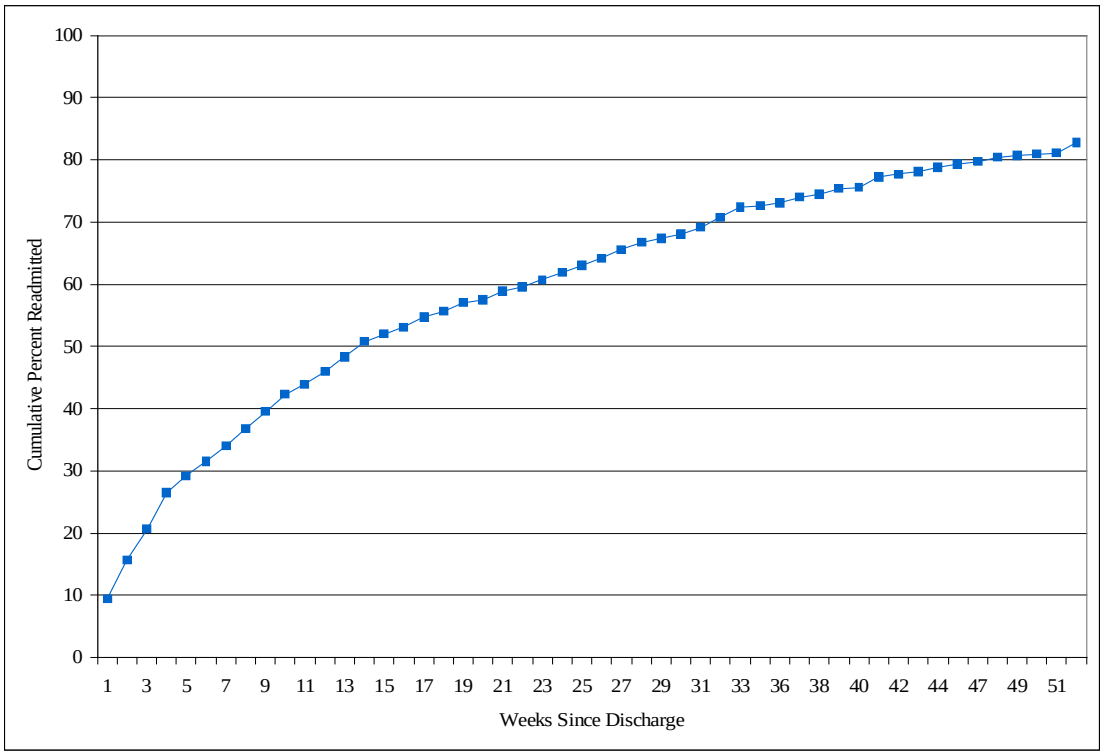
Only claims that occurred during periods of eligibility were included in the utilization measures. For both the demonstration and baseline periods, claims were included if services were started during days that the beneficiary met KTBH's CMHCB program eligibility criteria, as determined from the ARC daily eligibility file. We flagged claims for services that occurred during a period of eligibility by comparing the eligibility period with a specific date on the claim, following the decision rules that were applied for the financial reconciliation. The exact date fields used are based on the claim type, as follows:

- inpatient and skilled nursing facility claims: *admission date;*

- all other types of services: *from date.*

Prior to conducting our final set of analyses, we critically examined the timing of readmissions using data from the year prior to the start of the demonstration. ***Figure 2-4*** displays a graphic representation of time from discharge to next admission for original population comparison beneficiaries who had a subsequent admission. In this figure, we display all-cause readmission; thus, beneficiaries were not required to have the same reason for both the initial and subsequent admission for the hospitalization to be considered a readmission. The graphic shows that there is a steep trajectory of readmissions during the first 90-day period following discharge, with a gradual tapering off of number of readmissions thereafter. Thus, we constructed 90-day readmission rates to capture close to 50% of subsequent admissions in our analyses[3].

Figure 2-4
Percent with readmission for any diagnosis: KTBH's original baseline comparison population



We examined readmissions following admissions that occurred during two 12-month periods for the original population and one 12-month period for the refresh population. In order to capture readmissions following admissions that occurred late in the baseline and demonstration periods, we used a total of 15 months of data for each period to identify readmissions. For the baseline period, we identified admissions during the 12 months preceding the start of the demonstration and also

3 We evaluated time to readmission based upon days post sentinel hospitalization discharge; however, the graph displays time to readmission in increments of weeks for visual presentation purpose.

included readmissions through the first 3 months of the intervention period for those admissions that occurred within 3 months of the start of the demonstration. The intervention periods for the original populations examined admissions during the periods of months 7 through 18 and months 22 through 33 and included readmissions through months 21 and 36, respectively. The intervention period for the refresh population examined admissions during months 10 through 21 and readmissions through month 24. A readmission was defined as an admission up to 90 days after an index hospitalization discharge date. We constructed all-cause readmission rates for all hospitalizations and same-cause readmission rates for the 10 ACSCs.

6) ***Expenditures***. RTI constructed a set of Medicare payment variables to reflect payments during periods of baseline and demonstration eligibility using the claims selection decision rules discussed previously. Total Medicare payments—exclusive of beneficiary deductibles, coinsurance payments, and third-party payments—were summarized for the annual period prior to the start date of the demonstration and also for the full intervention period and placed on a per beneficiary per month (PBPM) basis by dividing total payments by the total number of eligible days divided by 30.42. We defined a month as 30.42 days (365 days in a year divided by 12 months, rounded to two decimal places). This standardizes the definition of a month. For the demonstration period, total Medicare payments were summarized for the 36-month original intervention period and the 24-month refresh intervention period.

7) ***Guideline Concordant Care***. We define quality of care as adherence to evidence-based guideline-concordant care and have selected measures from the National Quality Forum (NQF)-endorsed National Voluntary Consensus Standards for Physician-Focused Ambulatory Care (February 2008). The selected measures are also used by other CMS pay-for-performance initiatives, such as the PQRI, or in evaluations of other pay-for-performance demonstrations (physician group practice demonstration) or pilot programs (Medicare Health Support). Thus, these measures have been extensively tested and are widely accepted as clinically important measures and appropriate for use in pay-for-performance initiatives. Further, we restrict the selection of measures to those that do not require the use of CPT II codes.

   First, we selected a measure that is broadly applicable to the Medicare fee-for-service population, influenza vaccination. Second, we selected several measures that are specific to beneficiaries with diabetes and heart failure as these populations are prevalent in the KTBH demonstration population. We will subset the study populations to the appropriate clinical cohorts when constructing these measures. Special consideration was given to identifying measures appropriate for KTBH's population of chronic kidney disease (CKD) beneficiaries.

   The selected measures and relevant disease population are as follows:

   - Rate of influenza shots for adults > 50 years (for patients with ESRD, the age is 18 years and older) – all beneficiaries

   - Rate of annual HbA1c testing – diabetes

- Rate of low-density lipoprotein cholesterol (LDL-C) testing – diabetes
- Rate of low-density lipoprotein cholesterol (LDL-C) testing – ischemic vascular disease
- Rate of fistula/graft placement prior to initiation of dialysis among beneficiaries with ESRD
- Rate of progression to ESRD

With respect to the KTBH special population of CKD, the HbA1c testing measure focuses on the importance of careful control of blood glucose in diabetics to slow progression of CKD toward ESRD. Because diabetes is the leading cause of CKD, we expect that there will be large numbers of beneficiaries with diabetes in both the intervention and comparison groups of the KTBH program. A key goal of the KTBH program is to have a permanent A-V fistula in place prior to the initiation of hemodialysis.

The methodology used to create these measures can be found in ***Supplement 2A***. CMS requested that we use existing, widely adopted specifications for evidence-based measures of care. Based on that request, RTI selected the National Quality Forum (NQF)–endorsed National Voluntary Consensus Standards for Physician-Focused Ambulatory Care. While the NQF-endorsed specifications restrict the diabetes quality-of-care measures to beneficiaries ages 18 to 75, we did not use this age restriction because no such restriction is used by the KTBH program. The specifications used for the final set of analyses are from NQF-Endorsed™ National Voluntary Consensus Standards for Physician-Focused Ambulatory Care, Appendix A—National Committee for Quality Assurance (NCQA) Measure Technical Specifications, April 2008, V.7.

Claims for these process-of-care measures were included regardless of CMHCB demonstration eligibility in order to ensure that we fully captured the behavior of intervention and comparison populations that was not subject to Medicare eligibility or payment rules and to provide credit to the KTBH program in case the services occurred after exposure to the CMHCB demonstration intervention and during the intervention period. One could envision that the KTBH program encouraged the receipt of the process-of-care measures; however, the actual service was provided during a brief period of ineligibility (e.g., nonpayment of the Part B premium for a month). To the extent that the service was included in the Medicare claims files during a period of ineligibility as a denied claim, it reflects actual receipt of the service and was therefore included in our analyses.

8) Mortality. Date of death during the demonstration period was obtained from the Medicare EDB and was used to create a binary mortality variable.

9) ***Measures of CMHCB Program Intervention***. Using the encounter data submitted by the KTBH program, we constructed counts of the number of contacts with the participants—either telephonically or in-person—as well as total contacts (both).

CHAPTER 3
BENEFICIARY AND PHYSICIAN SATISFACTION

3.1 Beneficiary Satisfaction

The CMHCB demonstration programs' principal strategy to improve quality of care while reducing costs is by empowering Medicare beneficiaries to better cope with their chronic disease(s) and manage their care. The programs do this in three ways: (1) by enhancing beneficiary knowledge of their chronic condition through educational and coaching interventions, (2) by improving beneficiary communication with their care providers, and (3) by improving beneficiary self-management skills. Successful interventions should alter beneficiaries' use of medications, eating habits, and exercise, as well as promoting more effective interaction with their primary health care providers. The CMHCB programs hypothesized that lifestyle changes and better communication with providers would mitigate acute flare-ups in the chronic conditions and should reduce hospital admissions and readmissions and the use of other costly health services such as nursing homes and visits to specialists. Experiencing better health, beneficiaries should also be more satisfied that their health care providers are effectively helping them to cope with their chronic medical conditions[4].

The primary outcomes examined in the beneficiary survey were experience of care, self-management, and physical and mental function. We anticipated that the intervention's more intensive disease management activities would lead to greater levels of service helpfulness and greater self-efficacy. This in turn would increase the frequency with which intervention beneficiaries would engage in self-care activities, resulting in better functioning and higher satisfaction levels than in the comparison group. The same survey methodology and instrument was used across all six CMHCB demonstration programs for budgetary reasons. To isolate the intervention effects, the same survey instrument was administered to samples of beneficiaries from both the intervention and comparison groups. The findings from all six CMHCB beneficiary surveys have been reported to the Centers for Medicare & Medicaid Services (CMS) previously (Smith et al., 2008).

3.1.1 Survey Instrument Design

The beneficiary survey was designed to obtain assessments directly from beneficiaries about key outcomes of beneficiaries' ***experience of care, self-management***, and ***physical and mental function.*** We asked beneficiaries about the extent to which their health care providers helped them to cope with their chronic conditions. We supplemented this item with questions related to two key components of the CMHCB interventions: helpfulness of discussions with their health care teams and quality of communication with their health care teams. In addition, the survey instrument collected information about beneficiary ***self-care*** frequency and ***self-efficacy*** related to medications, diet, and exercise and Clinician and Group Adult Primary Care

[4] In our survey, we examine satisfaction more broadly than satisfaction with a particular member of their health care team or a particular member of the KTBH demonstration program team. We do so for the primary reason that we are asking the comparison population the same question and we desire to isolate the effect of the KTBH intervention on the beneficiaries' assessment of satisfaction that their full health care team is helping them to cope with their chronic conditions.

Ambulatory Consumer Assessments of Health Plans Survey (CAHPS®) measures of communication with health care providers. Last, the survey instrument included four physical and mental health functioning measures.

3.1.1.1 Measures of Experience and Satisfaction with Care

The impact of the care management organization (CMO) interventions is critically dependent on the relationships between beneficiaries and their "health care teams" (defined as nurses, case managers, doctors, and/or pharmacists with whom they interacted, either in person or telephonically). The first set of survey measures assesses several dimensions of the interactions between beneficiaries and providers. These items were worded to be applicable to all beneficiaries, regardless of their intervention or participation status. As a result, questions referred to beneficiaries' health care teams rather than to the names of the CMOs.

Helping to cope with a chronic condition—The single item "How would you rate your experience with your health care providers in helping you cope with your condition?" provides an overall satisfaction rating. Ratings are made on a five-point scale (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent).

Helpfulness of discussions with the health care team—This section addresses services received during the previous 6 months. Five types of services are addressed: (1) one-on-one educational or counseling sessions, (2) discussions about when and how to take medicine, (3) discussions about dealing with stress or feeling sad, (4) discussions about diet, and (5) discussions about exercise. The services could be provided through in-person visits, telephone calls, or mailings. Each service is rated on a four-point scale ranging from "very helpful" to "not helpful." A fifth response option identifies services that had not been discussed. Responses are summarized by counting the number of discussion topics rated as "very" or "somewhat" helpful so that the score for this item ranges from 0 (for no items helpful) to 5 (for all items helpful).

Discussing treatment choices—This item assesses a specific aspect of communication with providers by asking beneficiaries whether their health care team talks to them about pros and cons of their medical treatment or health care in general. Ratings are made on a four-point scale (1 = definitely no, 2 = somewhat no, 3 = somewhat yes, 4 = definitely yes).

Communication with health care team—Beneficiary communication is an important dimension of experience and satisfaction. Six communication items from the CAHPS® Survey were included in the questionnaire. These items assess how often the team (1) explained things in a way that was easy to understand, (2) listened carefully, (3) spent enough time with the beneficiary, (4) gave easy-to-understand instructions about what to do to take care of health problems, (5) seemed informed about up-to-date health issues, and (6) showed respect. Six frequency options (always, almost always, usually, sometimes, almost never, and never) are converted into CAHPS® composite scores ranging from 0 (never to all items) to a maximum of 100 (always to all items).

Getting answers to questions quickly—This measure includes two survey items that assess how quickly the health care team gets back to beneficiaries with answers to their medical questions. The questions ask how often beneficiaries received answers the same day during office hours or if they called after regular office hours, how often their questions were answered.

Six frequency options (always, almost always, usually, sometimes, almost never, and never) are converted into composite scores ranging from 0 (never to all items) to a maximum of 100 (always to all items).

Medication support and information about treatment options—The Multimorbidity Hassles scale is designed to measure frustrating problems that patients experience in getting comprehensive care for chronic illnesses (Parchman, Noel, and Lee, 2005). Unlike disease-specific or physician-specific measures, this instrument was developed to apply broadly to patients with single or multiple conditions. Of the 16 items in the full scale, we selected the first six questions, which focus on problems with medications and treatment options. Example items are "lack of information about treatment options" and "side effects from my medications." Each item is rated on a five-point scale ranging from 0 = "no problem" to 4 = "a very big problem." The total Hassles score is the sum of the scores for the individual items and can range from 0 to 24. A higher score indicates more problems. Cronbach's alpha was 0.94 for the full scale. In the original development sample, the mean Hassles score for these six items was 5.86 (Parchman, Noel, and Lee, 2005).

3.1.1.2 Self-Management Measures

Patient self-management has been shown to be critical to health outcomes, particularly in chronic disease management (Hibbard et al., 2007). Chronic disease self-management interventions begin by helping patients set goals and make plans to address those goals and by helping patients manage their illnesses by practicing behaviors that may affect their health and well-being.

Setting health care goals—The question asks whether someone from the team had "helped you SET GOALS to take care of your health problems in the past 6 months." This item is answered either yes or no.

Making health care plans—A second yes or no item asks whether someone had "helped you MAKE A PLAN to take care of your health problems."

Self-efficacy—Self-efficacy refers to the confidence that one can perform health promotion activities. Previous research has shown that self-efficacy is a key determinant of adherence to recommended behaviors, and self-efficacy expectations are a key target of many health care interventions. To assess self-efficacy, respondents were asked how sure they were that they could perform each of three specific behaviors: taking medications, planning meals according to dietary guidelines, and engaging in physical exercise. These items were drawn in part from the Confidence in Diabetes Self-Care Scale (Van Der Ven et al., 2003). Ratings are made on a five-point scale ranging from 1 = very unsure to 5 = very sure.

Self-care activities—A goal of chronic disease management is to promote patient compliance with self-care behaviors that may help to maintain or improve health status. Health-promoting behavior is assessed by the frequency with which beneficiaries engage in the same three self-care activities that are used to evaluate self-efficacy. These items were adapted from the Summary of Diabetes Self-Care Activities instrument (Toobert, Hampson, and Glasgow, 2000). Respondents indicate the number of days (0-7) in the past week that they performed each self-care activity.

3.1.1.3 Physical and Mental Health Function

Self-reported health status and function are important outcome measures that are not available through claims data. To assess the impact of the CMHCB demonstration on beneficiary function, the survey included two broad constructs: (1) physical and mental functioning and (2) activities of daily living. Here, we describe in detail how these constructs are measured.

Physical and mental function—Functioning levels were tracked by the responses to the Veterans RAND-12 (VR-12) instrument (Kazis, 2004). The VR-12 consists of 12 items, half of which reflect physical function and half of which are indicators of mental function. We used the RAND-12 scoring algorithm (Hays, 1998) to compute summary Physical Health Composite (PHC) and Mental Health Composite (MHC) scores. These scores are normalized so that the mean composite score is 50 (SD = 10) in the general U.S. adult population. Higher scores indicate higher levels of functioning. The scoring algorithm is based on Item Response Theory scaling yielding composite scores that may be correlated with one another. The algorithm also imputes scores for no more than one missing item in each composite.

Mental health status was also measured by the Patient Health Questionnaire-2 (PHQ-2), a widely used depression screening tool (Kroenke, Spitzer, and Williams, 2003). The PHQ-2 consists of two items: one for anhedonia ("How often have you been bothered by little interest or pleasure in doing things?") and one tapping depressed mood ("How often have you been bothered by feeling down, depressed, or hopeless?"). Each item is assessed in terms of weekly frequency (0 = not at all, 3 = nearly every day). The total PHQ-2 score is the sum of these values, which may range from 0 to 6 points. Higher scores indicate greater depressive symptoms. Scores of three points or more are commonly used in screening to identify cases that require further clinical evaluation.

Activities of daily living—A related measure of beneficiary functioning is the ability to perform basic activities of daily living (ADLs). The questionnaire collected information about six standard activities—bathing, dressing, eating, getting in and out of chairs, walking, and using the toilet. Respondents were first asked if they had any difficulty performing each activity. Possible responses were that they were unable to perform, had difficulty, or did not have difficulty doing the activity. They were then asked, with responses of yes or no, if they needed help from another person to perform the activity. An ADL difficulty score was created by counting the number of activities that the beneficiary had difficulty with or was unable to do. The ADL help score was the number of activities for which the beneficiary needed help. Each score ranges from 0 to 6.

3.1.1.4 Background Characteristics

The final section of the questionnaire collected information about demographic characteristics such as race (Hispanic and African American status), educational attainment in years, living arrangements—whether beneficiaries lived alone or with a spouse or a relative—presence and type of health insurance coverage in addition to Medicare, and proxy information.

3.1.2 Analytic Methods

We conducted a series of statistical analyses to explore intervention-comparison differences and CMHCB intervention effects, including a response propensity analysis and

descriptive and scaling analyses. We restrict our discussion in this report to the analyses associated with the outcomes variables.

3.1.2.1 Analysis of Covariance Model for Intervention Effects

We estimated weighted regression models to examine the effects of the KTBH's interventions on the outcomes appearing in the conceptual model. The research design for this evaluation involved only a single round of the survey conducted during the demonstration period. Baseline levels of the individual study outcomes are not available. To increase the precision of the intervention effect estimates, we constructed multivariable regression models consisting of a broad set of beneficiary characteristics as explanatory covariates. Many of these covariates are drawn from claims data, while other background characteristics are reported in the survey questionnaire.

Two key indicators of initial status are the HCC risk score and PBPM expenditures. Both of these variables are measured for the year prior to the start of the demonstration. The following covariates are used:

- what demographic characteristics (age, gender, Hispanic ethnicity, African American, years of education) were,
- what Medicaid/dual eligible status was,
- whether the beneficiary lived alone,
- whether the beneficiary had health insurance coverage in addition to Medicare or Medicaid,
- whether the beneficiary used a proxy respondent, and
- whether the beneficiary completed a mail survey (versus a telephone survey).

Proxy and mail status are included to capture any systematic differences in responses that can be attributed to response mode. Previous research indicates that, compared with telephone surveys, mail surveys frequently elicit less favorable ratings of health status.

A general Analysis of Covariance (ANCOVA) model for the intervention analyses is

$$Y = a + b_1X_1 + b_kX_k + e,$$

where

Y = outcome measure;

X_1 = intervention status (1 = intervention, 0 = control or comparison);

X_k = a vector of k covariates;

b_1 and b_k = regression coefficients to be estimated;

a = an intercept term; and

e = an error term.

In this model, coefficient b_1 estimates the overall effect of the intervention in an intent-to-treat (ITT) analysis. The covariate coefficients correspond to direct effects of the mediating variables (e.g., communication with the health care team, self-management, and the helpfulness of health care services). Models in this general format were estimated separately for each CMO to test the impact of the program in each site. A logistic regression model consisting of the same set of covariates was used for dichotomous outcomes. The covariates in the model increase the precision of an intervention effect estimate by accounting for other sources of variation in the outcome measure. As described in ***Chapter 1***, the intervention and comparison beneficiaries were initially matched on either diagnostic status or Medicare expenditure levels. The covariate adjustments therefore control for other factors that may affect beneficiary outcomes and equalize any potential imbalances between the intervention and comparison groups when evaluating the impact of the KTBH program.

3.1.2.2 Sampling Frame

The first step in the design process was to identify a sample frame for the survey in each of the six demonstration sites. Beneficiaries were eligible for the survey if (1) they were members of the starting intervention or comparison group populations and (2) they met the criteria for inclusion in quarterly monitoring reports at the time the frame was identified. Beneficiaries who met any of the exclusion criteria (death, loss of Part A or B coverage, enrollment in a Medicare Advantage plan, etc.) were ineligible for the survey frame. To maximize the number of eligible respondents in the frame, we performed a Medicare Enrollment Database (EDB) run prior to sampling to identify decedents and other beneficiaries who had recently become ineligible.

3.1.2.3 Data Collection Procedures

We surveyed beneficiaries by mail with a telephone follow-up of nonrespondents. We used a multiple-mode, multiple-contact approach that has proved very successful on surveys conducted with the Medicare population and incorporates suggestions from Jenkins and Dillman's best mail survey practices guidelines (Jenkins and Dillman, 1997). Beneficiaries were surveyed once during the intervention period. The KTBH program's survey was conducted between June 11, 2007 and October 10, 2007.

3.1.2.4 Sample Size, Statistical Power, Survey Weights, and Survey Response Rate

The target was 300 completed surveys for the intervention and comparison populations. From the sample frame for each group, we randomly selected 300/.7 = 429 beneficiaries. The response rate for the KTBH program was 62%. The targeted sample size permits us to detect effect sizes (Cohen's d) of 0.23 or more for continuous outcome measures (power = .80, alpha = .05, two-sided tests). For a binary outcome, this is equivalent to the difference between percentages of 61% in the intervention group and 50% in the comparison group. The covariates in the ANCOVA models further increase the precision of coefficient estimates, allowing us to

detect even smaller effects for many outcomes. Response weights were computed as the inverse of the probability of response predicted from each site's response propensity model. These weights were then rescaled to reflect the actual number of survey respondents.

3.1.3 Medicare Health Services Survey Results for the KTBH Program

This section presents the results of the Medicare Health Services Survey data analysis for the KTBH program. We present the ANCOVA results with survey outcomes organized into three domains: beneficiary experience and satisfaction with care, self-management, and physical and mental functioning. Overall, we present results for 19 survey outcomes.

3.1.3.1 Experience and Satisfaction with Care

The primary measure of satisfaction was a rating of experience with health care providers to help the beneficiary cope with his or her condition. The survey also included five other measures of satisfaction with care experience. ***Table 3-1*** displays the satisfaction and experience with care measures for the KTBH program.

Table 3-1
Medicare Health Services Survey: Estimated intervention effects for experience and satisfaction with care, KTBH (N = 508)

Outcome	Intervention mean	Comparison group	ANCOVA-adjusted intervention effect	Stat. sig.
Helping to cope with a chronic condition (1 to 5)	3.59	3.55	0.10	N/S
Number of helpful discussion topics (0 to 5)	2.11	2.06	0.08	N/S
Discussing treatment choices (1 to 4)	3.13	3.22	-0.19	*
Communicating with providers (0 to 100)	75.5	73.6	2.7	N/S
Getting answers to questions quickly (0 to 100)	64.0	65.3	-0.8	N/S
Multimorbidity Hassles score (0 to 24)	3.63	3.38	0.15	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; ANCOVA = Analysis of Covariance.

Statistical significance (Stat. sig.): * Indicates significance at the 5% level; ** Indicates significance at the 1% level; otherwise N/S means not statistically significant.

SOURCE: RTI analysis of the Medicare Health Services Survey, 2008. Computer program: CreqD2

Overall experience: helping beneficiary to cope with chronic condition— The average score for the key satisfaction outcome item that assessed how well the health care team helped beneficiaries cope with their illness was 3.6 for both the intervention and for the control groups or about midway between "very good" and "good" ratings). It is not uncommon among the elderly to see high satisfaction ratings. For that reason, the mean scale score was used in the analyses so that transitions between all response categories would be captured. For this overall satisfaction measure, we observe no statistically significant intervention effect for the KTBH program.

Across the six measures of experience and satisfaction with care, we observe one statistically significant negative intervention effects. Beneficiaries in the KTBH demonstration program reported that they were less likely to discuss treatment choices with their health care team than beneficiaries in the control group. For five other measures of experience and satisfaction with care, we found that the effects were not statistically significant.

3.1.3.2 Self-Management

A goal of chronic disease management is to improve compliance with self-care activities that may slow the decline in functioning and health status. The survey included three sets of questions related to self-management: receiving help with setting goals and making a care plan, self efficacy ratings, and self-care activities. ***Table 3-2*** displays the self-management measures for the KTBH program.

Table 3-2
Medicare Health Services Survey: Estimated intervention effects, self-management, KTBH (N = 508)

Outcome	Intervention mean	Comparison group	ANCOVA-adjusted intervention effect	Stat. sig.
Percent receiving help setting goals	65.1	57.6	9.5	N/S
Percent receiving help making a care plan	60.1	55.7	4.0	N/S
Self-efficacy ratings				
Take all medications (1 to 5)	4.36	4.30	0.03	N/S
Plan meals and snacks (1 to 5)	3.85	3.86	-0.08	N/S
Exercise 2 or 3 times weekly (1 to 5)	3.32	3.14	0.14	N/S
Self-care activities				
Prescribed medications taken (mean # of days)	6.67	6.81	-0.15	N/S
Followed healthy eating plan (mean # of days)	4.92	4.90	-0.03	N/S
30 minutes of continuous physical activity (mean # of days)	2.68	2.84	-0.30	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; ANCOVA = Analysis of Covariance.

* Indicates significance at the 5 percent level. ** Indicates significance at the 1 percent level.

N/S means not statistically significant.

SOURCE: RTI analysis of the Medicare Health Services Survey, 2008.

Computer program: CreqD2

Setting goals and making a care plan—The survey included two questions that asked if someone from their health care team helped set goals or a plan to take care of their health problems. Sixty five percent of KTBH beneficiaries in the intervention group reported receiving help setting goals compared to 58 %, although the difference is not statistically significant. Similarly, 60% of KTBH beneficiaries in the intervention group reported receiving help making a care plan compared to 56 %, where the difference is also not statistically significant. The

ANCOVA results reveal the KTBH program was not effective at increasing the proportion of beneficiaries who had received help to set goals for self-care management, nor was it effective at increasing the proportion of beneficiaries reporting that they had help from their health care team in making health care plans. For other covariates in the models, KTBH beneficiaries living alone were less likely to receive help on both setting goals and making a care plan, but those with additional health coverage were more likely to receive help with their goals; Black KTBH beneficiaries were more likely to receive help in making a care plan compared to beneficiaries of other races.

Self-efficacy ratings— Overall, KTBH beneficiaries typically reported high levels of self-efficacy with mean ratings averaging around 3.5- 4 (somewhat sure of their ability to perform self-care activities) out of a maximum of 5 (very sure). The highest self-efficacy scores were reported for taking medications as prescribed (4.4 for the intervention group versus 4.3 for the control group), and the lowest scores were for getting exercise two or three times per week (3.3 for the intervention group versus 3.1 for the control group). The ANCOVA results reveal that with their program's intervention, the KTBH program was not effective at increasing beneficiaries' self-confidence on the three specific behaviors such as taking medications, planning meals according to dietary guidelines, and engaging in physical exercise. In terms of other characteristics, Black and proxy KTBH beneficiaries expressed significantly less confidence in taking their medications appropriately. Proxy respondents for beneficiaries participating in the KTBH program also have less confidence in planning meals and engaging in physical exercise then self-respondents. KTBH beneficiaries who live alone and mail respondents are significantly more likely to feel confident about their meal planning. In terms of confidence with exercise guidelines, females appear to be less confident, while those who are better educated – more confident that they can engage in this behavior..

Self-care activities—A goal of chronic disease management is to promote patient compliance with self-care behaviors and activities that may help to maintain or improve health status. The reported compliance rate for self-care activities ranged from quite high for both groups among some activities (taking medications) to more modest compliance rates among other activities (exercise). For example, the mean number of days that beneficiaries said they take their medications as prescribed ranged from 6.7 to 6.8 out of 7 days, but the mean number of days that beneficiaries said they have 30 minutes of continuous physical activity ranged from 2.7 to 2.8 days. For self-care activities, we observe no statistically significant intervention effects for the KTBH program: there were no significant differences in frequencies of any of the three self-care activities between the intervention and the control groups. In terms of other characteristics predictive of self-care behaviors, proxy KTBH respondents are more likely to be compliant with their prescribed medications while Medicaid enrollees are less likely to be compliant; KTBH beneficiaries follow a healthy eating plan more often with increased age, and less often if they are respondents by mail; and female and proxy respondents are significantly less likely to engage in physical activity than their counterparts.

3.1.3.3 Physical and Mental Health Functioning

Physical and mental function—***Table 3-3*** displays the mental and physical functioning outcomes for the KTBH program. The mean PHC scores for the intervention and control group were very similar and ranged from 29.6 to 29.7, while the mean MHC scores were also similar

and ranged from 36.9 to 36.5. PHQ-2 scores averaged about 2 for the in intervention group and 2.4 for the control group. The ANCOVA estimation revealed only one statistically significant intervention effect for physical and mental function outcomes: the KTBH intervention group reported significantly lower PHQ-2 scores than the control group, leading to a significant intervention effect in the desired direction of fewer depressive symptoms. Consistently, for the second mental health outcome, the MHC score, the direction of the coefficient was positive, indicating an improvements in mental health functioning (the result is not statistically significant).There was no difference in the physical health functioning in the KTBH intervention group compared to the controls.

Table 3-3
Medicare Health Services Survey: Estimated intervention effects, physical and mental health function, KTBH
(N = 508)

Outcome	Intervention mean	Comparison mean	ANCOVA-adjusted intervention effect	Stat. sig.
PHC score (physical health, mean =50, std=10)	29.6	29.7	-0.1	N/S
MHC score (mental health, mean =50, std=10)	36.9	36.5	0.0	N/S
PHQ-2 score (depression, 0 to 6)	2.00	2.37	-0.45	*
Number of ADLs difficult to do (0 to 6)	2.55	2.59	-0.02	N/S
Number ADLs receiving help (0 to 6)	1.51	1.30	0.21	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; ANCOVA = Analysis of Covariance; PHC = Physical Health Composite; MHC = Mental Health Composite; PHQ-2 = Patient Health Questionnaire 2; ADLs = activities of daily living.

* Indicates significance at the 5 percent level. ** Indicates significance at the 1 percent level.

N/S means not statistically significant.

SOURCE: RTI analysis of the Medicare Health Services Survey, 2008.

Computer program: CreqD2

Activities of daily living—A related measure of beneficiary functioning is the ability to perform basic ADLs. On average, respondents reported limitations on about 2.6 ADLs and received help with an average of 1.5 to 1.3 ADLs. We observe no statistically significant differences in ADL outcomes for the KTBH program. Among KTBH beneficiaries, when other characteristics are held constant, proxy respondents report more ADL limitations than self-respondents. As expected, those with higher baseline HCC score also report significantly higher levels of functional impairment. In terms of needing help with ADLs, females and proxy respondents report needing help on a significantly higher number of ADLs. Those with additional health coverage also report needing help with fewer ADLs. Those living alone and

mail survey respondents report needing help on a significantly few ADLs then those who live with others and phone respondents respectively.

3.1.4 Conclusions

The KTBH demonstration program employs strategies to improve quality of care for high cost Medicare beneficiaries while reducing costs by empowering Medicare beneficiaries to better manage their care. KTBH program staff hypothesized that lifestyle changes and better communication with providers will mitigate acute flare-ups in the chronic conditions. Experiencing better health, beneficiaries should also be more satisfied that their health care providers are effectively helping them to cope with their chronic medical conditions. Among the 19 outcomes covered by the survey, the KTBH program demonstrated one positive intervention effect that resulted in the decrease of the depression symptoms, and one negative intervention effect on discussing treatment choices within the self-management survey domain

3.2 Physician Satisfaction

RTI made two site visits to meet with the KTBH program staff during the demonstration period. The first site visit was conducted in June 2006, 8 months after initiation of the KTBH demonstration program. During this visit, RTI evaluators consulted with the senior management of VH and key KTBH program staff. We also spoke by telephone with physicians from two of KTBH's nephrology practice partners. We were unsuccessful at arranging phone interviews with non–nephrology partner physicians. RTI conducted a more comprehensive evaluation of physician satisfaction with the KTBH demonstration program during its second site visit in January 2008.

In this section, we begin by describing the outreach efforts of the KTBH program to community-based physicians and sharing beneficiary information with those physicians. We conclude with an assessment of the value of the KTBH program to the interviewed physicians.

3.2.1 KTBH Clinical Partnership Relations

All of the nephrology groups stated that the KTBH program was introduced to them very early, as soon as it started. One group noted that in the last 6 months they had not heard as much about the program. They thought this was because the KTBH program was functioning smoothly. The nephrologists noted that beneficiaries really listen and communicate with the KTBH staff when they are contacted by the KTBH nurse practitioner. The nephrologists felt that the participants are very willing to communicate with the KTBH staff, and felt that the home visits by the KTBH field-based nurses were beneficial in that the beneficiaries were on their own turf and therefore more comfortable. All of the nephrology practices reported that they were extremely satisfied with the KTBH program and believed that the beneficiaries who were participating were responding well and were happy in the program. Many of the nephrologists reported that their beneficiaries were benefiting from the KTBH program because it was reinforcing the same message that they get from the nephrologists regarding proper care for CKD. The nephrologists reported that participants appreciated the KTBH staff calling and following up on what was going on with their care.

One nephrology group reported that at the beginning of the KTBH program, the beneficiaries often wondered who the people were who were contacting them and why they wanted to come to their house. They looked to the nephrologists for reassurance and once they realized the nephrologists knew the KTBH program staff, their suspicion level went down. Nephrologists also reported that participants who were not under the care of a nephrologist were anxious at first to see if their relationship with their PCPs was going to change once they started seeing a nephrologist, but the KTBH staff assured them that it would not, and they felt great about it.

One nephrologist reported that he believed one of the big successes of the KTBH program had been in staff's ability to get fistula placements in beneficiaries earlier. Another nephrologist reported that the KTBH program had made beneficiaries have a much more positive attitude about their care. They reported that an educated beneficiary does a much better job of taking care of himself, asking better questions, and is generally more aware of what is going on with his care. This nephrologist felt that the KTBH program had improved the quality and continuity of care overall for the participants. Another nephrologist reported that KTBH participants felt they got comprehensive care and that they were pleased that all of their comorbidities were taken care of.

One of the nephrologists partnering with the KTBH program had a specific success story to report. He said that the KTBH program identified a beneficiary for whom they thought the program would be beneficial because he was already progressing towards stage 4 CKD. The KTBH program was able to coordinate nephrology care with his primary care physician and cardiologist and prepare him for dialysis before he was symptomatic. The nephrologist had seen the participant on the day in which we had our telephone conference and reported that he was doing very well.

All nephrologists reported that they received some data and information back from the KTBH program. All of the nephrology partners reported that they reviewed the quarterly reports from the KTBH program as well as the reports on the number of visits and the number of encounters with participants. Some nephrologists expressed concern that they were not receiving very much "bigger picture" information on the KTBH program (such as trends over time for their participants or for the KTBH program as a whole).

3.2.2 KTBH Provider Recommendations

The nephrologists did have a few specific recommendations for how the KTBH program could be improved. Many of the nephrology groups stated that they would like to get more feedback and data on hospitalization rates of their patients. They reported that if a participant had been hospitalized with a serum creatinine level greater than 2, then they found out about it. Otherwise, if the serum creatinine value was low or the patient was stable, they often did not know about the hospitalization. The KTBH Nurse Practitioner responded that this information would start going into the quarterly reports for the nephrologists. The partnering nephrologists expressed an interest in obtaining this high level information on their patients and on the overall program.

Another recommendation was that the KTBH program be individualized. One nephrologist felt that the program took a "cookie cutter approach." One example was provided by this nephrologist: Some beneficiaries who had been stable for ten years and were being watched and cared for by a nephrologist were told by KTBH staff that they were in kidney failure and needed to prepare for renal replacement therapy by having vessel mapping and a fistula placed. There was, for example, no discrimination between those who had been stable over 10 years and being watched, and those who were starting to progress to stage 4 or 5 CKD in a rapid manner. This nephrologist expressed the desire to be contacted first by KTBH staff first to get background information or history on the participant so that an individualized plan of care could be developed between the nephrologist and the KTBH program staff.

CHAPTER 4
PARTICIPATION RATES IN THE KTBH CMHCB DEMONSTRATION PROGRAM AND LEVEL OF INTERVENTION

4.1 Introduction

Our participation analysis is designed to critically evaluate the level of engagement by the KTBH program in this population-based demonstration program and to identify any characteristics that systematically predict participation versus nonparticipation. Furthermore, we seek to evaluate the degree to which beneficiaries who consented to participate were exposed to the KTBH programmatic interventions. The analyses are designed to answer a broad policy question about the depth and breadth of the reach into the community: how well did the KTBH program engage their intended audiences? Specific research questions include the following:

- Were there systematic baseline differences in demographic characteristics and disease burden between the intervention and comparison group beneficiaries at the start of the demonstration?
- How many individuals did the KTBH program engage, and what were the characteristics of the participants versus nonparticipants (in terms of baseline clinical measures, demographics, and health status)?
- What beneficiary characteristics predict participation in the KTBH program?
- To what extent were the intended audiences exposed to the KTBH programmatic interventions? To what extent did participants engage in the various features of the program?
- What beneficiary characteristics predict a high level of KTBH demonstration intervention versus a low level of intervention?

The overall design of the CMHCB demonstration follows an intent-to-treat (ITT) model, and all CMOs are held at risk for their monthly management fees based on the performance of the full population of eligible beneficiaries randomized to the intervention group and compared with all eligible beneficiaries in the comparison group. The CMHCB demonstration has been designed to provide strong incentives to gain participation by all eligible beneficiaries in the intervention group. In our June 2006 site visit, KTBH staff reported that they had engaged 37% of their CMHCB intervention population, a little lower than the company's goal of 40% participation (Brody and McCall, 2006). As of December 2007, 27% of the refresh population had agreed to participate in the KTBH program (Spain and McCall, 2008). In our first analysis of participation in the CMHCB demonstration, we examined participation during the initial 6-month outreach period of the demonstration (McCall et al., 2008). In this report, we examine the level of participation for the full intervention period and the beneficiary characteristics that predict participation.

We also examine the level of intervention between the KTBH program and its randomized beneficiaries. The KTBH intervention had a variety of telephonic and in-person elements (e.g., facilitated patient relationships with physicians, helped patients to comply with

physician care plans, hospital discharge planning support, support patient adherence to medication regimens, and provided education related to self-management activities to decrease risk for acute exacerbations of chronic diseases). Therefore, we examine the number of telephonic and in-person contacts between KTBH staff and their participants. For each participating beneficiary, the KTBH program provided RTI with a count of the number of contacts by type: telephonic, in-person visits, and written communications (e.g., mail, fax, and e-mail). The KTBH program also provided information on who was contacted (e.g., caregiver, patient, provider, and nephrologist).

4.2 Methods

4.2.1 Participation Analysis Methods

We determined participation status during the demonstration period using a monthly indicator provided to us by ARC in the *Participant Status* file to align with dates of eligibility for the KTBH demonstration. We report the percentage of intervention beneficiaries who consented to participate for at least 1 month during the intervention period as well as those who never consented to participate and the reason for nonparticipation (refused or never contacted/unable to be reached). We also report the percentage of beneficiaries who, after initial consent, were continuous participants (while eligible for the KTBH program) and the percentage of beneficiaries participating for more than 75% of their eligible months.[5] These latter two sets of numbers provide an estimate of the number of beneficiaries with whom the KTBH program had the greatest opportunity to intervene. Because beneficiaries lose eligibility for various reasons over time (e.g., loss of Part A or Part B benefits, or due to death), we report counts of full-time equivalents (FTEs) or numbers of intervention and comparison beneficiaries weighted by the fraction of the demonstration period each beneficiary was eligible. Only beneficiaries who had at least 1 day of eligibility in both the baseline and demonstration periods are included in these analyses.

We also conduct a multivariate logistic regression analysis to determine the predictors of participation versus nonparticipation among those in the intervention group. The logistic model used in this study to identify differences in the likelihood of a beneficiary being in the participant group versus the nonparticipant group as a function of baseline and intervention period clinical factors, baseline cost, and baseline demographic factors is specified as

$$\text{Log e}\,(p_i / [1 - p_i]) = \beta X_i + \text{error}, \qquad (4\text{-}1)$$

where P_i = the probability that the *i*th individual will consent to participate, βX_i = an index value for the *i*th individual based on the person's specific set of characteristics (represented by the vector), and e = the base of natural logarithms. The probability of a beneficiary being in the participant group is thus explained by the variables.

[5] A beneficiary becomes ineligible to participate if he/she enrolls in a Medicare Advantage (MA) plan, loses eligibility for Part A or B of Medicare, moves out of the demonstration area, gets a new primary payer (i.e., Medicare becomes secondary payer), receives hospice care, or dies.

Logistic regression produces an odds ratio for every predictor variable in the model; that is, an estimate of that variable's effect on the dependent variable, after adjusting for the other variables in the model. The odds ratio is greater than 1.0 when the presence (or higher value) of the variable is associated with an increased likelihood of being in the participant group versus the nonparticipant group; odds ratios less than 1.0 mean that the variable is inversely associated with being in the participant group.

We estimate three participation regression models to allow for evaluation of whether characteristics of participation differed across time (first 6 months versus the full intervention period) and across levels of participation (at least 1 day versus at least 75% of eligible months). The participation model investigates whether group membership is influenced by beneficiary demographic attributes, clinical characteristics, and utilization and cost factors previously defined in **Chapter 2**. The demographic variables included in the model are defined as follows from the Medicare enrollment database (EDB) and determined as of the date of randomization for the original population (October 3, 2005) and the refresh population (October 1, 2006):

- male, a dichotomous variable, set at 1 for males;
- African American/other/unknown, a dichotomous variable, set at 1 for beneficiaries whose race code is African American, other, or unknown;
- aged-in, a dichotomous variable, set at 1 for beneficiaries whose entitlement to Medicare benefits is based on age rather than disability;
- age, three dichotomous variables set at 1 for age less than 65 years, age 75-84, and age greater than or equal to 85 years; age 65-74 is the reference group; and
- Medicaid, a dichotomous variable, set at 1 for beneficiaries enrolled in Medicaid. Medicaid enrollment is based on a beneficiary being enrolled in Medicaid at any point 1 year prior to the go-live date.

Baseline clinical and financial characteristics included in the model are defined as follows:

- baseline HCC score medium and high, two dichotomous variables set at 1 if the prospective HCC score was between 2.0 and 3.1 (medium) and greater than 3.1 (high); HCC score less than 2.0 is the reference group;
- baseline Charlson score medium and high, two dichotomous variables set at 1 if the Charlson index score was 3 (medium) and 4 or greater than (high); Charlson score of less than 3 is the reference group for the original population. For the refresh population, baseline Charlson scores of 3 or 4 were medium and 5 or greater were in the high group. The reference group was a score of less than 3.
- baseline costs PBPM medium and high, two dichotomous variables set at 1 if the PBPM cost calculated by RTI for a 12-month period prior to the *start* of the KTBH original demonstration program was greater than or equal to $567 and less than $1,837 (medium) and $1,838 or greater (high); PBPM cost less than $567 is

the reference group for the original population. For the refresh population, baseline PBPM costs greater than or equal to $527 and less than $2,075 were assigned to the medium group and $2,075 or greater to the high category; PBPM cost less than $527 is the reference group.

Intervention period beneficiary characteristics included in the model are defined as follows:

- died, a dichotomous variable, set at 1 for beneficiaries who died during the intervention period;

- institutionalized, a dichotomous variable, set at 1 for beneficiaries who were resident in a long-term care setting for any 1 or more months of the initial 6 months of the intervention period; and

- concurrent HCC score medium and high, two dichotomous variables set at 1 if the concurrent HCC score calculated by RTI for the initial 6-month original intervention period was greater than 0.696 but less than 1.868 (medium) and greater than or equal to 1.868 (high); concurrent HCC score less than or equal to 0.696 is the reference group. These scores were re-calculated for the first 6-months of the refresh intervention period with the medium category assigned to values between 0.806 and 1.791 and values greater than or equal to 1.791 were assigned to the high category; a concurrent HCC score less than or equal to 0.805 is the reference group.

4.2.2 Level of Intervention Analysis Methods

The KTBH program provided RTI with the number and nature of contacts with participating beneficiaries at the beneficiary level from May 1, 2007 through the end of Phase I of the CMHCB demonstration. We use these data to develop estimates of the level of intervention provided to KTBH participants. The core of the intervention was one-on-one nurse care manager support provided via telephone and/or in-person visits complemented by support from the KTBH program pharmacist, social worker, and dietician and access to a 24-hour care manager hotline (Brody and McCall, 2006). Care managers engaged in the following core activities to support program participants: conducted initial and continuous risk evaluation of participant medical and psychosocial needs, such as laboratory tests or access to eldercare for a spouse; coordinated care through the development of a care plan that summarized participant needs and outlined action plans to ensure that issues were addressed in a timely way; educated participants about slowing the progression of renal disease, the benefits of early referral to a nephrologist, management of comorbid conditions, and treatment options for renal disease such as preparation for renal replacement therapy; coordinated medication therapy management; and monitored participant status during each interaction either by telephone or in-person visit to detect changes in health status, psychosocial needs, and medical therapy, so that care plans could be adjusted to continually address issues pertinent to each participant.

Using the encounter data submitted by the KTBH program, we constructed counts of the number of contacts with participants (both inbound and outbound), in total, by who was contacted or doing the contacting: patient/caregiver, provider, or facility, and by method of

contact: telephonic, in-person, or other (mail, fax, e-mail). We also report the mean and median number of total contacts and the distribution of beneficiaries across six categories of contacts (0, 1, 2-4, 5-9, 10-19, and 20 or more). We also estimate a multivariate logistic regression model of the likelihood of being in the high total contact category relative to the low total contact category. A dichotomous dependent variable was created and set at 1 for beneficiaries who had a high level of contact with the KTBH program and 0 for beneficiaries who had a low level of contact. Beneficiaries who had a medium level of contact with the KTBH program were the reference group in the regression analysis. Independent variables in the contact regression model included those that we have described for the participation regression model and two additional demonstration period utilization measures:

- one intervention period hospitalization set at 1 if the beneficiary had one hospitalization in months 7-18 for the original population and months 13-24 for the refresh population; and

- multiple intervention period hospitalizations set at 1 if the beneficiary had more than one hospitalization during these same time periods.

We included these two additional demonstration period intervention variables because KTBH staff attempted to identify beneficiaries at risk of a hospitalization and to intervene to prevent the hospitalization from occurring or to identify beneficiaries at the time of hospitalization or shortly thereafter to intervene to prevent readmission. Thus, we would expect these two variables to be positively associated with being in the high contact group.

We report levels of intervention with the original and refresh intervention populations during the last 18 months of the demonstration (May 1, 2007 through October 31, 2008). Because beneficiaries could have intermittent periods of eligibility and participation, we restricted inclusion in this analysis to beneficiaries who were eligible for and participating in the KTBH demonstration program for each month during this 18 month period. This is the subset of beneficiaries with whom the KTBH program would have had the maximum opportunity to intervene. Beneficiaries who died during this period but were fully eligible and participating up to their deaths were also included. The number of intervention beneficiaries that met these criteria was 1,198 for the original population and 581 for the refresh population.

4.3 Findings

4.3.1 Participation Rates for the KTBH Population

Analyses presented in this section include only beneficiaries who had at least 1 day of eligibility in the year prior to the start of the intervention period and at least 1 day of eligibility in the demonstration. The results are based on the full demonstration period for both the original and refresh populations. The number of months for the full demonstration period for the KTBH program is 36 months for the original population and 24 months for the refresh.

Tables 4-1 and 4-2 display the number of beneficiaries included in our participation analyses for the original and refresh populations and illustrates the impact of loss of eligibility by reporting the FTEs. We report

1. Number of beneficiaries. The number of beneficiaries is equal to all beneficiaries who had at least 1 day of eligibility in the 1-year baseline period and had at least 1 day of eligibility in the period tabulated.

2. Full-time equivalents. FTEs defined here are the total number of beneficiaries weighted by the number of days eligible in the intervention period divided by the total number of days in the intervention period. For example, a beneficiary in the KTBH program had a total of 36 months (or 1,096 days) of possible enrollment. If they died after 90 days, their FTE value would be 90/1,096 or 0.082 FTEs. If someone were eligible for all 36 months, then his or her value is 1. The sum of this value across all beneficiaries gives the total FTE value reported in the tables below.

3. Number fully eligible. The number fully eligible is the number of beneficiaries that had no gap in the KTBH program eligibility during the demonstration period.

The ratio of FTEs to the total number of eligible beneficiaries in the original intervention population is 0.77 for the entire intervention period (months 1-36) compared with a higher ratio (0.91) for each individual year of the demonstration. These differences in ratios illustrate the effect of subsetting to beneficiaries in the different time periods and attrition over time of the original beneficiaries due primarily to death. Beneficiaries also became ineligible for participation in the KTBH demonstration program if they joined a Medicare Advantage (MA) plan, lost Medicare Part A or B eligibility, Medicare became a secondary payer, elected the hospice benefit, or they moved out of the service area.

Forty-three percent of the original intervention and 42% of comparison beneficiaries had a spell of ineligibility. This can be estimated as the difference in the number of eligible beneficiaries and the number of fully eligible beneficiaries. Within the intervention group, eligibility was higher for participants and lower for nonparticipants. KTBH's nonparticipant group was eligible only 70% of all possible days—much lower than the 85% of days for participants. Also, the participant group had a higher rate of beneficiaries being fully eligible for the entire intervention period (66%) compared with 50% for the nonparticipant group.

Table 4-2 displays eligibility data for the refresh population, which is about one-half the size of the original population. The ratio of total number of beneficiaries to FTEs was lower for the full 24 months (0.85) compared to the two 12-month periods (0.92) for the intervention population. This held true for the comparison population as well. However, the percent of beneficiaries that were fully eligible for the full refresh time period is higher among participants (74%) than nonparticipants (68%) or the comparison group (70%), but the difference narrows by the last 12-months of the demonstration (84%, 83%, and 82%, respectively).

Table 4-1
Number of Medicare FFS beneficiaries eligible for and participating in the KTBH CMHCB demonstration: Original population

Characteristics	Months 1-36	Months 1-12	Months 13-24	Months 25-36
Intervention group				
Number eligible[1]	4,882	4,879	4,056	3,433
Full time equivalent[2]	3,753	4,423	3,700	3,135
Number fully eligible	2,793	4,000	3,369	2,846
Participants				
Number eligible	2,284	2,050	1,851	1,352
Full time equivalent	1,947	1,980	1,723	1,245
Number fully eligible	1,504	1,848	1,572	1,137
Participants > 75%				
Number eligible	1,256	789	1,468	1,150
Full time equivalent	1,091	765	1,357	1,056
Number fully eligible	855	716	1,246	970
Non-participants				
Number eligible	2,598	2,829	2,205	2,081
Full time equivalent	1,806	2,443	1,978	1,890
Number fully eligible	1,289	2,152	1,797	1,709
Comparison group				
Number eligible	1,951	1,949	1,637	1,388
Full time equivalent	1,511	1,778	1,494	1,262
Number fully eligible	1,134	1,612	1,362	1,153

NOTES:

FFS = fee-for-service; KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

SOURCES: Medicare claims data, Medicare enrollment database.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tabKTBH-1.sas 09FEB2010.

Table 4-2
Number of Medicare FFS beneficiaries eligible for and participating in the KTBH CMHCB demonstration: Refresh population

Characteristics	Months 1-24	Months 1-12	Months 13-24
Intervention group			
Number eligible[1]	2,326	2,325	1,985
Full time equivalent[2]	1,977	2,138	1,817
Number fully eligible	1,645	1,954	1,656
Participants			
Number eligible	1,037	991	724
Full time equivalent	918	942	666
Number fully eligible	769	872	610
Participants > 75%			
Number eligible	599	546	571
Full time equivalent	530	520	517
Number fully eligible	444	475	472
Non-participants			
Number eligible	1,289	1,334	1,261
Full time equivalent	1,059	1,196	1,151
Number fully eligible	876	1,082	1,046
Comparison group			
Number eligible	941	941	809
Full time equivalent	802	871	733
Number fully eligible	662	795	667

NOTES:

FFS = fee-for-service; KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

SOURCES: Medicare claims data, Medicare enrollment database.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tabKTBH-1.sas 09FEB2010.

Tables 4-3 and 4-4 present participation rates for the KTBH original and refresh populations and display the participation status of the beneficiary after verbal consent to participate was given (continuous participation, became a continuous nonparticipant after initial participation period, or intermittent participation). We also display the reasons for nonparticipation and the percent of beneficiaries who participated more than 75% of eligible months. Numbers of participants by selected months are also reported. Continuous versus intermittent participation is important because it effects the ability of the KTBH program to contact beneficiaries and, ultimately, to have any impact on utilization and costs.

Participation rates for the KTBH original population. Of all KTBH original intervention group beneficiaries, 47% verbally consented to participate in its demonstration at some point during the intervention period. We previously reported (Brody and McCall, 2006) that, as of June 2006, 37% consented in the initial 8-month engagement period and we observe an increase in the KTBH program's enrollment over the entire intervention period. Only 27% of beneficiaries were continuous participants (***Table 4-3***), which equates to 57% of participants. Among the KTBH beneficiaries, 33% refused to participate. The percent not contacted or unable to be located was 21%.

Participation rates were heavily influenced by length of eligibility during the intervention period. An alternative measure of participation is the percentage of beneficiaries who participated more than 75% of months they were eligible for the CMHCB demonstration. Of KTBH's intervention beneficiaries, 26% participated for more than 75% of their eligible months, which is very close to the continuous participant percentage. ***Table 4-3*** also reports the number of participants over time (for months 6, 12, 24 and 36, the last month of the demonstration). The number of participants declined over time as would be expected given the attrition due to loss of eligibility primarily due to death.

Participation rates for the KTBH refresh population. The criteria for selection of the intervention and comparison refresh populations were similar to the criteria used to select the initial populations with one noted exception. VH requested that beneficiaries, who were institutionalized during March 2006 through May 2006, be excluded from the refresh population. With the selection criterion change, there was no improvement in their participation rate ***(Table 4-4)***. Overall, 45% of the refresh intervention beneficiaries consented to participate at some point during the 24-month period. Of those, 27% were continuous participants, which equates to 60% of participants. The percent that refused to participate was modestly higher (37%), and the percent that were not contacted or were unable to be contacted was modestly lower at 19%.

Table 4-3
Participation in the KTBH CMHCB demonstration program: Original population

Characteristics	Statistic
Number of intervention months	36
Participation rate (entire demonstration period)	47%
Length of participation	
Continuous participation after engagement	27%
After initial participation, became a continuous non-participant	18%
Intermittent participation	2%
Nonparticipation (never agreed)	53%
Refused to participate when contacted	33%
Not contacted/unable to be contacted	21%
Beneficiaries participating more than 75% of eligible months	26%
Number of participants in selected months[1]	
Month 6	1,810
Month 12	1,640
Month 24	1,383
Month 36 (last month)	1,018

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

Data Sources: Medicare claims data, Medicare enrollment database.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tableKTBH-2.sas 09FEB2010.

Table 4-4
Participation in the KTBH CMHCB demonstration program:
Refresh population

Characteristics	Statistic
Number of intervention months	24
Participation rate (entire demonstration period)	45%
Length of participation	
Continuous participation after engagement	27%
After initial participation, became a continuous nonparticipant	15%
Intermittent Participation	2%
Nonparticipation (never agreed)	55%
Refused to participate when contacted	37%
Not contacted/unable to be contacted	19%
Beneficiaries Participating more than 75% of eligible months	26%
Number of participants in selected months[1]	
Month 6	790
Month 12	687
Month 24 (last month)	527

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

Data Sources: Medicare claims data, Medicare enrollment database.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tableKTBH-2.sas 09FEB2010.

4.3.2 Characteristics of the KTBH Intervention and Comparison Populations

In addition to evaluating the level of initial engagement by KTBH, our participation analysis is designed to confirm that the selection procedures produced similar demographic, disease, and economic burden profiles between the intervention and comparison groups for both the original and refresh populations. Identifying any systematic baseline differences in demographic characteristics, health status, or baseline chronic condition patterns between the intervention and comparison group beneficiaries is important because the contractual and financial benchmarks established as part of the CMHCB demonstration program are based on an ITT framework and an assumption that the intervention and comparison groups are equivalent or essentially equivalent at the start of the demonstration.

Because the date of randomization and the go-live date for each CMO was a month or less apart, we used the go-live date as our reference point and examined claims for 1 year prior to the go-live date. Only beneficiaries that had some eligibility in both the baseline and intervention periods were selected for this analysis. We explore the sufficiency of the randomization procedures for producing similar populations based on the selection strata and other variables. We also examine whether there are any systematic baseline differences in the disease burden between the intervention and comparison group beneficiaries assessed at the start of the demonstration. ***Supplement 4A*** provides tables showing the percent of beneficiaries by these characteristics for the intervention and comparison populations for both the original and refresh populations.

Characteristics of the KTBH original population—Beneficiaries for both the intervention and comparison groups were eligible based on having annual Medicare costs of $5,000 or higher in 2004, having a 2004 HCC risk score of 1.7 or greater, and meeting specific diagnostic criteria. We observe both cost and HCC score equivalency between the intervention and comparison groups. The mean HCC score for both the intervention and comparison groups was 1.4, meaning that beneficiaries selected for the demonstration were, on average, predicted to be 40% more expensive than the average fee-for-service (FFS) beneficiary.

Based on beneficiary characteristics, there were no statistically significant differences between the intervention and comparison populations at baseline. The intervention group had similar beneficiary characteristics and similar baseline rates of chronic conditions. Out of a large number of comparisons, one would expect to find a small number of the comparisons statistically significant by chance, but none were found.

Characteristics of the KTBH refresh population—Beneficiaries for both the original and refresh populations were eligible for the same reasons as above with the additional exclusion of institutionalized beneficiaries. We observe only one statistically significant difference in the beneficiary characteristics – the intervention population had a 2.8 percentage point higher rate of strokes at baseline than the comparison group.

Characteristics of Participants in the KTBH Original and Refresh Populations - In ***Supplement 4A,*** we report the beneficiary characteristics that predict participation in the KTBH CMHCB demonstration program for both the original and refresh populations. Within the original population, beneficiaries who participated were in better health than those who did not and participants showed significantly higher rates of chronic conditions such as coronary artery disease, diabetes with complications, and renal disease, indicating that the KTBH program had some success with enrolling beneficiaries with significant chronic conditions. The results for the refresh population indicate more success with enrolling sicker beneficiaries as measured by high costs, high risk scores and higher rates of chronic conditions. ***Supplement 4A*** also provides participation rates during the first 6 months of the demonstration by beneficiary demographic characteristics, baseline clinical and financial characteristics, and intervention period health status that we use in the multivariate modeling of participation.

4.3.3 Characteristics of Participants in the KTBH Original and Refresh Populations

In order to better understand the characteristics that most strongly predicted participation in the demonstration, we estimated three logistic regression models for both the original and refresh populations:

1. Model 1: Beneficiaries who participated at least 1 month in the first 6 months of the intervention period compared with all other beneficiaries (nonparticipants);
2. Model 2: Beneficiaries who participated at least 1 month during the full intervention period compared with all other beneficiaries (nonparticipants); and
3. Model 3: Beneficiaries who participated at least 75% of eligible months compared with all other beneficiaries (nonparticipants and minimal participants).

Presentation of these regression results allows for a comparison of characteristics of beneficiaries who agreed to participate during the initial 6-month engagement period for at least 1 month versus characteristics of beneficiaries who agreed to participate at any point during the entire intervention period versus those who participated in the KTBH demonstration program more than 75% of their eligible months. Model 1 reflects the initial recruitment emphasis by the KTBH program, or characteristics of beneficiaries with whom the KTBH program had the longest potential period of intervention. Model 3 reflects characteristics of the beneficiaries who demonstrated the greatest willingness or ability to participate in the KTBH demonstration. For each model, we estimated two equations; an equation with just demographic characteristics and a full model equation that includes baseline and demonstration utilization and health status variables. Because there is correlation between beneficiary characteristics and the other variables, such as health status and baseline characteristics, we were most interested in examining which beneficiary characteristics had the greatest effect on willingness to participate before controlling for these other factors. The results for all three models were very similar in direction and magnitude of effect of beneficiary characteristics on the likelihood of participation so we do not display results of Models 1 and 2 in the body of the text (see ***Supplement 4A***).

Tables 4-5 and 4-6 present the results of the logistic regression analyses that predict participation based on various beneficiary characteristics for the original and refresh populations for Model 3. Model 3a (columns 1 and 2) contains the odds ratio and associated statistical level of significance for the equation with just beneficiary characteristics. Model 3b (columns 3 and 4) contains the odds ratio and associated statistical level of significance for the equation with additional utilization and health status variables. An odds ratio less than 1 means that beneficiaries with a particular characteristic were less likely to participate; an odds ratio greater than 1 means that beneficiaries with the particular characteristic were more likely to participate. In general, the reference group comprises characteristics associated with younger and healthier beneficiaries. Across all three models, the explanatory power of the studied beneficiary characteristics was extremely low. Thus, the set of variables that we used were not strong predictors of likelihood of participation. Pseudo R-squares for all of the models were less than 0.09, with the full Model 3 exhibiting pseudo R-squares of 0.05 for the original population and 0.02 for the refresh population. ***Supplement 4A*** contains tables that present the odds ratios and level of significance for Models 1 and 2.

Table 4-5
Logistic regression modeling results comparing beneficiaries that participated at least 75% of eligible months during the KTBH CMHCB intervention period to all other intervention beneficiaries: Original population[1,2]

Characteristics	Model 3A OR	p[3]	Model 3B OR	p[3]
Intercept	0.48	**	0.40	**
Beneficiary characteristics				
Male	0.87	N/S	0.88	N/S
African American/other/unknown	1.12	N/S	1.19	N/S
Age < 65 years	1.23	N/S	1.34	*
Age 75-84	0.97	N/S	1.02	N/S
Age 85 + years	0.52	**	0.68	**
Medicaid	0.54	**	0.49	**
Baseline characteristics				
Baseline HCC score medium	N/I	N/I	0.91	N/S
Baseline HCC score high	N/I	N/I	0.94	N/S
Medium baseline PBPM	N/I	N/I	1.19	N/S
High baseline PBPM	N/I	N/I	1.23	N/S
Baseline Charlson score medium	N/I	N/I	0.90	N/S
Baseline Charlson score high	N/I	N/I	1.08	N/S
Demonstration period health status				
Died	N/I	N/I	0.90	N/S
Institutionalized	N/I	N/I	0.06	**
Concurrent HCC score medium	N/I	N/I	1.26	*
Concurrent HCC score high	N/I	N/I	1.32	**
Number of cases	4,882	N/A	4,882	N/A
Chi-square (p<)	58.47	**	268.01	**
Pseudo R-square	0.01	N/A	0.05	N/A

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

N/I means not included; N/A means not applicable; N/S means not statistically significant.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $567. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .696 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene02, partab3b, partab4b 27APR2010.

Table 4-6
Logistic regression modeling results comparing beneficiaries that participated at least 75% of eligible months during the KTBH CMHCB intervention period to all other intervention beneficiaries: Refresh population[1,2]

Characteristics	Model 3A OR	p[3]	Model 3B OR	p[3]
Intercept	0.43	**	0.26	**
Beneficiary characteristics				
Male	1.15	N/S	1.06	N/S
African American/other/unknown	1.00	N/S	1.02	N/S
Age < 65 years	0.79	N/S	0.76	N/S
Age 75-84	0.70	**	0.69	**
Age 85 + years	0.71	*	0.77	N/S
Medicaid	0.76	N/S	0.90	N/S
Baseline characteristics				
Baseline HCC score medium	N/I	N/I	1.07	N/S
Baseline HCC score high	N/I	N/I	1.16	N/S
Medium baseline PBPM	N/I	N/I	0.95	N/S
High baseline PBPM	N/I	N/I	0.85	N/S
Baseline Charlson score medium	N/I	N/I	1.66	**
Baseline Charlson score high	N/I	N/I	1.60	**
Demonstration period health status				
Died	N/I	N/I	1.15	N/S
Institutionalized	N/I	N/I	0.15	**
Concurrent HCC score medium	N/I	N/I	1.34	*
Concurrent HCC score high	N/I	N/I	1.38	*
Number of cases	2,326	N/A	2,326	N/A
Chi-square (p<)	12.99	*	58.04	**
Pseudo R-square	0.01	N/A	0.02	N/A

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

N/I means not included; N/A means not applicable; N/S means not statistically significant.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $527. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .805 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene02, partab3b, partab4b 27APR2010

Model 3a shows that beneficiaries who were 85 years of age and older or those enrolled in Medicaid were less likely to be participants, both proxies for poorer health status. (***Table 4-5***). Examining Model 3b for the original population ***(Table 4-5)***, we continue to observe the same pattern of influence of beneficiary characteristics on the likelihood of participation with one exception: the introduction of baseline and demonstration period health status measures introduces the influence of age less than 65 on participation status. This implies correlation between baseline utilization and health status and being disabled. Beneficiaries who were institutionalized during the first 6-month period of the demonstration more than 90% less likely to participate than those not institutionalized, holding other factors constant. KTBH staff had reported challenges engaging both the disabled and the institutionalized populations and worked with CMS to exclude institutionalized beneficiaries from their refresh population. Beneficiaries with medium and high concurrent HCC scores were more likely to be participants. Baseline health status characteristics (e.g., HCC risk score, PBPM costs, and comorbidity indices) had no impact on the likelihood of participation when controlling for baseline demographics and demonstration period health status. This would suggest that the KTBH program was able to engage those most immediately at risk of an acute event because of concurrent poor health status. After the first eight months of the demonstration, KTBH reported that engagement with the first group of beneficiaries, who were under the care of a nephrologist, was the easiest, whereas healthier beneficiaries were less receptive to the program since they felt fine, did not think they needed support offered by the program, and were not interested in having additional calls or people coming to their homes.

There are a few noted differences in the results for the refresh population ***(Table 4-6)*** such as age less than 65 or 85 and older having no impact on the likelihood of participation – beneficiaries ages 75-84 are now found to be less likely to participate. Further, medium and high baseline Charlson scores were positive predictors of participation, indicating more success in engaging the sicker reference beneficiaries into their program. During the second site visit, KTBH felt that they were limited in the ways that they could engage nursing home patients and have them participate in all the features that the program offered. However, the percent of institutionalized beneficiaries in the refresh population that participated was 14%, which was an increase over 8% for the original population. Additionally, KTBH staff recommended that future renal management programs target a younger age group so that they could make a difference in the trajectory of beneficiaries' quality of life at an earlier stage. With the increased participation of older beneficiaries, there is a correlation with the indicators of decreased health status in the refresh population.

4.3.4 Level of Intervention

In this section, we report the frequency of interaction between KTBH and intervention beneficiaries for a subset of original intervention population beneficiaries who were fully eligible and participating for the last 18 months of the KTBH CMHCB demonstration program. The KTBH program evolved considerably over the first 18 months as KTBH staff began to understand their population was not a target population specifically for advanced CKD and they developed their chronic care program (Spain and McCall, 2008). Therefore, this analysis focuses on the time period during which the KTBH program would have the most effect. We also examine whether there is evidence of selective targeting of beneficiaries for intervention contacts based upon level of perceived need as determined by beneficiary demographic, health status,

baseline costliness, and acute care utilization during the demonstration period. The KTBH program target population had a high prevalence of comorbid conditions, such as diabetes and HF. During the second site visit, KTBH staff reported that they had expanded the clinical focus of the program to also include identifying and treating the comorbid conditions of CKD—HF, hypertension, cardiovascular disease, and diabetes mellitus – in order to slow the progression of CKD. The KTBH program also developed a new program called the Late Stage Intervention Program (LSIP) that targeted members with Stage 4 and 5 CKD, who were followed by the nephrology partners. Thus, we expect to see a pattern of higher levels of intervention contacts for beneficiaries in poorer health status or higher users of hospitalization services, especially for the refresh population.

Descriptive statistics were performed using beneficiaries participating in the KTBH demonstration program to determine the breadth and depth of contacts related to care management. The data represent beneficiaries who were fully eligible and participating (unless they died) for the last 18 months demonstration. ***Tables 4-7 and 4-8*** provide a detailed description of the type of contact and number of contacts during this time period for the subset of eligible beneficiaries. ***Table 4-7*** gives a broad sense of the primary person with whom the KTBH care managers were contacting. The majority of contacts were made to or from the patient/caregiver (about 90%) followed by providers at 7%. This confirms that the contacts are really focused on coaching intervention and not on care coordination with providers. ***Table 4-8*** shows the method of contact. Telephonic contact was the dominant form of contact (90%), with about 4% of contacts being in-person.

Table 4-7
Frequency distribution of KTBH Care Manager interactions: Total contacts[1,2]

Contacted	Original Frequency	Percent	Refresh Frequency	Percent
Patient/caregiver	30,250	89.8	14,956	90.3
Patient	25,405	75.4	12,708	76.7
Caregiver	4,845	14.4	2,248	13.6
Total provider	2,433	7.2	1,180	7.1
Provider	1,993	5.9	1,023	6.2
Nephrologist	422	1.3	139	0.8
Health plan	18	0.1	18	0.1
Facility/other	989	2.9	431	2.6
Dialysis center	256	0.8	59	0.4
Facility-not dialysis center	465	1.4	231	1.4
Other	268	0.8	141	0.9
Total contacts	33,672	100.0	16,567	100.0

NOTES: KTBH = VillageHealth's Key to Better Health.
[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.
[2] Includes any inbound and outbound contact as well as fax, e-mail, and mailings.
Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/encount2 15MAR2010

Table 4-8
Frequency distribution of KTBH's method of interaction: Total contacts[1]

Method	Original Frequency	Percent	Refresh Frequency	Percent
Total telephonic	30,442	90.4	14,910	90.0
Telephonic outbound	28,161	83.6	13,755	83.0
Telephonic inbound	2,281	6.8	1,155	7.0
In-Person[2]	1,379	4.1	638	3.9
Other[3]	1,851	5.5	1,019	6.2
Total contacts	33,672	100.0	16,567	100.0

NOTES: KTBH = VillageHealth's Key to Better Health.

[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[2] Any in-person contact: outbound, inbound, and not specified.

[3] E-mail, fax, and mail outbound, inbound, and not specified.

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/encount2 15MAR2010

Table 4-9 displays the overall distribution of care management-related contacts for the original population. A total of 1,198 unique original population beneficiaries met the selection criteria - fully eligible and participating (unless they died) for the last 18 months of the demonstration period. Observations were weighted by the fraction of eligible days, accounting for fewer contacts due to attrition because of death, which resulted in 1,059 full-time equivalent beneficiaries. The mean number of contacts for each beneficiary was 28 and the median was 22. One-third of beneficiaries had less than 17 contacts and one-third of beneficiaries had 27 or more contacts over the 18 month period.

Table 4-10 displays this same information for the refresh population. A total of 581 unique refresh population beneficiaries met the selection criteria (505 full-time equivalents). The distribution of the contacts was similar to the original population.

Table 4-11 displays the percent of participants with care manager interactions – in-person visits, telephone contacts inbound and outbound, and total contacts (telephonic and in-person) by frequency of contact over the last 18 months of the demonstration for the original population. Nearly 60% of beneficiaries had no in-person visits. Sixteen percent of beneficiaries had one in-person visit and another 20% of beneficiaries had 2 to 4 in-person visits during the 18-month period.

Table 4-9
Distribution of number of contacts[1] with participants[2] in the KTBH CMHCB demonstration: Original intervention population

Statistic	Number	Percent
Number of beneficiaries[3]	1,198	—
FTE beneficiaries[4]	1,059	—
Mean number of contacts	28	—
Median number of contacts	22	—
Mean number of months of contact	13	—
Median number of months of contact	13	—
Distribution low to high contact variables	FTE beneficiaries	Percent
0-16 contacts	287	27.1%
17-26 contacts	379	35.8%
27+ contacts	393	37.1%
Total	1,059	100.0%

NOTES: KTBH = VillageHealth's Key to Better Health; FTE = full time equivalent.

[1] Contacts are restricted to in-person and telephonic inbound and outbound.

[2] Participants are defined as patients and caregivers in this analysis.

[3] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[4] Beneficiary counts weighted by fraction of eligible days = full-time equivalents.

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab2 16MAR2010; encount5 08JUNE2010.

Table 4-10
Distribution of number of contacts[1] with participants[2] in the KTBH CMHCB demonstration: Refresh intervention population

Statistic	Number	Percent
Number of beneficiaries[3]	581	—
FTE beneficiaries[4]	505	—
Mean number of contacts	30	—
Median number of contacts	22	—
Mean number of months of contact	13	—
Median number of months of contact	13	—
Distribution low to high contact variables	FTE beneficiaries	Percent
0-16 contacts	119	23.6%
17-26 contacts	203	40.3%
27+ contacts	182	36.1%
Total	505	100.0%

NOTES: KTBH = VillageHealth's Key to Better Health; FTE = full time equivalent.

[1] Contacts are restricted to in-person and telephonic inbound and outbound.

[2] Participants are defined as patients and caregivers in this analysis.

[3] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[4] Beneficiary counts weighted by fraction of eligible days = full-time equivalents.

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab2 16MAR2010; encount5 08JUNE2010..

Table 4-11
Percent distribution of participants[1] with KTBH care manager interactions[2]: Original intervention population

Type and frequency of contact	Number of FTE beneficiaries[3,4]	Percent
In-person		
0	600	56.6
1	168	15.9
2-4	210	19.8
5-9	74	7.0
10-19	6	0.6
20+	1	0.1
Telephonic inbound		
0	529	50.0
1	190	18.0
2-4	227	21.4
5-9	74	7.0
10-19	27	2.6
20+	11	1.0
Telephonic outbound		
0	2	0.2
1	6	0.5
2-4	11	1.0
5-9	36	3.4
10-19	455	43.0
20+	549	51.9
Total telephonic and in-person		
0	2	0.2
1	6	0.6
2-4	10	0.9
5-9	29	2.8
10-19	379	35.8
20+	633	59.8

NOTES: KTBH = VillageHealth's Key to Better Health; FTE = full time equivalent.

[1] Participants are defined as patients and caregivers in this analysis.

[2] Contacts are restricted to in-person and telephonic inbound and outbound.

[3] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[4] Beneficiary counts weighted by fraction of eligible days = full-time equivalents.

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab1 16MAR2010.

Participants in the KTBH program received a lot of phone calls during the last 18 months of the demonstration. All but 2 beneficiaries received a telephone call from a care manager, while 95% received 10 or more calls. Also of note is the number of inbound calls made to the care managers – 50% of participants contacted the care manager. Combining telephone and visit contacts, we observe that less than 1% of fully eligible and participating beneficiaries had no contact for the 18-month period and another 4% had fewer than 10 contacts. Yet at the same time, we observe 60% of beneficiaries had 20 or more contacts with the majority being telephone contacts. We find very similar results in ***Table 4-12***, which provides the same distributions for the refresh population

Table 4-12
Percent distribution of participants[1] with KTBH care manager interactions[2]: Refresh intervention population

Type and frequency of contact	Number of FTE beneficiaries[3,4]	Percent
In-person		
0	265	52.5
1	98	19.5
2-4	110	21.7
5-9	28	5.6
10-19	4	0.7
20+	0	0.0
Telephonic inbound		
0	250	49.6
1	89	17.6
2-4	106	20.9
5-9	39	7.8
10-19	18	3.6
20+	3	0.6
Telephonic outbound		
0	1	0.2
1	2	0.4
2-4	3	0.5
5-9	18	3.6
10-19	209	41.4
20+	272	53.8
Total telephonic and in-person		
0	1	0.2
1	2	0.4
2-4	2	0.4
5-9	16	3.1
10-19	180	35.6
20+	305	60.3

NOTES: KTBH = VillageHealth's Key to Better Health; FTE = full time equivalent.
1 Participants are defined as patients and caregivers in this analysis.
2 Contacts are restricted to in-person and telephonic inbound and outbound.
3 Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.
4 Beneficiary counts weighted by fraction of eligible days = full-time equivalents.
Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab1 16MAR2010.

Table 4-13 displays the frequency of care management contacts by baseline HCC score and type of contact. Contact by mode was not mutually exclusive in that a beneficiary could have a combination of telephone and visit contacts any time during the last 18 months of the demonstration period. Beneficiaries were stratified into three HCC categories ranging from an HCC score greater than 3.1 to less than 2.0.

In-person visits—Beneficiaries in the highest risk category appear to have been targeted for in-person visits. Beneficiaries in the high HCC risk group were 25 percentage points more likely to have had 1 or more in-person visits as beneficiaries in the low HCC risk group. High risk beneficiaries were almost 2 times more likely to have had 5 or more in-person visits compared with the low risk group (7.7% versus 4.4%). These findings suggest that KTBH made a focused effort to visit their higher acuity beneficiaries.

Telephone contacts—There is a high level of outbound telephonic contact across the three risk categories. When examining the two highest categories of outbound calls, there are no meaningful differences across the risk categories – more than 93% of participants received 10 or more calls during the 18 month period. The high risk group was concentrated in the high outbound call category, which equates to more than one call per month over the last 18 months of the demonstration.

There is no difference in the percent of beneficiaries that received one or more contacts when all modes of contact are combined – basically every beneficiary received at least one contact. However, 66% of high risk beneficiaries had twenty or more contacts as compared to 53% for low risk category beneficiaries.

Similar results are found for the refresh population (***Table 4-14***). There are a higher percentage of beneficiaries in the high HCC risk group for the refresh population (33%). Beneficiaries in the high HCC risk group were 14 percentage points more likely to have had 1 or more in-person visits as beneficiaries in the low HCC risk group. The main difference between the original and refresh distribution of services by HCC risk is the narrowing of the differences between the high and low risk categories indicating more of a breadth of contact for the refresh population.

Table 4-15 provides a snapshot of the contact information for both the original and refresh populations. Beneficiary participation was 47% for the original and 45% for the refresh populations. For beneficiaries who were fully eligible and fully participating the last 18 months of the demonstration, the mean number of contacts with the KTBH program was about 0.7 per month for both populations. An alternative way of looking at rate of contact is number of months between contacts. On average, the KTBH program contacted participants about every 1.4 months with 43 days between contacts. Over an 18-month month intervention period, every 1.4 months converts into 13 contacts.

Table 4-13
Frequency of KTBH contacts by HCC score:
Original intervention population

Contact mode	HCC Score High (>3.1) N = 272 Frequency	%	HCC Score Medium (2-<3.1) N = 359 Frequency	%	HCC Score Low (<2) N = 428 Frequency	%
In-person						
0	119	43.8	186	51.8	295	68.9
1	55	20.2	61	17.0	52	12.1
2-4	73	26.8	76	21.2	61	14.3
5-9	21	7.7	34	9.5	19	4.4
10-19	4	1.5	2	0.6	0	0.0
20+	0	0.0	0	0.0	1	0.2
Telephonic inbound						
0	134	49.3	177	49.4	218	50.9
1	47	17.3	60	16.8	83	19.4
2-4	56	20.6	81	22.6	90	21.0
5-9	20	7.4	29	8.1	25	5.8
10-19	12	4.4	7	2.0	8	1.9
20+	3	1.1	4	1.1	4	0.9
Telephonic outbound						
0	1	0.4	1	0.3	0	0.0
1	3	1.1	0	0.0	2	0.5
2-4	4	1.5	3	0.8	4	0.9
5-9	11	4.0	14	3.9	11	2.6
10-19	102	37.4	141	39.4	212	49.6
20+	152	55.7	199	55.6	198	46.4
Total telephonic and in-person						
0	0	0.0	1	0.0	0	0.0
1	3	1.1	0	0.1	2	0.5
2-4	3	1.1	3	0.8	4	0.8
5-9	8	2.9	13	3.5	9	2.1
10-19	79	29.0	116	32.2	185	43.2
20+	179	65.8	226	63.1	227	53.2

NOTES: KTBH = VillageHealth's Key to Better Health; HCC =Hierarchical Condition Category; N = number of beneficiaries.

[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[2] Beneficiary counts weighted by fraction of eligible days = full-time equivalents

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab1 16MAR2010

Table 4-14
Frequency of KTBH contacts by HCC score:
Refresh intervention population

Contact mode	HCC Score High (>3.1) N = 168 Frequency	%	HCC Score Medium (2-<3.1) N = 173 Frequency	%	HCC Score Low (<2) N = 164 Frequency	%
In-person						
0	75	44.6	94	54.3	96	58.2
1	34	20.2	38	22.0	27	16.4
2-4	45	26.8	30	17.3	35	21.2
5-9	12	7.1	9	5.2	7	4.2
10-19	2	1.2	2	1.2	0	0.0
20+	0	0.0	0	0.0	0	0.0
Telephonic inbound						
0	77	46.1	91	52.6	83	50.3
1	31	18.6	29	16.8	29	17.6
2-4	37	22.2	27	15.6	41	24.8
5-9	14	8.4	20	11.6	5	3.0
10-19	7	4.2	4	2.3	7	4.2
20+	1	0.6	2	1.2	0	0.0
Telephonic outbound						
0	1	0.6	0	0.0	0	0.0
1	1	0.6	1	0.6	0	0.0
2-4	1	0.6	1	0.6	1	0.6
5-9	6	3.6	9	5.2	4	2.4
10-19	62	36.9	75	43.4	72	43.6
20+	97	57.7	87	50.3	88	53.3
Total telephonic and in-person						
0	0	0.0	0	0.0	0	0.0
1	1	0.6	1	0.6	0	0.0
2-4	1	0.6	1	0.6	0	0.0
5-9	5	3.0	7	4.0	4	2.4
10-19	53	31.5	67	38.7	60	36.6
20+	108	64.3	97	56.1	100	61.0

NOTES: KTBH = VillageHealth's Key to Better Health; HCC =Hierarchical Condition Category; N = number of beneficiaries.

[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the KTBH demonstration.

[2] Beneficiary counts weighted by fraction of eligible days = full-time equivalents

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab1 16MAR2010

Table 4-15
KTBH beneficiary contact rates among fully eligible and fully participating beneficiaries

	Overall participation rate (%)[1]	Mean contacts per active month	Mean number of months between contacts	Mean number of days between contacts
Original	47	0.71	1.41	42.88
Refresh	45	0.70	1.43	43.44

NOTES: KTBH = VillageHealth's Key to Better Health

[1] Overall participation rate for all beneficiaries for the full demonstration period.

[2] Contacts include telephonic and in-person.

[3] Mean contacts per active month: Ratio of mean number of contacts per month to active intervention months.

[4] Number of months between contacts: Inverse of mean contacts per active month, which is defined as ratio of mean contact months to active intervention months.

[5] Number of days between contacts: Number of months between contacts multiplied by 30.42.

Data Sources: RTI analysis of 2007-2008 Medicare enrollment, eligibility, and KTBH encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/encount416MAR2010; encount5 08JUNE2010.

To more directly examine the targeting strategy of the KTBH program, a multivariate logistic regression model was estimated with the number of total contacts as the dependent variable. The model estimates the likelihood of a participant receiving a high number of contacts. The medium contact group was omitted, thus comparing the high contact group to the low contact group. ***Tables 4-16*** (original population) ***and 4-17*** (refresh population) display the odds ratios for discrete categories of demographic characteristics, baseline health status, baseline Medicare payments, and demonstration health status. Beneficiaries were weighted by their period of eligibility during the last 18 months of the demonstration, and their number of contacts categorized either as low (0-16) or high (27+). Odds ratios are partial in the sense that all other variables are held constant. For example, the odds of a beneficiary younger than 65 years of age experiencing a high contact rate are 1.5 times greater than those for a beneficiary age 65 and older, adjusting for any baseline difference in HCC score and characteristics.

For the original population, no beneficiary characteristics or baseline characteristics were found to be statistically significant indicators of the likelihood of being in the high contact category (***Table 4-16***). Demonstration period acute care utilization was not a strong predictor of a high level of contact and likely reflects the challenges that the KTBH staff expressed in knowing when one of their participants had been to an emergency room or hospitalized. A high concurrent HCC score, or health status measured during the first 6 months of the demonstration period, was found to be a positive predictor of being in the high contact group. Beneficiaries who died during the demonstration were less likely to be in the high contact category. The explanatory power of the studied beneficiary characteristics was extremely low, suggesting that there is not a strong set of variables that predict likelihood of a beneficiary being in the high contact group. The pseudo R-square for this model was 0.07.

Table 4-16
Logistic regression modeling results comparing the likelihood of being in the KTBH program high contact category relative to the low contact category: Original intervention population

Characteristics	Odds ratio[1,2]	p[3]
Intercept	0.58	*
Beneficiary characteristics		
Male	1.18	N/S
African American/other/unknown	1.09	N/S
Age <65	1.52	N/S
Age 75-84	1.00	N/S
Age 85+ years	0.88	N/S
Medicaid	0.81	N/S
Baseline characteristics		
Baseline HCC score medium	1.25	N/S
Baseline HCC score high	1.25	N/S
Medium base PBPM	1.45	N/S
High base PBPM	1.25	N/S
Baseline Charlson score medium	0.81	N/S
Baseline Charlson score high	1.37	N/S
Demonstration period health status		
Died	0.36	**
Institutionalized	0.50	N/S
Concurrent HCC score medium	1.41	N/S
Concurrent HCC score high	2.10	**
One hospitalization	1.04	N/S
Multiple hospitalizations	1.29	N/S
Number of cases	802	N/A
Chi-square (p<)	57.38	**
Pseudo R2	0.07	N/A

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the demonstration.

[2] Beneficiary counts weighted by fraction of eligible days = full-time equivalents

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

N/A means not applicable; N/S means not statistically significant.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $567. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .696 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab4 28APR2010.

For the refresh population, we do observe a relationship between demonstration period acute care utilization and likelihood of being in the high contact group (***Table 4-17***). Beneficiaries who had one hospitalization were 3 times more likely to be in the high contact group while beneficiaries with multiple hospitalizations were nearly 11 times more likely to be in the high contact group (10.9), than those who had no hospitalizations. A high concurrent HCC score was also a positive predictor of being in the high contact group. Beneficiaries who died during the demonstration were less likely to be in the high contact category. These findings suggest that the KTBH program was able to make a more focused effort to contact the refresh beneficiaries who were at high risk of hospitalization or who had been hospitalized.

Table 4-17
Logistic regression modeling results comparing the likelihood of being in the KTBH program high contact category relative to the low contact category: Refresh intervention population

Characteristics	Odds ratio[1,2]	*P*[3]
Intercept	0.38	*
Beneficiary characteristics		
Male	0.84	N/S
African American/other/unknown	1.43	N/S
Age <65	1.66	N/S
Age 75-84	2.02	*
Age 85+ years	1.42	N/S
Medicaid	0.37	N/S
Baseline characteristics		
Baseline HCC score medium	1.52	N/S
Baseline HCC score high	1.48	N/S
Medium base PBPM	0.98	N/S
High base PBPM	0.44	N/S
Baseline Charlson score medium	0.91	N/S
Baseline Charlson score high	1.39	N/S
Demonstration period health status		
Died	0.06	**
Institutionalized	17.93	N/S
Concurrent HCC score medium	1.59	N/S
Concurrent HCC score high	3.39	**
One hospitalization	3.01	**
Multiple hospitalizations	10.91	**
Number of cases	370	N/A
Chi-square (p<)	94.19	**
Pseudo R2	0.22	N/A

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Beneficiaries had to be fully eligible and full participants in the last 18 months of the demonstration.

[2] Beneficiary counts weighted by fraction of eligible days = full-time equivalents

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

N/S means not statistically significant.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $527. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .805 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/enctab4 28APR2010.

4.4 Summary

For the KTBH program, we find that participants from the original population were healthier and younger than beneficiaries who never participated. The very old (85 years of age and older), Medicaid enrollees, institutionalized beneficiaries, those that died, and those with higher prospective and concurrent HCC scores were less likely to be participants. In the multivariate regression analysis, the same baseline health status characteristics (e.g., prospective HCC risk score, PBPM costs, and Charlson comorbidity indices) had no impact on the likelihood of participation after controlling for baseline demographics and demonstration period health status. Beneficiaries with medium and high concurrent HCC scores were more likely to be participants. This suggests that the KTBH program was unable to engage the historically sicker Medicare beneficiaries but did make some inroads with engaging those with acute clinical deterioration as measured by the concurrent HCC score. The results for the refresh population were similar to the original population, with one noted difference: higher baseline Charlson scores were positive predictors of participation. These differences suggest that the KTBH program was more successful at gaining participation from the sicker and more costly beneficiaries in their program as it matured.

A cornerstone of the KTBH's program was health coaching interactions with care manager nurses. Nearly every participating beneficiary received at least one call or in-person visit from a care manager in the last 18 months of the demonstration and over 60% received more than 20 contacts during this same time period. Telephone contact was the most dominant form of contact. In our multivariate regression modeling of likelihood of being in a high contact versus low contact group for the original population, we found that beneficiary characteristics, baseline characteristics, and demonstration period acute care utilization were not indicators of being in the high contact category. A high concurrent HCC score, or health status measured during the first 6 months of the demonstration period, was found to be a positive predictor of being in the high contact group indicating that the KTBH staff made an effort to contact beneficiaries that had progressive health issues. Among the refresh population, there was evidence that KTBH staff were successful contacting beneficiaries who were at high risk of hospitalization or who had been hospitalized during the demonstration period. Acute care utilization was a strong predictor of more contacts. These findings suggest that the KTBH program was successful contacting beneficiaries who were at high risk of hospitalization or who had been hospitalized with the refresh population.

CHAPTER 5
CLINICAL QUALITY PERFORMANCE

5.1 Introduction

RTI's analysis of quality of care focuses on measuring effectiveness of the KTBH demonstration program by answering the following evaluation question:

- *Clinical Quality of Care:* Did VillageHealth's Key to Better Health demonstration program improve quality of care, as measured by improvement in the rates of beneficiaries receiving guideline concordant care?

In this chapter, we present analyses related to clinical quality performance during the KTBH demonstration program by examining changes in the rate of receipt of four evidence-based, process-of-care measures during the demonstration, relative to a 12-month baseline period in both the intervention and comparison populations. We selected three measures appropriate for different populations of elderly beneficiaries: influenza vaccine for all beneficiaries; low-density lipoprotein cholesterol (LDL-C) testing for beneficiaries with diabetes or ischemic vascular disease (IVD); and rate of annual HbA1c testing for beneficiaries with diabetes. We also create two ESRD-related measures: rate of progression to ESRD and rate of fistula/graft placement prior to initiation of dialysis among beneficiaries who progress to ESRD.

Under an intent-to-treat (ITT) model and our difference-in-differences evaluation approach, we require information for the pre- and demonstration periods and for both the intervention and comparison populations for four of our measures. Therefore, in our evaluation, we selected measures that could be reliably calculated using Medicare administrative data to assess improvements in quality of care and health outcomes. Further, these data are available for both the intervention and comparison populations and do not require medical record abstraction or beneficiary self-report. Medical record data are not available to us for either the intervention or comparison populations, and beneficiary self-report data would only be available for the intervention beneficiaries who participated during the demonstration. Further, beneficiary self-report is subject to recall error and to the willingness of beneficiaries to provide the information.

5.2 Methodology

We created four process-of-care measures for the 12-month period immediately prior to the go-live date for the KTBH program for its original and refresh populations and for two intervention periods (months 7-18 and months 25-36) for its original population and for one intervention period (months 13-24, or the last 12 months of the demonstration) for its refresh population. Rates of progression to ESRD and fistula/graft placement among beneficiaries who progress to ESRD were calculated for the full 36-month demonstration period for the original population and 24-month intervention period for the refresh population. Baseline rates were not calculated as beneficiaries who had progressed to ESRD prior to the selection of the KTBH original and refresh populations were considered ineligible for selection. Only beneficiaries who had at least 1 day of eligibility in both baseline and in each of the intervention periods were included in the analysis of all six measures. ***Table 5-1*** provides the number of beneficiaries who were included in the analyses of the quality of care measures, in total, and by three disease cohorts: diabetes, ESRD, and IVD.

Table 5-1
Number of beneficiaries included in analyses of guideline concordant care and acute care utilization for KTBH

Statistics	All	Diabetes	ESRD[2]	Ischemic vascular disease
Original beneficiaries				
Months 7-18				
Intervention				
Total number of beneficiaries	4,432	2,020	229	2,283
Full time equivalents[1]	4,414	2,012	183	2,277
Comparison				
Total number of beneficiaries	1,781	805	102	924
Full time equivalents[1]	1,770	800	85	918
Months 25-36				
Intervention				
Total number of beneficiaries	3,433	1,549	N/A	1,718
Full time equivalents[1]	3,416	1,544	N/A	1,713
Comparison				
Total number of beneficiaries	1,388	616	N/A	716
Full time equivalents[1]	1,380	612	N/A	710
Refresh beneficiaries				
Months 13-24				
Intervention				
Total number of beneficiaries	1,985	907	64	1,073
Full time equivalents[1]	1,977	905	57	1,070
Comparison				
Total number of beneficiaries	809	373	33	435
Full time equivalents[1]	807	372	30	434

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries.

[1] Full Time Equivalent for the intervention group during the baseline period is the total number of beneficiaries weighted by their period of eligibility for the demonstration.

[2] The full time equivalent measure is for the full intervention period.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: gcc01, gcc02, gcctab, gcc_rob, gcctabx, gcctab1 05APR2010.

Medicare claims for the full baseline and intervention period were included regardless of beneficiary eligibility for the KTBH demonstration (e.g., claims were included even if beneficiaries did not pay the Part B premium for 1 or 2 months). This allowed us to provide credit to the KTBH program for services received after exposure to their intervention and possibly as a result of the intervention. To the extent that the service was included in the Medicare claims files during a period of ineligibility for the KTBH demonstration program—or as a denied claim due to disenrollment from Part B, for example—it reflects actual receipt of the service and was therefore included in our analyses.

Rates per 100 beneficiaries are reported for the intervention and comparison groups for the 12-month baseline period and for the intervention periods, weighted by beneficiary eligibility in each time period. For each measure, the difference-in-differences rate is reported and reflects the growth (or decline) in the intervention group's mean rate of receipt of care relative to the growth (or decline) in the comparison group's mean rate. A positive intervention effect for the guideline-concordant care measures occurred if the intervention group's mean rate increased more than the comparison group's mean rate, or declined less, during the demonstration period. A negative intervention effect occurred if the intervention group's mean rate increased less than the comparison group's mean rate, or declined more, during the demonstration period. Within demonstration intervention versus comparison group differences were calculated for the progression to ESRD and graft/fistula placement among beneficiaries who progressed to ESRD with t-tests conducted to determine statistical significance.

Statistical testing of the change in the rate of receipt of the quality of care measures was performed at the individual beneficiary level. The standard method for modeling a binary outcome, such as receiving an HbA1c test or not, is logistic regression. The experimental design for the CMHCB demonstration also requires that the variance of the estimates be properly adjusted for the repeated (pre- and post-) measures observed for each sample member within a nested experimental design. The CMHCB demonstration was based on two nested cohort samples of Medicare beneficiaries who were assigned to intervention and comparison groups within five strata defined by baseline costs. In addition, an eligibility fraction ranging from 0 to 1 was assigned to the pre- and post- time periods for each sample member. STATA SVY was used to fit the model with robust variance estimation. Operationally, the five strata and a beneficiary identifier were included in the SVYSET statement to reflect the stratified sampling design. The eligibility fraction was included as the weight to reflect the period of time during which the beneficiary met the KTBH demonstration eligibility criteria in the baseline and demonstration periods.

Logistic regression produces an odds ratio for every predictor variable in the model; that is, an estimate of that variable's effect on the dependent variable, after adjusting for the other variables (randomization factors) in the model. The odds ratio is greater than 1.0 when the presence of the variable is associated with an increased likelihood of receiving the service; an odds ratio less than 1.0 means that the variable is inversely associated with receiving the test. The statistical test determines whether the odds ratio is 1.0. We report the odds ratio associated with the D-in-D interaction term, or the test of the difference-in-differences of the rate, and the odds ratio's associated *p* value and 95% confidence level.

To better understand the movement underlying the reported difference-in-differences rates, we stratified the KTBH CMHCB demonstration original and refresh beneficiaries into four categories based upon whether or not they received each of the four quality of care measures during the pre-demonstration baseline period and the last 12 months of the demonstration: compliant in both baseline and demonstration; compliant in baseline but not in demonstration; not compliant in baseline but compliant in demonstration; and not compliant in both periods. We report on the natural trends observed in the comparison and intervention populations over the 3-year period.[6] Only beneficiaries who had at least 1 day of eligibility in both baseline and the last 12 months of the demonstration were included and the percentages were weighted by eligibility in each of the periods.

5.3 Findings

Process-of-care rates per 100 KTBH original population beneficiaries are reported in ***Table 5-2***. We report the baseline and intervention period rates for the intervention and comparison groups as well as the difference-in-differences rates (baseline period intervention versus comparison rate difference minus intervention period intervention versus comparison rate difference). Positive difference-in-differences rates per 100 beneficiaries indicate that the intervention group's mean rate improved more than the comparison group's mean rate or the intervention group's mean rate declined at a lower rate than the comparison group's mean rate. Negative difference-in-differences rates per 100 beneficiaries indicate that comparison group exhibited higher rates of growth or less of a decline than the intervention group. For progression to ESRD and graft/fistula placement among beneficiaries progressing to ESRD, we report the odds ratio of the statistical test of differences in likelihood during the demonstration period between the intervention and comparison groups.

At baseline, rates for the four measures calculated for the pre- and post-demonstration period in the original comparison group ranged from a low of 38% for influenza vaccine to a high of 88% for HbA1c testing for beneficiaries with diabetes. Rates were very similar for the original intervention population. With the exception of influenza vaccine, rates in the comparison group either remained the same or declined over the course of the 36-month demonstration period. We observe a more than 20 percentage point increase in rate of influenza vaccine between baseline and months l7-18 within the comparison group and a 10 percentage point increase between baseline and months 13-24. We observe similar trends within the intervention population for both time periods. Not surprisingly, we observe only modest separation in the difference-in-differences rates; none are statistically significant.

Rates of progression to ESRD were modest within the original population’s comparison and intervention groups, 6% and 5%, and the refresh population’s comparison and intervention groups, 4% and 3% respectively. Neither of these differences is significant. Among beneficiaries who developed ESRD, 82% of the original comparison population and 76% of the original intervention population had a graft or fistula inserted prior to initiating dialysis. However, the six

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[6] We do not conduct statistical testing of the differences in distributions. Our formal test of quality improvement is conducted on the difference-in-differences rates using a model based test of statistical significance to allow for robust variance estimation. These data are provided for illustrative purpose only to better understand the natural movement in rate of receipt of quality of care measures in a cohort of elderly, ill fee-for-service (FFS) beneficiaries.

Table 5-2
Comparison of rates of guideline concordant care for the Months 7-18 and last 12 months of the KTBH demonstration period with rates for a 1-year period prior to the start of the KTBH demonstration: Original and refresh populations

Process of care measures	Rate per 100 Baseline I[1]	Rate per 100 Baseline C[1]	Rate per 100 Demo period I[1]	Rate per 100 Demo period C[1]	D-in-D Rate per 100	D-in-D OR	D-in-D p	D-in-D CI Low	D-in-D CI High
ORIGINAL POPULATION									
Months 7-18									
All beneficiaries									
Influenza vaccine	38	38	58	59	-0.40	0.98	0.85	0.84	1.16
Progression to ESRD[3,4]	N/A	N/A	5	6	-0.75	-1.27	0.20	-1.90	0.41
Beneficiaries with diabetes									
HbA1c test	87	87	84	86	-2.42	0.82	0.27	0.58	1.16
LDL-C test	80	82	79	81	-0.42	0.98	0.88	0.72	1.32
Beneficiaries with ESRD									
Graft or fistula[3,4]	N/A	N/A	76	82	-6.08	-1.24	0.22	-15.75	3.59
Beneficiaries with IVD[2]									
LDL-C test	78	78	76	78	-1.64	0.91	0.50	0.70	1.19
Months 25-36									
All beneficiaries									
Influenza vaccine	38	39	50	49	2.73	1.12	0.23	0.93	1.34
Beneficiaries with diabetes									
HbA1c test	88	88	87	87	0.28	1.02	0.91	0.68	1.54
LDL-C test	83	84	80	78	2.71	1.19	0.33	0.84	1.68
Beneficiaries with IVD[2]									
LDL-C test	82	81	78	78	-0.28	0.98	0.91	0.72	1.35
REFRESH POPULATION									
Months 13-24									
All beneficiaries									
Influenza vaccine	46	46	51	54	-2.43	0.91	0.42	0.72	1.15
Progression to ESRD	N/A	N/A	3	4	-0.91	-1.35	0.18	-2.23	0.41
Beneficiaries with diabetes									
HbA1c test	87	89	84	87	-1.01	0.95	0.85	0.56	1.61
LDL-C test	87	89	83	90	-4.18	0.72	0.23	0.42	1.24
Beneficiaries with ESRD									
Graft or fistula	N/A	N/A	71	68	2.87	0.29	0.77	-16.72	22.46
Beneficiaries with IVD[2]									
LDL-C test	87	89	82	87	-2.26	0.88	0.61	0.54	1.43

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; I = intervention population; C = comparison population; D-in-D = difference-in-differences; OR = odds ratio; COPD = chronic obstructive pulmonary disease; LDL-C = low-density lipoprotein cholesterol; IVD = ischemic vascular disease; CMO = care management organization.

[1] All rates are per 100 beneficiaries and are adjusted for periods of demonstration eligibility during the one-year period prior to the start of the demonstration and each set of months the care management organization (CMO) was active in the program. Only beneficiaries who had at least one day of eligibility in both the baseline and demonstration periods are included in this analysis.

[2] Ischemic Vascular Disease is defined using the National Qualify Forum definition.

[3] The calculated differences for ESRD beneficiaries is a simple intervention minus comparison rate. T-tests are used to determine statistical significance.

[4] Rates are calculated for the full intervention time period.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: gcc01, gcc02, gcc_rob, gcctabx, gcctab1 05APR2010; gcctab13MAY2010.

percentage lower rate among the intervention beneficiaries is not statistically significant and is likely due to lower power to detect statistical differences due to small sample sizes. In contrast, the rate of graft or fistula placement was 3 percentage points higher among the refresh intervention beneficiaries than the comparison beneficiaries (71% versus 68%), but this difference is also not statistically significant.

Table 5-3 displays the percentages of the KTBH's demonstration original and refresh beneficiaries who did or did not receive one of the four pre-post process-of-care measures (influenza vaccine, HbA1c testing, and LDL-C testing rates for diabetes and IVD beneficiaries separately) during the baseline and last 12 months of its respective demonstration period. We display the distribution of intervention and comparison beneficiaries across four categories of compliance:

- always compliant, meaning compliant in both baseline and intervention periods;
- became noncompliant, meaning compliant in the baseline period but noncompliant in the intervention period;
- never compliant, meaning noncompliant in either the baseline or intervention period; and
- became compliant, meaning noncompliant in the baseline period but compliant in the intervention period.

The first column for each quality of care measure contains the percentage distributions for the comparison populations and the second column displays the percentage distributions for the intervention populations. The top half displays rates of compliance for the original population and the bottom half for the refresh population. For the original population, there appears to be similar levels of compliance in both the baseline and intervention periods among the intervention and comparison beneficiaries across all four measures and all four categories of compliance. Thus, it is not surprising that we did not observe any statistically significant changes over time between the two groups for these four measures.

In contrast, rates across the four measures of always being compliant were generally higher within the refresh population than the original population. Of particular note, the rates of always being compliant for the comparison group are higher across the board than rates for the intervention group. There is a trend of higher rates of becoming noncompliant among the intervention beneficiaries when evaluating HbA1c and LDL-C testing.

Table 5-3
Percentage of comparison and intervention beneficiaries meeting process of care standards in the baseline year and last 12 months of the KTBH CMHCB demonstration: Original and refresh populations

	HbA1c testing[1,2]	HbA1c testing[1,2]	LDL-C diabetes	LDL-C diabetes	LDL-C IVD	LDL-C IVD	Influenza vaccine	Influenza vaccine
Original population	C	I	C	I	C	I	C	I
Always compliant	78%	78%	70%	71%	68%	68%	26%	26%
Became noncompliant	10	10	13	11	13	13	13	12
Never compliant	6	6	9	11	11	12	35	35
Became compliant	7	6	7	7	8	7	26	27
Refresh population	C	I	C	I	C	I	C	I
Always compliant	83	78	83	76	81	75	31	30
Became noncompliant	8	10	7	11	9	12	16	16
Never compliant	5	6	4	6	4	4	30	32
Became compliant	4	7	7	7	6	6	24	22

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; LDL-C = low-density lipoprotein cholesterol; IVD = ischemic vascular disease; C = comparison population; I= intervention population; CMO = care management organization.

[1] All percentages are adjusted for periods of beneficiary CMHCB demonstration eligibility during the one-year period prior to the start of the demonstration and the last 12 months the CMO was active.

[2] Only beneficiaries who had at least one day of eligibility in both the baseline and demonstration periods are included in this analysis.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: gcc01, gcc02, gcctab, gcc_rob, gcctabx, gcctab3.sas 10MAY2010.

5.4 Summary of Findings and Conclusion

In this chapter, we report on RTI's assessment of the effect of the KTBH demonstration program on quality of care. Specifically, we report findings for the key research question: did KTBH improve quality of care, as measured by improvement in the rates of beneficiaries receiving guideline concordant care? We find no evidence of systematic improvement in quality of care in the KTBH CMHCB demonstration program. Out of six measures, there were no statistically significant differences in the rate of receipt of evidence-based care between the intervention and comparison original and refresh populations.

Over the course of the demonstration, the KTBH program had expected to increase rates of adherence to evidence-based care. However, during the last year of its demonstration program, we observe lower or very similar rates of adherence to the selected measures among its intervention beneficiaries relative to the comparison group beneficiaries for all measures. We also observe between roughly one-fourth to one-third of intervention beneficiaries in both the

original and refresh populations were not compliant during the last year of the KTBH demonstration program despite focused efforts by KTBH staff to encourage beneficiaries to become compliant with evidence-based care. These findings suggest that improving or sustaining adherence to guideline concordant care in a cohort of ill Medicare FFS beneficiaries was more challenging than originally envisioned.

CHAPTER 6
HEALTH OUTCOMES

6.1 Introduction

RTI's analysis of health outcomes focuses on answering the following two evaluation questions:

- Did the KTBH program improve intermediate health outcomes by reducing acute hospitalizations, readmissions, and emergency room (ER) utilization?
- Did the KTBH program improve health outcomes by decreasing mortality?

In this chapter, we present analyses related to intermediate clinical health outcomes by examining changes in the rate of hospitalizations, ER visits, and readmissions during months 7-18 and the last 12 months of the KTBH demonstration relative to a 12-month baseline period for the original population and the last 12 months of the demonstration for the refresh population. We also examine differences in the rate of mortality between the intervention and comparison original and refresh beneficiaries during the entire demonstration period.

6.2 Methodology

6.2.1 Rates of Hospitalizations and Emergency Room Visits

Rates of hospitalization and ER visits were constructed for the 12-month period immediately prior to the launch of the KTBH demonstration program date, for months 7-18 for the original population, and the last 12 months of the intervention period for both the original and refresh populations. We constructed rates of all-cause hospitalization and ER visits and a combined utilization measure for 10 ambulatory care sensitive condition (ACSC) reasons for admission—heart failure, diabetes, asthma, cellulitis, chronic obstructive pulmonary disease and chronic bronchitis, dehydration, bacterial pneumonia, septicemia, ischemic stroke, and urinary tract infection—using the primary diagnosis on the claim. Only claims that occurred during periods of eligibility were included in the utilization measures and only beneficiaries who had at least 1 day of eligibility in both baseline and the demonstration periods are included in these analyses. ***Table 5-1*** in Chapter 5 provides the number of beneficiaries who were included in these utilization analyses.

All-cause and 10 ACSC rates of hospitalization and ER visits per 1,000 beneficiaries are reported for the intervention and comparison groups for the 12-month baseline period and for intervention periods, weighted by beneficiary eligibility in each time period. For each measure, the difference-in-differences (D-in-D) rate is reported and reflects the decline (or growth) in the intervention group's mean rate of utilization relative to the decline (or growth) in the comparison group's mean rate. A positive intervention effect for the acute care utilization measures occurs if the intervention group's mean rate decreased more or increased less than the comparison group's mean rate during the demonstration period. A negative intervention effect occurs if the intervention group's mean rate declined less or grew more than the comparison group's mean rate during the demonstration period.

We performed statistical testing of the change in the utilization rates at the individual beneficiary level. The distributional properties of the data led us to select a negative binomial generalized linear model to account for the presence of beneficiaries with no hospitalizations or ER visits in one time period or the other, as well as heterogeneity in rates of acute care service use. As with the process-of-care measures, STATA SVY was used to fit the model with robust variance estimation to adjust for the repeated (pre- and post-) measures and multiple hospitalizations or ER visits observed for sample members within a nested experimental design. An eligibility fraction ranging from 0 to 1 was assigned to the pre- and post- time periods for each beneficiary and was included as the weight to reflect the period of time the beneficiary met the KTBH CMHCB demonstration eligibility criteria in the baseline and demonstration periods.

Negative binomial regression models produce an incidence rate ratio (IRR) that is an estimate of that variable's effect on the dependent variable, after adjusting for the other variables in the model. An IRR greater than 1.0 is associated with an increased likelihood of acute care utilization; an IRR less than 1.0 means that the variable is inversely associated with utilization. We report the IRR associated with the test of the D-in-D of the rate of hospitalizations and ER visits, and the incidence rate ratio's associated *p* value and 95% confidence interval.

6.2.2 Rates of 90-Day Readmissions

We estimated the percent of beneficiaries with at least one readmission and the readmission rate per 1,000 beneficiaries. Readmissions are estimated for index admissions that occurred during 12-month spans in the baseline and demonstration periods. For the baseline, we included index admissions in the 12-month period immediately prior to the go-live date of KTBH's program. For the original population's first demonstration period, we included index admissions for months 7 through 18, and for the second demonstration period, we included index admissions for months 22-33. For the refresh population's demonstration period, we included index admissions for months 10-21. As described in Chapter 2, we counted readmissions that occurred within 90 days after an index hospitalization discharge date. Therefore, readmissions for baseline period admissions were counted through the first 3 months of the demonstration period. Demonstration period readmissions were counted through the end of the demonstration period.

For all admissions, we calculated readmissions for any diagnosis (all-cause readmissions). For the subset of admissions for the 10 ACSC conditions, we calculated readmissions with a primary diagnosis in the same ACSC category (same cause readmissions). Because readmissions can only occur if there is an initial admission, admission rates can influence readmission rates. To provide context for readmission rate estimates, we estimated the percent of beneficiaries with an admission for any diagnosis and the percent with an admission for one of the 10 ACSC conditions.

The analyses included beneficiaries who had at least 1 day of eligibility in both the baseline and demonstration periods in which index admissions were identified. Only claims that occurred during periods of eligibility were included in the admission and readmission estimates. Estimates of admission rates were weighted by the fraction of days eligible in the 12-month baseline or demonstration periods. Readmission estimates were weighted by the fraction of days eligible until a readmission occurred or up to 90 days following an index hospitalization

discharge if there was no readmission within 90 days. For beneficiaries with more than one index hospitalization, the fraction was calculated by summing eligible days following each admission. To equalize the impact of differences in days of eligibility on readmission rates per 1,000 beneficiaries, counts of admissions were inflated by the fraction of days eligible following index hospitalizations.

The percent of beneficiaries with an admission, the percent with a readmission, and the readmission rate per 1,000 beneficiaries are presented for the baseline and demonstration periods for the intervention and comparison groups. For each measure, we compare the change from the baseline to the demonstration period for the intervention group relative to the comparison group and test for the significance of this D-in-D between the groups. If the KTBH program reduced admissions and readmissions, we expect to observe negative D-in-D, reflecting greater reductions or smaller increases in the intervention group relative to the comparison group.

Logistic regression was used to estimate the likelihood of having an admission; a negative binomial generalized linear model was used for estimates of readmission rates. STATA SVY was used to fit the model with robust variance estimation. Regressions were weighted by the eligibility fractions described above. We report the odds ratio (OR) from the logistic regressions and the IRR from the negative binomial regressions of the D-in-D test along with the associated *p* value and 95% confidence interval. ORs and IRRs less than 1.0 are associated with a negative D-in-D, indicating that the KTBH program reduced admissions or readmissions for the intervention group relative to the comparison or slowed the growth in rates.

6.2.3 Mortality

Another outcome metric in this evaluation is mortality. We constructed mortality rates per 100 beneficiaries and compare differences in mortality rates between the original and refresh intervention and comparison groups between the go-live date and the end of the demonstration period. Date of death was obtained from the Medicare enrollment data base (EDB). Statistical comparison of the mortality rates was made using a *t*-test of differences in mean rates between the intervention and comparison groups.

6.3 Findings

6.3.1 Rates of Hospitalizations and Emergency Room Visits

Rates of hospitalization and ER visits per 1,000 original population beneficiaries for the year prior to go-live and the KTBH demonstration periods are presented in ***Table 6-1***. Rates of hospitalization and ER visits are presented for all causes and then for the 10 ACSCs. Next to the columns of the utilization rates are the D-in-D rates of change observed between the baseline period and the demonstration intervention periods. Negative D-in-D rates indicate that the intervention group's mean rate of hospitalization or ER visits declined more than the comparison group's mean rate or the intervention group's mean rate of hospitalization or ER visits grew at a lower rate than the comparison group's mean rate. Positive D-in-D rates, as statistically determined through the IRR, indicate that the comparison group exhibited either lower rates of growth or greater decline of hospitalization or ER visits than the intervention group. The last four columns contain the IRR and its statistical level of significance (*p*) value as well as the 95% confidence interval for the IRR.

Not unexpectedly, the baseline rates of hospitalization and ER visits were very high in the KTBH intervention and comparison populations. The baseline rate of all-cause hospitalization was 905 per 1,000 original intervention group beneficiaries. And, the baseline rate of all-cause ER visits was 1,149 per 1,000 original intervention beneficiaries. Original population beneficiaries eligible for the later months of the demonstration had modestly lower baseline utilization rates reflecting the attrition through death of higher users of services. The 10 ACSC reasons for hospitalization combined accounted for roughly one-third of all-cause hospitalizations and all-cause ER visits. Thus, Medicare fee-for-service (FFS) beneficiaries in the KTBH demonstration program were being treated in acute care settings for many reasons other than prevalent chronic medical conditions such as heart failure, diabetes, and COPD as well as prevalent acute medical conditions such as pneumonia.

The rate of all-cause and ACSC hospitalization and ER visits increased similarly in the original intervention and the comparison groups between the baseline and the both demonstration periods. The D-in-D is negative for all the hospitalization rates and for all but one ER visit rate, indicating that the intervention rates increased less than the comparison group, but none of the findings were statistically significant. The D-in-D rate in months 7-18 for all-cause hospitalizations is 120 per 1,000 beneficiaries lower in the intervention group than the comparison group (p-value of 0.07).

Rates of hospitalization and ER visits per 1,000 refresh population beneficiaries for the year prior to go-live and months 13-24 of the KTBH refresh demonstration period are presented in ***Table 6-2***. Once again, we observe an increase in the hospitalization and ER visit rates for both the intervention and comparison groups during the demonstration period. We observe no statistically significant differential rates of hospitalizations or ER usage—either all-cause or for ambulatory care sensitive conditions—during the demonstration period relative to the baseline period.

Table 6-1
Comparison of rates of utilization for months 7-18 and the last 12 months of the KTBH CMHCB demonstration with rates of utilization for a 1-year period prior to the start of the KTBH CMHCB demonstration: Original population

Utilization	Baseline rate per 1,000 I [1,2,3]	Baseline rate per 1,000 C[1,2,3]	Demo period rate per 1,000 I[1,2,3]	Demo period rate per 1,000 C[1,2,3]	D-in-D	IRR[4]	*p*-value	Low CI	High CI
Months 7-18									
Hospitalizations									
All cause	905	905	1,040	1,159	-120	0.90	0.07	0.80	1.01
10 ACSCs[5]	313	306	375	412	-44	0.89	0.23	0.74	1.08
ED/Obs visits									
All cause	1,149	1,204	1,307	1,384	-23	0.99	0.85	0.88	1.11
10 ACSCs	330	329	388	434	-47	0.89	0.24	0.73	1.08
Months 25-36									
Hospitalizations									
All cause	825	818	1,128	1,194	-74	0.94	0.33	0.82	1.07
10 ACSCs	263	249	387	439	-66	0.83	0.10	0.67	1.04
ED/Obs visits									
All cause	1,054	1,110	1,368	1,388	37	1.04	0.58	0.91	1.19
10 ACSCs	281	277	389	437	-53	0.87	0.22	0.71	1.08

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; I= intervention population; C = comparison population; D-in-D = difference-in-differences; IRR = incidence rate ratio; ACSC = ambulatory care sensitive condition; ED/Obs = emergency room visits, including observation bed stays; CMO = care management organization.

[1] The baseline period is the one-year period prior to the go-live date of the CMO.

[2] Rates are per 1,000 beneficiaries adjusted for periods of CMHCB program eligibility for the 1-year period prior to the start of the demonstration and for CMHCB program eligibility during two intervention periods.

[3] Only beneficiaries who at least 1 day of eligibility in the baseline and demonstration period are included in this analysis.

[4] Statistical testing of the difference-in-differences is conducted in STATA using negative binomial regression for rates/1,000 beneficiaries with robust variance estimation. The IRR is reported for negative binomial regressions. The p-value and confidence interval is reported for the IRRs.

[5] The 10 ambulatory care sensitive conditions are as follows: Heart failure, Diabetes, Asthma, Cellulitis, COPD and Chronic Bronchitis, Dehydration, Bacterial Pneumonia, Septicemia, Ischemic Stroke, and UTI.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: acsc01 acsc02 acsctab acsc acsctab1 15MAR2010.

Table 6-2
Comparison of rates of utilization for the last 12 months of the KTBH CMHCB demonstration with rates of utilization for a 1-year period prior to the start of the KTBH CMHCB demonstration: Refresh population

Utilization	Baseline rate per 1,000 I[1,2,3]	Baseline rate per C[1,2,3]	Demo period rate per 1,000 I[1,2,3]	Demo period rate per 1,000 C[1,2,3]	D-in-D	IRR[4]	*p*-value	Low CI	High CI
Months 13-24									
Hospitalizations									
All cause	957	901	1,121	1,099	-34	0.96	0.66	0.80	1.15
10 ACSCs[5]	277	254	409	367	20	1.02	0.87	0.77	1.36
ED/Obs visits									
All cause	1,181	1,034	1,426	1,240	39	1.01	0.95	0.82	1.24
10 ACSCs	289	257	434	361	41	1.07	0.67	0.79	1.45

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; I= intervention population; C = comparison population; D-in-D = difference-in-differences; IRR = incidence rate ratio; ACSC = ambulatory care sensitive condition; ED/Obs = emergency room visits, including observation bed stays; CMO = care management organization.

[1] The baseline period is the one-year period prior to the go-live date of the CMO.

[2] Rates are per 1,000 beneficiaries adjusted for periods of CMHCB program eligibility for the one-year period prior to the start of the demonstration and for CMHCB program eligibility during the last 12 months the CMO was active in the program.

[3] Only beneficiaries who at least one day of eligibility in the baseline and demonstration period are included in this analysis.

[4] Statistical testing of the difference-in-differences is conducted in STATA using negative binomial regression for rates/1,000 beneficiaries with robust variance estimation. The incidence rate ratio (IRR) is reported for negative binomial regressions. The p-value and confidence interval is reported for the IRRs.

[5] The 10 ambulatory care sensitive conditions are as follows: Heart failure, Diabetes, Asthma, Cellulitis, COPD and Chronic Bronchitis, Dehydration, Bacterial Pneumonia, Septicemia, Ischemic Stroke, and UTI.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: acsc01 acsc02 acsctab acsc acsctab1 15MAR2010.

6.3.2 Rates of 90-Day Readmissions

Table 6-3 displays the number of original and refresh population beneficiaries included in the readmission analyses. ***Table 6-4*** displays the percent of original population beneficiaries with an admission and 90-day readmission and rate of 90-day readmission per 1,000 beneficiaries. Data are displayed for all-cause and ACSC admissions and readmissions. In general, we observe a pattern of increasing percent of both intervention and comparison beneficiaries being hospitalized or having a readmission over the course of the demonstration. However, there are no statistically significant reductions in admissions or readmissions among the original intervention beneficiaries during the early stage of the demonstration (months 7-18), nor during the last 12 months of the demonstration. We do observe a statistically insignificant but a sizeable 21% lower rate of growth in rate of all-cause readmission among the intervention beneficiaries during months 7-18; which increases to a 25% lower rate of growth in months 22-33. Given that we observe no decline in percent of beneficiaries with all-cause readmissions, the trend of declining all-cause readmission rates implies that the KTBH program was more successful at reducing readmissions for beneficiaries with frequent readmissions than for beneficiaries with less frequent readmissions relative to the comparison group.

Table 6-3
Number of beneficiaries included in analyses of readmissions for KTBH

Counts of beneficiaries	Intervention	Comparison
Original beneficiaries		
Months 7-18		
Total number of beneficiaries	4,432	1,781
Full time equivalents[1]	4,414	1,770
Months 22-33		
Total number of beneficiaries	3,571	1,430
Full time equivalents[1]	3,555	1,421
Refresh beneficiaries		
Months 10-21		
Total number of beneficiaries	2,069	839
Full time equivalents[1]	2,061	836

NOTES: KTBH = VillageHealth's Key to Better Health.

[1] Full Time Equivalent for the intervention group during the baseline period is the total number of beneficiaries weighted by their period of eligibility for the demonstration.

SOURCE: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data; Computer runs: readm01 readm02 readmtab1 18MAR2010.

Table 6-4
Change in 90-day readmission[1] rates between the year prior to the KTBH CMHCB demonstration and months 7-18 and months 23-33 of the demonstration: Original population

Utilization	Baseline rate per 1,000[1,2,3] I	Baseline rate per 1,000[1,2,3] C	Demo period rate per 1,000[1,2,3] I	Demo period rate per 1,000[1,2,3] C	D-in-D	OR/IRR[4]	*p*	Low CI	High CI
Months 7-18									
Hospitalizations									
Percent with an admission	47	47	44	47	-3	0.89	0.15	0.76	1.04
Percent with ACSC[5] admission	21	20	20	20	-2	0.90	0.29	0.74	1.10
All-cause 90-day readmission									
Percent with readmission	38	38	45	48	-3	0.88	0.31	0.70	1.12
Readmission rate / 1,000	714	719	1,013	1,147	-129	0.89	0.24	0.73	1.08
ACSC same-cause 90-day readmission									
Percent with readmission	12	15	16	19	-0	1.02	0.93	0.63	1.65
Readmission rate / 1,000	178	209	248	290	-11	1.01	0.98	0.62	1.64
Months 22-33									
Hospitalizations									
Percent with an admission	45	45	46	47	-0	0.98	0.86	0.82	1.18
Percent with ACSC admission	19	17	21	21	-2	0.86	0.20	0.69	1.08
All-cause 90-day readmission									
Percent with readmission	36	36	46	48	-2	0.92	0.53	0.70	1.20
Readmission rate / 1,000	675	613	1,064	1,168	-166	0.83	0.10	0.66	1.04
ACSC same-cause 90-day readmission									
Percent with readmission	10	14	16	16	3	1.36	0.30	0.76	2.41
Readmission rate / 1,000	153	180	267	251	42	1.25	0.46	0.70	2.23

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; I= intervention population; C = comparison population; D-in-D = difference-in-differences; OR = odd ratio; IRR = incidence rate ratio; ACSC = ambulatory care sensitive condition.

1 Readmissions are defined as admissions that occur within 90 days after the discharge date of an index admission.

2 Rates are per 1,000 beneficiaries adjusted for periods of CMHCB program eligibility for the one-year period prior to the start of the demonstration and for CMHCB program eligibility during the demonstration period.

3 Only beneficiaries who at least one day of eligibility in the baseline and demonstration period are included in this analysis.

4 Statistical testing of the difference-in-differences is conducted in STATA using logistic regression for percentages and negative binomial regression for rates/1,000 beneficiaries. Robust variance estimation is used for both logistic and negative binomial regressions. The OR is reported for logistic regressions; the IRR is reported for negative binomial regressions. The *p*-value and confidence interval is reported for odds ratios and IRRs.

5 The 10 ambulatory care sensitive conditions are as follows: Heart failure, Diabetes, Asthma, Cellulitis, COPD and Chronic Bronchitis, Dehydration, Bacterial Pneumonia, Septicemia, Ischemic Stroke, and UTI.

SOURCE: RTI analysis of Medicare enrollment, eligibility, claims and intervention data; Computer runs: readm01 readm02 readmtab1 18MAR2010.

Table 6-5 displays the percent of refresh population beneficiaries with an admission and readmission and rate of readmission per 1,000 beneficiaries. As with the original population, there is a general trend of increasing utilization over time. We do not observe any statistically significant moderation of growth in the readmission rates among the intervention refresh population in comparison with the secular changes over time in the comparison group.

6.3.3 Mortality

Table 6-6 displays mortality rates during the KTBH CMHCB demonstration for both the original and refresh intervention and comparison populations. Over the 36-month demonstration period for the original population, about one-third of both the intervention and comparison group beneficiaries died. And, during the 24-month demonstration period for the refresh population, about one-quarter of both groups of beneficiaries died. Thus, we observe no statistically significant differences in mortality rates for either population. The percentage point difference in mortality rates between the original and refresh populations is due to a 12 month longer demonstration period for the original population. As noted in Chapter 4, the original and comparison groups were had very similar baseline characteristics, thus we would expect similar mortality rates without any intervention.

A major component of the KTBH program was encouraging appropriate end-of-life-care planning, including use of the hospice benefit. We examine rates of hospice use between the intervention and comparison groups of both the original and refresh populations. ***Table 6-7*** provides the hospice rates and the mean and median days in hospice. We observe low use rates of the Medicare hospice benefit among the original and refresh intervention and comparison populations, ranging from 5% to 7% (statistically insignificant). However, we do observe considerably different lengths of time in hospice. Most notably, there is a statistically significant lower median number of days in hospice among the refresh intervention group, 10 days, compared with the median number of days in hospice among the refresh comparison group, 24 days ($p=0.03$).

Table 6-5
Change in 90-day readmission[1] rates between the year prior to the KTBH CMHCB demonstration and months 10-21 of the demonstration: Refresh population

Utilization	Baseline rate per 1,000[1,2,3] I	Baseline rate per 1,000[1,2,3] C	Demo period rate per 1,000[1,2,3] I	Demo period rate per 1,000[1,2,3] C	D-in-D	OR/IRR[4]	p	Low CI	High CI
Months 10-21									
Hospitalizations									
Percent with an admission	49	47	48	47	-2	0.94	0.59	0.74	1.18
Percent with ACSC[5] admission	20	18	21	20	-1	0.93	0.65	0.70	1.25
All-cause 90-day readmission									
Percent with readmission	38	40	46	45	3	1.12	0.50	0.80	1.58
Readmission rate / 1,000	787	731	1054	997	1	0.98	0.91	0.73	1.32
ACSC same-cause 90-day readmission									
Percent with readmission	12	8	14	16	-7	0.52	0.12	0.23	1.18
Readmission rate / 1,000	210	113	291	221	-27	0.71	0.43	0.30	1.68

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries; I= intervention population; C = comparison population; D-in-D = difference-in-differences; OR = odd ratio; IRR = incidence rate ratio; ACSC = ambulatory care sensitive condition.

[1] Readmissions are defined as admissions that occur within 90 days after the discharge date of an index admission.

[2] Rates are per 1,000 beneficiaries adjusted for periods of CMHCB program eligibility for the one-year period prior to the start of the demonstration and for CMHCB program eligibility during the demonstration period.

[3] Only beneficiaries who at least one day of eligibility in the baseline and demonstration period are included in this analysis.

[4] Statistical testing of the difference-in-differences is conducted in STATA using logistic regression for percentages and negative binomial regression for rates/1,000 beneficiaries. Robust variance estimation is used for both logistic and negative binomial regressions. The OR is reported for logistic regressions; the IRR is reported for negative binomial regressions. The *p*-value and confidence interval is reported for odds ratios and IRRs.

[5] The 10 ambulatory care sensitive conditions are as follows: Heart failure, Diabetes, Asthma, Cellulitis, COPD and Chronic Bronchitis, Dehydration, Bacterial Pneumonia, Septicemia, Ischemic Stroke, and UTI.

SOURCE: RTI analysis of Medicare enrollment, eligibility, claims and intervention data; Computer runs: readm01 readm02 readmtab1 18MAR2010.

Table 6-6
Mortality rates during the KTBH CMHCB demonstration: Original and refresh populations

Description	Intervention number of deaths	Percent	Comparison number of deaths	Percent	Difference	p value
Original population (36 months)	1,662	34.0	648	33.2	0.8	0.51
Refresh population (24 months)	506	21.8	215	22.9	-1.1	0.49

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Medicare Care Management for High Cost Beneficiaries.

SOURCE: RTI analysis of Medicare enrollment, eligibility, claims and intervention data; Computer runs: mortality.sas 12MAR2010.

6.4 Conclusions

RTI's analysis of quality of care focuses on measuring effectiveness of the KTBH CMHCB demonstration intervention by answering the following evaluation questions:

- Did the KTBH program improve intermediate health outcomes by reducing acute hospitalizations, readmissions, and ER utilization?
- Did the KTBH program improve health outcomes by decreasing mortality?

During the course of the KTBH demonstration, we observed increasing rates of all-cause and ACSC hospitalizations, ER visits, and 90-day readmissions in both the intervention and comparison groups and for both the original and refresh populations. However, we observe no statistically significant differential rates of hospitalizations, ER visits, or 90-day readmission—either all-cause or for ambulatory care sensitive conditions—during the demonstration period relative to the baseline period for any of the populations. Further, we found no differential rate of mortality between the intervention and comparison original and refresh populations. The only statistically significant finding was within the refresh population and their use of the Medicare hospice benefit; the median number of days of hospice use was 14 days longer in the comparison group than in the intervention group.

Table 6-7
Rates of Hospice use and mean and median days of Hospice use among original and refresh KTBH CMHCB demonstration beneficiaries that elected the Hospice benefit

	Intervention N	Comparison N	Hospice Rate I	Hospice Rate C	I vs. C	p value	Mean Days I	Mean Days C	I vs. C	p value	Median Days I	Median Days C	I vs. C	p value
Original population														
All	4,882	1,951	7%	6%	1.1	0.11	49	68	-19	0.09	13	14	-1	0.67
Refresh population														
All	2,326	941	5%	6%	-0.6	0.48	46	73	-27	0.08	10	24	-14	0.03

SOURCE: RTI analysis of Medicare enrollment, eligibility, claims and intervention data; Computer runs: hsp01 hospicetab1, hsptest 13MAY2010.

CHAPTER 7
FINANCIAL OUTCOMES

7.1 Introduction

In this section, we present *final* evaluation findings on levels and trends in Medicare costs for the year prior to the go-live date and over the full 36 months that the Key to Better Health (KTBH) for High Cost Beneficiaries (CMHCB) program was in operation (or 24 months for the refresh sample). The evaluation questions we address are:

- What were the Medicare costs per beneficiary per month (PBPM) in the base year versus the first 36 or 24 months of the demonstration for the intervention and the comparison groups?
- What were the levels and trends in PBPM costs for intervention group participants and nonparticipants? Did nonparticipation, alone, materially reduce the intervention's overall cost savings?
- How variable are PBPM costs in this high cost, high risk, population? What was the minimal detectable savings rate given the variability in beneficiary PBPM costs?
- How did Medicare savings for the 36- or 24-month period compare with the fees that were paid out? How close was the KTBH program in meeting budget neutrality?
- How balanced were the intervention and comparison group samples prior to the demonstration's start date? How important were any differences to the estimate of savings?
- Did the intervention have a differential effect on high cost and high risk beneficiaries?
- What evidence exists for regression-to-the-mean (RtoM) in Medicare costs for beneficiaries in the intervention and comparison groups?

The cost analyses presented in this section differ from those that will be conducted for financial reconciliation by Actuarial Research Corporation (ARC) under contract to CMS. ARC will determine savings based on the demonstration's terms and conditions negotiated between CMS and KTBH. RTI's estimation of savings, detailed subsequently, differs in that

- differences in savings rates between intervention and comparison groups are first determined at the beneficiary level and are then tested using statistical confidence intervals,
- beneficiary PBPM costs are not trimmed using a 1% outlier dollar threshold, and

- both base year and demonstration period PBPM costs are weighted by each beneficiary's fraction of eligible days during the demonstration period.

A more detailed explanation and justification for these differences is provided in ***Section 7.3***.

The rest of this chapter has five sections. The next two sections describe our data sources, variable construction, and analytic methods. ***Section 7.4*** presents our primary findings on trends in PBPM costs between base and demonstration periods. ***Section 7.5*** shows PBPM savings in relation to average monthly fees and whether the KTBH program achieved budget neutrality using RTI's costing methods. ***Section 7.6*** stratifies PBPM costs and savings by high cost and high risk categories to test for possible imbalances in the intervention and comparison groups. ***Section 7.7*** examines regression-to-the-mean (RtoM) effects. ***Section 7.8*** uses multivariate regression to control for any imbalances between intervention and comparison samples that might affect t-tests of mean differences in PBPM growth rates. The chapter concludes in ***Section 7.9*** with a summary of key findings.

7.2 Data and Key Variables

7.2.1 Sample Frame and Data

The data used in RTI's analysis of PBPM costs are Medicare Parts A and B claims extracted for all eligible beneficiaries in the intervention and comparison groups. Eligibility in the original and refresh samples was based on the following criteria.

Original Sample:

- Medicare fee-for-service beneficiaries with a primary residence in designated counties of Nassau, Suffolk, and Queens, New York in calendar year, 2004
- With one of 27 renal ICD-9 codes, excluding patients in renal failure, cancer, or AIDS/HIV in the base year, 2004
- With calendar year 2004 total Medicare costs > $5,000,
- With an HCC risk score > 1.7.

Refresh Sample:

- Medicare fee-for-service beneficiaries with a primary residence in designated counties of Nassau, Suffolk, and Queens, New York between June 1, 2005 through May 31, 2006
- With one of 27 renal ICD-9 codes, excluding patients in renal failure, cancer, or AIDS/HIV in the base year, 2005-2006
- With additional exclusions of institutionalized patients between March and May 2006, identified with CPT-4 codes 99301-99303 (Comprehensive Nursing Facility Assessments), 99311-99313 (Subsequent Nursing Facility Care), 99321-

99333 (Domiciliary, Rest Home, or Custodial Care Services, or having any service in a SNF, Assisted Living, Nursing, or Custodial Facility, or in an ICF-Mentally Retarded Facility.

- With base year 2005-2006 total Medicare costs > $5,000,
- With an HCC risk score > 1.7.

Beneficiaries meeting the inclusion and exclusion criteria were randomized to the intervention (4,996) and control (2,000) groups at a rate of 2.5:1. The refresh population was also randomized at a 2.5:1 rate: intervention (2,385), control (956). The original sample focused on beneficiaries with high annual costs, and it would be quite likely to expect lower costs during the demonstration period based on regression-to-the-mean (RtoM). As RtoM should affect intervention and comparison groups equally, any bias from this factor should cancel out, on average, when benchmarking intervention performance against the comparison group. Offsetting the negative effect on costs of selecting high cost beneficiaries will be the severity level of their chronic disease. While higher and lower cost beneficiaries may converge between the base and intervention periods, convergence may occur around a secular increase in average costs.

Because of more than a year's gap between selection for and the start of the demonstration, a new base year of claims data were extracted for the intervention and comparison populations. Consequently, it is likely that some beneficiaries who originally qualified during the randomization process would no longer qualify for the demonstration during the base period just 1 year before the KTBH program's start date. They still remain in the intervention and comparison groups, however, for our analysis.

We restrict all analyses to beneficiaries who were alive at the start date of the demonstration. Claims costs are accumulated until a beneficiary dies or otherwise becomes ineligible (e.g., joins a managed care plan). Claims represent utilization anywhere in the United States, not just the target area of the KTBH program. Medicare costs are based on eligible claims submitted during the full demonstration period plus 12 months prior to the start date. A 9-month "run-out" period after the demonstration ended assures a complete set of costs.

7.2.2 Constructing PBPM costs

All financial analyses were conducted on a PBPM basis, or the ratio of eligible Medicare costs to eligible months. The baseline period is defined as 365 days (or 1 year) prior to the KTBH program's start date. The 36-month demonstration period for the original population includes 1,095 days (36 months × 30.42 days/month) after the start date. The refresh population covers 24 months, or 730 days.

Medicare program costs in the numerator of PBPM costs include

- only Medicare program Part A and B payments; patient obligations and Part C (managed care) and D (drugs) are excluded;

- only claims for utilization of beneficiaries when they are eligible for the demonstration[7]; and

- only claims for eligible services; end-stage renal disease [ESRD] and hospice services are excluded.

To statistically test hypotheses regarding *trends* in beneficiary costs, average PBPM costs first must be calculated at the beneficiary level. Constructing individual PBPM costs required dividing a beneficiary's total cost during eligible periods by his or her own fraction of eligible months during the base year and the demonstration period. Most beneficiaries had 12 months of base year eligibility and 36 or 24 months of demonstration period eligibility. However, some beneficiaries had fewer than the maximum number of eligible months (or days), usually due to death. At the extreme, a beneficiary could have a 10-day hospital admission at the beginning of the intervention period with a combined Part A and B payment of $30,000 before dying. This $30,000 outlay is divided by approximately 1/3 (10 days / 30.42 days), resulting in an adjusted PBPM outlay of $90,000. Consequently, (unweighted) PBPM costs exhibit substantial variation that, in turn, reduces the likelihood of finding statistical differences.

Table 7-1 shows unweighted mean intervention group PBPM costs in KTBH's original population (4,882 with eligible days in both the base and intervention period) stratified by beneficiaries' number of eligible days in the demonstration period (1,095 maximum). Those with 10 or fewer eligible days had overall PBPM costs averaging $11,262. Beneficiaries eligible for a year or more had average PBPM costs of $2,448. Beneficiaries with very truncated eligibility averaged monthly costs 6.7 times greater than those with much longer eligibility. Although beneficiaries with a month or less of eligibility were only about one-half of 1% of the entire intervention group, their PBPM costs add disproportionately both to the mean and variation in PBPM costs. (See ***Section 7.3.2*** for statistics on PBPM variation.) Maximum intervention period PBPM costs were $132,805.

Table 7-2 shows the unweighted cost effects of short term eligible beneficiaries ($2,326) in the refresh population. Again, short-eligibility beneficiaries were over 12 times as costly per month as those with more than 1 year's eligibility, although only 3 beneficiaries were eligible as few as 10 days or less. Maximum PBPM costs were $171,054.

Variation can be reduced by trimming high PBPM outliers at the 99th percentile, as done by CMS for financial reconciliation. While the 1% trim reduces the KTBH program's financial risk, we wanted to avoid biasing comparisons against interventions that constrained spending among the most expensive beneficiaries.

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[7] For example, if a beneficiary joined a managed care plan for a few months then returned to fee for service (FFS) Medicare, any claims for plan services were excluded.

Table 7-1
KTBH demonstration period PBPM mean costs by eligible days, intervention group, original population

Eligible days[1]	N (%)	PBPM	Range
< 10	26 (0.5%)	$11,262	$0–132,805
11–30	48 (1.0)	11,330	0–49,107
31–60	76 (1.6)	10,932	0–103,559
61–90	83 (1.7)	7,861	0–82,175
91–365	601 (12.3)	6,245	0–58,571
366+	4,048 (82.9)	2,448	0–28,554
Mean	4,882	3,274	0–132,805

NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key To Better Health; N (%) = number of beneficiaries (percent of all eligibles).

[1] Number of days beneficiary eligible for intervention.

SOURCE: Medicare 2004-2008 Part A & B claims; COSTRUN2-alt1(1/15/10).

Table 7-2
KTBH demonstration period PBPM mean costs by eligible days, intervention group, refresh population

Eligible days[1]	N (%)	PBPM	Range
< 10	3 (0.1%)	$27,813	$0–81,540
11–30	15 (0.6)	10,865	0–30,963
31–60	31 (1.3)	17,375	0–171,054
61–90	43 (1.8)	7,339	0–53,183
91–365	256 (17.7)	7,285	0–53,611
366+	1,978 (11.0)	2,308	0–19,729
Mean	2,326	3,237	0–171,054

NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key To Better Health; N (%) = number of beneficiaries (percent of all eligibles).

[1] Number of days beneficiary eligible for intervention.

SOURCE: Medicare 2004-2008 Part A & B claims; COSTRUN2-alt1(1/15/10).

Instead of trimming or deleting outliers, RTI weighted PBPM mean costs and standard errors by each beneficiary's eligible fraction of days, or exposure to the intervention. In the previous example, the beneficiary's adjusted $90,000 PBPM cost is weighted by 10/1,095 = 0.009 in the original population, or roughly 110-times less than beneficiaries with full eligibility through the entire demonstration period. This weighting method is equivalent to simply adding the beneficiary's $30,000 and 10 eligible days to total costs and days of fully eligible beneficiaries and then calculating the combined PBPM cost.

7.2.3 Monthly Fees

Demonstration Care Management Organizations (CMOs) proposed monthly fees when submitting their applications for the demonstration program to the CMS Office of Demonstrations. CMS then negotiated final fees as part of each CMO's agreed-upon contract terms and conditions. RTI benchmarked savings against each CMO's initially negotiated fee. For the KTBH program, its negotiated management fee was $100 for the original intervention group during the first 6-month outreach period and $225 per beneficiary month thereafter. The KTBH program was paid $225 per beneficiary-month for refresh intervention beneficiaries from the effective date of the cohort. To be consistent with the calculation of gross savings, these two fees were weighted by the share of fee-bearing to all eligible months in the intervention group.

7.3 Analytic Methods

RTI's analytic approach is based on a *comparison of growth rates in PBPM costs at the individual beneficiary level*. This approach has two principal strengths:

- First, it controls in a more precise, beneficiary-specific manner for any differences in PBPM costs between the base year and the demonstration period that are not accounted for through the selection process.

- Second, by calculating changes in PBPM costs at the beneficiary level (i.e., "paired" base-demonstration period PBPM costs), we can conduct statistical *t*-tests of the differences in spending growth rates between intervention and comparison groups.

In addition to answering the question of whether any or all of the CMHCB demonstration programs achieved budget neutrality (or even any savings), we also are interested in *generalizing* results to future care management activities by answering the question, "What savings are likely to be realized if the demonstration is expanded?" This question necessarily requires testing the hypothesis that any savings in a sample of beneficiaries during a particular time period could have been caused by chance with no long-run implications. RTI conducted a range of analyses to answer the key financial questions.

7.3.1 Tests of Gross Savings

Gross savings to Medicare is defined as the difference between the claims costs of the intervention and comparison groups. There are two ways to calculate these differences. Assuming that the selection process balanced the intervention and comparison populations, PBPM cost differences between the two groups can be based solely on the demonstration period.

That is, the KTBH program was neither advantaged nor disadvantaged by the costliness of their sample relative to their comparison group. However, more than 1 year passed between the time the beneficiaries were assigned to the intervention and comparison groups and when the KTBH program began recruiting beneficiaries to the intervention. Also, because we wanted to conduct statistical tests of intervention effects, it was necessary to construct PBPM cost estimates at the beneficiary level and then use variation in the observations to produce confidence intervals around the estimates.

Recognizing that base year costs may be different between intervention and comparison populations, we used a mixed paired sample approach. First, we used each beneficiary's own mean PBPM costs in the base year just prior to the KTBH program's start date and the intervention period to construct a change in costs. This was done for all beneficiaries in both the intervention and comparison groups, thereby producing a paired comparison within group. Next, we determined the mean difference in the differences in PBPM cost growth rates for each group, treating the mean differences as independent samples.[8] The strength of first calculating the change in PBPM costs at the beneficiary level is that it completely controls for any unique clinical and socioeconomic characteristics that might differ between the intervention and comparison groups. Any imbalances in beneficiary characteristics that might produce inter-temporal differences in medical utilization or costs are factored out using first-differencing. Our gross savings rate, in equation form, is

$$\text{Gross Savings} = \text{Diff}[I] - \text{Diff}[C] = [I_t^* - I_b^*] - [C_t^* - C_b^*] = \Delta I^* - \Delta C^* \qquad (7.1a)$$

$$\text{Gross Savings} = [I_t^* - C_t^*] - [I_b^* - C_b^*], \qquad (7.1b)$$

where * = the mean difference in PBPM costs within all intervention (I) or comparison (C) beneficiaries, t and b = demonstration and base periods, and Δ = the change in PBPM costs between the base and demonstration periods. Savings, as the difference-in-(paired) differences, is equivalent to adjusting the difference in intervention and comparison means during the demonstration by the mean difference that existed in the base year (eq. 7.1b).

In calculating mean changes in PBPM costs across beneficiaries, each beneficiary's *change* needs to be weighted to produce an unbiased estimate of the overall mean change. We used the beneficiary's fraction of eligible days during the demonstration period as weights. This effectively weights each beneficiary's base period PBPM costs by their proportion of days during the demonstration period. Consequently, early demonstration dropouts (usually due to death) will have their base period PBPM costs underweighted relative to their actual contribution when displaying base period mean costs for intervention or comparison groups. As early demonstration dropouts tend to be more costly in the base period, our mean base year costs will appear lower than actuarial means based on their proportion of days during the base period. It did not seem reasonable to give beneficiaries with only a few days involvement in the actual demonstration full credit in calculating mean base year costs even if they had 12 months of base year Medicare eligibility.

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8 For a more detailed description of this approach, see Rosner (2006, chapter 8).

7.3.2 Detectable Savings

In all of the analyses in this chapter, we test the hypothesis of whether gross savings is statistically different from zero, or no savings. Gross savings must be sufficiently greater than zero to assure the government that the measured savings rate was not due to chance.[9] A critical evaluation question is the power we had to detect relatively small savings rates. By "detectable" we mean the rate of savings that would force us to reject the null hypothesis of no savings at all. Having completed the demonstration, we now have the information on both the level and variation in savings rates that allows us to calculate the detectable savings threshold for the KTBH program.

The fundamental test statistic is the Z-ratio of gross savings (see eq. 7.1a) to its standard error (SE)

$$Z = [\Delta I - \Delta C]/SE_{[\Delta I - \Delta C]} \qquad (7.2)$$

$$SE_{[\Delta I - \Delta C]} = [SE_{\Delta I}{}^2 + SE_{\Delta C}{}^2]^{0.5}. \qquad (7.3)$$

A two-sided test[10] of intervention savings uses the following confidence interval:

$$-1.96\ SE_{[\Delta I - \Delta C]} <= \text{Savings} <= 1.96\ SE_{[\Delta I - \Delta C]}, \qquad (7.4)$$

and the detectable threshold is

$$\text{Detectable Threshold (DT)} = -1.96\ SE_{[\Delta I - \Delta C]}. \qquad (7.5)$$

Intervention savings must equal or exceed -1.96 times the standard error of the difference in the growth in intervention and comparison PBPM costs. (Savings are expressed in negative terms if intervention PBPM cost growth is less than the comparison group cost growth.) The detectable threshold (DT) is approximately double the standard error of the difference in mean growth rates, which in turn varies with the square root of the intervention and comparison group sample sizes. It is also convenient for some analyses to express the DT as a percent of the comparison group's demonstration mean PBPM cost, or $DT/PBPM_c$.

Table 7-3 and ***7-4*** show the variation that exists in the (unweighted) PBPM costs in the base year prior to the start date and the demonstration period for the KTBH program's

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9 Chance savings can occur primarily because of random fluctuations in the utilization of health services required in the intervention and comparison groups. It is possible that random declines in health in the intervention group unrelated to the intervention could explain lower savings rates.

10 A reasonable argument can be made that the detectable threshold should be based on a one-sided *t*-test if one assumes that any chronic care management intervention would not be expected to *increase* Medicare outlays. If an intervention is likely only to reduce costs, a one-sided test effectively puts all 5% of the possible error on the negative side, resulting in a detectable threshold only -1.68 times the standard error.

intervention and comparison, original and refresh samples. Mean PBPM costs in the base period ranged from a low of $0 to a high of $21,441 in the comparison group. The coefficient of variation (CV), or the standard deviation of beneficiary-level PBPM costs divided by the mean, is fairly large in the base year (standard deviations roughly 25% greater than mean costs). CVs in the original and refresh samples increased slightly in the comparison group during the demonstration period while they increased substantially in the intervention group, implying growing variation in monthly costs across intervention beneficiaries. Some of the variation is reduced after weighting observations when determining intervention savings later in this chapter.

Table 7-3
KTBH CMHCB demonstration program PBPM cost distribution thresholds, comparison and intervention group, base, and demonstration period, original population

	Base year		Demonstration Period	
Quantiles[1]	Comparison	Intervention	Comparison	Intervention
(N)	(1,951)	(4,882)	(1,951)	(4,882)
Minimum	$0	$0	$0	$0
<10%	174	179	320	285
<25%	407	404	711	689
Median	983	1,002	1,785	1,740
>25%	2,483	2,573	4,143	3,798
>10%	4,902	4,950	7,885	7,444
Maximum	21,441	36,793	71,168	132,805
Mean	1,892	1,928	3,277	3,274
CV	1.24	1.29	1.38	1.64

NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key to Better Health; N = number of beneficiaries; CV = coefficient of variation.

[1] <10%, <25%, >25%, >10%: PBPMs below or above percentage.

SOURCE: Medicare 2004-2008 Part A & B claims; COSTRUN2-alt1(1/15/10).

Table 7-4
KTBH CMHCB demonstration program cost distribution thresholds, comparison and intervention group, base and demonstration period, refresh population

	Base year		Demonstration Period	
Quantiles[1]	Comparison	Intervention	Comparison	Intervention
(N)	(941)	(2,326)	(941)	(2,326)
Minimum	$0	$0	$0	$0
<10%	0	0	291	254
<25%	352	317	640	614
Median	1,011	1,087	1,493	1,627
>25%	2,764	2,828	3,899	3,767
>10%	5,183	5,478	7,624	7,351
Maximum	24,528	25,231	96,076	171,054
Mean	2,039	2,123	3,163	3,237
CV	1.37	1.33	1.63	1.94

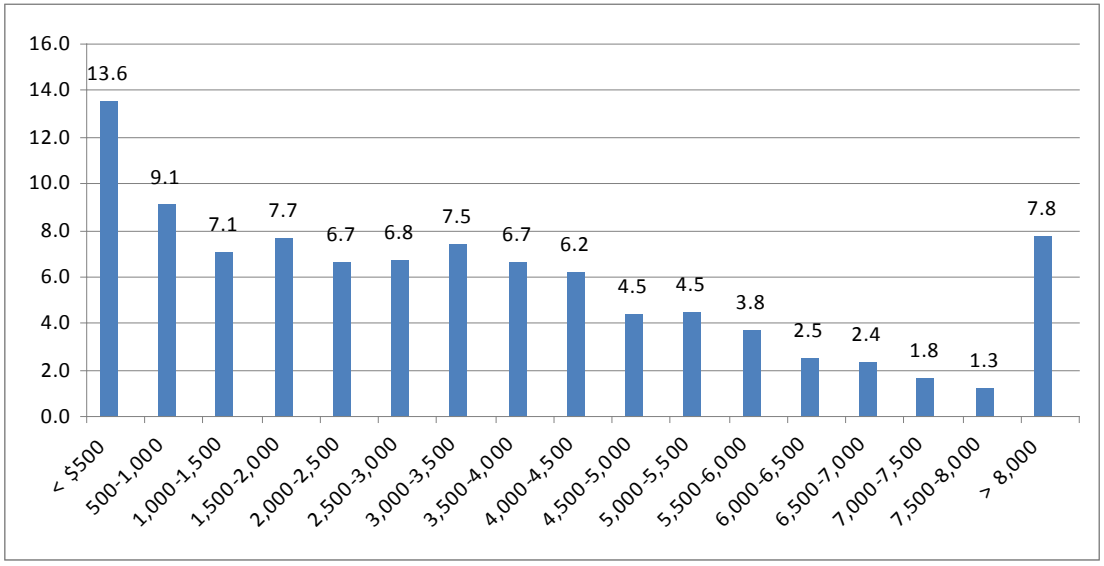
NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key to Better Health; N = number of beneficiaries; CV = coefficient of variation.

[1] <10%, <25%, >25%, >10%: PBPMs below or above percentage.

SOURCE: Medicare 200x-200Y Part A & B claims; COSTRUN2-alt1(1/15/10).

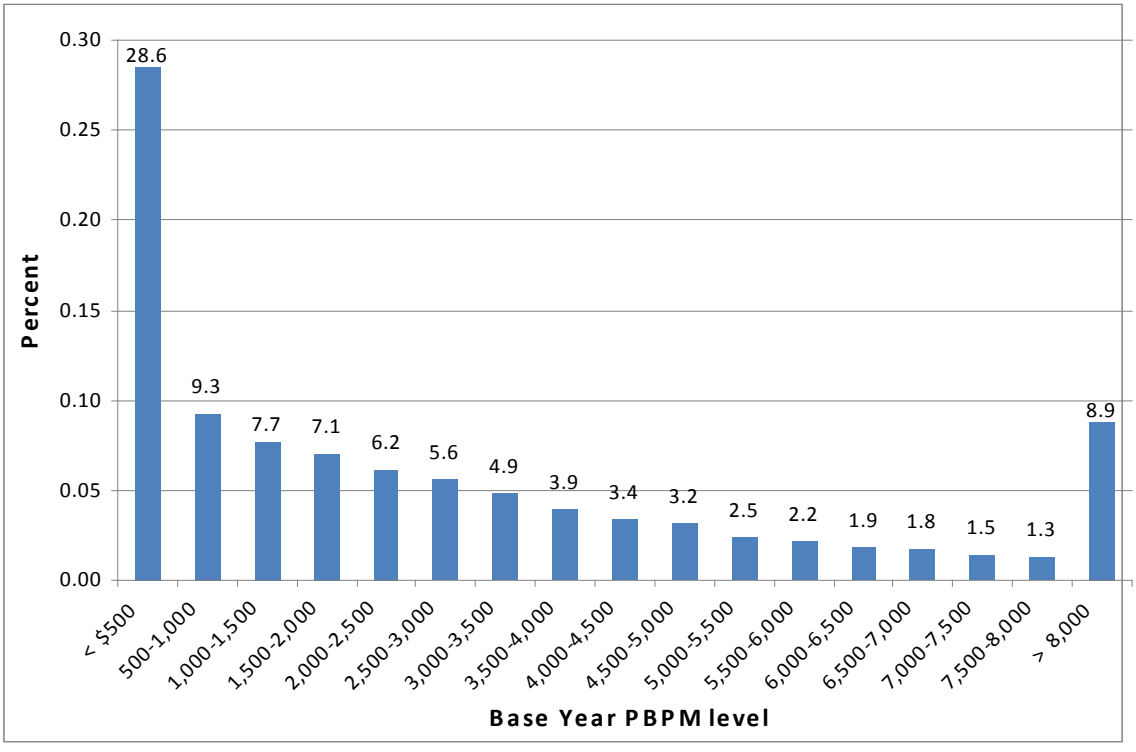
The difference between median and mean PBPM costs indicates how skewed costs actually are. Mean costs are roughly double median costs in the original sample's base year with little change during the intervention period, indicating a strong right tail of very high costs. Costs were similarly skewed in the refresh group (***Table 7-4***). Note that 25% of refresh beneficiaries had base year costs less than $350. These initially low-cost beneficiaries experienced large increases in costs during the demonstration, as shown by the near doubling of the <25% threshold. Maximum values show how high PBPM costs can be before weighting, $130,000-170,000 per month. As shown earlier in ***Table 7-1***, these costs are often incurred by beneficiaries with very short eligibility who died very early in the demonstration period. Weighting these short-eligible, very high cost beneficiaries reduces overall variance and produces lower detectable thresholds.

Figure 7-1
Frequency distribution of PBPM costs, comparison group, original sample, base year: KTBH



NOTES: PBPM = per beneficiary per month; KTBH = Key to Better Health.

Figure 7-2
Frequency distribution of PBPM costs, comparison group, refresh sample, base year: KTBH



NOTES: PBPM = per beneficiary per month; KTBH = Key to Better Health.

Because of the relatively large variances in the base year PBPM costs (CV[comparison] = 1.25), coupled with adjustments for the repeated nature of the experimental design, the power afforded by the sample sizes was modest, i.e., about 40% at best.[11]

7.3.3 Budget Neutrality

Each CMO is obligated to produce net savings for the Medicare program. The net savings requirements for those CMOs that complete a 36-month demonstration period are 5% for the original cohort and 2.5% for the refresh cohort. Thus, to avoid paying back any fees fees with a 5% net savings requirement.

$$PBPM_I <= 0.95PBPM_c - MF \qquad (7.6a)$$

or as a fraction of the comparison PBPM cost,

$$PBPM_I/PBPM_c <= 0.95 - (MF/PBPM_c), \qquad (7.6b)$$

where $PBPM_I$, $PBPM_C$ = average monthly costs in the intervention and comparison groups, MF = the average monthly fee.

For example, if a CMO's monthly fee were 5% of the comparison PBPM cost, then intervention PBPM costs would have to be 90% or less of monthly comparison costs to avoid paying back fees. Debt obligation per intervention beneficiary month is the positive difference:

$$PBPM_I - [0.95PBPM_c + MF].$$

RTI's conclusion regarding budget neutrality will differ from those of the CMS during financial reconciliation, given the way we adjust for unequal base period costs, how fees are calculated, the lack of an outlier trim, and a few other minor differences. Because we use statistical confidence intervals to judge the extent of gross savings, we test whether a CMO achieved any savings at all: the z-test against zero savings.

In addition to Z-tests of mean cost differences between the entire intervention group and the comparison group, we also tested for differences in PBPM cost growth rates between intervention beneficiary participants and nonparticipants relative to the comparison group. If the intervention had more success with those beneficiaries it actually engaged, then savings should be greater for participants than nonparticipants.

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[11] Power for a comparison of two mean changes in PBPMs is given by $\Phi[-1.96 + (\sqrt{n}\Delta/(\sigma_d\sqrt{2})]$ (Rosner, 2006, p. 336).

$\sigma_d = [\sigma_1^2 + \sigma_2^2 - 2\rho\sigma_1\sigma_2]^{0.5}$, where subscript 1 and 2 pertain to variances in study and control PBPMs, and ρ = correlation between observations between the base and intervention periods. The study and control standard deviations in the base period were 2,215 and 2,129, respectively. Assuming a .33 intra-patient correlation, σ_d = 2,515. If there were no increase in the comparison group's PBPM over time, then Δ = .05($1,716) = $86 (see Table 7-5). The treatment n = 4,882. Thus, power = $\Phi[-1.96 + (\$86 \bullet 70/3{,}546 = 1.7) = -.26] = 1 - \Phi[.26] = .40$. With the KTBH intervention sample, we had 40% likelihood of accepting a significant difference if the true mean change in the intervention PBPM was $86 less than the change in the comparison PBPM. This is likely an overestimate of the power because the comparison sample was only 1,951.

7.3.4 Adjusting for Unbalanced Intervention and Comparison Groups

Two approaches were used to test the effects of imbalances between the intervention and comparison groups in base year characteristics. First, we produced frequency distributions of key beneficiary characteristics between the two groups. Second, we used multivariate regressions to quantify the effects of any imbalances on trends in PBPM costs. We pooled base and demonstration period observations and regressed each beneficiary's own demonstration period PBPM cost on group status (I = intervention; C = comparison); each beneficiary's own base period $PBPM_{pb}$ cost; the beneficiary's high cost or high risk group eligibility status in the base year, $Risk_{pr}$; and a vector of base period beneficiary characteristics (φChar):

$$PBPM_{pt} = \alpha + \beta Status_p + \gamma PBPM_{pb} + \Sigma_r \rho_r Risk_{pr} + \Sigma_k \delta_k \varphi Char_{pk} + \varepsilon_{pt}. \qquad (7.7)$$

The intercept, α, is the comparison group's average PBPM cost in the base year, while γ = each beneficiary's dollar increase in PBPM costs over 14 months (i.e., the sixth month of the base year to the eighth mid-period month of the demonstration). γ provides a test of RtoM effects (see ***Appendix 7-1***). The smaller is γ, the greater is RtoM. The *t*-value for β tests the differences in intervention and comparison demonstration cost growth, while ρ_r tests for the difference in the growth rates for the "*r*" cost-risk groups. By including each beneficiary's age, gender, race, urban/rural residence, disabled status, Medicaid eligibility, and institutional status at the start of the demonstration, we purge the status and other coefficients of any systematic differences between the intervention and comparison groups that remained at the start of the demonstration. Inclusion of these variables also narrows the confidence intervals around the other coefficients, thereby reducing detectable thresholds that give more precise estimates of mean intervention effects (Greene, 2003, chapter 6).

7.4 PBPM Cost Levels and Trends

7.4.1 Original Sample

Table 7-5 displays PBPM cost levels and rates of growth in average PBPM costs between the 12-month base year and the 36-month demonstration period for the original sample. Results are shown for the entire intervention group and for participating and nonparticipating beneficiaries, separately. PBPM costs in both periods have been weighted by the fraction of days beneficiaries were eligible in the demonstration period so as not to overweight beneficiaries who were exposed to the intervention for shorter periods. Only beneficiaries with at least 1 day of demonstration eligibility in both periods were included.

Overall. The weighted base year average PBPM cost was $16 more (*p* = insig) in the intervention group versus the comparison group ($1,731 versus $1,716), or 0.9%. The intervention-comparison difference in PBPM Medicare costs reversed to -$96 (*p* = insig) in the demonstration period ($2,410 versus $2,505). Between the base year and the end of the 36-month demonstration period, the average comparison group PBPM cost increased significantly by $790 ($p < .01$), while the intervention group's PBPM average Medicare costs rose more slowly by $678 ($p < .01$). Consequently, the intervention group's PBPM cost rose $111 more slowly (*p* = insig) than the comparison group's PBPM cost. Intervention beneficiaries, who were 0.9% more costly on a weighted basis at baseline, became 3.8% less costly, on average, than the comparison group after 36 months.

Table 7-5
PBPM cost growth rates between base year and demonstration period, intervention and comparison groups, original population: KTBH

Study group	Beneficiaries	Base year PBPM Mean[1]	Base year PBPM Standard error	Demonstration PBPM Mean[1]	Demonstration PBPM Standard error	Differences in means	Standard error
Intervention	4,882	$1,731	31.7	$2,410	42.0	$678**	44.8
Participants	2,284	1,715	44.6	2,461	59.4	747**	63.1
Nonparticipants	2,598	1,749	45.1	2,354	59.6	605**	63.9
Comparison	1,951	1,716	48.2	2,505	66.7	790**	69.2
Differences							
I – C	—	16	58.5	-96	78.6	-111	83.2
Participants – C	—	-1	66.0	-44	89.4	-43	94.6
Nonparticipants – C	—	34	66.1	-151	89.2	-185*	93.7
Participants – Nonparticipants	—	-35	63.4	107	84.1	142	89.7

NOTE: CMHCB = Care Management for High Cost Beneficiaries; PBPM = per beneficiary per month; KTBH = Key to Better Health; I = intervention; C = comparison.

[1] Means weighted by beneficiary fraction of eligible days in demonstration period.

*p < .05; **p < .01.

SOURCE: Medicare 2004-2008 Part A&B claims; run costrun1-bbaker(1/19/10).

Participation Status. The participation rate, based on beneficiaries used in this cost analysis, was 53% (2,284/4,882 - 1). Participants in the KTBH intervention and comparison groups were equally costly in the base period. Non-participants were $34 more costly (p = insig). Participants became $43 less costly (p = insig) than comparison beneficiaries. Non-participants became $185 less costly (p<.05) during the demonstration period. Thus, the $111 slower growth in intervention PBPM costs appears to be due to slower growth in the randomized portion of the intervention group not directly impacted by the intervention.

7.4.2 Refresh Sample

Table 7-6 displays PBPM cost levels and rates of growth in average PBPM costs between the 12-month base year and the end of the 24-month demonstration period for the refresh sample. The weighted base year average PBPM cost was $126 more ($p$ = insig) in the intervention versus comparison group ($1,960 versus $1,834), or 7%. The intervention-comparison gap in PBPM Medicare costs reversed in the demonstration period ($2,437 versus $2,454). The average comparison group PBPM increased $620 (p<.01) while the intervention group's PBPM average Medicare costs increased $478 (p<.01). As a result, the intervention group's PBPM cost increased $142 slower ($p$ = insig) compared with the comparison group's PBPM cost. Intervention beneficiaries, who were 7% more costly at baseline, were essentially equally as costly the comparison group, on average, after 24 months.

The participation rate, based on beneficiaries used in the refresh cost analysis, was 45% (1,037/2,326 – 1). Participants in the base period in the KTBH intervention group were $352 more costly (p<.01) than comparison group beneficiaries and nonparticipants were $70 less costly (p=insig). Participants became $524 more costly (p<.01). Non-participants also became $437 more costly (p<.01) during the demonstration period. Consequently, the participant group's PBPM cost rose $95 more slowly (p=insig) than the comparison group's while the non-participant group's PBPM cost rose $183 more slowly (p=insig) than the comparison group's PBPM cost.

Table 7-6
PBPM cost growth rates between base year and demonstration period, intervention and comparison groups, refresh population: KTBH

		Base year PBPM		Demonstration PBPM			
Study group	Beneficiaries	Mean[1]	Standard error	Mean[1]	Standard error	Differences in means	Standard error
Intervention	2,326	$1,960	54.6	$2,437	66.8	478**	75.2
Participants	1,037	2,185	82.0	2,710	108.1	524**	118.1
Nonparticipants	1,289	1,764	72.8	2,201	82.4	437**	95.5
Comparison	941	1,834	77.9	2,454	103.4	620**	114.3
Differences							
I – C	—	126	99.1	-16	123.8	-142.1	138.7
Participants - C	—	352**	113.9	256	150.6	-95	165.3
Nonparticipants – C	—	-70	107.7	-252*	130.6	-183	148.9
Participants - Nonparticipants	—	421**	109.1	509**	133.5	87	150.7

NOTE: PBPM = per beneficiary per month; KTBH = Key to Better Health; I = intervention; C = comparison.

[1] Means weighted by beneficiary fraction of eligible days in demonstration period.

*p < .05; **p < .01.

SOURCE: Medicare 2004-2008 Part A&B claims; run costrun1-bbaker(1/19/10).

7.5 Savings and Budget Neutrality

7.5.1 Original Sample

Table 7-7 presents summary statistics on savings from the KTBH's original intervention sample. It also includes the minimum level of savings necessary to achieve statistical significance, expressed in negative terms, and as a percentage of the comparison group's PBPM cost. The KTBH program's monthly fee is reported also as a percentage of the comparison group's PBPM cost.

Over the course of the 36-month intervention, average monthly costs increased $678 in the intervention group and $790 in the comparison group. The result was a $111 relative decrease in PBPM cost growth in the intervention group. This negative difference implies

savings at a rate of 4.4% of the comparison group's demonstration period PBPM cost. However, savings were statistically insignificant.

With roughly 4,900 beneficiaries in the intervention group and only 2,000 in the comparison group, the minimal detectable savings threshold was $163 at the 95% confidence level. This rate is 6.5% of the comparison group's PBPM cost, implying that the intervention would have had to achieve this level of savings to be considered statistically reliable in repeated patient samples.[12]

The KTBH program's average monthly fee was $90, which amounted to 3.6% of the comparison group's PBPM during the demonstration period. Thus, the KTBH program would have had to achieve 8.6% (3.6% + 5%) savings in order to retain all of its fees—at least according to RTI's calculations, which are not official under financial reconciliation. An actuarial analysis that ignores statistical significance would show KTBH intervention savings of $111, and a Medicare return on investment of 1.23. Because we cannot say with confidence that the savings are not zero, it is possible that the intervention's RoI is zero.

7.5.2 Refresh Sample

Table 7-8 presents summary statistics on savings from the KTBH intervention with the refresh sample. Over the course of the 24-month intervention, average monthly costs increased $478 in the intervention group and $620 in the comparison group. The result was a $142 smaller relative increase in PBPM cost growth in the intervention group. This negative difference implies *savings* at a rate of 5.8% of the comparison group's PBPM cost.

With roughly 1,000 beneficiaries in each study group, the minimal detectable savings threshold was $224 at the 95% confidence level. This rate is 9.1% of the comparison group's PBPM cost, implying that the intervention would have had to achieve this level of savings to be considered statistically reliable in repeated patient samples. Ignoring the fact that the $142 in intervention savings was not statistically different from zero, the net fee to Medicare was reduced from $71 per beneficiary per month to -$71, resulting in a net cost of -2.9% to Medicare of the comparison group's average monthly outlay on claims. Based on actuarial methods, Medicare's return on investment was 2.0, implying savings (albeit statistically insignificant) double that average monthly fee on all intervention beneficiaries. However, the refresh RoI could also be zero in a future intervention.

[12] If minimal savings were based just on differences in PBPM costs during the demonstration period, the intervention would have to achieve a 6.1% savings rate based on RTI's weighting methodology.

Table 7-7
Average PBPM gross savings, fees, and budget neutrality status, original population: KTBH

	PBPM cost change
Intervention group	$678
Comparison group	790
Difference	-$111
Gross (dis)saving %[1]	-4.4%
Minimal Detectable Savings[2]	
Absolute	-$163
% of comparison PBPM[3]	-6.5%
Monthly Fee	
Absolute[4]	$90
% of comparison PBPM[3]	3.6%
Net Fee	
Absolute[5]	-$21
% of comparison PBPM[3]	-0.8%
Return on Investment (RoI)[6]	1.23

NOTES: PBPM = per beneficiary per month; KTBH = Key to Better Health.

[1] Gross (Dis)Savings % = Difference in PBPM outlay changes as % of comparison PBPM (= $2,505). Negative values imply true savings.

[2] Minimum Detectable Savings = 1.96*standard error of difference in mean PBPM changes.

[3] % Comparison PBPM = Absolute variable as % of comparison PBPM ($2,505) in demonstration period.

[4] Absolute Monthly Fee = $100 outreach and $225 post-outreach fees weighted by monthly ratio of fee-bearing to total intervention eligible months throughout demonstration.

[5] Absolute Net Fee = Monthly fee + Difference in PBPM outlay change.

[6] RoI = gross savings difference/Absolute Monthly Fee.

SOURCE: Medicare 2004-2008 Part A&B claims; PBPM cost changes and detectable savings: Table 7-5; monthly fees: ARC, Final Reconciliation for Village Health Phase I, October 23, 2009, Table 3.

Table 7-8
Average PBPM gross savings, fees, and budget neutrality status, refresh population: KTBH

	PBPM cost change
Intervention group	$478
Comparison group	$620
Difference	-$142
Gross (dis)saving %[1]	-5.8%
Minimal Detectable Savings[2]	
Absolute	-$224
% of comparison PBPM[3]	-9.1%
Monthly Fee	
Absolute[4]	$71
% of comparison PBPM[3]	2.9%
Net Fee	
Absolute[5]	-$71
% of comparison PBPM[3]	-2.9%
Return on Investment (RoI)[6]	2.0

NOTES: PBPM = per beneficiary per month; KTBH = Key to Better Health.

[1] Gross (Dis)Savings % = Difference in PBPM outlay changes as % of comparison PBPM (= $2,454). Negative values imply true savings.

[2] Minimum Detectable Savings = 1.96*standard error of difference in mean PBPM changes.

[3] % Comparison PBPM = Absolute variable as % of comparison PBPM ($2,454) in demonstration period.

[4] Absolute Monthly Fee = $225 fee weighted by ratio of total fee-bearing eligible months to all intervention eligible months.

[5] Absolute Net Fee = Monthly fee + Difference in PBPM outlay change.

[6] RoI = gross savings difference/Absolute Monthly Fee.

SOURCE: Medicare 2004-2008 Part A&B claims; PBPM cost changes and detectable savings: Table 7-5; monthly fees: ARC, Final Reconciliation for Village Health Phase I, October 23, 2009, Table 3.

7.6 Imbalances between Intervention and Comparison Samples

Initial random sampling should have balanced the intervention and comparison groups. Yet, it is still possible that small, but possibly important, imbalances remained simply by chance. It is possible that high cost and high risk beneficiaries exhibit opposing regression-to-the-mean (RtoM) cost trends between the base and demonstration periods. High cost beneficiaries should have declining costs, while high risk but lower cost beneficiaries might have increasing costs. If the distribution of high cost and high risk beneficiaries differs between KTBH's intervention group and its comparison group, then demonstration period PBPM cost comparisons could be biased against the intervention, if it had a disproportionate number of high risk, more cost-increasing, beneficiaries. We created four, mutually exclusive, high-low cost-risk groups. The high-cost threshold was set at $30,000/month, or the top 25% of cases in either sample based on their costs the year prior to randomization. The 25% high-risk threshold was set at 1.73 (original sample) and 1.81 (refresh sample).

For differences in other beneficiary characteristics to have any effect on intervention savings, two things must happen. First, one or more characteristics must have a statistically important effect on PBPM cost growth rates. Second, unless the same important characteristics also significantly differ, numerically, between the intervention and comparison groups, they will not affect the intervention savings rates. Because most characteristics are simple binary (0, 1) indicators, there must be substantial numbers of "costly" beneficiaries involved and not just a large differences in relative frequencies. Because beneficiaries were randomly assigned to the intervention and comparison groups, differences in cost-risk and patient characteristics across the two groups should be minimal even with some attrition. Nevertheless, we test for the cost impacts of any imbalances as shown below.

7.6.1 Frequencies of Beneficiary Characteristics

Table 7-9 and ***7-10*** show that the intervention and comparison groups were nearly identically distributed by cost and risk during the randomization period. No material differences are found in patient characteristics between the intervention and comparison groups. These similarities would indicate that the lack of intervention savings cannot be explained by intervention-comparison group differences in cost and risk group status.

Because of the roughly one year lag between randomization of the original population into intervention and comparison groups and the official base year, only about 6% qualified as high cost alone in the base year versus 25% that met the criterion in the year before when randomization took place.

Table 7-9
Frequency distribution of beneficiary characteristics, intervention and comparison groups, base year, original population: KTBH

	Intervention (%)	Comparison (%)
COST-RISK Group		
High cost > =$ 30,000	6.1%	6.7%
Both	16.5	14.9
High risk: HCC > 1.73	12.3	13.3
Neither	65.2	65.1
Age Group		
<65	12.9	13.0
65-69	11.4	11.0
70-74	18.7	20.1
75-79	23.5	22.0
80-84	16.9	18.6
85+	16.7	15.2
Gender		
Female	52.7	51.8
Male	47.3	48.2
Race		
Minority	19.1	19.2
White	80.9	80.8
MEDICAID Eligible		
No	95.2	95.7
Yes	4.8	4.3
DISABLED		
No	87.1	87.1
Yes	12.9	12.9
Urban residence		
No	0.0	0.0
Yes	100.0	100.0
Long-term care		
No	100.0	100.0
Yes	0.0	0.0
SNF		
No	87.9	87.4
Yes	12.1	12.6

NOTE: Beneficiaries weighted by fraction of eligible days in demonstration period.
KTBH = Key to Better Health; HCC = Hierarchical Condition Category; SNF = skilled nursing facility.

SOURCE: Medicare 2004-2008 Part A & B claims; Cost4b1-bbaker(1/19/10).

Table 7-10
Frequency distribution of beneficiary characteristics, intervention and comparison groups, base year, refresh population: KTBH

	Intervention (%)	Comparison (%)
COST-RISK Group		
High cost > =$ 30,000	6.9%	7.8%
Both	19.3	17.7
High risk: HCC > 1.81	12.1	10.7
Neither	61.9	63.8
Age Group		
<65	11.1	10.8
65-69	12.2	13.0
70-74	18.6	18.1
75-79	21.9	23.8
80-84	17.6	18.2
85+	18.5	16.3
Gender		
Female	50.2	49.6
Male	49.8	50.4
Race		
Minority	19.0	18.2
White	81.0	81.8
MEDICAID Eligible		
No	95.9	95.1
Yes	4.1	4.9
DISABLED		
No	88.9	89.2
Yes	11.1	10.8
Urban residence		
No	0.0	0.0
Yes	100.0	100.0
Long-term care		
No	100.0	100.0
Yes	0.0	0.0
SNF		
No	89.5	89.3
Yes	10.5	10.7

NOTE: Beneficiaries weighted by fraction of eligible days in demonstration period.
KTBH = Key to Better Health; HCC = Hierarchical Condition Category; SNF = skilled nursing facility.

SOURCE: Medicare 2004-2008 Part A & B claims; Cost4b1-bbaker(1/19/10).

7.6.2 PBPM Cost Levels and Trends by Cost and Risk Group

7.6.2.1 Original Sample

Table 7-11 displays PBPM costs stratified by cost and risk group. Extreme cost differences are found between the high cost and high risk groups in the base year. High risk only intervention beneficiaries averaged PBPM costs of just $1,420 in the base year compared with $3,752 for high cost only beneficiaries (2.6 times greater) and both high cost and high risk beneficiaries ($5,343; 3.8 times greater). Both high cost groups experienced large declines in their PBPM costs while the high risk–only group's PBPM cost more than doubled. The comparison group showed almost identical patterns of cost levels and trends. Costs in the "Neither high-cost-high risk" group saw costs rise faster than in the other three groups with higher base year costs, which is suggestive of strong RtoM effects in the "Neither" group.

Focusing on the difference in trends at the bottom of ***Table 7-11***, we find no statistically significant differences between the original intervention and comparison group growth rates in 3 of the 4 cost-risk groups, although all 3 suggest lower costs within the intervention group. Among the 6% of intervention beneficiaries who were only high cost in the base period, their costs fell more slowly than in the comparison group ($p<.05$).

7.6.2.2 Refresh Sample

Table 7-12 presents similar results on PBPM cost trends by the four cost-risk groups for the refresh sample. None of the difference-in-differences in growth rates are statistically significant across the four groups. The large standard errors for the refresh sample are noteworthy. We had little power to detect savings rates even as large as a few hundred dollars per month given the small sample sizes and high cost variance from year to year.

7.7 Regression-to-the-Mean

Tables 7-13 and ***7-14*** demonstrate the extensive RtoM occurring in this high cost population. Changes in comparison group PBPM costs are stratified by base period cost group from low to high in $500 increments. Using comparison group data avoids any effects the intervention might have on the underlying RtoM phenomenon. Unweighted mean costs were $1,892 in the comparison group's base period in the original sample (***Table 7-13***), with an overall increase of $1,385. Cost increases are inversely correlated with a beneficiary's base period PBPM costs. At the extremes, beneficiaries with less than $500 in base period PBPM costs saw their average costs increase by $1,727 while those with initial costs greater than $6,000 experienced average decreases of $1,615. Mean costs in both periods are well above median costs and indicate a strong skewness in PBPM costs.

Regression-to-the-mean is also quite strong in the refresh sample (***Table 7-14***). Mean costs increased $778 due mostly by much larger cost increases for beneficiaries with base year costs under $2,000 per month. This suggests that for the intervention to be successful, it would need to identify initially low cost beneficiaries most likely to experience major cost increases.

Table 7-11
PBPM costs by cost and risk group, intervention and comparison groups, base and demonstration periods, original population: KTBH

	High-cost and high-risk		High-cost only		High-risk only		Neither	
	PBPM	SE	PBPM	SE	PBPM	SE	PBPM	SE
Intervention (N)	(977; 20%)		(274: 6%)		(675: 14%)		(2,956; 61%)	
Base Year	$5,343	94.5	$3,752	75.1	$1,420	24.9	688	10.2
Demonstration	4,068	135.4	2,660	161.5	2,953	129.4	1,864	40.6
Difference	-1,275	152.9	-1,092	168.8	1,583	128.7	1,176	40.4
% Change	-24%	—	-29%	—	108%	—	171%	—
Comparison (N)	(350; 18%)	—	(130; 7%)	—	(270; 14%)	—	(1,201; 62%)	—
Base Year	5,441	143.6	3,859	110.9	1,406	38.2	706	17.9
Demonstration	4,614	219.0	2,157	191.8	3,147	185.1	1,929	68.8
Difference	-828	242.1	-1,703	213.5	1,742	184.0	1,223	68.2
% Change	-15%	—	-44%	—	124%	—	173%	—
Difference-in-Differences								
Difference-in-Differences	-447	292.6	611*	289.7	-$159	230.2	-47	77.0

NOTE: Beneficiary PBPM weighted by fraction of eligible days in demonstration period.
PBPM = per beneficiary per month; KTBH = Key to Better Health; SE = standard error;
N = number of beneficiaries; HCC = Hierarchical Condition Category.

High-Cost: Beneficiaries with annual healthcare spending greater than $30,000 in base period.

High-Risk: HCC > 1.73 in base period.

% Change: Difference/Base Year.

SOURCE: Medicare 2004-2008 Part A & B claims; Cost4b1-bbaker(1/19/10).

Table 7-12
PBPM costs by cost and risk group, intervention and comparison groups, base and demonstration periods, refresh population: KTBH

	High-cost and high-risk		High-cost only		High-risk only		Neither	
	PBPM	SE	PBPM	SE	PBPM	SE	PBPM	SE
Intervention (N)	(497; 21%)	—	(153: 7%)	—	(298: 13%)	—	(1,378; 59%)	—
Base Year	$5,860	151.3	$3,944	122.5	$1,542	33.8	617	16.9
Demonstration	3,895	213.8	2,583	221.8	2,668	195.9	1,931	64.7
Difference	-1,965	245.1	-1,405	370.8	1,125	195.8	1,314	66.4
% Change	-34%	—	-36%	—	73%	—	212%	—
Comparison (N)	(194; 21%)	—	(66; 7%)	—	(108; 11%)	—	(573; 61%)	—
Base Year	5,544	213.1	3,815	201.1	1,379	56.2	641	26.2
Demonstration	3,780	298.5	1,892	279.0	3,025	330.1	2,059	115.8
Difference	-1,764	316.4	-1,923	319.7	1,646	326.0	1,417	118.2
% Change	-32%	—	-50%	—	119%	—	221%	—
Difference-in-Differences								
Difference-in-Differences	-201	443.9	518	370.8	-521	380.8	-103	128.0

NOTE: Beneficiary PBPM weighted by fraction of eligible days in demonstration period.
PBPM = per beneficiary per month; KTBH = Key to Better Health; SE = standard error;
N = number of beneficiaries; HCC = Hierarchical Condition Category.

High-Cost: Beneficiaries with annual healthcare spending greater than $30,000 in base period.

High-Risk: HCC > 1.81 in base period.

% Change: Difference/Base Year.

SOURCE: Medicare 2004-2008 Part A & B claims; Cost4b1-bbaker(1/19/10).

Table 7-13
Regression to the Mean in comparison group PBPM costs, original population: KTBH

Base year PBPM level	N	Base year PBPM	Demonstration period PBPM	Change
< $500	592	$252	$1,979	$1,727
500-1,000	396	715	2,608	1,893
1,000-1,500	220	1,231	3,354	2,124
1,500-2,000	140	1,746	3,484	1,738
2,000-2,500	120	2,226	3,594	1,368
2,500-3,000	90	2,742	4,068	1,327
3,000-3,500	56	3,231	3,867	636
3,500-4,000	54	3,723	4,088	364
4,000-4,500	58	4,226	4,317	91
4,500-5,000	37	4,715	4,963	248
5,000-5,500	33	5,284	5,659	376
5,500-6,000	27	5,777	8,001	2,225
> 6,000	128	8,574	6,958	-1,615
Mean	1,951	1,892	3,277	1,385
Median	—	983	1,786	803

NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key to Better Health; N = number of beneficiaries.

SOURCE: Medicare 2004-2008 Part A & B claims; COSTRUN2-alt1(1/15/10).

Table 7-14
Regression to the Mean in comparison group PBPM costs, refresh population: KTBH

Base year PBPM level	N	Base year PBPM	Demonstration period PBPM	Change
< $500	296	$161	$2,626	$2,466
500-1,000	170	720	2,122	1,402
1,000-1,500	103	1,214	3,777	2,563
1,500-2,000	64	1,725	3,114	1,389
2,000-2,500	47	2,245	2,661	417
2,500-3,000	44	2,753	2,380	-373
3,000-3,500	41	3,231	2,289	-942
3,500-4,000	33	3,727	4,793	1,066
4,000-4,500	26	4,220	3,723	-498
4,500-5,000	17	4,814	3,881	-933
5,000-5,500	17	5,261	6,255	994
5,500-6,000	14	5,806	3,534	-2,272
> 6,000	69	9,698	6,507	-3,191
Mean	5,240	3,020	3,798	778
Median	—	1,812	1,882	70

NOTES: Observations unweighted. PBPM = per beneficiary per month; KTBH = Key to Better Health; N = number of beneficiaries.

SOURCE: Medicare 2004-2008 Part A & B claims; COSTRUN2-alt1(1/15/10).

7.8 Multivariate Regression Tests of Intervention Savings

7.8.1 Original Sample

Three sets of regression coefficients in ***Table 7-15*** test the intervention effect by using the beneficiary's base year PBPM cost (PBPM_base) to explain each beneficiary's demonstration period PBPM cost. Coefficients can be interpreted as differences between each beneficiary's demonstration and base year PBPM costs. In the first column of results controlling only for each beneficiary's base period PBPM cost, the intervention coefficient of -102 is insignificant implying no statistically significant success in slowing beneficiary cost increases. This intervention effect is almost identical to the $111 slower growth shown in *Table 7-5*.

The base period PBPM cost coefficient (0.391; $p < .01$), when combined with the intercept coefficient, implies substantial RtoM effects on costs (= 0.391 - 1 = -0.609, the RtoM effect). Imagine two comparison group beneficiaries, one with a relative low ($1,000) and another with a relatively high ($6,000) PBPM cost in the base period. The predicted PBPM cost of the initially "low cost" comparison beneficiary would increase 2.1-fold during the intervention period, while the "high cost" beneficiary's PBPM cost would decline by roughly one-third.[13] Whereas cost differences were 6:1 in the base period, they would now be compressed to 2:1.

RtoM effects are quite substantial but clearly not in one direction. Including only high cost beneficiaries in the original sample would clearly have produced even greater declines in comparison group PBPM costs during the demonstration. Major cost increases did occur among initially lower cost beneficiaries, as evidenced in ***Table 7-13***. Also note that the standard error of comparison group costs was slightly higher in the demonstration period, not lower (***Table 7-5***), as might be expected with compression of costs.

The second regression model controls for which cost-risk group the beneficiary was in during the base period. The key intervention coefficient is essentially unaffected and still insignificant. This is true even though two of the three cost-risk groups are much more costly than the neither group. The lack of effect is due to the initial balance of the intervention and comparison groups. The PBPM base coefficient is even smaller, implying more RtoM within each of the cost-risk groups.

[13] The calculation is as follows based on Table 7-15, column 1:

PBPM[base]	PBPM[demo]	PBPM Change	%Change
$1,000	$2,124	$1,124	+112%
$6,000	$4,079	-$1,921	-32%

Table 7-15
KTBH Regression results: Intervention gross savings controlling for base period PBPM and beneficiary characteristics: Original population

Independent Variable	PBPM_ Demo Coefficient	PBPM_ Demo t	PBPM_ Demo Coefficient	PBPM_ Demo t	PBPM_ Demo Coefficient	PBPM_ Demo t
Intercept	1,733	35.8	1,656	50.1	3,097	1.2
Intervention	-102	1.4	-109	1.5	-111	1.5
PBPM_Base	0.391	25.2	0.282	10.9	0.289	10.9
High cost–high risk	N/I	N/I	1,016	6.6	1,087	7.0
High cost	N/I	N/I	-251	1.6	-200	1.2
High risk	N/I	N/I	924	8.8	927	8.7
Male	N/I	N/I	N/I	N/I	75	1.1
Minority	N/I	N/I	N/I	N/I	24.4	0.3
Age 65-69	N/I	N/I	N/I	N/I	-286	0.4
70-74	N/I	N/I	N/I	N/I	-354	0.5
75-79	N/I	N/I	N/I	N/I	-336	0.4
80-84	N/I	N/I	N/I	N/I	-422	0.5
85+	N/I	N/I	N/I	N/I	-490	0.6
Medicaid	N/I	N/I	N/I	N/I	71.9	0.4
Disabled	N/I	N/I	N/I	N/I	-28	0.0
Urban	N/I	N/I	N/I	N/I	-1,142	0.5
LTCB	N/I	N/I	N/I	N/I	797	0.4
SNFB	N/I	N/I	N/I	N/I	-303	2.5
R^2	.085		.102		.106	
N	6,832		6,832		6,832	

NOTES: Dependent Variable: Beneficiary's demonstration period PBPM cost. KTBH = Key to Better Health; PBPM = per beneficiary per month; LTCB = long-term care beneficiaries; SNFB = skilled nursing facility beneficiaries; N = number of beneficiaries.

Observations weighted by beneficiary's fraction of eligible days during demonstration.

PBPM_Demo: Dependent variable: Beneficiary's average PBPM during demonstration.

PBPM_Base: Beneficiary's average PBPM in base period just prior to start date.

High Cost-High Risk: PBPM > $30,000 and HCC > 1.73 in base year.

High Cost: PBPM > $30,000 and HCC< 1.73.

High Risk: PBPM < $30,000 and HCC > 1.73.

LTCB, SNFB = 1 if beneficiary had long-term care hospital or SNF payments in base year.

SOURCE: Medicare 2004-2008 Part A & B claims ; Cost4b1-bbaker (1/19/10).

In the third model controlling for beneficiary characteristics, the intervention coefficient remains insignificant (-$111; t = 1.5). After controlling for the beneficiary's base year PBPM cost, the cost-risk group, and many other sociodemographic and utilization characteristics, we still find no statistically reliable cost-saving intervention effect on the trend in Medicare PBPM claims costs. All age coefficients for the over-65 elderly are negative and significant, implying higher costs, on average, among the under-65 disabled population. Beneficiaries in a SNF prior to the intervention had somewhat lower costs, controlling for their base period PBPM cost and which cost-risk group they were in.

7.8.2 Refresh Sample

In the first column of refresh results in ***Table 7-16,*** controlling only for each beneficiary's base period PBPM cost, the intervention coefficient of -54.2 is insignificant, implying no statistical difference between intervention and comparison groups in terms of average cost changes, *ceteris paribus*. The base period PBPM cost coefficient (0.301; $p < .01$), when combined with the intercept coefficient, again implies substantial RtoM of costs in the refresh sample (= 0.301 - 1 = -0.699, the RtoM effect).

The second regression model controls for which cost-risk group the beneficiary was in during the base period. The key intervention coefficient remains insignificant. Two of the three cost-risk groups show higher costs than the neither group after controlling for each beneficiary's base period cost and what cost-risk group they were in. The lack of effect of the high risk and cost groups on the intervention effect is due to the initial balance of the intervention and comparison groups. The PBPM_base coefficient declines somewhat, implying more RtoM within each of the cost-risk groups.

In the third model, controlling for beneficiary characteristics, the intervention coefficient remains highly insignificant (-$66; t = 0.6). After controlling for the beneficiary's base year PBPM cost, the cost-risk group, and many other sociodemographic and utilization characteristics, we still find no cost-saving intervention effect on the trend in Medicare PBPM claims costs. Only Medicaid eligibility among the many patient characteristics was statistically significant and had somewhat higher costs controlling for all other variables.

7.9 Conclusion

PBPM costs showed considerable variability because of the nature of the population selected for the demonstration, including a few very high cost beneficiaries with short spells of eligibility. Nevertheless, the nearly 5,000 original (and 2,300 refresh) beneficiaries in the intervention group and nearly 2,000 original (and 941 refresh) beneficiaries in the comparison groups allowed us to detect an intervention savings rate as low as 6.5% to 9%, respectively.

Table 7-16
KTBH Regression results: Intervention gross savings controlling for base period PBPM and beneficiary characteristics: Refresh population

Independent variable	PBPM_ Demo Coefficient	PBPM_ Demo t	PBPM_ Demo Coefficient	PBPM_ Demo t	PBPM_ Demo Coefficient	PBPM_ Demo t
Intercept	1,847	24.0	1,794	22.2	1,190	0.7
Intervention	-54.2	0.5	-68.4	0.6	-66	0.6
PBPM_Base	0.301	14.2	0.246	7.1	0.266	7.4
High Cost-High Risk	N/I	N/I	624	2.7	653	2.8
High Cost	N/I	N/I	-445	1.8	-368	1.5
High Risk	N/I	N/I	579	3.3	596	3.4
Male	N/I	N/I	N/I	N/I	-13	0.1
Minority	N/I	N/I	N/I	N/I	255	1.8
Age 65-69	N/I	N/I	N/I	N/I	388	0.2
70-74	N/I	N/I	N/I	N/I	482	0.3
75-79	N/I	N/I	N/I	N/I	464	0.3
80-84	N/I	N/I	N/I	N/I	572	0.3
85+	N/I	N/I	N/I	N/I	494	0.3
Medicaid	N/I	N/I	N/I	N/I	830	3.0
Disabled	N/I	N/I	N/I	N/I	720	0.4
Urban	N/I	N/I	N/I	N/I	N/A	N/A
LTCB	N/I	N/I	N/I	N/I	-2,349	0.8
SNFB	N/I	N/I	N/I	N/I	-291	1.4
R^2	.058	N/I	.066	N/I	.072	N/I
N	3,266	N/I	3,266	N/I	3,266	N/I

NOTES: Dependent Variable: Beneficiary's demonstration period PBPM cost. KTBH = Key to Better Health; PBPM = per beneficiary per month; LTCB = long-term care beneficiaries; SNFB = skilled nursing facility beneficiaries; N = number of beneficiaries.

Observations weighted by beneficiary's fraction of eligible days during demonstration.

PBPM_Demo: Dependent variable: Beneficiary's average PBPM during demonstration.

PBPM_Base: Beneficiary's average PBPM in base period just prior to start date.

High Cost-High Risk: PBPM > $30,000 and HCC > 1.81 in base year.

High Cost: PBPM > $30,000 and HCC< 1.81.

High Risk: PBPM < $30,000 and HCC > 1.81.

LTCB, SNFB = 1 if beneficiary had long-term care hospital or SNF payments in base year.

SOURCE: Medicare 2004-2008 Part A & B claims; Cost4b1-bbaker (1/19/10).

No statistically significant savings, however, were found for the intervention in either the original or refresh sample. Costs rose $111 slower in the original intervention group (4.4% of comparison costs), but savings needed to exceed $163 to be considered statistically significant. The KTBH program may have performed slightly better with its refresh sample because intervention costs increased $142 less than in the comparison group. This difference, however, was still insignificant, as savings needed to be $224 to be considered statistically significant.

Because the KTBH program's intervention and comparison groups were randomly determined, no material imbalances were found across many cost, severity, and other patient characteristics in the base period. Consequently, any slight differences that did exist in the subsequent base year had little effect on our final conclusion of no significant savings.

Responding to KTBH's request, CMS staff selected a very costly, complex set of Medicare beneficiaries for their intervention and comparison groups. Mean per beneficiary per month base year claims costs (weighted by fraction of time eligible for the intervention) were approximately $1,800 in both groups, a figure considerably higher than in the general Medicare population. As a result, the comparison group exhibited both rapidly rising costs during the intervention period as well as extreme RtoM effects.

While the randomized experimental design should cancel out RtoM effects and isolate a pure intervention effect, the large churning of beneficiaries from lower (higher) to higher (lower) cost groups over time adds considerable statistical noise to the test of savings. Even still, we would have considered the intervention to be a success if it had saved roughly 6.5% of costs. The large increases in demonstration period costs in otherwise less costly beneficiaries in the base period make it very difficult for intervention staff to target those at highest risk of increasing costs. In fact, the greater is the potential for regression-to-the-mean, the greater the effort is required to identify lower cost, lower utilizing beneficiaries to avoid expensive hospitalizations in the near future. The "low cost" beneficiary was exacerbated by the one-year lag between randomization and start date. Many originally high cost beneficiaries two years prior to start date became much lower cost one year prior to start date.

Part of the problem comes from using the prospective HCC score as a selection indicator. Although this score is based on cost weights that predict future costs, it may be biased in certain ways against identifying the chronically ill and favoring those with acute flare-ups. While HCC scores may correctly predict higher costs next period, on average, the higher the HCC score, the greater the reduction in a beneficiary's costs *even though costs still may be higher than average*. In targeting beneficiaries, it is far more difficult for disease management groups to prospectively focus on previously lower cost beneficiaries who are likely to experience large cost increases than it is to target those during the intervention period who actually incur major flare-ups and hospitalizations.

CHAPTER 8
KEY FINDINGS FROM VILLAGEHEALTH'S KEY TO BETTER HEALTH MEDICARE CARE MANAGEMENT FOR HIGH COST BENEFICIARIES DEMONSTRATION EVALUATION

The purpose of this report is to present the findings from RTI International's evaluation of the Key to Better Health (KTBH) Medicare Care Management for High Cost Beneficiaries (CMHCB) demonstration program. Our evaluation focuses upon three broad domains of inquiry:

- **Implementation.** To what extent was KTBH able to implement its program?
- **Reach.** How well did KTBH engage its intended audience?
- **Effectiveness.** To what degree was KTBH able to improve beneficiary and provider satisfaction, improve functioning and health behaviors, improve clinical quality and health outcomes, and achieve targeted cost savings?

Organizing the evaluation into these areas focuses our work on the policy needs of the Centers for Medicare & Medicaid Services (CMS) as it considers the future of population-based care management programs or other interventions in Medicare structured as pay-for-performance initiatives. We use both qualitative and quantitative research methods to address a comprehensive set of research questions within these three broad domains of inquiry.

8.1 Key Findings

In this section, we present key findings based upon the 36 months of KTBH operations with its original population and 24 months with its refresh population. Our findings are based on the experience of approximately 7,500 ill Medicare beneficiaries with chronic kidney disease (CKD) assigned to an intervention or a comparison group. Six key findings on participation, intensity of engagement in the KTBH program, beneficiary satisfaction and experience with care, clinical quality, health outcomes, and financial outcomes have important policy implications for CMS and future disease management or care coordination efforts among Medicare fee-for-service (FFS) beneficiaries.

Key Finding #1: Several vulnerable subpopulations of Medicare FFS beneficiaries were less likely to agree to participate in the KTBH demonstration program.

Of all KTBH intervention beneficiaries, 46% verbally consented to participate in the CMHCB demonstration at some point during the intervention period. For the KTBH program, we find that participants from the original population were healthier and younger than beneficiaries who never participated. The very old (85 years of age and older), Medicaid enrollees, institutionalized beneficiaries, those that died, and those with higher prospective and concurrent HCC scores were less likely to be participants after controlling for baseline health status through the use of the prospective HCC score. In the multivariate regression analysis, the same baseline health status characteristics (e.g., prospective HCC risk score, PBPM costs, and Charlson comorbidity indices) had no impact on the likelihood of participation after controlling for baseline demographics and demonstration period health status. Beneficiaries with medium and high concurrent HCC scores were more likely to be participants. This suggests that the

KTBH program was unable to engage the historically sicker Medicare beneficiaries but did make some inroads with engaging those with acute clinical deterioration as measured by the concurrent HCC score. The results for the refresh population were similar to the original population, with one noted difference: higher baseline Charlson comorbidity scores were positive predictors of participation. These differences suggest that the KTBH program was more successful gaining participation during the last 2 years of the program from sicker and more costly beneficiaries as their program matured.

Key Finding #2: As the KTBH program matured, KTBH staff was more successful targeting for intervention beneficiaries at high risk of hospitalization or who had been hospitalized.

A cornerstone of the KTBH's program was health coaching interactions with care manager nurses. Nearly every participating beneficiary received at least one call or in-person visit from a care manager in the last 18 months of the demonstration and over 60% received more than 20 contacts during this same time period. Telephone contact was the most dominant form of contact. In our multivariate regression modeling of likelihood of being in a high contact versus low contact group for the original population, we found that beneficiary characteristics, baseline characteristics, and demonstration period acute care utilization were not indicators of being in the high contact category. A high concurrent HCC score, or health status measured during the first 6 months of the demonstration period, was found to be a positive predictor of being in the high contact group indicating that the KTBH staff made an effort to contact beneficiaries that had progressive health issues. Among the refresh population, there was evidence that KTBH staff made contact with beneficiaries who were at high risk of hospitalization or who had been hospitalized during the demonstration period. Acute care utilization was a strong predictor of more contacts. These findings suggest that the KTBH program was successful in their effort to contact the refresh beneficiaries who were at high risk of hospitalization or who had been hospitalized.

Key Finding #3: The KTBH program did not substantially improve beneficiary reported experience with care, level of physical activity, and self-reported physical health.

The beneficiary survey was designed to obtain assessments directly from beneficiaries about key outcomes of beneficiary experience of care, self-management, and physical and mental function. We asked beneficiaries about the extent to which their health care providers helped them to cope with their chronic condition. We supplemented this item with questions related to two key components of the KTBH CMHCB intervention: helpfulness of discussions with their health care team and quality of communication with their health care team. In addition, the survey instrument collected information about beneficiary self-care frequency and self-efficacy related to medications, diet, and exercise and Clinician and Group Adult Primary Care Ambulatory Consumer Assessments of Health Plans Survey (CAHPS®) measures of communication with health care providers. Last, the survey instrument included four physical and mental health functioning measures.

The KTBH demonstration program employs strategies to improve quality of care for high cost Medicare beneficiaries while reducing costs by empowering Medicare beneficiaries to better manage their care. KTBH program staff hypothesized that lifestyle changes and better

communication with providers will mitigate acute flare-ups in the chronic conditions. Experiencing better health, beneficiaries should also be more satisfied that their health care providers are effectively helping them to cope with their chronic medical conditions. Among the 19 outcomes covered by the survey, the KTBH program demonstrated one positive intervention effect that resulted in the decrease of the depression symptoms, and one negative intervention effect on discussing treatment choices within the self-management survey domain

Key Finding #4: KTBH had no positive intervention effects on six quality of care process measures.

We have defined quality improvement for this evaluation as an increase in the rate of receipt of claims-derived, evidence-based process-of-care measures. We selected three measures appropriate for different populations of elderly beneficiaries: influenza vaccine for all beneficiaries; low-density lipoprotein cholesterol (LDL-C) testing for beneficiaries with diabetes or ischemic vascular disease (IVD); and rate of annual HbA1c testing for beneficiaries with diabetes. We also create two ESRD-related measures: rate of progression to ESRD and rate of fistula/graft placement prior to initiation of dialysis among beneficiaries who progress to ESRD. Of the six measures, there were no statistically significant differences in the rate of receipt of evidence-based care between the intervention and comparison original and refresh populations.

Over the course of the demonstration, the KTBH program had expected to increase rates of adherence to evidence-based care. However, during the last year of its demonstration program, we observe lower or very similar rates of adherence to the selected measures among its intervention beneficiaries relative to the comparison group beneficiaries for all measures. We also observe between roughly one-fourth to one-third of intervention beneficiaries in both the original and refresh populations were not compliant during the last year of the KTBH demonstration program despite focused efforts by KTBH staff to encourage beneficiaries to become compliant with evidence-based care. These findings suggest that improving or sustaining adherence to guideline concordant care in a cohort of ill Medicare FFS beneficiaries was more challenging than originally envisioned.

Key Finding #5: The KTBH program did not reduce acute care utilization as measured by rate of hospitalization, ER visits, or 90-day readmissions nor did the KTBH program have any success reducing mortality or increasing the use of the Medicare hospice benefit.

During the course of the KTBH demonstration, we observed increasing rates of all-cause and ACSC hospitalizations, ER visits, and 90-day readmissions in both the intervention and comparison groups and for both the original and refresh populations. We observed no statistically significant differential rates of hospitalizations, ER visits, or 90-day readmission—either all-cause or for ambulatory care sensitive conditions—during the demonstration period relative to the baseline period for either the original or refresh populations. These findings are disappointing given the evidence that the KTBH staff made an effort to contact beneficiaries who were at high risk of hospitalization or who had been hospitalized during the demonstration period. Acute care utilization was a strong predictor of more contacts.

Further, we found no differential rate of mortality between the intervention and comparison original and refresh populations. The only statistically significant finding was within

the refresh population and their use of the Medicare hospice benefit; the median number of days of hospice use was 14 days longer in the comparison group than in the intervention group.

Key Finding #6: Medicare cost growth in the intervention group was not different from the rate of growth in the comparison group.

No statistically significant savings were found for the intervention in either the original or refresh populations. Per beneficiary per month (PBPM) costs rose $111 slower in the original intervention group (4.4% of comparison costs), but savings needed to exceed $163 to be considered statistically significant. The KTBH program's average monthly fee was $90 for the original population. The KTBH program may have performed slightly better with its refresh sample because intervention costs increased $142 less than in the comparison group. This difference, however, was still insignificant, as savings needed to be $224 to be considered statistically significant.

Because the KTBH program's intervention and comparison groups were randomly determined, no material imbalances were found across many cost, severity, and other patient characteristics in the base period. Consequently, any slight differences that did exist in the subsequent base year had little effect on our final conclusion of no significant savings. Responding to KTBH's request, CMS staff selected a very costly, complex set of Medicare beneficiaries for their intervention and comparison groups. Mean per beneficiary per month base year claims costs (weighted by fraction of time eligible for the intervention) were approximately $1,800 in both groups, a figure considerably higher than in the general Medicare population. As a result, the comparison group exhibited both rapidly rising costs during the intervention period as well as extreme regression-to-the-mean effects.

8.2 Conclusion

Based on extensive qualitative and quantitative analysis of performance, we find that the KTBH program had no success improving key processes of care or beneficiary experience with care, self-management, or functional status, reducing acute care utilization or reducing mortality, or increasing use of the Medicare hospice benefit. Although PBPM costs rose slower in the original and refresh intervention groups relative to the comparison groups, statistically significant savings were not achieved. The lack of program savings to offset monthly management fees and lack of any impact on other outcomes cannot justify the KTBH model for chronically ill Medicare fee-for-service beneficiaries with CKD on cost effectiveness grounds.

What might explain the lack of success in the KTBH demonstration program? One explanation may be the targeting of beneficiaries at greatest risk of intensive, costly, service use (as distinct from the need for general care management). Responding to the KTBH program's request, CMS selected a very costly, complex set of Medicare beneficiaries for their intervention and comparison groups. Mean per beneficiary per month base year claims costs (weighted by fraction of time eligible for the intervention) were approximately $1,800 in both groups, a figure considerably higher than in the general Medicare population.

The KTBH program's lack of success is not surprising in light of the extreme regression-to-the-mean (RtoM) behavior that we observed among their selected beneficiaries. The KTBH staff focused on those most likely to be major users of acute care services or who had been

hospitalized. Yet, many of these beneficiaries experienced declines in use and costs regardless of the intervention, as evidenced in the comparison group. The large increases in demonstration period costs in otherwise less costly beneficiaries in the base period suggests that the intervention staff should have targeted those at highest risk of increasing costs. In fact, the greater is the potential for regression-to-the-mean, the greater the effort is required to identify lower cost, lower utilizing beneficiaries to avoid expensive hospitalizations in the near future.

A second explanation may be their recruitment strategy. Given the KTBH program's high monthly management fee ($225 per month) and the population-based financial risk feature of this demonstration, engagement of less than 50% of the intervention population required the KTBH program to have been extremely successful in reducing costs associated with the participating beneficiaries. The KTBH program was not successful in reducing hospitalizations during the demonstration period. The lack of substantive improvements in acute care utilization broadly across their intervention population translated into limited financial savings. And, their targeting strategy was costly. Each contact cost was roughly $262 ($16.9 million in total fees divided by 64,423 contacts) or over twice the national average payment amount for a face-to-face office visit with an established patient with the ***highest level of complexity*** under the Medicare Fee Schedule[14].

And, a third explanation may be the model of intervention itself. Prior evaluations of Medicare care management programs that were primarily telephonic have not demonstrated savings sufficient to cover fees one-half the size of the KTBH program's fee. A cornerstone of the KTBH's program was health coaching interactions with care manager nurses. Nearly every fully participating beneficiary during the last 18 months of the program received at least one call or in-person visit from a care manager and over 60% received more than 20 contacts during this same time period. This is a relatively high contact rate compared to other care management programs that we have evaluated. However, communicating by telephone with elderly and disabled patients is complicated by the relatively high frequency of cognitive impairments, and the most dominant form of contact was telephonic.

Furthermore, the nurse care managers were not part of the beneficiaries' primary health care teams, hindering their ability to directly interact with the beneficiaries' primary providers, either primary care physician or nephrologist, and effectively help facilitate changes in medical care plans to mitigate deterioration in health status. The care manager served only as an adjunct to the patients' primary physicians with a stated goal of facilitating the relationship between the patient and his or her community-based provider with a focus on CKD or other chronic issues. Although the KTBH program established partnerships with a number of nephrologists in their targeted geographic area, the total number of participating beneficiaries being treated by the partners was small. Thus, the care managers had to interact with a large number of community-based providers with whom they had little or no prior relationship. During our site visits, the care managers cited several challenges working with theses physicians, most notably, obtaining detailed clinical and laboratory data to clinically stage the beneficiaries' CKD status, and concern voiced by the community-based providers that their patients would be "stolen" by the partner nephrologists. Thus, the care managers had to implement a "shared care plan" with

[14] National non-facility price of $124.79 for HCPCS code 99215 for 2009.

community-based physicians and specialists that were not fully supportive of the KTBH program. Lastly, by complementing, not substituting, for the primary care physician, the nurse care managers were not directly determining whether a patient was admitted to a hospital or what service intensity the beneficiaries would receive during the demonstration period.

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APPENDIX A

SUPPLEMENT 2A
DETAILED SPECIFICATIONS FOR THE CONSTRUCTION OF CLINICAL ANALYTIC VARIABLES

1. Health Status Variables

a. Charlson Comorbidity Index SAS Code

Array all the diagnoses from the dataset and search for each of the codes in the Charlson categories. If any are found, the category has a value of 1, else 0. Add weighted categories to create Charlson score.

```
AMI=0;          Acute Myocardial Infarction;
CHF=0;          Congestive Heart Failure;
PVD=0;          Peripheral Vascular Disease;
CVD=0;          Cerebrovascular Disease;
dementia=0;     Dementia;
COPD=0;         Chronic Pulmonary disease;
conn_tissuedz=0; Connective Tissue disease;
ulcer=0;        Ulcer disease;
liverdz_mild=0; Mild liver disease;
diabetes=0;     Diabetes without complications;
hemiplegia=0;   Hemiplegia;
CRF=0;          Moderate or severe renal disease;
DMwcc=0;        Diabetes with complications;
neoplasia=0;    Neoplasia;
leukemia=0;     Leukemia;
lymphoma=0;     Lymphoma;
liverdz_modsev=0; Moderate or severe liver disease;
cancer_mets=0;  Metastatic solid tumor;
HIV=0;          HIV/AIDS

array diag(6) diag1 diag2 diag3 diag4 diag5 diag6;
do i = 1 to 6;
dg3 = substr(diag(i),1,3);
dg4 = substr(diag(i),1,4);

select;
when (dg3='410') AMI=1;
when (dg3='428') CHF=1;
when (dg3='441' or dg4 in ('4439' '7854' 'V434')) PVD=1;
when (dg3 in ('430' '431' '432' '433' '434' '435' '436' '437' '438')) CVD=1;
when (dg3='290') dementia=1;
when (dg3 in ('490' '491' '492' '493' '494' '495' '496' '500' '501' '502' '503' '504' '505') or
    dg4='5064') COPD=1;
when (dg3 in ('710' '714' '725')) conn_tissuedz=1;
when (dg3 in ('531' '532' '533' '534')) ulcer=1;
when (dg3 in (‘571’)) liverdz_mild=1;
when (dg3 in ('250','249') or dg4 in ('7915','9623') or
 &dx in ('V5867','99657')) diabetes=1;
when (dg3='342' or dg4='3441') hemiplegia=1;
```

```
when (dg3 in ('582' '583' '585' '586' '588')) chronic renal failure=1;
when (dg4 in ('2504' '2505' '2506')) diabetes with complications=1;
when (dg3 in ('200' '201' '202' '203' '204')) lymphoma=1;
when (dg3 in ('205' '206' '207' '208')) leukemia=1;
when (dg3 in ('140' '141' '142' '143' '144' '145' '146' '147' '148' '149' '150' '151' '152' '153'
    '154' '155' '156' '157' '158' '159' '160' '161' '162' '163' '164' '165' '170' '171' '172' '174'
    '175' '176' '179' '180' '181' '182' '183' '184' '185' '186' '187' '188' '189' '190' '191' '192'
    '193' '194' '195')) neoplasia=1;
when (dg4 in ('5722' '5723' '5724' '5728' '4560' '4561' '4562')) moderate to severe liver
    disease=1;
when (dg3 in ('196' '197' '198' '199')) metastisized cancer =1;
when (dg3 in ('042' '043' '044')) HIV=1;
otherwise;
end; end;

chscore=AMI + CHF + PVD + CVD + dementia + COPD + conn_tissuedz + ulcer +
  liverdz_mild + diabetes + 2*hemiplegia + 2*CRF + 2*DMwcc + 2*neoplasia +
  2*leukemia + 2*lymphoma + 3*liverdz_modsev + 6*cancer_mets + 6*HIV;
```

b. Chronic Conditions SAS code

```
%MACRO CHECKCC(DX);
DX4=SUBSTR(&DX,1,4);
DX3=SUBSTR(&DX,1,3);
DXL=SUBSTR(&DX,5,1);
IF DX4='4280' THEN CHF_CC=1;
IF (('41400'<=&DX<='41407') OR
 ('41000'<=&DX<='41092') OR
    DX4 in ('4142','4143','4148','4149') OR
 ('4110 '<=&DX<='41189') OR
 ('4130'<=DX4<='4139') OR DX3='412') THEN CAD_CC=1;
 IF (DX3 IN ('496','492','493','494') OR DX4='4912') THEN
 RESP_CC=1;
 IF DX4='2500' or DX4='2490' THEN DIABWO_CC=1;
 IF ('2501'<=DX4<='2509' or '2491'<=DX4<='2499' or
 DX4 in ('7915','9623') or &dx in ('V5867','99657')) THEN DIABC_CC=1;
 IF (DX3='401') THEN HYPER_CC=1;
 IF (DX3='424') THEN VALV_CC=1;
 IF (DX3='425') THEN CARD_CC=1;
 IF (DX3 IN ('584','586')) THEN RENFAIL_CC=1;
 IF (DX4='4439') THEN PVD_CC=1;
 IF (DX3='272') THEN LIPID_CC=1;
 IF (DX3 IN ('427','426')) THEN DYS_CC=1;
 IF (DX3='290') THEN DEM_CC=1;
 IF ((DX3 IN ('434','433') & DXL='1') OR DX3='431' OR
 &DX='V1259') THEN STROKE_CC=1;
 IF (DX4 IN ('2504','4039','5811','5818','5819','5829','5939','5996','7100',
```

```
'7531','7910') OR DX3 IN ('582','585') OR &DX='58381') THEN ACREN_CC=1;
IF DX4='7865' then CHPAIN_CC=1;
IF DX4 in ('5990','5999') THEN UTI_CC=1;
IF DX3='285' THEN ANEMIA_CC=1;
IF DX4='7807' THEN MALAISE_CC=1;
IF (&DX IN ('78002','78009','78093','78097','78039') OR DX4 IN ('7802','7804'))
THEN DIZZ_CC=1;
IF DX3='719' THEN JOINT_CC=1;
IF DX3='244' THEN THYROID_CC=1;

%MEND;

%LET CCDXLIST=%STR(CHF_CC CAD_CC RESP_CC DIABWO_CC DIABC_CC
    HYPER_CC VALV_CC CARD_CC ACREN_CC RENFAIL_CC PVD_CC
    LIPID_CC DYS_CC DEM_CC STROKE_CC CHPAIN_CC UTI_CC ANEMIA_CC
    MALAISE_CC DIZZ_CC JOINT_CC THYROID_CC);
```

c. Ambulatory Care Sensitive Conditions (ACSCs).

```
%LET ACSCLIST = %STR(ALL DIAB CELL ASTHMA COPD CHF DHYD PNEU
    SEPT STROKE UTI);
%macro chkdx(diag);
dx3=substr(&diag,1,3);
dx4=substr(&diag,1,4);
all=1;
if dx3='250' or dx4='7915' then diab=1;
if dx3 in ('681','682') then cell=1;
if dx3 in ('493') then asthma=1;
if dx3 in ('491','492','494','496') then copd=1;
if dx3='428' or &diag in ('40201','40211','40291','40401','40411','40491',
 '39891','40403','40413','40493','78550','78551') then chf=1;
if dx4='2765' then dhyd=1;
if dx3 in ('481','482','483','485','486') then pneu=1;
if dx3='038' then sept=1;
if dx3 in ('434','436') then stroke=1;
if dx4 in ('5990','5999') then uti=1;
```

2. Hospitalization, Emergency Room and Readmission Analytic Variables

To report descriptive statistics on the rates of ACSCs by location of service using claims files to create of rates of ACSCs by location of service: 1) inpatient; 2) hospital outpatient department or physician's office; and) ER/observation bed stays. For example, we will be examining the number of inpatient cellulitis admissions per 1,000 beneficiaries, the number of physician office/OPD visits per 1,000 beneficiaries, and the number of ER visits per 1,000 beneficiaries in the baseline, and the last 12 months of the intervention period.

A. Hospitalizations: Step 1 Combine transfer records as follows:

1. If the admission date (ADMSN_DT) or discharge date (DSCHRGDT) is missing on the claim, or equal to "0," set them equal to "from" (FROM_DT) and "through" (THRU_DT) dates, respectively.

2. Combine multiple claims that represent pieces of stays or transfers between hospitals, or separately administered units of a single hospital, into a single record representing an admission. Some records in the Inpatient claims file that look like new admissions are actually transfers between or within facilities. This process uses all claims; do not exclude claims for periods if ineligibility until after the transfers have been processed.

    a. Create a claim type variable as CLMB_TYP = FAC_TYPE || TYPESRVC

    b. Sort the data by HICNO FROM_DT THRU_DT

    c. Designate the first record for each HICNO in the reference period as a new admission.

    d. If the length between reference record discharge date and next admission date is more than one day, the next admission record is considered a new admission.

    e. If the discharge status code of the reference record is not equal to 30, 02, 05, 61, or 62 and the status code of the record previous to the reference record is not equal to 30, 02, 05, 61, or 62, then the reference record is considered a new admission. The definition of the discharge status codes are:
    30: Still a patient
    02: Discharged/transferred to other short term general hospital for inpatient care
    05: Discharged/transferred to skilled nursing facility (SNF)
    61: Discharged/transferred within this institution to a hospital-based Medicare-approved swing bed (1/1/02)
    62: Discharged to another IRF or IRF unit (1/1/02)

    f. If the discharge status code of the record previous to the reference record is equal to 30, 02, 05, 61, or 62 and the difference between the reference record's admission date and the record previous to the reference record's admission date is less than or equal to 1 day, then the reference record is considered a transfer.

    g. If the discharge status code of the reference record is equal to 30, 02, 05, 61, or 62 and the discharge status code of the record previous to the reference record is not equal to 30, 02, 05, 61, or 62, then the reference record is considered a new admission.

    h. The length of stay is calculated, as described for the row 2 measure below. If the length of stay is negative, the record is removed.

    i. The system counts each unique admission falling within the reference period.

j. Note that admission dates that fall within the reference period are counted even if the discharge date falls outside of the reference period. Also note that, in some cases, the system will be missing the later pieces of a stay that commences within the period, especially when hospitals "split-bill" at calendar year-end, but the admission will still be counted in the reference period.

B. Step 2: Create Causes of Hospitalization Analytic Variables: All cause and 10 ACSCs

(1) All cause hospitalizations:
Select if PDGNS_CD = any diagnosis code

(2) Heart failure hospitalization:
Select if PDGNS_CD = 428
40201
40211
40291
40401
40411
40491
39891
40403
40413
40493
78550
78551

(3) Diabetes hospitalization:
Select if PDGNS_CD = 250
7915

(4) Cellulitis:
Select if PDGNS_CD = 681
682

(5) Asthma hospitalization:
Select if PDGNS_CD = 493

(6) COPD and Chronic Bronchitis
Select if PDGNS_CD = 491
492
494
496

(7) Dehydration
Select if PDGNS_CD = 2765

(8) Bacterial Pneumonia
Select if PDGNS_CD = 481
482
483
485
486

(9) Septicemia
Select if PDGNS_CD = 038

(10) Ischemic Stroke
Select if PDGNS_CD = 434
436

(11) UTI
Select if PDGNS_CD = 5990
5999

C. Emergency Room Visits, including observation stays

Calculate the number of beneficiary visits to a hospital's outpatient emergency room (ER) **or** for an observation stay during the reference period. Restrict the measure to ER and observation visits identified on the Outpatient (OPD) claims file. Keep records with a revenue center line item (REV_CNTR) equal to 045X or 0981 (emergency room care) unless the HCPCS for the line item equals 70000 through 79999 or 80000 through 89999 (thus excluding claims where only radiological or pathology/laboratory services were provided) for revenue code dates (REV_DT) that fall within the reference period. Keep records with a revenue center line item (REV_CNTR) equal to 0762 (treatment of observation room-observation room) for revenue code dates (REV_DT) that fall within the reference period. This will capture ER claims for beneficiaries that were not subsequently admitted to the hospital.

To capture ER visits that led to a hospitalization, claims are identified in the MedPAR (inpatient) file. Keep records with revenue center code values of 0450-0459, 0981, and 0762. The diagnostic emergency room details are on the inpatient claim.

Count each of the 10 types of ACSC visits for a unique beneficiary on a unique date. If a beneficiary has more than one visit on the same day, count them insofar as they are of different types. That is, no one can have more than one "all cause" visits on a given day; no one can have more than one CHF visit on a given day. A person can have a CHF visit and a CAD visit on the same day, however. Visit type is the same as for hospitalizations.

D. 30-day Hospital Readmissions

Each admission within the reference period is eligible to be a readmission; that is, a single beneficiary can be counted more than once if she/he had more than one hospital admission during the period. Calculate all measures after handling transfers, as described in the hospital admission specifications. After identifying unique hospital admissions in the reference period, calculate the number of days between the admission date and the most immediate previous discharge date, if any, from a short-stay acute-care inpatient hospital department, for any reason, as identified in the Inpatient claims file. Flag as a 90-day readmit, if admission date is less than or equal to 90 days from date of discharge. The intervention period examined admissions during the period from 15 months through 3 months prior to the end of the demonstration and included readmissions through the end of the demonstration period. We constructed: all cause readmission rates for all hospitalizations and same cause readmission rates for the ten ambulatory care sensitive conditions.

a. All cause readmissions after all cause hospitalizations

b. Same cause readmissions for the 10 ACSCs.

3. Guideline Concordant Care

Quality of Care Variables

1) Rate of influenza shots during influenza season (September through February) for adults – all beneficiaries (AMA, NQF endorsed measure – for patients $\geq$ 50 years but we will evaluate for all beneficiaries).

   - ***Denominator***: All beneficiaries with at least one day of eligibility in both baseline and the demo period(s). (Note: we are not excluding those with egg allergies or known adverse reaction to influenza vaccine in the past for simplification.)

   - ***Numerator:*** Beneficiaries who receive a test between September 1 and February 28 (or 29th if a leap year (2004, 2008, 2012)) for the baseline or demo periods.

     i. For the KTBH original population, the dates would be as follows:
        Baseline: 11/1/04 – 2/28/05; 9/1/05 – 10/31/05
        Demo Period 1: 9/1/06 – 2/28/07
        Demo Period 2: 11/1/07 – 2/29/08; 9/1/08 – 10/31/08
        For the KTBH refresh population, the dates would be as follows:
        Baseline: 11/1/05 – 2/28/06; 9/1/06 – 10/31/06
        Demo Period 1: 11/1/07 – 2/29/08; 9/1/08 – 10/31/08

     ii. CPT Codes to define receipt of influenza vaccine in either physician claims or OPD file: 90656, 90658, 90660, 90661, 90662, 90663, G0008

2) Rate of progression to ESRD

   1. ***Denominator***: All beneficiaries with any eligibility in the baseline and demo period.
      - ***Numerator:*** Beneficiaries who have ESRD during the demonstration period. ESRD status during the demonstration period was determined using the EDB.

3) Rate of annual HbA1c testing – beneficiaries with diabetes in baseline (Alliance, NQF endorsed measure – exclusive of CPT II or LOINC codes for identification of test being performed).

   - ***Denominator***: All beneficiaries with diabetes identified in the baseline period and at least one day of eligibility in both baseline and the demo period.

   - ***Numerator:*** Beneficiaries who have a claim for a test as defined by CPT codes in the physician and OPD file: 83036, 83037.

4) Rate of annual low-density lipoprotein cholesterol (LDL-C) testing – beneficiaries with diabetes or ischemic vascular disease (Alliance, NQF endorsed for diabetes and NCQA, NQF endorsed for ischemic vascular disease – exclusive of CPT II or LOINC codes for identification of test being performed).

   - ***Denominator A***: All beneficiaries with diabetes identified in the baseline period and at least one day of eligibility in both baseline and the demo periods.
   - ***Denominator B***: All beneficiaries with ischemic vascular disease identified in the baseline period and at least one day of eligibility in both baseline and the demo periods.
   - ***Numerator:*** Beneficiaries who have a claim for a test as defined by CPT codes in the physician and OPD file: 80061, 83715, 83700, 83716, 83701, 83704, 83721.

5) Rate of fistula/graft placement prior to initiation of dialysis

   - ***Denominator***: All beneficiaries with initiation of hemodialysis in the demo period.
   - ***Numerator:*** Beneficiaries who have a claim for a graft or fistula prior to the initiation of hemodialysis.
     CPT codes for physician claims to indicate a graft or fistula: 36830, 36818, 36819, 36820, 36821, 36825. Retain first date if multiple claims are present.
     Select only claims for evaluation that have one of the following primary diagnosis codes provided by KTBH:
     if dx3 in ('160','580','581','582','583','584','585','586','587','588',
     '591','954') or dx4 in ('1890','1899','2230','2504','2714','2741','4401',
     '4421','4473','5724','5800','5804','5808','5809','5810','5811','5812','5813',
     '5818','5819','5820','5821','5822','5824','5828','5829','5830','5831','5832',
     '5834','5836','5837','5838','5839','5845','5846','5847','5848','5849','5851',
     '5852','5853','5854','5855','5856','5859','5880','5881','5888','5889','6421',
     '6462','7532','7944') or &diag in ('23691','25040','25041','25042','25043',
     '28311','40301','40311','40391','40402','40403','40412','40413','40492',
     '40493','58081','58089','58181','58189','58281','58289','58381','58389',
     '58881','58889','75312','75313','75314','75315','75316','75317','75319')
     Initiation of hemodialysis: Inpatient or outpatient claims with revenue center code: 0801, 0820, 0821, 0825, 0829. Identify first date.

SUPPLEMENT 4A
PARTICIPATION TABLES

Supplement Table 4A-1
Characteristics of the KTBH CMHCB demonstration program intervention and comparison populations: Original population

Characteristics	Rate per 100[1,2] I	Rate per 100[1,2] C	I vs. C	p[3]
Total number of beneficiaries	4,882	1,951	—	—
Full time equivalent	3,753	1,511	—	—
Beneficiary characteristics				
Aged-in (vs. disabled)	87.1	87.1	0.0	N/S
In Medicaid (vs. not in Medicaid)	4.8	4.3	0.5	N/S
Male (vs. female)	47.3	48.2	-0.8	N/S
Urban (vs. rural)	100.0	100.0	0.0	N/S
Age				
Mean	74.8	74.7	0.1	N/S
<65	12.9	13.1	-0.2	N/S
65-69	11.4	11.0	0.4	N/S
70-74	18.7	20.1	-1.4	N/S
75-79	23.5	22.0	1.4	N/S
80-84	16.9	18.6	-1.7	N/S
85+	16.7	15.2	1.5	N/S
Race				
White	80.9	80.8	0.1	N/S
African American	11.8	11.9	-0.1	N/S
Other	7.1	7.1	0.0	N/S
Unknown	0.2	0.2	0.1	N/S
Health status				
Recalculated HCC score				
Mean	1.4	1.4	0.0	N/S
Low: $\geq$ 1.35 and < 2.00	37.9	36.5	1.4	N/S
Medium: $\geq$ 2.00 and $\leq$ 3.10	33.3	35.4	-2.0	N/S
High: > 3.10	28.8	28.1	0.6	N/S
Baseline PBPM low	35.6	36.4	-0.8	N/S
Baseline PBPM medium	34.5	33.4	1.1	N/S
Baseline PBPM high	29.9	30.2	-0.3	N/S
Charlson comorbidity index—mean	3.1	3.1	0.1	N/S

(continued)

Supplement Table 4A-1 (continued)
Characteristics of the KTBH CMHCB demonstration program intervention and comparison populations: Original population

Characteristics	Rate per 100[1,2] I	Rate per 100[1,2] C	I vs. C	p[3]
Chronic conditions				
HF	23.7	22.3	1.4	N/S
Coronary artery disease	45.6	47.0	-1.4	N/S
Other respiratory disease	20.3	20.5	-0.1	N/S
Diabetes without complications	36.3	36.4	-0.1	N/S
Diabetes with complications	18.1	17.5	0.6	N/S
Essential hypertension	60.2	60.4	-0.1	N/S
Valve disorders	8.9	8.3	0.6	N/S
Cardiomyopathy	5.1	4.7	0.4	N/S
Acute & chronic renal disease	32.6	30.2	2.4	N/S
Renal failure	11.0	11.3	-0.3	N/S
Peripheral vascular disease	6.8	6.6	0.2	N/S
Lipid metabolism disorders	27.9	27.6	0.3	N/S
Cardiac dysrhythmias & conduction disorders	25.4	26.5	-1.1	N/S
Dementias	3.4	3.3	0.1	N/S
Strokes	5.2	5.3	-0.1	N/S
Chest pain	10.7	10.9	-0.2	N/S
Urinary tract infection	14.8	14.4	0.4	N/S
Anemia	25.8	25.9	0.0	N/S
Malaise & fatigue (including CFS)	4.6	5.0	-0.3	N/S
Dizziness, syncope, convulsions	11.9	11.9	0.1	N/S
Disorders of joint	9.1	8.8	0.3	N/S
Hypothyroidism	9.7	9.2	0.6	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; I = intervention population; C = comparison population; HCC = Hierarchical Condition Category; HF = heart failure; CFS = chronic fatigue syndrome.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

[3] * denotes statistical significance at the 5% level; ** denotes statistical significance at the 1% level.

N/S means not statistically significant.
Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tableKTBH-3.sas 27APR2010.

Supplement Table 4A-2
Characteristics of the KTBH CMHCB demonstration program intervention and comparison populations: Refresh population

Characteristics	Rate per 100[1,2] I	Rate per 100[1,2] C	I vs. C	p[3]
Total number of beneficiaries	2,326	941	—	—
Full time equivalent	1,977	802	—	—
Beneficiary characteristics				
Aged-in (vs. disabled)	88.9	89.2	-0.3	N/S
In Medicaid (vs. not in Medicaid)	4.1	4.9	-0.9	N/S
Male (vs. female)	49.8	50.4	-0.5	N/S
Urban (vs. rural)	100.0	100.0	0.0	N/S
Age				
Mean	75.3	75.2	0.1	N/S
<65	11.1	10.8	0.4	N/S
65-69	12.2	13.0	-0.7	N/S
70-74	18.6	18.1	0.5	N/S
75-79	21.9	23.8	-1.9	N/S
80-84	17.6	18.2	-0.6	N/S
85+	18.5	16.3	2.2	N/S
Race				
White	81.0	81.8	-0.9	N/S
African American	10.9	9.9	1.1	N/S
Other	7.8	8.2	-0.4	N/S
Unknown	0.3	0.1	0.2	N/S
Health Status				
Recalculated HCC score				
Mean	1.5	1.5	0.0	N/S
Low: $\geq$ 1.35 and < 2.00	34.7	35.2	-0.5	N/S
Medium: $\geq$ 2.00 and $\leq$ 3.10	34.1	36.4	-2.4	N/S
High: > 3.10	31.2	28.4	2.8	N/S
Baseline PBPM low	34.4	34.2	0.3	N/S
Baseline PBPM medium	34.6	36.3	-1.7	N/S
Baseline PBPM high	31.0	29.6	1.5	N/S
Charlson comorbidity index—mean	3.4	3.4	0.0	N/S

(continued)

Supplement Table 4A-2 (continued)
Characteristics of the KTBH CMHCB demonstration program intervention and comparison populations: Refresh population

Characteristics	Rate per 100[1,2] I	Rate per 100[1,2] C	I vs. C	p[3]
Chronic conditions				
HF	29.8	28.7	1.1	N/S
Coronary artery disease	48.8	49.0	-0.2	N/S
Other respiratory disease	22.0	25.2	-3.2	N/S
Diabetes without complications	40.3	40.1	0.2	N/S
Diabetes with complications	23.0	25.1	-2.1	N/S
Essential hypertension	67.7	67.7	0.0	N/S
Valve disorders	14.0	13.2	0.9	N/S
Cardiomyopathy	9.0	9.6	-0.6	N/S
Acute & chronic renal disease	44.6	45.4	-0.8	N/S
Renal failure	14.8	17.4	-2.6	N/S
Peripheral vascular disease	10.0	11.7	-1.7	N/S
Lipid metabolism disorders	47.6	50.0	-2.5	N/S
Cardiac dysrhythmias & conduction disorders	33.7	31.9	1.9	N/S
Dementias	2.2	2.0	0.2	N/S
Strokes	6.4	3.6	2.8	**
Chest pain	14.3	13.1	1.2	N/S
Urinary tract infection	12.3	13.9	-1.5	N/S
Anemia	28.9	30.8	-1.9	N/S
Malaise & fatigue (including CFS)	11.5	13.2	-1.7	N/S
Dizziness, syncope, convulsions	14.2	14.2	0.0	N/S
Disorders of joint	13.3	14.4	-1.1	N/S
Hypothyroidism	11.4	11.8	-0.4	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; I = intervention population; C = comparison population; HCC = Hierarchical Condition Category; HF = heart failure; CFS = chronic fatigue syndrome.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

[3] * denotes statistical significance at the 5% level; ** denotes statistical significance at the 1% level.

N/S means not statistically significant.
Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tableKTBH-3.sas 27APR2010.

Supplement Table 4A-3
Characteristics of the KTBH CMHCB demonstration program intervention population by participation status: Original population

Characteristics	Any participation Rate per 100[1,2]	> 75% participation Rate per 100[1,2]	Never participated Rate per 100[1,2]	P vs. NP Rate per 100[1,2]	p[3]
Total number of beneficiaries	2,284	1,256	2,598	—	—
Full time equivalent	1,947	1,256	1,806	—	—
Beneficiary characteristics					
Aged-in (vs. disabled)	86.6	84.3	87.7	-1.1	N/S
In Medicaid (vs. not in Medicaid)	4.1	3.3	5.5	-1.4	*
Male (vs. female)	46.0	45.9	48.8	-2.8	N/S
Urban (vs. rural)	100.0	100.0	99.9	0.1	N/S
Age					
Mean	74.1	73.4	75.5	-1.4	**
<65	13.4	15.7	12.3	1.1	N/S
65-69	12.4	11.9	10.3	2.2	*
70-74	19.5	19.7	17.9	1.6	N/S
75-79	25.1	26.4	21.7	3.5	**
80-84	16.2	15.3	17.6	-1.4	N/S
85+	13.4	11.0	20.3	-6.9	**
Race					
White	80.3	79.6	81.6	-1.4	N/S
African American	12.5	14.2	11.1	1.4	N/S
Other	7.0	6.0	7.1	-0.1	N/S
Unknown	0.2	0.3	0.2	0.0	N/S
Health status					
Recalculated HCC score					
Mean	1.4	1.4	1.5	-0.1	**
Low: $\geq$ 1.35 and < 2.00	38.9	39.0	36.8	2.0	N/S
Medium: $\geq$ 2.00 and $\leq$ 3.10	33.3	32.3	33.4	-0.1	N/S
High: > 3.10	27.8	28.7	29.8	-1.9	N/S
Baseline PBPM low	33.6	32.5	37.8	-4.2	**
Baseline PBPM medium	37.6	36.9	31.1	6.5	**
Baseline PBPM high	28.8	30.6	31.0	-2.2	N/S
Charlson comorbidity index—mean	3.2	3.3	3.1	0.1	*

(continued)

Supplement Table 4A-3 (continued)
Characteristics of the KTBH CMHCB demonstration program intervention population by participation status: Original population

Characteristics	Any participation Rate per 100[1,2]	> 75% participation Rate per 100[1,2]	Never participated Rate per 100[1,2]	P vs. NP Rate per 100[1,2]	P[3]
Chronic conditions					
HF	22.4	23.2	25.2	-2.7	*
Coronary artery disease	47.1	49.7	44.1	3.0	*
Other respiratory disease	19.4	18.0	21.3	-1.9	N/S
Diabetes without complications	37.1	40.6	35.4	1.7	N/S
Diabetes with complications	19.4	21.1	16.6	2.8	*
Essential hypertension	60.5	61.3	60.0	0.5	N/S
Valve disorders	9.2	9.7	8.5	0.7	N/S
Cardiomyopathy	5.3	6.4	4.9	0.4	N/S
Acute & chronic renal disease	35.6	37.4	29.5	6.1	**
Renal failure	10.6	10.6	11.3	-0.7	N/S
Peripheral vascular disease	7.4	7.0	6.2	1.1	N/S
Lipid metabolism disorders	30.7	32.3	24.8	5.9	**
Cardiac dysrhythmias & conduction disorders	26.3	28.0	24.5	1.8	N/S
Dementias	1.4	1.0	5.5	-4.1	**
Strokes	5.3	5.5	5.1	0.2	N/S
Chest pain	11.8	12.7	9.5	2.4	**
Urinary tract infection	12.0	10.7	17.9	-5.9	**
Anemia	26.5	27.4	25.1	1.4	N/S
Malaise & fatigue (including CFS)	5.1	5.2	4.1	1.0	N/S
Dizziness, syncope, convulsions	11.8	11.9	12.1	-0.3	N/S
Disorders of joint	9.6	10.0	8.6	1.0	N/S
Hypothyroidism	10.2	10.4	9.2	1.0	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; P = participating; NP = nonparticipating; C = comparison population; HCC = Hierarchical Condition Category; HF = heart failure; CFS = chronic fatigue syndrome.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

[3] * denotes statistical significance at the 5% level; ** denotes statistical significance at the 1% level.

N/S means not statistically significant.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.
Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tableKTBH-4.sas 27APR2010.

Supplement Table 4A-4
Characteristics of the KTBH CMHCB demonstration program intervention population by participation status: Refresh population

Characteristics	Any participation Rate per 100[1,2]	> 75% participation Rate per 100[1,2]	Never participated Rate per 100[1,2]	P vs. NP Rate per 100[1,2]	p[3]
Total number of beneficiaries	1,037	599	1,289	–	–
Full time equivalent	918	599	1,059	–	–
Beneficiary characteristics					
Aged-in (vs. disabled)	89.5	89.2	88.4	1.1	N/S
In Medicaid (vs. not in Medicaid)	3.3	3.4	4.8	-1.5	N/S
Male (vs. female)	52.4	52.6	47.6	4.8	*
Urban (vs. rural)	100.0	100.0	100.0	0.0	--
Age					
Mean	75.4	74.9	75.2	0.1	N/S
<65	10.6	11.0	11.6	-1.0	N/S
65-69	14.3	17.7	10.5	3.8	**
70-74	17.8	18.5	19.3	-1.4	N/S
75-79	21.8	19.4	22.0	-0.2	N/S
80-84	17.7	16.6	17.5	0.2	N/S
85+	17.8	16.9	19.2	-1.4	N/S
Race					
White	82.2	81.0	79.9	2.4	N/S
African American	12.0	12.0	10.0	2.1	N/S
Other	5.4	6.7	9.8	-4.3	**
Unknown	0.3	0.2	0.4	-0.1	N/S
Health status					
Recalculated HCC score					
Mean	1.6	1.6	1.4	0.3	**
Low: $\geq$ 1.35 and < 2.00	29.8	31.6	38.9	-9.1	**
Medium: $\geq$ 2.00 and $\leq$ 3.10	34.3	33.9	33.9	0.4	N/S
High: > 3.10	35.8	34.6	27.2	8.6	**
Baseline PBPM low	29.3	30.6	38.9	-9.5	**
Baseline PBPM medium	36.0	37.0	33.3	2.7	N/S
Baseline PBPM high	34.6	32.3	27.9	6.8	**
Charlson comorbidity index—mean	3.9	3.8	3.1	0.8	**

(continued)

Supplement Table 4A-4 (continued)
Characteristics of the KTBH CMHCB demonstration program intervention population by participation status: Refresh population

Characteristics	Any participation Rate per 100[1,2]	> 75% participation Rate per 100[1,2]	Never participated Rate per 100[1,2]	P vs. NP Rate per 100[1,2]	p[3]
Chronic conditions					
HF	35.5	31.8	24.9	10.6	**
Coronary artery disease	55.3	53.8	43.1	12.3	**
Other respiratory disease	25.1	25.2	19.3	5.8	**
Diabetes without complications	44.9	45.9	36.2	8.7	**
Diabetes with complications	26.8	28.7	19.8	7.0	**
Essential hypertension	73.2	72.8	62.8	10.4	**
Valve disorders	17.7	17.8	10.8	6.8	**
Cardiomyopathy	11.5	9.6	6.9	4.6	**
Acute & chronic renal disease	49.9	50.7	40.0	9.9	**
Renal failure	17.2	17.3	12.7	4.4	**
Peripheral vascular disease	12.0	10.9	8.3	3.7	**
Lipid metabolism disorders	52.5	50.4	43.3	9.1	**
Cardiac dysrhythmias & conduction disorders	38.5	37.6	29.6	8.8	**
Dementias	1.9	1.9	2.4	-0.5	N/S
Strokes	7.1	7.4	5.8	1.3	N/S
Chest pain	16.3	15.5	12.6	3.7	*
Urinary tract infection	13.7	13.6	11.1	2.6	N/S
Anemia	31.1	30.9	27.0	4.0	*
Malaise & fatigue (including CFS)	14.2	12.2	9.1	5.0	**
Dizziness, syncope, convulsions	15.6	15.4	12.9	2.7	N/S
Disorders of joint	12.5	10.7	14.0	-1.5	N/S
Hypothyroidism	12.0	11.1	10.9	1.1	N/S

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; P = participating; NP = nonparticipating; C = comparison population; HCC = Hierarchical Condition Category; HF = heart failure; CFS = chronic fatigue syndrome.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

[3] * denotes statistical significance at the 5% level; ** denotes statistical significance at the 1% level.

N/S means not statistically significant.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: H:/project/07964/025 hiccup/pgm/larsen/programs/ktbh/tables/tableKTBH-4.sas 27APR2010.

Supplement Table 4A-5
Participation rates during the first 6 months of the KTBH CMHCB demonstration by beneficiary characteristics, baseline characteristics, and intervention period health status: Original and refresh populations

Characteristics	Original (%)	Refresh (%)
Overall participation rate[1,2]	42	42
Beneficiary characteristics		
Male	41	44
Female	43	40
White	41	43
African American/other/unknown	45	39
Age < 65 years	47	38
Age 65-74	46	45
Age 75-84	43	42
Age 85 + years	31	40
Medicaid	37	35
Non-Medicaid	42	42
Baseline characteristics		
Baseline HCC score low	45	37
Baseline HCC score high	39	47
Low baseline PBPM	40	36
High baseline PBPM	40	45
Baseline Charlson score low	43	33
Baseline Charlson score high	42	49
Demonstration period health status		
Died	33	43
Alive	46	42
Institutionalized	8	14
Not institutionalized	47	43
Concurrent HCC score low	42	36
Concurrent HCC score high	39	45
Number of participants	1,953	942
Number of total beneficiaries	4,660	2,239

NOTES: KTBH = VillageHealth's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] Counts of beneficiaries are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the program.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: partab2.sas 27APR2010.

Supplement Table 4A-6
Logistic regression modeling results comparing beneficiaries that participated at least one eligible month in the first 6 months of the KTBH CMHCB demonstration to all other intervention beneficiaries: original population[1,2]

	Model 1A OR	p[3]	Model 1B OR	p[3]
Intercept	0.90	**	0.90	**
Beneficiary Characteristics				
Male	0.86	*	0.87	*
African American/Other/Unknown	1.11		1.19	*
Age < 65 years	1.02		1.10	
Age 75-84	0.91		0.96	
Age 85 + years	0.52	**	0.74	**
Medicaid	0.73	*	0.64	**
Baseline Characteristics				
Baseline HCC Score Medium			0.98	
Baseline HCC Score High			0.98	
Medium Baseline PBPM			1.25	**
High Baseline PBPM			1.16	
Baseline Charlson Score Medium			0.88	
Baseline Charlson Score High			0.95	
Demonstration Period Health Status				
Died			0.80	**
Institutionalized			0.10	**
Concurrent HCC Score Medium			1.14	
Concurrent HCC Score High			1.16	
Number of Cases	4,876		4,876	
Chi-Square (p<)	71.68	**	468.71	**
Pseudo R-square	0.01		0.09	

NOTES: KTBH = Care Level Management; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the first 6 months the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $567. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .696 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene03 partab3, partab4 27APR2010

Supplement Table 4A-7
Logistic regression modeling results comparing beneficiaries that participated at least one eligible month in the first 6 months of the KTBH CMHCB demonstration to all other intervention beneficiaries: refresh population[1,2]

	Model 1A OR	p[3]	Model 1B OR	p[3]
Intercept	0.78	*	0.43	**
Beneficiary Characteristics				
Male	1.14		1.02	
African American/Other/Unknown	0.89		0.92	
Age < 65 years	0.76		0.71	*
Age 75-84	0.90		0.89	
Age 85 + years	0.83		0.92	
Medicaid	0.77		0.96	
Baseline Characteristics				
Baseline HCC Score Medium			1.15	
Baseline HCC Score High			1.22	
Medium Baseline PBPM			1.00	
High Baseline PBPM			0.95	
Baseline Charlson Score Medium			1.65	**
Baseline Charlson Score High			1.80	**
Demonstration Period Health Status				
Died			1.01	**
Institutionalized			0.17	**
Concurrent HCC Score Medium			1.38	**
Concurrent HCC Score High			1.36	**
Number of Cases	2,325		2,325	
Chi-Square (p<)	10.11		97.65	**
Pseudo R-square	0.00		0.04	

NOTES: KTBH = Village Health's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the first 6 months the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $527. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .805 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene03 partab3, partab4 27APR2010

Supplement Table 4A-8
Logistic regression modeling results comparing beneficiaries that participated at least one eligible month in the KTBH CMHCB demonstration to all other intervention beneficiaries: original population[1,2]

	Model 2 OR	p[3]
Intercept	1.16	
Beneficiary Characteristics		
Male	0.86	*
African American/Other/Unknown	1.18	
Age < 65 years	1.04	
Age 75-84	0.97	
Age 85 + years	0.77	*
Medicaid	0.59	**
Baseline Characteristics		
Baseline HCC Score Medium	0.97	
Baseline HCC Score High	1.00	
Medium Baseline PBPM	1.29	**
High Baseline PBPM	1.09	
Baseline Charlson Score Medium	0.91	
Baseline Charlson Score High	1.07	
Demonstration Period Health Status		
Died	0.86	
Institutionalized	0.10	**
Concurrent HCC Score Medium	1.20	*
Concurrent HCC Score High	1.37	**
Number of Cases	4,882	
Chi-Square (p<)	360.04	**
Pseudo R-square	0.07	

NOTES: KTBH = Village Health's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $567. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .696 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene03 partab1.sas 27APR2010

Supplement Table 4A-9
Logistic regression modeling results comparing beneficiaries that participated at least one eligible month in the KTBH CMHCB demonstration to all other intervention beneficiaries: refresh population[1,2]

	Model 2 OR	p[3]
Intercept	0.44	**
Beneficiary Characteristics		
Male	1.06	
African American/Other/Unknown	0.92	
Age < 65 years	0.79	
Age 75-84	0.92	
Age 85 + years	0.97	
Medicaid	0.90	
Baseline Characteristics		
Baseline HCC Score Medium	1.18	
Baseline HCC Score High	1.30	
Medium Baseline PBPM	0.96	
High Baseline PBPM	0.99	
Baseline Charlson Score Medium	1.74	**
Baseline Charlson Score High	1.82	**
Demonstration Period Health Status		
Died	0.96	
Institutionalized	0.15	**
Concurrent HCC Score Medium	1.41	**
Concurrent HCC Score High	1.72	**
Number of Cases	2,326	
Chi-Square (p<)	111.81	**
Pseudo R-square	0.05	

NOTES: KTBH = Village Health's Key to Better Health; CMHCB = Care Management for High Cost Beneficiaries; OR = odds ratio; HCC = Hierarchical Condition Category; PBPM = per beneficiary per month.

[1] Numbers reported for the intervention periods include only persons who have some baseline eligibility.

[2] The regressions are adjusted for CMHCB program eligibility during the entire period the Care Management Organization (CMO) was active in the demonstration.

[3] * denotes statistical significance at the 5% level;** denotes statistical significance at the 1% level.

The baseline HCC score reference group is <2. The age reference group is 65-74 years. The PBPM reference group is LT $527. The baseline Charlson score reference group is LT 3. The concurrent HCC score reference group is .805 or less.

Data Sources: RTI analysis of 2004-2008 Medicare enrollment, eligibility, claims and encounter data.

Program: bene03 partab1.sas 27APR2010

SUPPLEMENT 7A
REGRESSION-TO-THE-MEAN

Regression-to-the-mean (RtoM) cannot be quantified simply by tracking the change in mean PBPM costs because of secular changes in costs of a particular group. RtoM more specifically refers to low (high) initial costs gravitating to the mean cost over time which could be rising or falling due to other factors. It would be possible to observe a rising PBM mean cost still with significant RtoM. Unbiased random sampling of a chronically ill population should have most of the positive and negative changes in beneficiary PBPM costs cancelling out, leaving the secular growth trend. A "biased" sample of high cost chronically ill, by contrast, should produce more declines in costs than increases and a lower (negative?) cost trend.

To estimate the impact of RtoM, we specify the following equation:

$$\Delta PBPM_{tp} = PBPM_{tp} - PBPM_{bp} = \alpha + \rho[PBPM_{bp} - PBPM_b^*] + \beta Status_p + \varepsilon_{tp} \qquad (7.1a)$$

- $\Delta PBPM_{tp}$ = the change in PBPM cost between the base period (b) and current period (t) for the p-th patient.
- $PBPM_{tp}$, $PBPM_{bp}$ = the p-th patient's average PBPM cost in the current and base periods, respectively.
- $PBPM_b^*$ = the mean PBPM cost for all patients in the base period.
- $Status_p$ = 1 if patient in the intervention group; 0 otherwise.

The growth in a beneficiary's PBPM cost from base to demonstration period is assumed to have a secular component, α, for the control group and $\alpha + \beta$ for the intervention group. Regression to the mean is captured by ρ. Beneficiaries with greater than average base year PBPM costs should exhibit lower PBPM costs in the demonstration period while those with below-average PBPM costs should exhibit growth in their PBPM costs, after adjusting for the secular trend in Medicare spending. Therefore, we assume that $\rho < 0$ and we should observe a compression in PBPM costs towards the secular mean rate over time. No regression to the mean would result in an estimate of $\rho = 0$. Solving equation 7.1a for $PBPM_{tp}$ gives

$$PBPM_{tp} = (\alpha - \beta Status_p - \rho PBPM_b^*) + (1 + \rho)PBPM_{bp} \qquad (7.2)$$

or

$$PBPM_{tp} = \gamma_p + \theta PBPM_{bp} \qquad (7.3)$$

where $\gamma_p = (\alpha - \beta Status_p - \rho PBPM_b^*)$ = the overall mean secular growth in PBPM costs that varies only by which study group to patient is in, and $\theta = (1 + \rho)$, or $\rho = \theta - 1$.

The ANCOVA regression specification is represented by equation 7.3. The intervention effect, β, can also be separated out of γ_p . The smaller the estimate of θ, the greater is the regression to the mean. For example, if the estimate of θ = 0.20, then ρ = 1 - .20 = -.80, implying very substantial regression to the mean. Relative to secular growth, a $100 higher base year PBPM cost versus the mean would lower current period costs by $80 and vice-versa for a beneficiary with a base period PBPM cost of $100 less than average. At $PBPM_{bp}$ = $500 for the control group, the expected current period $PBPM_{tp}$ = $1,320, an increase of $820. At $PBPM_{bp}$ = $2,500, the current period $PBPM_{tp}$ = $1,720, a $780 decrease.