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**Medicaid Policy Analysis Options:  
A Report for the  
University of Connecticut – Medicaid Partnership**

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**Prepared by:**



**June 2014**

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The Center for Public Health and Health Policy, a research and programmatic center founded in 2004, integrates public health knowledge across the University of Connecticut campuses and leads initiatives in public health research, health policy research, health data analysis, health information technology, community engagement, service learning, and houses several referral services.

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This report was prepared by the

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## Executive Summary

The University of Connecticut – Medicaid Partnership Collaborative Project Agreement, in its Future Policy Report Options section, requires the University’s Center for Public Health and Health Policy (CPHHP) to conduct a scan for evidence-based practices in health care delivery and shifts in standards of care that are highly relevant to the cost of and quality of care of the Connecticut Medicaid population. In this report CPHHP presents five evidence-based practice topics worthy of further investigation for their potential impact on the Connecticut Medicaid program, pursuant to the requirements of this Deliverable.

The five topics selected for the analyses presented in this report are:

- Cardiac Nuclear Imaging
- Cardiac Computed Tomography Angiography for Detection of Coronary Artery Disease
- Radiofrequency Catheter Ablation to Treat Atrial Fibrillation
- Oral Treatments for Gestational Diabetes
- Antibiotic Prescribing Behavior

**Overall, our preliminary analyses indicate that there is the potential for modest to substantial cost savings to the Connecticut Medicaid program related to antibiotics prescribing, cardiac nuclear imaging, coronary computed tomography angiography, and treatment of gestational diabetes among Medicaid participants. In contrast, catheter ablation for atrial fibrillation, although a relatively high cost procedure, is utilized too infrequently among Connecticut Medicaid participants to see much budget impact associated with alternative treatments. Specific recommendations for future study are presented below.**

1. With respect to antibiotic prescribing, our analyses have documented the substantial spending associated with antibiotic treatment in the Connecticut Medicaid population.

*Further analysis should seek to (a) identify patterns of antibiotic usage among Connecticut Medicaid participants - who is using (and who is prescribing) antibiotics, for what diagnoses, at what times, and (b) place the state’s utilization of antibiotics in context by comparing the rate of antibiotic prescribing among CT Medicaid participants to national averages.*

*We recommend conducting an examination of condition-specific and season-specific (i.e., coinciding with cold season or flu outbreaks) prescribing patterns to identify trends toward antibiotic overuse.*

*We strongly recommend augmenting and enhancing the claims files used for further analyses.*

2. For cardiac nuclear imaging, our analyses suggest the three procedures studied (single photon emission computed tomography [SPECT], the treadmill stress test [ETT] and the

echocardiogram [ECHO]) have comparable effectiveness in diagnosing coronary artery disease (CAD). There could be significant savings to the Medicaid program were ETT and ECHO to be used instead of SPECT.

*We recommend benchmarking how Connecticut's Medicaid program compares to other state Medicaid programs as an important next step for identifying potential overuse of SPECT.*

*It is critical to ensure that patient sickness and/or co-morbidities, which are more problematic in the Medicaid population relative to privately insured patients, are accounted for in assessing the potential for changes in use of these procedures.*

3. The substantial difference in cost between cardiac computed tomography angiography (CCTA) and invasive coronary angiography, coupled with the almost exclusive utilization of invasive coronary angiography among physicians treating Medicaid patients suspected of having CAD, makes this a strong candidate for further research. However, the ICER report upon which our preliminary investigation is based concluded that CCTA was comparable to invasive coronary angiography in its ability to detect CAD among patients presenting with acute chest pain in an emergency setting only, which is a small subset of patients receiving CCTA.

*We recommend further analysis of the comparative effectiveness of invasive coronary angiography and CCTA when used in the outpatient setting prior to conducting a budget impact analysis based on all Medicaid patients suspected of CAD.*

4. Our preliminary analysis indicates that the use of the oral agent, glyburide, for management of gestational diabetes, as opposed to insulin, could reduce per patient expenditures considerably, although the total budget impact may be fairly small.

*We recommend verifying the medical reasons for treating gestational diabetes with insulin rather than glyburide.*

## Introduction

In this report, the Center for Public Health and Health Policy (CPHHP) presents five evidence-based practice topics worthy of further investigation pursuant to the requirements of the University of Connecticut – Medicaid Partnership Collaborative Project Agreement - 1 (CPA-1), Deliverable 1, “Future Policy Report Options.” CPHHP reviewed effectiveness reports produced by the Institute for Clinical and Economic Review (ICER), effectiveness reports produced on behalf of the Agency for Health Care Research and Quality (AHRQ), and health care innovations described in AHRQ’s “Research Activities” newsletters issued between January 2013 and January 2014. From these reports, CPHHP identified five topics for which Connecticut Medicaid data were analyzed to establish current use and cost of care. The findings presented here, preliminary in nature, are intended solely to identify promising areas for future analyses that could be conducted through the UConn Medicaid Partnership.

The five topics selected for the analyses presented in this report are:

- Cardiac Nuclear Imaging
- Cardiac Computed Tomography Angiography for Detection of Coronary Artery Disease
- Radiofrequency Catheter Ablation to Treat Atrial Fibrillation
- Oral Treatments for Gestational Diabetes
- Antibiotic Prescribing Behavior

This report includes a description of the methods that CPHHP employed to select the five topics; a brief description of the topics; and for each topic, utilization and costs of associated medical procedures or medications. For the topic description, all factual assertions are taken from the summarized reports unless otherwise noted in the text. The report concludes with recommendations for future analyses under the UConn Medicaid Partnership.

## Topic Selection Procedure

The Future Policy Report Options Deliverable requires that: “CPHHP will conduct a scan for evidence-based practices in health care delivery and shifts in standards of care that are highly relevant to the cost of and quality of care for the Connecticut Medicaid population. Using reports and recommendations from reputable resources such as the Agency for Health Care Research and Quality (AHRQ) and the Institute for Clinical and Economic Review (ICER), we will identify five interventions, policies, or treatment modalities and/or guidelines worthy of further investigation. Connecticut Medicaid data will be analyzed to establish current volumes and cost of care related to the policies/guidelines/interventions identified for preliminary evaluation. A brief report will be issued summarizing the findings of our initial analysis and prioritizing these policies/treatment modalities as potential topics for future reports.”

Many different types of topics are examined by the AHRQ and ICER reports. As a result, CPHHP developed several criteria, based on the requirements of our project agreement, with which to evaluate the various types of topics and select five for further investigation.

AHRQ-sponsored reports were initially screened based on potential cost ramifications to the Connecticut Medicaid program. Reports and newsletter items that did not appear to have any relation to cost were eliminated. The remaining AHRQ items and all of the ICER reports were then reviewed by two CPHHP policy analysts to identify promising topics. Each topic selected is identified in an AHRQ or ICER report. The review to select each report was guided by the following selection criteria:

- Included evidence-supported effectiveness conclusions
- Focused on specific, identifiable underlying conditions
- Examined activities that might be further investigated with Connecticut Medicaid claims data
- Examined activities that were sufficiently specific to be appropriate for utilization and cost modeling
- Included a demographic younger than 65
- Related to a larger public health concern in Connecticut

The initial review of potential topics included 10 ICER reports, 108 recently published AHRQ-sponsored reports, and 11 AHRQ newsletter articles. A sequential elimination strategy was employed to narrow down the list of potential topics. Initially, reports were eliminated that failed to minimally satisfy any of the selection criteria. Remaining reports were rated on how well they satisfied the selection criteria in totality. Two CPHHP policy analysts independently compiled a list of ten promising topics. A thorough review of each of these topics was conducted to determine the following: (1) whether the available Connecticut Medicaid claims data could be used to support a cost and utilization analysis; (2) whether other evidence was available that might support a model of quality of care for individuals insured by the Connecticut Medicaid program; and (3) whether the topic had the potential for significant cost savings related to high costs or volume.

## Selected Topics

### Cardiac Nuclear Imaging (ICER, 2013)<sup>1</sup>

ICER's cardiac nuclear imaging report was selected because of the relatively strong evidence supporting the conclusions; the detailed methods section of the report which will enable a replication using Connecticut Medicaid data; and the recent interest in Coronary Artery Disease (CAD) detection and treatment, as evidenced by recently completed and ongoing AHRQ sponsored reports. Specifically, AHRQ sponsored a review of the effectiveness of non-invasive tools for detecting CAD among women, the results of which were released in June, 2012.<sup>2</sup> It is currently sponsoring a comparative effectiveness review of similar tools that includes male and female populations.<sup>3</sup>

CAD is a condition in which the arteries narrow, leading to a decrease in blood and oxygen flow. This is often caused by an accumulation of plaque in the affected arteries, which is called atherosclerosis. Eventually, CAD may lead to occlusion, or total blockage of an artery, and a heart attack thereafter. CAD is the leading heart-related cause of death among Americans. The Centers for Disease Control and Prevention estimate that 380,000 deaths are caused by CAD annually in the United States.<sup>4</sup>

The standard of care for detecting CAD is invasive coronary angiography. This procedure involves inserting a catheter into the patient, typically through the femoral blood vessel. Contrast dye is then injected through the catheter and x-ray images are taken so that the clinician may observe blood flow through the potentially affected artery. While major adverse events arising from angiography are rare, they may be serious and include heart attack, cardiac arrhythmia, and stroke, among other things. Further, many patients dislike the invasive nature of the procedure. As a result, several diagnostic alternatives have been developed.

ICER conducted a review of various alternatives to invasive coronary angiography for the detection of CAD for the Washington State Health Care Authority, Health Assessment Program, the results of which were published in August, 2013. The report examined, among other things, the nuclear

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<sup>1</sup> Ollendorf D, Colby J, Cameron C, Sitaram S, Pearson S (August 12, 2013). Cardiac Nuclear Imaging. Institute for Clinical and Economic Review (Prepared for the Washington State Health Care Authority Health Technology Assessment Program), available at: <http://www.icer-review.org/cardiac-nuclear-imaging/> (accessed April 24, 2014).

<sup>2</sup> Dolor R, Patel M, Melloni C, Chatterjee R, McBroom A, Musty M, Wing L, Coeytaux R, Ross A, Bastian L, Anderson M, Kosinski A, Sanders G (June, 2012). Noninvasive Technologies for the Diagnosis of Coronary Artery Disease in Women. Comparative Effectiveness Review No. 58 (Prepared by the Duke Evidence-based Practice Center for the Agency for Healthcare Research and Quality, Rockville, MD), available at: [http://www.effectivehealthcare.ahrq.gov/ehc/products/202/1019/CER58\\_Diagnosis-CAD-in-Women\\_FinalReport\\_20120607.pdf](http://www.effectivehealthcare.ahrq.gov/ehc/products/202/1019/CER58_Diagnosis-CAD-in-Women_FinalReport_20120607.pdf) (accessed April 21, 2014).

<sup>3</sup> AHRQ, "Draft Key questions: Non-invasive Testing for Coronary Artery Disease" available at: <http://www.effectivehealthcare.ahrq.gov/ehc/index.cfm/search-for-guides-reviews-and-reports/?pageAction=displayTopic&topicID=566> (accessed April 23, 2014).

<sup>4</sup> Centers for Disease Control and Prevention, "Heart Disease Facts," (updated February 19, 2014), available at: <http://www.cdc.gov/heartdisease/facts.htm> (accessed April 23, 2014).



imaging technique of single photon emission computed tomography (SPECT) in comparison to the treadmill stress test (ETT) and the echocardiogram (ECHO) test.

- SPECT is an imaging process whereby radiotracers are injected into the patient's vein and imaged using a gamma camera. This produces a three-dimensional picture that allows the clinician to determine perfusion, or blood and oxygen flow, through the artery.
- An ETT measures cardiac electrical activity to provide information about perfusion. Electrical activity is measured twice: when the patient is at rest and after the patient has engaged in a period of physical exertion.
- An Echo test relies upon sound waves to produce information about perfusion and heart function. As with ETT, typically two measures are taken, the first when the patient is at rest and the second after a period of physical exertion.

Among these three tests, SPECT is sometimes favored by clinicians because ETT has been shown to have relatively low sensitivity to patients at high risk of CAD and Echo lacks precision in differentiating single-vessel from multi-vessel disease and may be less effective among obese patients and patients with other conditions. ICER asserts that SPECT may now be overused, noting that in the 1990s more than 40 percent of SPECT exams resulted in a finding of CAD, whereas in the period 2006 to 2009 only 8.7 percent of them did. While all three tests present only minimal short-term risk to the patient, SPECT exposes the patient to radiation, the long-term effects of which have not been well-studied.

ICER selected patient mortality and major adverse cardiovascular events as the outcomes of interest. It concluded that the available effectiveness evidence comparing SPECT to ETT supported moderate confidence that the two procedures produced comparable benefits in symptomatic populations at low to intermediate risk for CAD, and also moderate confidence that SPECT provided a small benefit over ETT for symptomatic populations at high risk for CAD. Comparing SPECT to Echo, ICER concluded that the evidence supported high confidence that the two procedures were comparable among symptomatic patients with any level of risk for CAD.

ICER also compared estimated costs of the various procedures. It concluded that SPECT had a comparable value to ETT when used for symptomatic patients at high risk for CAD. It also found comparable value between SPECT and Echo tests for low, intermediate and high risk patients.

## **Coronary Computed Tomographic Angiography for Detection of Coronary Artery Disease (ICER, 2009)<sup>5</sup>**

This ICER report was selected because of the relatively strong evidence supporting the conclusions and active ongoing research in CAD detection and treatment, as noted in the nuclear cardiac imaging summary above.

Coronary Computed Tomographic Angiography (CCTA) is another diagnostic alternative to invasive coronary angiography for the detection of CAD. As stated above, invasive coronary angiography is the standard of care for detecting CAD. CCTA employs a CT scanner to deliver ionized radiation in order to produce an image of the area. In some cases contrast dye is injected into the patient to produce a high-definition image.

In 2009, ICER released a review of various alternatives to invasive coronary angiography, focusing on CCTA. It examined two primary settings in which CCTA might be used to detect CAD: an emergency setting, in which CCTA is used to quickly eliminate CAD as a possibility among patients presenting with acute chest pain; and in an outpatient setting, in which a clinician administers CCTA in response to symptoms consistent with CAD.

ICER concluded that CCTA was comparable to invasive coronary angiography in its ability to detect CAD in an emergency setting among patients presenting with acute chest pain. ICER found the evidence to be insufficient to conclude that CCTA was as effective as an alternative in an outpatient setting. The ICER economic analysis concluded that CCTA had the potential of being a high-value alternative to invasive coronary angiography when used in an emergency setting. It noted, however, that while CCTA had few short-term risks, the long-term health ramifications of increased exposure to radiation were not well known.

## **Radiofrequency Catheter Ablation to Treat Atrial Fibrillation (AHRQ, 2009)<sup>6</sup>**

This AHRQ report, drafted by Tufts Medical Center's Evidence-Based Practice Center (Tufts Medical Center), was selected based on the relatively strong evidence that radiofrequency catheter ablation was effective when used in conjunction with administration of antiarrhythmic drugs, and our future ability to model costs associated with this procedure by adapting the modeling methods

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<sup>5</sup> Ollendorf D, Gohler A, Pearson S, Kuba M, Jaeger M (2009). Coronary Computed Tomographic Angiography for Detection of Coronary Artery Disease. Institute for Clinical and Economic Review, available at: [http://www.icer-review.org/wp-content/uploads/2013/04/CCTA\\_Final.pdf](http://www.icer-review.org/wp-content/uploads/2013/04/CCTA_Final.pdf) (accessed April 14, 2014).

<sup>6</sup> Ip S, Terasawa T, Balk E, Chung M, Alsheikh-Ali A, Garlitski A, Lau J (July 2009). Comparative Effectiveness of Radiofrequency Catheter Ablation for Atrial Fibrillation. Comparative Effectiveness Review No. 15 (Prepared by Tufts Medical Center Evidence-based Practice Center for the Agency for Healthcare Research and Quality, Rockville, MD) available at: [http://www.effectivehealthcare.ahrq.gov/ehc/products/51/114/2009\\_0623RadiofrequencyFinal.pdf](http://www.effectivehealthcare.ahrq.gov/ehc/products/51/114/2009_0623RadiofrequencyFinal.pdf) (accessed April 21, 2014).

provided in a follow-up report prepared for the New England Comparative Effectiveness Public Advisory Council (CEPAC).<sup>7</sup>

Atrial fibrillation is a condition in which the heart muscles contract quickly or irregularly. It is the most common form of heartbeat irregularity, or cardiac arrhythmia, in the United States.<sup>8</sup> Atrial fibrillation is associated with a two-fold increase in death and a five-fold increase in the likelihood of stroke.

Atrial fibrillation is categorized into three types, based on the duration of the fibrillation.

Paroxysmal atrial fibrillation describes a situation in which two or more episodes of atrial fibrillation spontaneously return to a normal rhythm, which is called normal sinus rhythm, within seven days.

Persistent atrial fibrillation refers to an arrhythmia that lasts more than seven days. Fibrillation that lasts more than one year is called longstanding persistent atrial fibrillation.

In some cases, the patient's symptoms arising from the fibrillation can be adequately addressed by reducing the patient's heart rate. For other patients, however, simple reduction of heart rate is insufficient, and attempts are made to return the heart rhythm back to its sinus rhythm. Current standard of care for patients who need long-term rhythm control management involves indefinite administration of antiarrhythmic drugs (AADs).

The long-term effect of AADs is not well studied, but evidence suggests that consumption of AADs has a detrimental effect on overall health. While studies show that "the presence of sinus rhythm [is] associated with a considerable reduction in the risk of death," they have also produced evidence that the standard medical means by which sinus rhythm is achieved, AADs, is "associated with increased mortality" and that the risks of AADs may outweigh the benefits of sinus rhythm, in terms of mortality. For this reason and others, medical researchers and providers have developed several atrial fibrillation treatment options other than administration of AADs, such as radiofrequency ablation. These alternative procedures focus on restoring sinus rhythm by ablating, or destroying, any physical obstruction that may have developed in the arteries.

Tufts Medical Center conducted a review comparing, among other things, the effectiveness of radiofrequency catheter ablation for the treatment of atrial fibrillation and standard of care treatment with AADs. The initial review was completed in July of 2009. CEPAC reviewed the report in

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<sup>7</sup> Ablation Strategies for Atrial Fibrillation: Supplemental Data and Analyses to the Comparative Effectiveness Review of the Agency for Healthcare Research and Quality, Institute for Clinical and Economic Review. (Prepared for the New England Comparative Effectiveness Public Advisory Council June, 2011) available at: <http://cepac.icer-review.org/wp-content/uploads/2011/04/RAPiD-Afib-FINAL-Meeting-Report.pdf> (accessed April 21, 2014).

<sup>8</sup> Atrial Fibrillation Fact Sheet, Centers for Disease Control and Prevention, available at: [http://www.cdc.gov/dhdspl/data\\_statistics/fact\\_sheets/fs\\_atrial\\_fibrillation.htm](http://www.cdc.gov/dhdspl/data_statistics/fact_sheets/fs_atrial_fibrillation.htm) (accessed April 21, 2014).

2011,<sup>9</sup> and Tufts Medical Center conducted a structured assessment of the continuing validity of the 2009 findings in December, 2012.<sup>10,11</sup>

Tufts Medical Center found that there was a moderate level of evidence supporting the conclusion that patients who received radiofrequency catheter ablation in addition to administration of AADs to treat atrial fibrillation had a significantly higher likelihood of returning to sinus rhythm than those treated solely with medications. At the time of the original study and the 2012 update, there was insufficient evidence to determine whether radiofrequency catheter ablation alone was more or less effective than administration of AADs alone in returning the patient to sinus rhythm.

## **Oral Treatments for Gestational Diabetes (AHRQ, 2008)<sup>12</sup>**

This topic was selected because the treatment affects pregnant women, a population that accounts for large percentage of Medicaid expenditures.<sup>13</sup>

Gestational diabetes mellitus is any degree of glucose intolerance, other than overt diabetes, the onset of which is first recognized during pregnancy.<sup>14</sup> It is the most common medical complication of pregnancy, and is associated with nearly 200,000 births annually. Gestational diabetes leads to health complications for both the mother and the infant.

Intravenous injection of insulin is the standard of care for gestational diabetes when the condition cannot be managed adequately through dietary adjustments alone. Many patients may consider injection of insulin to be uncomfortably invasive. Some cases of gestational diabetes have been treated recently with glyburide, which is administered orally.

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<sup>9</sup> Ablation Strategies for Atrial Fibrillation: Supplemental Data and Analyses to the Comparative Effectiveness Review of the Agency for Healthcare Research and Quality, Institute for Clinical and Economic Review (Prepared for the New England Comparative Effectiveness Public Advisory Council June, 2011) available at: <http://cepac.icer-review.org/wp-content/uploads/2011/04/RAPiD-Afib-FINAL-Meeting-Report.pdf> (accessed April 21, 2014).

<sup>10</sup> Tsertsvadze A, Ahmadzai N, Skidmore B, Daniel R, Moher D, Ansari M, Garrity C (December, 2012). Effectiveness of Radiofrequency Catheter Ablation for Atrial Fibrillation, AHRQ Comparative Effectiveness Review Surveillance Program, available at: <http://effectivehealthcare.ahrq.gov/ehc/products/51/1542/atrial-fibrillation-ablation-surveillance-130516.pdf> (accessed April 21, 2014).

<sup>11</sup> A more recent report examines a wide array of treatment options for patients suffering from Atrial Fibrillation. This later report does not focus specifically on radiofrequency catheter ablation. See Al-Khatib S, Lapointe N, Chatterjee R, Crowley M, Dupre M, Kong D, Lopes R, Povsic T, Raju S, Shah B, Kosinski A, McBroom A, Chobot M, Gray R, Sanders G (June 2013). Treatment of Atrial Fibrillation, Comparative Effectiveness Review 110 (Prepared by the Duke Evidence-based Practice Center for the Agency for Healthcare Research and Quality, Rockland, MD), available at: <http://www.effectivehealthcare.ahrq.gov/ehc/products/358/1559/atrial-fibrillation-report-130628.pdf> (accessed April 21, 2014).

<sup>12</sup> Nicholson W, Wilson L, Witkop C, Baptiste-Roberts K, Bennett W, Bolen S, et al. Therapeutic Management, Delivery, Postpartum Risk Assessment and Screening in Gestational Diabetes. Evidence Report /Technology Assessment No. 162 (Prepared by the Johns Hopkins University Evidence-based Practice Center). AHRQ Publication No. 08-E004. Rockville, MD: Agency for Healthcare Research and Quality. March 2008, available at: <http://www.ahrq.gov/research/findings/evidence-based-reports/gestdiab-evidence-report.pdf> (accessed April 28, 2014).

<sup>13</sup> Markus A, Andres E, West K, Garro N, Pellegrini C (2013). Medicaid covered births, 2008 through 2010, in the context of the implementation of health reform. *Women's Health Issues*, vol. 23(5):e273-e280.

<sup>14</sup> Jung, B (2008). "Gestational Diabetes Mellitus Surveillance in Connecticut," Connecticut Department of Public Health, Health Information Systems and Reporting Section, available at: <http://www.ct.gov/dph/lib/dph/hisr/pdf/gdmissuesbrief2008.pdf> (accessed April 28, 2014).

Researchers at Johns Hopkins Evidence-based Practice Center conducted an AHRQ-sponsored comparative effectiveness review for the treatment of gestational diabetes that included a comparison between glyburide<sup>15</sup> and insulin. They determined that the health outcomes for mothers and infants resulting from an insulin or glyburide treatment, for which they identified outcome evidence, did not significantly differ, but that the level of evidence supporting this conclusion was very low. Further, many of the selected outcomes of interest lacked any evidence.

Subsequent AHRQ reports related to gestational diabetes included a “future needs” report released in November 2010<sup>16</sup> and an investigation of various screening options for gestational diabetes released in October, 2012.<sup>17</sup>

### **Antibiotic Prescribing Behavior (AHRQ, 2006)<sup>18</sup>**

This AHRQ review was chosen because of antibiotic-resistant bacteria-related mortality and morbidity, the high percentage of the Connecticut Medicaid eligible population potentially affected, and the recent attention various public health entities have placed on addressing inappropriate antibiotic prescribing practices.

Bacteria destroying medications, collectively called antibiotics, have been used widely since at least the 1940s and have led to dramatic improvement in the treatment of bacteria caused illness. The use of antibiotics, however, has extended beyond the conditions for which their use is indicated, that is, beyond conditions involving bacteria. Further, starting near the close of the twentieth century, many physicians began prescribing broad-spectrum antibiotics, which destroy many types of bacteria, instead of antibiotics that specifically target the identified harmful bacteria. There is increasing evidence that these two practices have contributed to the greatly increasing incidence of antibiotic resistant bacteria, also called antimicrobial resistance (AMR), in recent years. Broadly speaking, over-prescription of antibiotics encourages AMR bacteria to reproduce, leading to more AMR in the environment; and prescribing overly-broad antibiotics destroys benign bacteria within individuals and thereby increases the opportunity for AMR bacteria to grow in those individual patients. Researchers noticed the occurrence of antibiotic-related AMR as early as the 1950s. The federal government began systematically investigating the phenomena in the mid-1990s. In recent

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<sup>15</sup> The reviewers also sought out studies on the effectiveness of another oral agent, metformin, to treat gestational diabetes, but were unable to locate any random control studies or observational studies providing evidence for this treatment.

<sup>16</sup> Bennett W, Nicholson W, Saldanha I, Wilson L, Mckoy N, Robinson K. Future Research Needs for the Management of Gestational Diabetes. Future Research Needs Paper No. 7. (Prepared by Johns Hopkins University). AHRQ Publication No. 11-EHC005-EF. Rockville, MD: Agency for Healthcare Research and Quality. November 2010, available at: [www.effectivehealthcare.ahrq.gov/reports/final.cfm](http://www.effectivehealthcare.ahrq.gov/reports/final.cfm) (accessed April 28, 2014).

<sup>17</sup> Hartling L, Dryden D, Guthrie A, Muise M, Vandermeer B, Aktary W, et al. Screening and Diagnosing Gestational Diabetes Mellitus. Evidence Report/Technology Assessment No. 210. (Prepared by the University of Alberta Evidence-based Practice Center). AHRQ Publication No. 12(13)-E021-EF. Rockville, MD: Agency for Healthcare Research and Quality. October 2012, available at: [www.effectivehealthcare.ahrq.gov/reports/final.cfm](http://www.effectivehealthcare.ahrq.gov/reports/final.cfm) (accessed April 28, 2014).

<sup>18</sup> Ranji S, Steinman M, Shojania K, Sundaram V, Lewis R, Arnold S, Gonzales R (January 2006). Antibiotic Prescribing Behavior. Vol. 4 of: Shojania K, McDonald K, Wachter R, Owens D, eds. Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies. Technical Review 9 (Prepared by the Stanford University-UCSF Evidence-based Practice Center). AHRQ publication no. 04(06)-0051-4. Rockville, MD, available at: <http://www.ahrq.gov/research/findings/evidence-based-reports/medigaptp.html> (accessed May 12, 2014).

years, infections of AMR bacteria have been responsible for an estimated 23,000 deaths in the US each year.<sup>19</sup>

Many different methods were attempted in the late 1990s and early 2000s to reduce the incidence of inappropriate prescription of antibiotics. Published studies of some of these interventions were reviewed by Stanford University – UCSF’s Evidence-based Practice Center on behalf of AHRQ. The resulting study organized the various interventions into seven categories:

- clinician education
- patient education
- provision of delayed prescriptions
- audit and feedback systems
- clinician reminder systems
- financial or regulatory incentives for patients
- financial or regulatory incentives for clinicians

The AHRQ review found that implementation of each category of prescribing interventions significantly reduced inappropriate prescribing behavior. The evidence it reviewed did not support the superiority of any one type of intervention compared with the others, although the researchers did note that active education techniques appeared to be better than passive education.

The researchers did not formally assess the quality of the total available evidence, as is common in more recent AHRQ reports, but they did note that most of the studies they examined produced at least “fair” quality evidence supporting the efficacy of prescription quality improvement interventions. The researchers also warned, however, that few of the identified studies examined potential negative consequences of implementing antibiotic prescribing quality improvements, such as increased revisits, poorer clinical outcomes, or patient dissatisfaction.

In addition to the AHRQ report, there has been a high volume of international, national, state, and local activity around AMR. For example, the Transatlantic Taskforce on Antimicrobial Resistance, an international body consisting of the United States and European Union governments, was formed in 2009 to investigate and make policy recommendations for addressing AMR.<sup>20</sup> The Taskforce released a progress report in May, 2014 highlighting the rising dangers of AMR infections, particularly in hospital settings. Nationally, the Centers for Disease Control and Prevention released a large study on antibiotic resistance in late 2013,<sup>21</sup> and AHRQ recently announced a review protocol to conduct a comparative effectiveness review of prescribing behaviors specifically focused

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<sup>19</sup> Transatlantic Taskforce on Antimicrobial Resistance: Progress Report, May 2014, Recommendations for future collaboration between the US and EU, available at: [http://www.cdc.gov/drugresistance/pdf/TATFAR-Progress\\_report\\_2014.pdf](http://www.cdc.gov/drugresistance/pdf/TATFAR-Progress_report_2014.pdf) (accessed May 13, 2014).

<sup>20</sup> The Centers for Disease Control and Prevention maintains a webpage describing the activities of the taskforce, available at: <http://www.cdc.gov/drugresistance/tatfar/about/about-TATFAR.html> (accessed May 13, 2014).

<sup>21</sup> Antibiotic Resistance Threats in the United States, 2013 (2013) available at: <http://www.cdc.gov/drugresistance/threat-report-2013/> (accessed June 9, 2014).

on upper respiratory illness.<sup>22</sup> At the state level, Connecticut’s Department of Public Health,<sup>23,24</sup> Department of Social Services,<sup>25</sup> UConn Health,<sup>26</sup> and Connecticut Children’s Medical Center,<sup>27</sup> among others, have either begun implementing Antimicrobial Stewardship plans or have released information about the dangers of antimicrobial resistance. Medicaid claims data have been recently investigated for use as one potential documentation source for antibiotic prescribing practices.<sup>28</sup>

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<sup>22</sup> AHRQ, Evidence-based Practice Center systematic Review Protocol. Project Title: Interventions to Improve Appropriate Antibiotic Use for Acute Respiratory Tract Infections. Published on-line May, 2014, available at: <http://www.effectivehealthcare.ahrq.gov/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productID=1913> (accessed June 2, 2014).

<sup>23</sup> Connecticut Department of Public Health, “Connecticut Antimicrobial Stewardship Prevention Collaborative,” Connecticut Epidemiologist (March, 2012), available at: [http://www.ct.gov/dph/lib/dph/infectious\\_diseases/ctepinews/vol33no2.pdf](http://www.ct.gov/dph/lib/dph/infectious_diseases/ctepinews/vol33no2.pdf) (accessed May 13, 2014).

<sup>24</sup> Connecticut Department of Public Health / Qualidigm Antimicrobial Stewardship Collaborative, available at: <http://www.qualidigm.org/index.php/current-initiatives/antimicrobial-stewardship-collaborative/> (accessed May 13, 2014).

<sup>25</sup> Connecticut Medical Assistance Program, Department of Social Services & Health Information Designs, Inc., “Antimicrobial Resistance,” Retrospective Drug Utilization Review Program Newsletters (March 2012): [https://www.ctdssmap.com/CTPortal/Portals/0/StaticContent/Publications/March\\_12\\_DUR\\_Newsletter.pdf](https://www.ctdssmap.com/CTPortal/Portals/0/StaticContent/Publications/March_12_DUR_Newsletter.pdf) (accessed May 13, 2014).

<sup>26</sup> UCHC Antimicrobial Stewardship Program (ASP): <http://pharmacy.uchc.edu/services/stewardship/index.html> (accessed May 13, 2014).

<sup>27</sup> Connecticut Children’s Medical Center, Antimicrobial Stewardship Program, available at: <http://www.connecticutchildrens.org/our-care/infectious-diseases-and-immunology/antimicrobial-stewardship/> (accessed May 13, 2014).

<sup>28</sup> Nett R, Campana D, Custis C, Helgerson S (2013). Office-related antibiotic prescribing for Medicaid-enrolled children. *Clinical Pediatrics*, vol. 52(5):403-410.

# Medicaid Utilization and Costs in Connecticut

## Methods

The State of Connecticut Department of Social Services (DSS) through its contracted administrative services provider, Community Health Network of Connecticut, Inc. (CHNCT), provided CPHHP with Medicaid paid claims data extracts from January 2012 to May 2013. The extracts were used to identify medical utilization and reimbursed medical costs for the five selected topics for the 2012 calendar year. Analyses of cardiac-related topics and gestational diabetes involved Connecticut's adult Medicaid population aged 18-65 whereas the antibiotics analysis used pharmacy claims for ages 0-65. Connecticut Medicaid claims related to the five selected topics were identified using Current Procedure Terminology (CPT) codes, National Drug Code (NDC) codes, and/or diagnosis (ICD-9) codes [See Appendix, Table A1].

ICER conducts cost estimates as part of its reviews. In its most recent reports, including that on cardiac nuclear imaging, ICER lists the CPT and ICD-9 codes it uses in its analysis. For cardiac nuclear imaging, CPHHP has used the codes identified by ICER so that our Connecticut-specific cost and utilization estimates followed the methods from the underlying report. For the other cardiac-related topics, various sources were consulted to determine the appropriate CPT and ICD-9 codes to use for the 2012 data. These sources are detailed in the notes for Table A1, located in the Appendix. In some cases, billing staff at UCHC verified the veracity of the chosen CPT codes.<sup>29</sup> In all cases, CPT codes were checked by CPHHP staff against the current edition of the AMA's CPT manual, available through the STAT!Ref database.

The NDC codes used for the antiarrhythmic drugs, insulin, glyburide and antibiotics needed to be identified. For glyburide and insulin, these codes were identified by conducting an ingredient search of the Food and Drug Administration's National Drug Code Directory.<sup>30</sup> The underlying report on catheter ablation for the treatment of atrial fibrillation compared catheter ablation to class IC and class III antiarrhythmic drugs, but it did not specify what these drugs were. A summary table available on UpToDate identified seven particular AADs that are classed as IC and III.<sup>31</sup> The seven identified drugs were then also searched in the National Drug Code Directory to determine relevant NDC codes. For antibiotics, we used the 2012 NDC codes listed by the National Committee for Quality Assurance (NCQA) for quality reporting purposes for the use of antibiotics.

For the cardiac-related topics and gestational diabetes, patients with paid claims listing diagnoses relevant to the diagnostic procedures or treatments of interest were identified as the Medicaid participants eligible for the analysis. All adult patients, regardless of diagnoses, were considered

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<sup>29</sup> Correspondence with UCONN Health Coding Manager Allison Patavino and Reimbursement Analyst Mary Ann Stemm.

<sup>30</sup> The National Drug Code Directory is available online at: <http://www.fda.gov/drugs/informationondrugs/ucm142438.htm> (accessed May 19, 2014).

<sup>31</sup> Makielski J, Myocardial action potential and action of anti-arrhythmic drugs. In UpToDate Levy S (Ed.) UpToDate, Waltham, Mass. (last updated September 4, 2014), table 2 (accessed May 19, 2014).



eligible for the antibiotic prescribing sample. Paid claims were reviewed to identify utilization and DSS's reimbursed medical cost for antibiotic prescribing and diagnostic technologies or treatments of interest involved in cardiac nuclear imaging (SPECT, ETT, and Echo), coronary computed tomographic angiography, radiofrequency catheter ablation to treat atrial fibrillation, and gestational diabetes.

Frequencies and percentages of the eligible samples receiving care with these technologies and treatments were calculated. Descriptive statistics were used to explore reimbursed medical spending overall, per participant and per procedure or treatment for Medicaid patient care related to the five selected topics. Descriptive analyses for antibiotics explored cost and utilization overall, by NCQA categories, and for repeat or additional fills (repeat fills) for any antibiotic prescriptions within 30 days. Repeat fills served as a proxy for potential overprescribing.

## Limitations

Medicaid claims data provide costs associated with CPT coded procedures and Medicaid pharmacy claims data provide costs associated with individual prescriptions. The Medicaid data alone do not provide direct evidence of whether the procedures themselves are overused or underused, or otherwise used inappropriately; nor do they provide an exact picture of diagnosis prevalence within the Medicaid population. The available data can be used to identify the frequency of procedures with paid claims, the amount paid for those claims, and an imperfect estimate of prevalence of diagnoses for Medicaid participants with paid claims. In claims data, a patient with a listed diagnosis may not have the condition. The condition may be suspected.

The estimates of cost and utilization in this report have additional limitations, involving the designated diagnosis and procedure codes and variation in the amount paid for the same individual CPT procedure code. First, the designated diagnosis and procedure codes may not be exhaustive for a given diagnostic procedure or treatment. In other words, if multiple procedure codes are often paid concurrently for a diagnostic procedure or treatment of interest, but were not identified for the analysis, then the cost may be underestimated

Second, the amount paid for the same individual CPT procedure code often varies greatly. Paid cost is influenced by the location of care and the conditions under which the procedure(s) are administered. This is captured to some extent by modifiers, which are reported with individual CPT codes, and CPT Add-ons, which are billed separately but relate to the same procedure as the associated CPT codes. The influence of these components was not examined

It is also important to note that for each of the procedures or treatments described in the report, "per patient" costs are costs of the applicable identified procedure (see Table A1) divided by the number of patients receiving at least one administration of those procedures, and not the total cost of care for the patient. The total cost incurred by any given patient arising from a particular condition may be much more than the costs of individual procedures or prescriptions.

Additionally, the pharmacy data did not include prescribing that occurred on an inpatient basis, thus restricting our analysis to outpatient pharmacy claims. Another constraint to the analysis was lack of data indicating the number of days of medication supplied per prescription. It appears that these data may actually be available, but according to CHNCT, it was not in the files provided.

## Findings

Table 1 displays an overview of 2012 utilization and DSS reimbursed costs for Medicaid participants with paid claims attributed to the medical procedures and prescription drugs for the five topics selected. Of the five topics, cardiac nuclear imaging and antibiotic prescribing stand out as having a larger rate of utilization and reimbursed cost, with total DSS Medicaid spending of \$1.4 million and \$16.4 million, respectively. Coronary angiography (CCTA and invasive coronary angiography) and gestational diabetes land a distant third and fourth for total reimbursed cost, with total DSS spending of \$560,964 and \$362,161. Conversely, coronary catheter ablation stands out for the low number of participants, just 11 with a paid claim, and a very low reimbursed cost of less than \$6,146.

Table 1. Utilization and Total Reimbursed Cost for CT Medicaid, 2012. <sup>a</sup>				
Selected Review Topics (procedure or prescription)		Utilization (Number of unique participants)	Utilization (Number of procedures/ prescriptions)	Total Reimbursed Cost
Antibiotic Prescribing	Antibiotics	252,965	604,760	\$16,391,097
	Repeat fills <sup>b</sup>	55,897	167,198	\$6,354,328
Cardiac Nuclear Imaging (SPECT, ETT, Echo <sup>c</sup> )		4,703	7,474	\$1,433,080
Angiography for Detection of Coronary Artery Disease (CCTA, Invasive Coronary Angiography)		982	1,060	\$560,964
Oral Treatments for Gestational Diabetes (Insulin, Glyburide)		516	1,911	\$362,161
Treatment for Atrial Fibrillation (Radiofrequency Catheter Ablation)		11	14	\$6,146
<sup>a</sup> These analyses are limited to the procedure codes and diagnoses listed in the methods. <sup>b</sup> Repeat fills include all paid antibiotic prescriptions filled for any participant who has more than one filled prescription for antibiotics within thirty days. <sup>c</sup> Some patients had more than one type of cardiac imaging procedure.				

Table A2 (Appendix) details results for all five topics, breaking down utilization and cost patterns by the specific procedures or treatments. The following discussion focuses on the findings and implications of the five topics, in the order shown in Table 1.

## Antibiotic Prescribing

In 2012, more than 1 out of 3 (35.4 percent) Medicaid participants aged 0-65<sup>32</sup> filled an antibiotic prescription resulting from outpatient care, for a total reimbursed cost to DSS of \$16.4 million for nearly 604,760 filled prescriptions. Antibiotics designated as “of concern” by NCQA accounted for 63 percent of the total reimbursed cost and two out of five filled antibiotic prescriptions. Of the 252,936 Medicaid participants who filled at least one antibiotic prescription, 22.1 percent (55,897) filled multiple antibiotic prescriptions within thirty days (“repeat fills”), at a total cost of \$6.4 million. Participants with repeat fills accounted for 38.8 percent of DSS’s outpatient spending on antibiotics and 167,198 filled antibiotic prescriptions.

The median number of prescriptions filled per participant was 2 (Appendix, Table A3). Approximately 25 percent of the participants had 3 or more antibiotic prescriptions and 10 percent filled 5 or more antibiotic prescriptions (results not shown). Based on the data used, it is unclear to what extent the repeat fills represent overprescribing or valid prescribing related to an inadequate initial dosage filled, bacteria resistance to the initial antibiotic prescribed, or a Medicaid participant misplacing the filled prescription order.

Of the 604,760 filled antibiotic prescriptions, 41 percent (248,370) were for antibiotics that were listed as “of concern” by NCQA. NCQA identifies several classes of antibiotics and six individual antibiotics as being “of concern,” because they are considered to be broad-spectrum.<sup>33</sup> Broad-spectrum antibiotics averaged approximately \$41 per claim, more than twice as much as the average payment of \$17 per claim for other antibiotics. While the cost comparison per claim may not be completely valid, due to unknown doses and durations of the prescriptions covered, total payments for broad spectrum antibiotics were also much higher than for other antibiotics. In 2012, Connecticut Medicaid paid approximately \$10.3 million for broad-spectrum antibiotics claims, compared to \$6.1 million for other antibiotics.

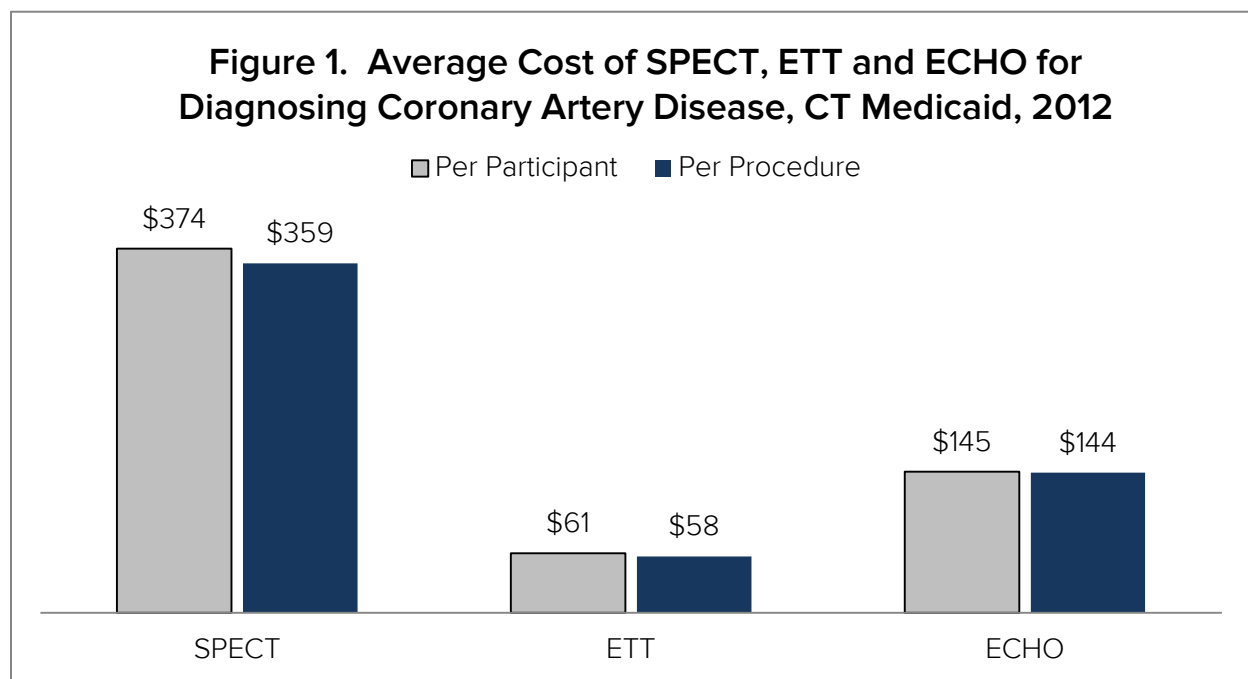
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<sup>32</sup> Denominator in this calculation is 713,085, the grand total eligibility reported for January 2012, CT DSS Active Medical Assistance Coverage Groups, grand total eligibility for January 2012. This includes eligibility for all ages and may include coverage groups, such as Charter Oak, which were not included in our claims analysis. Therefore, the estimated proportion of Medicaid participants under age 65 filling antibiotic prescriptions, 35.4% underestimates actual rate because the 713,085 includes some participants who are not part of this project.

<sup>33</sup> Steinman M, Yang K, Byron S, Maselli J, Gonzales R (2009). Variation in outpatient antibiotic prescribing in the United States. *The American Journal of Managed Care*, vol. 15(12): 861-868.

## Cardiac Nuclear Imaging

In 2012, DSS reimbursed over \$1.4 million for 7,474 procedures using SPECT, ETT, and Echo for Medicaid participants with a listed CAD diagnosis code. Of the 324,550 Medicaid participants who had paid Medicaid claims, 39,428 (12.1 percent), had listed diagnosed for eligible cardiac conditions (Appendix, Table A1 lists eligible diagnoses). A total of 4,703 Medicaid participants, 11.9 percent of participants with eligible cardiac conditions, underwent an average of 1.5 of these three diagnostic procedures. Of the three procedures, ETT accounted for nearly half (49.5 percent) of the claims but less than 15 percent of the total reimbursed cost. More than 3 of every 4 (78.8 percent) dollars paid were for SPECT claims, despite SPECT accounting for just 42.1 percent of cardiac imaging procedures. As shown in Figure 1, the average cost of SPECT per participant and per procedure was greater than the costs of ETT or Echo and ETT costs were the lowest.



The claims data revealed a fairly large variation in the cost of administering SPECT. The average cost for a CPT billed item was \$359, whereas the median (middle) cost for a CPT item was \$84. This suggests that some SPECT administrations are much less expensive than others. There are several possibilities. Among them, SPECT imaging is divided, for billing purposes, into two primary billing items (see Appendix, Table A1). The two CPT codes may incur substantially different costs. There also may be contextual differences that influence the level of effort to administer a SPECT that causes the cost of either or both of the CPT coded billing items to fluctuate. There is some, but much less, variation between the mean and median costs of SPECT when examined on a per participant, rather than per administration, basis. The mean cost (in 2012) of SPECT imaging per

participant was \$374 and the median cost was \$294. Some participants received more than one SPECT imaging procedure; though not explored for this report, it is possible that follow-up images are less costly than initial ones.

Similarly, for both of the functional tests, ETT and Echo, the average cost was higher than the median cost. This was true whether the costs were considered on a per-procedure administration basis, or a per patient basis. Unlike SPECT, however, for each of these procedures the difference between mean and median costs was similar whether considered per procedure or per participant. For ETT the cost per procedure averaged \$58 with a median cost of \$24; per participant, the average cost was \$61 and the median was \$24. For Echo, the parallel costs were \$144 and \$91 per procedure and \$145 and \$91 per participant. It is important to note that, for each of the procedures above, “per participant” costs are costs of the applicable identified procedure billing items (see Appendix, Table A1) divided by the number of participants receiving at least one administration of those procedures, and not the total cost of care for the participant.

### Angiography for Detection of Coronary Artery Disease

Of the 324,550 Medicaid participants who had paid Medicaid claims in 2012, 39,454 (12.2 percent), had a listed diagnosis for a cardiac condition that may be evaluated using CCTA (Appendix, Table A1 lists eligible diagnoses). A small proportion of these participants, 3.2 percent (982) underwent a coronary angiography procedure. Of these participants, 92.4 percent (907) underwent invasive coronary angiography only, 6.5 percent (64) of participants underwent CCTA only, and 1.1 percent (11) underwent both types of procedure (Figure 2).

**Figure 2. Utilization of CCTA and Invasive Coronary Angiography for CT Medicaid, 2012.**

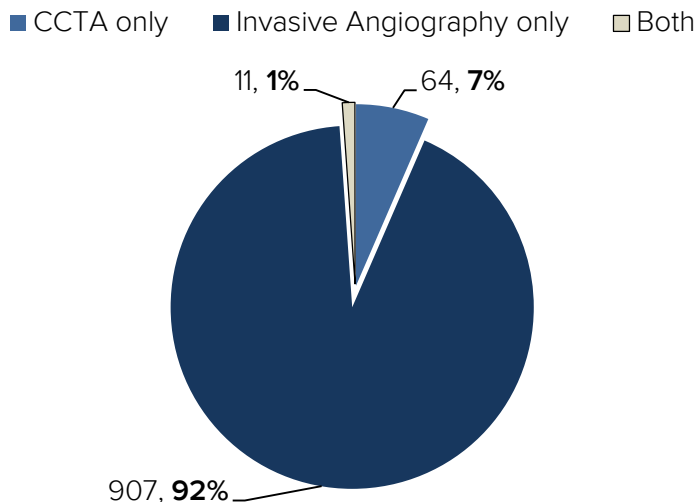
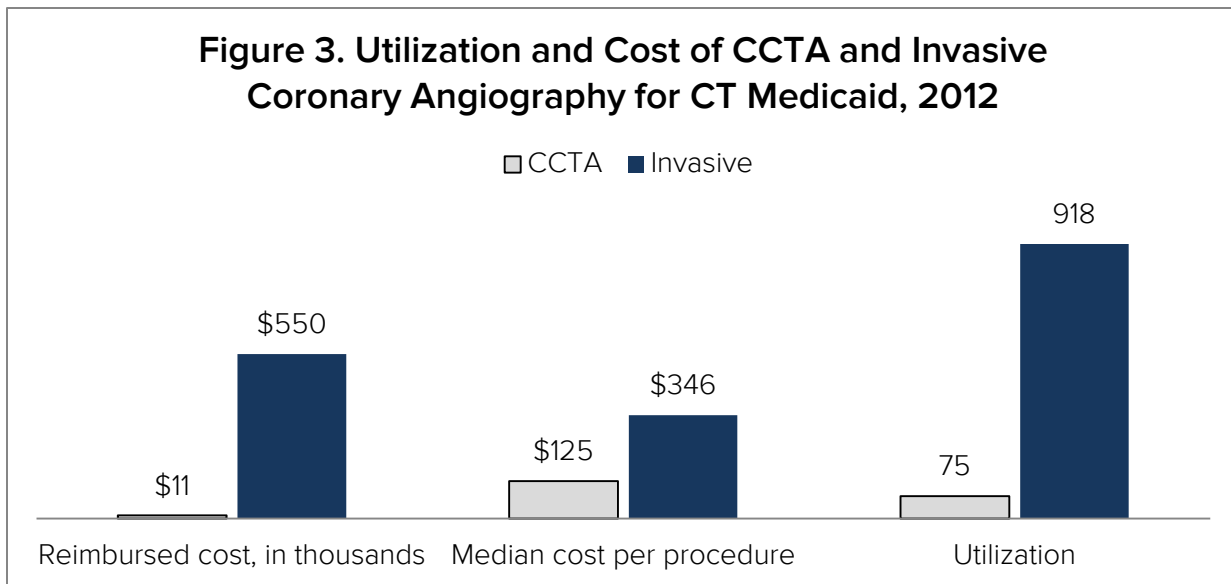


Figure 3 shows DSS’s reimbursed cost, the median cost per procedure and utilization by procedure type. Total spending for invasive coronary angiography outpaced that of CCTA, with a cost of \$549,939 versus \$11,025. This is driven by two factors. First, the number of participants with a related diagnosis who received invasive coronary angiography was 12.2 times greater than that of CCTA (918 vs. 75). Second, the median procedure cost of invasive coronary angiography is nearly 2.8 times that of CCTA (\$346 vs. \$125).

The median costs, presented in Figure 3, are lower than the average costs (Appendix, Table A2). The mean cost per procedure was 66 percent greater than the median (\$559) for invasive coronary angiography and 18 percent greater for CCTA (\$147). Mean and median costs per recipient for CCTA procedures were identical to the respective per procedure costs, as no recipient underwent this procedure more than once in 2012. For invasive coronary angiography, mean costs per participant were slightly higher than per procedure.



### Treatment of Gestational Diabetes

Appendix Table A2 presents costs of medication for gestational diabetes. Of the 324,550 Medicaid participants who had paid medical claims in 2012, 1,765 participants (0.54 percent) had a listed diagnosis of “Abnormal glucose tolerance of mother, antepartum condition or complication” (ICD9 diagnosis code: 648.83). This constitutes roughly 12.2 percent of mothers with publicly funded coverage who were pregnant during this period.<sup>34</sup> Of these 1,765 participants, 516 (29.2 percent) filled prescriptions for glyburide, insulin, or both.

<sup>34</sup> Based on the number of publicly funded births in Connecticut during 2010, as reported in: Connecticut Voices for Children. Births to Mothers with HUSKY Program and Medicaid Coverage: 2010 (February 2013), available at: <http://www.ctvoices.org/sites/default/files/h13birthsreport10.pdf> (accessed May 30, 2013).

Average annual costs varied widely by participant. For the 210 Medicaid participants who filled prescriptions for glyburide only, the average cost per participant was \$20. For the 263 (51.0 percent) patients who filled prescriptions for insulin only, the average cost per participant was \$1,232, which is 62 times higher than for glyburide only. As a result, total DSS spending for Medicaid participants using insulin only was 76 times more than for glyburide only (\$324,035 vs. \$4,189) despite the fact that the population receiving insulin only was only 25 percent larger than that receiving glyburide only. For the 43 (8.3 percent) Medicaid participants who filled prescriptions for both, the average cost of both glyburide and insulin was \$789 per participant, almost 40 times higher than for glyburide only. For all of these group-medication combinations, the median costs were much lower than the mean costs, indicating that the cost distributions were right-skewed and that the annual costs of these medicines were extremely high for some patients.

### **Treatment for Atrial Fibrillation**

Of the 324,550 Medicaid participants who had paid medical claims in 2012, 2,597 (0.8 percent) participants had a listed diagnosis of atrial fibrillation (see Appendix, Table A1 for eligible diagnoses). Only 346 participants of these patients (13.3 percent) underwent radiofrequency catheter ablation or filled prescription(s) for at least one of seven types of antiarrhythmic drugs (AADs) prescribed for atrial fibrillation (See Appendix, Table A1 for eligible drugs and procedure codes).

Almost all, 98.5 percent, of these 346 participants with a treatment had a paid claim for AADs. These 341 participants had an average cost per filled AAD prescription of \$110 and an average AAD prescription cost per participant of \$549. Only 3.2 percent of participants with an atrial fibrillation treatment had a paid claim for catheter ablation. These 11 participants underwent a total of 14 cardiac ablation procedures with an average cost per procedure of \$439 and average procedure cost per participant of \$559. DSS reimbursed a total of \$6,146 for these catheter ablation procedures.

According to the ICER report, use of catheter ablation in addition to AADs has higher likelihood of successful return to sinus rhythm, but there was insufficient evidence to determine whether use of catheter ablation alone is more or less effective than use of AADs alone. In our analysis, only 5 of the 11 participants with paid claims for catheter ablation also had paid claims for at least one of the designated AADs.

## Recommendations

Prior to providing recommendations for future study we would like to emphasize the limitations of the current analysis. First, the findings we present above were not derived from a rigorous cost or budget impact analysis. They are preliminary in nature and are intended solely to identify promising areas for future analyses conducted through the UConn Medicaid Partnership. Second, our analyses were based exclusively on claims data for one year and as such are limited. We cannot determine, for example, if changes in practice patterns associated with alternative treatments might carry other potential costs or savings that are currently unidentified. We have also not attempted to quantify the potential “downstream” costs or savings associated with alternative treatments, such as future ambulatory visits or hospitalization costs, or costs/savings associated with differences in adherence to alternative treatments. Finally, our analysis did not examine the efficacy or comparative effectiveness of different treatment options. A thorough examination of the medical merits and risks associated with changes in treatment patterns should be conducted prior to any changes to Medicaid coverage policies.

**Overall, our preliminary analyses indicate that there is the potential for modest to substantial cost savings to the Connecticut Medicaid Program related to antibiotics prescribing, cardiac nuclear imaging, coronary computed tomography angiography, and treatment of gestational diabetes among Medicaid participants. In contrast, catheter ablation for atrial fibrillation, although a relatively high cost procedure, is utilized too infrequently among Connecticut Medicaid participants to see much budget impact associated with alternative treatments. Specific recommendations for future study are presented below.**

1. With respect to antibiotic prescribing, our analyses have documented the substantial spending associated with antibiotic treatment in the Connecticut Medicaid population. Further analysis should seek to (a) identify patterns of antibiotic usage among Connecticut Medicaid participants - who is using (and who is prescribing) antibiotics, for what diagnoses, at what times, and (b) place the state’s utilization of antibiotics in context by comparing the rate of antibiotic prescribing among CT Medicaid participants to national averages. Further, we recommend conducting an examination of condition-specific and season-specific (i.e., coinciding with cold season or flu outbreaks) prescribing patterns to identify trends toward antibiotic overuse.
2. For cardiac nuclear imaging, our analyses suggest that given the comparable effectiveness of SPECT, ETT and Echo in diagnosing coronary artery disease (CAD), there could be significant savings to the Medicaid program were ETT and Echo to be used instead of SPECT. It is currently unclear how utilization rates and the predominant use of SPECT for Connecticut Medicaid participants compare to rates of other state Medicaid programs or to rates of commercial health plans in Connecticut and throughout the country. Benchmarking how Connecticut’s Medicaid program compares to other state Medicaid programs is an important next step for identifying potential overuse of SPECT.



In addition to benchmarking, further analyses of Connecticut Medicaid claims should attempt to determine whether there are patient- and/or provider-level factors associated with the use of SPECT vs. alternative imaging procedures. It is critical to ensure that patient sickness and/or comorbidities, which are more problematic in the Medicaid population relative to privately insured patients, are accounted for in assessing the potential for changes in use of these procedures. Additional research could also be conducted to determine if Medicaid programs or commercial health plans have made changes that have successfully led to cardiac imaging practice patterns for CAD that are not SPECT dominated.

3. Our preliminary analysis indicates that the use of the oral agent, glyburide, for management of gestational diabetes, as opposed to insulin, could reduce per patient expenditures considerably, although the total budget impact may be fairly small. Our results were consistent with previous studies demonstrating dramatically lower costs associated with glyburide relative to insulin therapy which are primarily attributable to the lower wholesale costs of the oral agent.<sup>35</sup> We recommend verifying the medical reasons for treating gestational diabetes with insulin rather than glyburide.
4. The substantial difference in cost between CCTA and invasive coronary angiography, coupled with the almost exclusive utilization of invasive coronary angiography among physicians treating Medicaid patients suspected of having CAD, makes this a strong candidate for further research. However, the ICER report upon which our preliminary investigation is based concluded that CCTA was comparable to invasive coronary angiography in its ability to detect CAD among patients presenting with acute chest pain in an emergency setting only, which is a small subset of patients receiving CCTA. As a result we recommend further analysis of the comparative effectiveness of invasive coronary angiography and CCTA when used in the outpatient setting prior to conducting a budget impact analysis based on all Medicaid patients suspected of CAD.
5. We also strongly recommend augmenting and enhancing the claims files used for further analyses. First, access to pharmacy information on the “number of days filled” is critical to assessing consistency with dose/duration guidelines. Second, longitudinal data spanning multiple years will be critical to quantifying potential downstream costs associated with changes in treatment patterns (e.g., costs associated with secondary bacterial infections). Third, access to inpatient data on pharmacy prescribing is likely to substantially alter projections related to budget impact and cost savings associated with the use of medications. Such data will greatly increase the utility and reliability of the proposed analyses.

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<sup>35</sup> Goetzl K, Wilkins I (July/August 2002). Glyburide compared to insulin for the treatment of gestational diabetes mellitus: A cost analysis. *Journal of Perinatology*, vol. 22 (5): 403-406.

## Appendix.

<b>Table A1. Definitions used to identify CT's Medicaid claims related to the five selected topics.</b>			
	CPT or NDC Codes	Diagnoses (ICD-9 codes)	
		Inclusions	Exclusions
<b>Cardiac Nuclear Imaging<sup>a</sup></b>			
SPECT	78451, 78452	402.00, 402.01, 402.10, 402.11, 402.90, 402.91, 411.0, 411.1, 411.8, 411.81, 411.89, 413.0, 413.1, 413.9, 428.0, 428.1, 428.2, 428.21, 428.22, 428.23, 428.3, 428.31, 428.32, 428.33, 428.4, 428.41, 428.42, 428.43, 428.9, 429.2, 429.3, 429.4, 429.7, 429.79, 429.83, 429.9, 786.5	393, 394, 395, 396, 397, 398, 429.0, 429.1, 429.5, 429.6, 429.71, 429.8, 429.81, 429.82, 997.1
ETT	93015, 93016, 93017, 93018		
Echo	93350, 93351		
<b>Angiography for Detection of Coronary Artery Disease<sup>b</sup></b>			
CCTA	75571, 75572, 75573, 75574	Same as above, plus 746.85.	Same as above.
Invasive Coronary Angiography	93451, 93452, 93453, 93454, 93455, 93456, 93457, 93458, 93459, 93460, 93461		
<b>Treatment of Atrial Fibrillation<sup>c</sup></b>			
Catheter Ablation	93651	427.31, 428.0	None
Administration of Anti-Arrhythmic Drugs	NDC codes for: Amiodardon, Dofetilide, Dronedarone, Flecainide, Ibutilide, Propafenone, and Sotalol <sup>1</sup>	Same as above.	None
<b>Oral Treatments for Gestational Diabetes<sup>d</sup></b>			
Oral agent (glyburide)	NDC codes for glyburide <sup>1</sup>	648.83	None
Insulin	NDC codes for insulin <sup>1</sup>	Same as above.	None
<b>Antibiotic Prescription Behavior (NCQA)<sup>e</sup></b>			
Antibiotics	NDC codes from NCQA list for 2012 <sup>1</sup>	All	None

<sup>1</sup>The NDC codes used are numerous and can be provided to DSS by CPHHP, upon request.

## Appendix.

### Notes for Table A1:

- <sup>a</sup> All CPT and ICD-9 codes for cardiac nuclear imaging are taken directly from the underlying ICER report: Ollendorf D, Colby J, Cameron C, Sitaram S, Pearson S (August 12, 2013). Cardiac Nuclear Imaging. Institute for Clinical and Economic Review (Prepared for the Washington State Health Care Authority Health Technology Assessment Program), available at: <http://www.icer-review.org/cardiac-nuclear-imaging/> (accessed April 24, 2014).
- <sup>b</sup> Ollendorf et al. (2009) did not provide ICD-9 codes in the CCTA report so CPHHP used the same codes as were used in the Cardiac Nuclear Imaging report. An additional ICD-9 code, 746.85 was added based on an Anthem policy: “Coronary CT Angiography (CCTA) to Detect Coronary Artery Disease (CAD), available at: [http://www.anthem.com/medicalpolicies/policies/mp\\_pw\\_a050551.htm](http://www.anthem.com/medicalpolicies/policies/mp_pw_a050551.htm) (accessed May 30, 2014). The CPT code for CCTA used in the report was 0145T. This code was discontinued in 2010; the current codes that replace this code are 75571 through 75574. See Society of Cardiovascular Computed Tomography, “New Reimbursement Codes” (2010), available at: <http://www.scct.org/advocacy/coverage/ReimbursementCodesa.pdf> (accessed May 19, 2014). For invasive coronary angiography, the 2012 ICER report on cardiac nuclear imaging used CPT codes 93454, 93455 and 93456. It is unclear why ICER did not examine the entire series of invasive coronary angiogram CPT codes, which is 93451 through 93461 (excluding procedures for congenital heart defects). The full series was examined here.
- <sup>c</sup> Ip et al. (2009) did not reference CPT or ICD-9 codes in their report on catheter ablation for the treatment of atrial fibrillation. The atrial fibrillation coverage policies of commercial insurers were consulted to identify appropriate ICD-9 and CPT codes. Specifically, ConnectiCare “Cardiac Ablation Procedures” available at: <http://connecticare.adam.com/content.aspx?productId=117&pid=1&gid=007368> (accessed May 19, 2014); Aetna, “Clinical Policy Bulletin: Cardiac Catheter Ablation Procedures. Number 0165.” Available at: [http://www.aetna.com/cpb/medical/data/100\\_199/0165.html](http://www.aetna.com/cpb/medical/data/100_199/0165.html) (accessed May 19, 2014); and Anthem “Transcatheter Ablation of arrhythmogenic foci in the pulmonary veins as a treatment of atrial fibrillation (radiofrequency and cryoablation), Medical Policy 00064, available at: [http://www.anthem.com/medicalpolicies/policies/mp\\_pw\\_a050106.htm](http://www.anthem.com/medicalpolicies/policies/mp_pw_a050106.htm) (accessed May 19, 2014). NDC codes were identified use the FDA’s National Drug Code Directory.
- <sup>d</sup> Glyburide and insulin were discussed in the underlying report. NDC codes were identified by searching the FDA’s National Drug Code Directory. The diagnosis code for gestational diabetes was identified using ICD9Data.com, an online resource.
- <sup>e</sup> National Committee for Quality Assurance (NCQA), Healthcare Effectiveness Data and Information Set (HEDIS), HEDIS 2012 NDC list, Table ABX-A, Antibiotic Medications.

## Appendix.

Table A2. 2012 CT Medicaid Utilization and Reimbursed Cost for the five selected topics.							
Topic	Utilization		Reimbursed cost (rounded, nearest dollar)				
	N Participants	N Procedures or prescriptions	Total	Per procedure or prescription		Per participant	
				Mean (SD)	Median	Mean (SD)	Median
<b>Cardiac Nuclear Imaging (Number of participants ages 18-65 with CAD diagnosis listed = 39,428)</b>							
SPECT	3,016	3,145	\$1,129,133	\$359 (393)	\$84	\$374 (403)	\$294
ETT	3,498	3,701	\$213,780	\$58 (86)	\$24	\$61 (92)	\$24
Echo	621	628	\$90,167	\$144 (136)	\$91	\$145 (139)	\$91
<b>Coronary CT Angiography (Number of participants ages 18-65 with CAD or 746.85 diagnosis listed = 39,454)</b>							
CCTA	75	75	\$11,025	\$147 (66)	\$125	\$147 (66)	\$125
Invasive Angiography	918	985	\$549,939	\$559 (966)	\$346	\$599 (1006)	\$346
<b>Treatment of Atrial Fibrillation (AFib) (Number of participants ages 18-65 with AFib diagnosis listed = 2,597)</b>							
Catheter Ablation	11	14	\$6,146	\$439 (180)	\$530	\$559 (50)	\$530
Anti-Arrhythmic Drugs <sup>a</sup>	341	1,705	\$187,301	\$110 (140)	\$60	\$549 (777)	\$241
<b>Treatment of Gestational Diabetes (GD) (Number of participants ages 18-65 with GD diagnosis listed= 1,765)</b>							
Glyburide only	210	396	\$4,189	\$11 (6)	\$7	\$20 (19)	\$14
Insulin only	263	1,277	\$324,035	\$254 (174)	\$227	\$1,232 (1,843)	\$482
Both, glyburide and insulin	43	238	\$33,937	\$143 (144)	\$73	\$789 (681)	\$518
<b>Antibiotic Prescribing (Number of participants ages 0-65 with any paid pharmacy claims = 487,245)</b>							
NCQA list, all	252,965	604,760	\$16,391,097	\$27 (131)	\$11	\$65 (485)	\$21
“of concern”	129,241	248,370	\$10,267,774	\$41 (123)	\$21	\$79 (320)	\$42
“all other”	184,101	356,390	\$6,123,323	\$17 (135)	\$7	\$33 (458)	\$10
Repeat prescriptions	55,897	167,198	\$6,354,328	\$38 (210)	\$13	\$114 (758)	\$42
<sup>a</sup> Amiodaron, Dofetilide, Dronedaron, Flecainide, Ibutilide, Propafenone, and/or Sotalol							

Table A3. Frequency of prescribed antibiotics						
Category	Participant (count)	Mean (SD)	25 <sup>th</sup> Percentile	Median	75 <sup>th</sup> Percentile	Maximum
NCQA list, all	252,965	2.39 (2.43)	1	2	3	135
“of concern”	129,241	1.92 (1.84)	1	1	2	96
“all other”	184,101	1.94 (1.84)	1	1	2	134