EVALUATION OF EDUCATIONAL INTERVENTIONS

FOR

THREE LESSER-KNOWN ILLNESSES

By

Paul L. Solano, PhD
Principal Investigator
Director[1] and Associate Professor[2]

And

Mary Joan McDuffie, MA
Senior Research Associate[1]

[1]Health Service Policy Research Group (HSPRG)
[1]Center for Community Research and Service
[2]School of Urban Affairs and Public Policy
University of Delaware
Newark DE 19716

December 2008

[1]solano@udel.edu
(302) 831-1693

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

LIST OF FIGURES (continued)

I. PURPOSE OF STUDY

The objective of this report is to evaluate separate educational interventions that have been applied to three lesser- known illness (LKI), -- hemochromatosis, celiac disease, and Lyme disease. The interventions occurred in Delaware during the years of 2002 through 2005 depending upon the type of illness. All the interventions encompassed an informational campaign to alert physicians about the need to be aware of the prevalence of the three LKI and to test their patients for carrying the diseases. The educational interventions were expected to have their impact through the medical services provided at either a physician office (outpatient) setting or an institutional (hospital) setting. For each LKI, the pertinent intervention is assessed for three outcomes in the form of prevalence measures: (a) the testing for an illness, (b) the diagnoses of the illness, and (c) the rate of diagnoses of an illness relative to the testing for the illness. The intervention evaluation entails a determination of whether these three prevalence measures manifested significant increases after an intervention. Three separate medical care service delivery units are the foci of the evaluations of the interventions: (1) medical care services provided at physician offices and financed through the State of Delaware Medicaid program, (2) medical care services provided at hospitals and clinics and financed through the State of Delaware Medicaid program and (3) medical care received in physician offices of the Christiana Care outpatient network. The time frame of the analysis and the data encompasses September 2001 through February 2008 for both Medicaid services, and September 2001 through May 2007 for the Christiana Care outpatient services.

The remainder of the paper is organized as follows. First, the three lesser-known illnesses are reviewed separately and briefly for their prevalence, etiology, symptoms, and prognoses. Second, the interventions are described. Third, the scope of analyses is given; this effort includes the research objectives, measurement of the three intervention outcomes (or prevalence rates), the measurements of each intervention, the data and its compilation into units of analysis, and the statistical techniques and models to be used to evaluate the each intervention. Fourth, in three subsections, the empirical results for each LKI are presented.

II. THE CONTEXT OF THE EVALUATION

A. THE SIGNIFICANCE OF LESSER-KNOWN ILLNESSES (LKI)

The health care system in the United States is widely regarded as having very advanced medical care capabilities, knowledge, and practices. This opinion is based on the notion that in the U.S. there are well-developed and sophisticated systems for the detection and treatment of illness. It is also widely considered that physicians and other health care professionals in the United States have the highest training and qualifications for diagnosing and managing these illnesses. In addition, there are increasing efforts to assist physicians and other health professionals in diagnosing and managing illnesses through the development of evidence-based guidelines. These guidelines are based on sophisticated analyses derived from the most current medical research and literature. Also, there are well-developed information systems that are employed to educate the public about the importance of early detection and treatment of disease. Because of the availability of these guidelines and the knowledge of both health care professionals and the public, an excellent system for management of common and deadly diseases such as heart disease, cancer, stroke, and diabetes mellitus has been established and operates very effectively.

This effectiveness prevails because success in diagnosing and treating a disease is based largely on having health care professionals and patients who are knowledgeable about the disease and its appropriate management. However, in contradistinction to the excellent record in the U.S. of diagnosing and treating common diseases such heart disease and diabetes, there are other diseases for which the American health care system often falls short. For example, there are many health/medical conditions for which little was known at the time physicians and other health care professionals received their training, and only a few guidelines have been developed to improve their knowledge. Often, these diseases are not commonly encountered, and therefore physicians have had little opportunity to educate themselves through experience. Consequently many of these “lesser-known” diseases often go undiagnosed and untreated. The failure to diagnose and appropriately treat these diseases can have devastating consequences for persons with the disease. The absence of early detection and treatment can also result in higher costs for treatment of potentially avoidable complications.

In order to reduce these negative consequences, health care officials and researchers must work with the medical community to develop better systems to detect and identify these lesser-known but potentially devastating and costly illnesses. In order to achieve this goal, a first step is to gain a better understanding the current state of care for these diseases, and to clarify options that patients and health care professionals have for early detection. Research prior to the present intervention assessment has been directed at the first step. That previous research entailed (a) a review of the current knowledge and medical evidence for lesser-known diseases, (b) a determination of the prevalence and burden of LKI, (c) the identification of the availability and costs of diagnostic tools for these diseases, and (d) the by identification of medical and community support systems involving detection, diagnosis and treatment of these diseases. Several diseases were identified as lesser-known but also potentially devastating

and costly to individual. The identified diseases are sarcoidosis, fibromyalgia, lupus, chronic fatigue immune deficiency syndrome, Lyme disease, hemochromatosis, and celiac disease. The last three LKI are the subject of an intervention evaluation undertaken in the present study.

B. THE THREE LESSER-KNOWN ILLNESSES (LKI)

1. Lyme Disease.

Lyme disease affects 0.5% of the population annually in the Northeast and Upper Midwest of the United States, making it the most common tick-borne illness in America. In 1996, Lyme disease was reported in 45 states, but primarily in Connecticut, Rhode Island, Massachusetts and the Mid-Atlantic region. In these areas, anyone spending time outside in grassy or wooded areas runs the risk of infection. If Lyme disease is undiagnosed and allowed to progress, the nervous system, joints and heart may sustain damage. Lyme disease is caused by a bacterium, the spirochete *Borrelia burgdorferi*, which infects deer ticks of the genus *Ixodes*. Transmission of Lyme disease occurs when a carrier tick attaches to a human for a minimum of 36 to 48 hours.

Lyme disease usually starts with a virus-like illness and a characteristic rash, erythema migrans, which occur from 1 to 30 days (median 7 days) after the tick bite, which usually does not cause symptoms. If Lyme disease is not recognized and treated at this stage, the infection may progress to the nervous and cardiac systems in weeks to months. This includes facial paralysis (Bell's palsy) and meningitis. Inflammation of the heart (myocarditis) may occur, resulting in heart conduction problems.

When untreated for months or years, late Lyme disease may develop as polyarthritis or joint pain. In addition, a nervous system syndrome progressive called "tertiary neuroborreliosis" may occur, which can include mental and/or psychiatric changes. Clinical recognition of Lyme disease is difficult due to non-specific initial symptoms if the erythema migrans rash is absent, and due to the variety of possible presentations of more advanced Lyme disease.

Diagnosis of Lyme disease is best made by recognition of the erythema migrans rash. If no rash is found, serologic laboratory confirmation of *Borrelia burgdorferi* infection with at least one objective sign of typical musculoskeletal, neurologic or cardiac disease is sufficient; however, serologic testing for Lyme disease may be falsely negative, so clinical findings are more important. Primary prevention for Lyme disease may be implemented by use of tick repellants, and skin protection with clothing and skin inspection. The Lyme vaccine may be 85% protective. Treatment is with oral antibiotics for early disease and by intramuscular or intravenous for major late sequelae of Lyme disease. Prognosis in Lyme disease is excellent with antibiotic treatment. However, when the diagnosis of Lyme disease is missed, the manifestations of late stage Lyme disease may persist for years.

2. Hemochromatosis.

Hemochromatosis is a disease of excess iron storage that affects approximately one in 5,000 people in the United States, typically in patients between the ages of 40 and 60 years. Men are usually more affected than women as menstruation in women may partially treat the condition. Inappropriate accumulation of iron in the body may result in extensive damage to many organs, especially the pancreas, liver, heart and pituitary, and death occurs with severe cardiomyopathy (heart failure) and cirrhosis of the liver. Etiology may be genetic in patients of European origin, or due to secondary accumulation of iron in the body through anemias such as beta-thalassemia in which intestinal absorption of iron is increased. Early symptoms are non-specific and possibly misleading to clinicians. These include fatigue, weight loss and abdominal pain. If iron deposition in the tissues is prolonged, cirrhosis, diabetes mellitus, arthritis, and cardiomyopathy may develop. Patients usually develop a brown or gray skin discoloration.

Diagnosis is supported by laboratory testing for elevated serum iron, iron saturation and ferritin, and definitive diagnosis requires liver biopsy. Treatment for hereditary hemochromatosis is by phlebotomy (i.e., bleeding) to decrease iron stores. In secondary hemochromatosis, chelation therapy is usually required as phlebotomy would worsen anemia. Prognosis is excellent when the disease is diagnosed before extensive organ damage has occurred. However, even when diagnosis is delayed, the five-year survival increases from 33 to 89% with treatment; liver function improves, skin pigmentation normalizes, cardiac failure is reversed and carbohydrate metabolism improves.

3. Celiac Disease.

Celiac disease is a genetic, autoimmune gastrointestinal disorder resulting in a toxic reaction to the ingestion of foods containing gluten (*wheat, rye, barley and sometimes oats*). This disease is primarily found in Caucasians. The resulting damage to the lining of the small intestine causes severe and sometimes life-threatening complications. The prevalence of celiac disease is much higher than previously confirmed. According to recent studies, celiac disease is dramatically under diagnosed. While over million Americans (*one in 133*) have celiac disease, only an estimated 60,000 Americans are diagnosed. Many people with celiac disease are asymptomatic or have only non-specific signs and symptoms. Diagnosis has become easier with the development of non-invasive serological tests. Treatment for celiac disease remains a gluten-free diet, which eliminates all gluten-containing foods.

III. THE INTERVENTIONS

Hemochromatosis, Lyme disease, and celiac disease were three of the illnesses that were studied in the first phase of the lesser-known illness (LKI) project. It was found that there is a particularly high potential for improving quality of care for individuals with these illnesses. Therefore, as part of the second phase of the LKI project, an extensive quality improvement program for these illnesses was implemented. This program was undertaken in the form of educational health care interventions. These interventions encompassed the dissemination of clinical practice guidelines for each of the three illnesses to physicians within the State of Delaware. The guidelines were comprised of medical information about the etiology, and causes of the diseases, the determination of the symptoms of the diseases manifested by a patient, and the clinical laboratory tests that would yield a positive of negative diagnosis, i.e., confirmation of whether a patient was had the disease or not, and treatment options.

Both hemochromatosis and celiac diseases was the object of the first wave of the intervention in which the initial preparations were begun in 2002; a second wave addressed Lyme disease with the preparation of the intervention beginning in 2005. Each wave included the following process:

- **Development of evidence-based guidelines with a panel of experts**;
  For each disease, various panels of medical experts were convened to review and update clinical guidelines and to create user-friendly two page summaries of the key recommendations. The guidelines were brought to several primary care offices in Delaware, which represent the main adult primary care specialties (family practice and internal medicine) in the three counties in Delaware. An hour-long educational session was conducted in each office, and feedback on the usability of the guidelines was obtained. Subsequently, the clinical guidelines were compiled and finalized.

- **Publication in a peer-reviewed medical journal**;
  The clinical guidelines published in various peer-reviewed medical journals to communicate to the practicing physicians. The separate guidelines for hemochromatosis and celiac disease were distributed in the *Delaware Medical Journal*. Guidelines for Lyme disease were also released through the journal of *American Family Physician.*

- **Academic detailing of the guidelines;**
  Information meetings were conducted with groups of physicians. In these meetings the doctors were provided the guidelines, and discussions of their content, objectives, and requirements were communicated.

- **Posting the guidelines to the Medical Society of Delaware (MSD) internet website;**
  To widen the scope of dissemination to the Delaware physicians, the clinical guidelines were posted on the website of the DMS. The guidelines have remained posted on the MSD website since this initial publication.

- **Mailing to the members of the Medical Society of Delaware (MSD);**
  Also, the separate sets of clinical guidelines for each illness were disseminated through mass mailings by the DMS to its members, most of whom are physicians within state of Delaware.

In general, the interventions were structured such that the guidelines were developed and published in an initial year and the academic detailing was conducted in the subsequent year. Each previous step could have a cumulative effect on subsequent steps which results in expansion of the scope of dissemination. As such, each additional step represents enhanced intensity of effort to disseminate the clinical guidelines to physicians.

The steps entailed in the development of clinical practice guidelines and the timing of their dissemination provides the bases for the evaluation period of the educational interventions of the three diseases. The evaluation periods span the months from September 2001 (9/2001) through May 2007 (5/2007) for Christiana Care Outpatient Services (CCOS) and September 2001 through February 2008 for both Medicaid services.

The evaluation period encompasses three separate time frames:

(1) the pre-intervention (or *Ex Ante* intervention*)* period which covers the months that preceded the educational intervention;

(2) the intervention period, the time frame in which the medical intervention (dissemination) activities were conducted; and

(3) the post intervention (or *Ex Post* intervention) period that comprises the months which follow the conducting of the intervention.

The dates of these different intervention periods for each LKI are shown on Table 1. Figure 1 provides a graph that depicts the processes encompassed by the separate interventions.

FIGURE 1: TIMELINES OF INTERVENTIONS

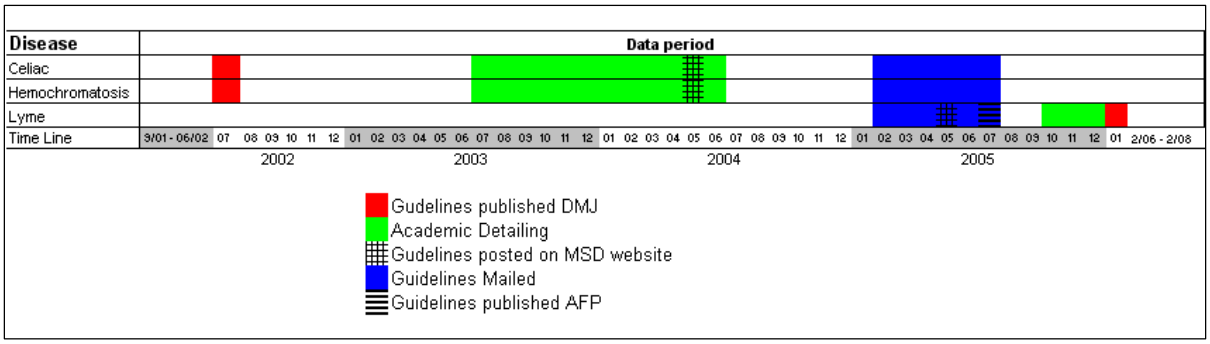


TABLE 1: EVALUATION PERIODS FOR LKI				
EVALUATION PERIODS	**INTERVENTION STEPS/PROCESS**	**CELIAC DISEASE**	**HEMOCHROMATOSIS**	**LYME DISEASE**
Pre- (*Ex Ante*) Intervention Period	TIME FRAME OF ENTIRE PERIOD	September 1, 2001 to April 31, 2002	September 1, 2001 to June 30, 2002	September 1, 2001 to April, 30, 2005
	No actions undertaken:	August/September 1, 2001 to December 31, 2001	August/September 1, 2001 to December 31, 2001	August/September 1, 2001 to February 28, 2005
	Guidelines developed:	January 1, 2002 to April 31, 2002	January 1, 2002 to June 30, 2002	March 31, 2005 To April, 30, 2005
Intervention Period	TIME FRAME OF ENTIRE PERIOD	May 1, 2002 to July 31, 2005	July 1, 2002 to July 31, 2005	February 1, 2005 to January 31, 2006
	Guidelines Published:	May 1, 2002**	July 1, 2002	July 1, 2005***
	Academic detailing:	July 1, 2003 to June 30, 2004	July 1, 2003 to June 30 2004	October 1, 2005 to December 31, 2005
	Guidelines posted On MSD* website:	May 2, 2004	May 25, 2004	May 1, 2005*
	Guidelines mailed:	February 2005 to July 31, 2005	February 2005 to July 31, 2005	February 1, 2005 to July 31, 2005
	Guidelines Published:	--	--	January 31, 2006*
Post (*Ex Post*) Intervention Period	TIME FRAME OF ENTIRE PERIOD	August 1, 2005 to May 31, 2007 & February 28, 2008[#]	August 1, 2005 to May 31, 2007 & February 28, 2008[#]	February 1,2005 to May 31, 2007 & February 28, 2008[#]
*MSD: Medical Society of Delaware; ** Delaware Medical Journal; ***American Family Physician. [#]The Medicaid data spans the time period of September 2001 to February 2008, and the Christiana data encompasses the time frame of September 2001 to May 2007.				

IV. SCOPE OF ANALYSIS

The purpose of this study is to determine whether the educational health interventions, which are comprised of the above-described quality improvement projects, have led to increases in the testing for and diagnoses of hemochromatosis, Lyme disease, and celiac disease. The interventions are evaluated for two different medical service delivery systems: the State of Delaware Medicaid program, and Christiana Care Outpatient Services (CCOS). For the Medicaid program separate evaluations are undertaken for services provided through what is identified in the data as (a) professional delivery, i.e., physician offices, and (b) institutional delivery, i.e., hospitals and clinics. The time frame of evaluation of the educational interventions, designated here as the evaluation period, differs slightly for the two organizations. For each illness the evaluation period for Medicaid program is from September 2001 (9/2001) through February 2008 (2/2008), and for Christian Care Health Services, the evaluation period is September 2001 (9/2001) through May 2007 (5/2007).

For the three medical services, the data units are based on observations of adults who have received services as patients, some of whom were tested for any one of the three illnesses. Subsequent to the tests, a positive or negative diagnosis was rendered. All the clients were 18 years of age or older for which claims have been made (but not necessarily paid).

Empirical results are presented for two interrelated research objectives.

1. Prevalence rates pertaining to the testing for and diagnoses of each LKI are compiled over the evaluation period.

2. The association of the educational interventions with the various prevalence rates is evaluated statistically with regression models.

Both of these research objectives employ the same prevalence rates whose measurements are discussed immediately below.

A. PREVALENCE MEASUREMENTS

1. Three Prevalence Rates

Three outcomes of each LKI are reported in the form of prevalence rates that occurred over the evaluation period. These prevalence rates have been calculated for every month included in the pre-intervention, the intervention, and the post intervention periods. The measurement of the prevalence rates are presented on Table 2.

TABLE 2: MEASUREMENT OF PREVALENCE RATES
The Rate of Testing for a LKI = The number of clients tested for a particular disease in each month of the evaluation period. --- The number of clients receiving services in each month of the evaluation period/100,000 clients
The Rate of Diagnosis for a LKI = The number of clients diagnosed with a particular disease in each month of the evaluation period. --- The number of clients receiving services in each month of the evaluation period/100,000 clients
The Diagnosis-Testing Rate for a LKI = The number of clients diagnosed with a particular disease in each month of the evaluation period. --- The number of clients tested for that disease in each month of the evaluation period.

The number of clients receiving services in each month, -- the denominator, -- is the number of individuals who were eligible clients of the pertinent Medicaid or Christiana Care programs and also received medical services during the month. These individuals were designated as "recipients of services" in the data sets. That is, they are the number of individuals who received medical services through the Delaware Medicaid program, or the Christiana Care Services (CCOS). Clients/patients receiving services for surgical procedures from physician specialties/taxonomies (e.g. psychiatrists, anesthesiologists, radiologists, pathologists) are excluded.

The number of clients tested for a particular disease in each month, -- a numerator, -- indicates that clients/patients have undergone a medical (including a) laboratory test or a number of tests to determine whether the individuals have the disease, i.e. to identify an illness or disorder for an individual. In effect, *the numerator measures the* number of persons *receiving tests (or tested) in a month, irrespective of the number of tests they obtained.*

The number of clients diagnosed, -- a numerator, -- refers to individuals who have been tested for a disease and a positive test result has been rendered that confirms that the individuals have the disease, i.e., they have been identified as having the illness.

Table 3 presents the appropriate codes utilized for determining the occurrences of testing and diagnosis of the three LKI. First, determination of testing for a particular LKI is delineated by CPT (Current Procedural Terminology) laboratory codes that physicians, hospitals, clinics, and medical laboratories utilize to bill for testing for an illness (and for filing a Medicaid claim for payment of services to a client, viz. a "recipient"). Second, determination of a positive diagnosis for a particular LKI is delineated by ICD 9 (International Statistical

Classification of Diseases and Related Health Problems) diagnosis codes that the medical profession uses to verify that an individual has a particular illness.

TABLE 3: CODES FOR TESTING AND DIAGNOSES		
LKI	**CPT Codes For Testing**	**ICD 9 Codes for Diagnoses**
Celiac Disease	82784	579.0
	83516	
	86255	
Hemochromatosis	83540	275.0
	83550	
	82728	
	84466	
Lyme Disease	86618 (x2)	088.81
	87476	
	86617 (x2)	
	87081	

2. Prevalence Rate Data

THE MEDICAID PROGRAM. All prevalence rates were compiled for each month from September 1, 2001 to February 28, 2008. The compilation process was based upon the structure of the MEDICAID data.

- The Prevalence Rates for Testing were obtained in the following way. Over the time frame, the Medicaid data identified a listing of unique individuals (identified by a code number) who had been tested for at least one of the three illnesses. All individuals who had their initial test for a particular illness, verified by CPT Codes, in the same month of the same year were counted to derive the total number of individuals tested in that month. This total number of individuals tested in a month (e.g., April 2002) was divided by the total number of individuals who received medical services in that same month (i.e., April 2002). The resulting quotient is the Prevalence Rate of Testing in that month for that illness.

- The Prevalence Rate of Diagnosis for each month was determined as follows. One of two results could be obtained for an individual (in the data set) who was tested. Either a positive diagnosis was affirmed, indicating that the individual had the illness, or the test rendered a negative finding, indicating that the individual did not have the disease. All **positive** diagnoses of each individual within the assigned month were aggregated for each particular month in which the positive diagnoses occurred, and then the total number of positive diagnoses in that month was divided by the number of individual receiving medical

services in that particular month. The resulting quotient yielded the dependent variable of The Prevalence Rate of Diagnoses for a LKI.

- The Diagnosis-Testing Rate for each LKI was calculated as merely the number of individuals with positive diagnoses verified with the illness in the assigned month divided by the number of individuals tested in the assigned month.

THE CHRISTIANA CARE OUTPATIENT DATA. The data set encompasses the period of September 1, 2001 through May 31, 2007. The mathematical calculations of various prevalence rates are the same as the Medicaid data, i.e., the same formula applies. However, the method of the Christiana Care service was more straightforward, given the format of the data. In the data set obtained from Christiana Care the monthly aggregates for testing and positive diagnoses were compiled by Christiana Care's data system. The number of individuals who were administered a test for a particular disease were provided in accordance with CPT Codes for the illness, and the number of individuals who had a resulting positive diagnosis was assigned to that same month.

B. DESCRIPTIVE ANALYSES OF PREVALENCE RATES

The descriptive analyses encompass the presentation of data arrays of prevalence rates.

1. For each disease, separate tabular displays are given for the value of the three prevalence rates over the evaluation period. These displays are provided separately for CCOS, Medicaid Professional services, and Medicaid Institutional services.

2. The prevalence rates are also shown on graphs that allow visual inspection of changes and pattern in value (or lack thereof) over the evaluation time frame.

C. STATISTICAL ASSESSMENT OF INTERVENTION OUTCOMES

1. Three Outcomes

For each of the three LKI, the prevalence rate outcomes of their educational intervention are evaluated with a basic regression model. The objective of the regression modeling is to assess whether there were statistically significant differences in the various prevalence rates (the three outcomes) before and after an intervention:

- Was there a statistically significant increase in the rate of testing (The Prevalence Rate of Testing) during and after the educational intervention?

- Did the rate of diagnosis (The Prevalence Rate of Diagnosis) manifest a statistically significant increase before, during, and after the educational intervention?
- Was there a statistically significant increase in the rate of diagnosis relative to the rate of testing (The Diagnosis-Testing Rate) before, during, and after the educational intervention?

2. Regression Analyses: The ANOVA Regression Models

The evaluation of the impact of the educational intervention on any selected prevalence rate entails the application of ANOVA (Analysis of Variance) regression models. As discussed in more detail below, the models for evaluating the intervention outcomes have two different measurement (or specifications) of the educational interventions. The ANOVA models are specified with dummy (or categorical) variables to determine whether the selected prevalence rates were higher either during (the intervention period) or after the educational intervention (the post intervention period) than the pre-intervention period.[1] Table 4 presents the names of the three prevalence rates for each LKI that are the selected dependent variables. The measurements of these variables were provided in Table 2.

TABLE 4. NAMES OF PREVALENCE RATES: THE DEPENDENT VARIABLES

HEMO_T = The Prevalence Rate of Testing for Hemochromatosis **HEMO_D** = The Prevalence Rate of Diagnosis for Hemochromatosis **HEMO _DT** = The Diagnosis-Testing Rate for Hemochromatosis
CEL_T = The Prevalence Rate of Testing for Celiac Disease **CEL_D** = The Prevalence Rate of Diagnosis for Celiac Disease **CEL_DT** = The Diagnosis-Testing Rate for Celiac Disease
LYME_T = The Prevalence Rate of Testing for Lyme Disease **LYME _D** = The Prevalence Rate of Diagnosis for Lyme Disease **LYME_DT** = The Diagnosis-Testing Rate for Lyme Disease

Moreover, a separate set of equations are estimated for the Christiana Care Outpatient Services (CCOS) data and the Medicaid data. For Medicaid data, two separate analyses are undertaken. One set of models is tested for prevalence rates associated with professional service delivery, i.e., physician offices, and another set of models is evaluated for prevalence rates associated with institutional service delivery, i.e., hospitals and clinics. The basic models are shown as equations in Table 5.

[1]In economics, an ANOVA model is often referred to as regression with only dummy (categorical or qualitative) independent variables.

Each type of model is tested with time-series data in which the units of observations encompass the pertinent prevalence rates of each month of the evaluation period. For Medicaid, there are a total of 78 observations corresponding to the 78 months of the evaluation period September 1, 2001 to February 28, 2008. For CCOS, a total of 69 observations were used covering 69 months in the evaluation period of September 1, 2001 through May 31, 2007. All the equations are estimated with the ordinary least squares estimator (OLS). A 5% level of statistical significance for the F-value of the model has been chosen to accept the validity of the estimated equation, and a 5% level of statistical significance has been selected for verification of the research hypotheses which are tested by the estimated regression coefficients of the dummy intervention variables. If the F-Value is not statistically significant, then the estimated equation does not contribute to the explanation of the dependent variable, and none of the independent variables can be considered as determinants of the variation of the selected prevalence rates. Statistical diagnostic checks have been undertaken to ensure that the models produce efficient and unbiased results.

TABLE 5: THE ANCOVA REGRESSION MODELS
A. Equations
CHRISTIANA CARE OUTPATIENT SERVICES (CCOS)
(1A). $PREV_{ts} = B_0 + B_1INTA_{ts} + B_2INTB_{ts} + U_{ts}$
MEDICAID: PROFESSIONAL SERVICE DELIVERY
(1B). $PREV_{ts} = B_0 + B_1 INTA_{ts} + B_2INTB_{ts} + U_{ts}$
MEDICAID: INSTITUTIONAL SERVICE DELIVERY
(1C). $PREV_{ts} = B_0 + B_1 INTA_{ts} + B_2INTB_{ts} + U_{ts}$
B. Model Components
$INTA_{ts}$ and $INTB_{ts}$ are measures of the educational interventions occurring in various months of the evaluation period;
B_0 is the intercept, and B_1 to B_n are the differential intercept coefficients/parameters that measure average differences in the impact of the variables;
U_{ts} is the error term.
Subscript "ts" indicate statewide time-series data;

3. Hypotheses and Model Interpretation

The Equations of Individual Providers (1A, 1B, 1C)

INTA and INTB. With these two measures, the time period after the initiation of an intervention is broken down into two separate time frames. (See Table 1 above). **INTA** represent the months that include the intervention period, and **INTB** covers the months of the *ex post* intervention period. Both **INTA** and **INTB** are dummy

variables. Each category is coded as 1, with the pre-intervention period, which is the reference category, is always coded as 0. The specific measurements are:

INTA = 1, for any of the months during which the intervention were implemented (the intervention period),

INTA = 0, for any of the months not encompassing the intervention period (i.e., both the *ex ante* and the *ex post* interventions periods are assigned zero),

INTB = 1, for any of the months encompassed by the *ex post* intervention period,

INTB = 0, for any of the months not in the *ex post* intervention period (i.e., both the *ex ante* intervention period and the intervention period are assigned zero).

In effect, the *ex ante* intervention period is the reference category. Thus the impact or value of the intervention period and *ex post* periods are compared separately with the *ex ante* intervention period.

If **INTA** is confirmed as a statistically significant variable with a positive sign in an estimated equation, then the conclusion would be that, on average, prevalence rates were higher during the months in which the intervention was implemented (the intervention period) than in the *ex ante* intervention period.[2] If **INTA** is not confirmed as a statistically significant variable, then the conclusion would be that, on average, prevalence rates in the *ex ante* intervention period were the same as the prevalence rates during the months in which the intervention was implemented (the intervention period). Thus during the months of its implementation, the educational intervention was not associated with increases in the selected prevalence rates. For example, a statistically insignificant impact of **INTA** for the analysis of **HEMO_T** would indicate that the rates for testing for Hemochromatosis did not change in the time period during which the educational intervention was undertaken.

The verification of **INTB** as a statistically significant variable with a positive sign in the equation would affirm that, on average, prevalence rates were higher in the *ex post* intervention period than the months in the *ex ante* intervention period. If the research hypothesis for **INTB** is rejected (i.e., it is not a statistically significant variable in the estimated equation), then the conclusion would be that, on average, prevalence rates in the *ex ante* intervention period were the same as prevalence rates in time frame of the *ex post* intervention period. Therefore the conclusion to be drawn is that the implementation of the educational intervention was not associated with increases in prevalence rates in the long-term. For example, the statistical insignificance of **INTB** with respect to **HEMO_T** would demonstrate that testing rates for Hemochromatosis were the same in the period after the intervention took place (the *ex post* intervention time frame) as in the *ex ante* intervention period.

[2] A much unexpected result would a negative sign for INTA as a statistically significant variable; this finding would verify the prevalence rates were lower after the intervention.

If both **INTA** and **INTB** were found to be statistically significant with positive signs, then the evidence supports the view that the educational intervention was associated with both a short-term and long-term increases in average prevalence rates in both periods than prevailed before the intervention began. Our expectation is that both **INTA** and **INTB** would be positive, but that the value of **INTB** regression coefficient for the *ex post* intervention period would be lower/smaller than the **INTA** regression coefficient. The basis of this prediction is that the implementation of the intervention involves more intense activities and a higher dosage of information available to physicians, and after the intervention, the intensity of information lessens so that the physicians' focus on the illness is reduced as time passes.

Given the hypotheses for **INTA** and **INTB**, $\mathbf{B_0}$, $\mathbf{B_1}$ and $\mathbf{B_2}$ (the estimated regression coefficients) are expected to have positive signs. $\mathbf{B_1}$ provides the estimate of the impact of **INTA**. The verification of the null hypotheses test $\mathbf{B_1} = 0$ would indicate that there was no difference between the prevalence rates of the ex *ante* and intervention periods. $\mathbf{B_2}$ provides the estimate of the association of **INTB** with the prevalence rates. The verification of the null hypotheses test $\mathbf{B_2} = 0$ would indicate that there was no difference between the prevalence rates of the *ex ante* and *ex post* intervention periods.

A more formal (mathematical) statement about $\mathbf{B_0}$, $\mathbf{B_1}$ and $\mathbf{B_2}$ is as follows:

- $\mathbf{B_0}$. The estimate of $\mathbf{B_0}$ shows the average value of the monthly prevalence rates in the *ex ante* intervention period. For example, a B_0 estimate of 60 for the prevalence rate of testing would indicate that the average monthly prevalence rates were 60/100,000 over the period before the intervention was implemented.

- $\mathbf{B_1}$. The statistically significant estimate of $\mathbf{B_1}$ indicates how much greater the average monthly value of prevalence rate is in the intervention period (INTA) compared to *ex ante* intervention period measured by $\mathbf{B_0}$. For example, a B_1 estimate of 75 for the prevalence rate of testing would indicate that the average monthly prevalence rates were 75/100,000 higher during the implementation period of the intervention than in the *ex ante* intervention period.

- $\mathbf{B_2}$. The statistically significant estimate of $\mathbf{B_2}$ indicates how much greater the average monthly value of a prevalence rates is in *ex post* intervention period (INTB) compared to *ex ante* intervention period measured by $\mathbf{B_0}$. For example, a B_2 estimate of 45 for the prevalence rate of testing would indicate that the average monthly prevalence rates were 45/100,000 higher during the implementation period of the intervention than in the *ex ante* intervention period.

Thus the following determinations can be calculated with the estimated coefficient estimate. These calculations are illustrated by continuing the above examples:

- **B_0** = average monthly prevalence rate for the *ex ante* intervention period, where B_0 does not = 0, i.e., B_0 is statistically significant. With $B_0 = 60$, the average monthly prevalence rates for the *ex ante* intervention period would be 60/100,000 clients.

- **$B_0 + B_1$** = average monthly prevalence rate for the intervention period, where B_0 and B_1 do not = 0, i.e., B_0 and B_1 are statistically significant. The average monthly prevalence rates during the intervention period would be 135/100,000 clients; i.e., with $B_0 = 60$ and $B_1 = 75$, $135 = 60 + 75$.

- **$B_0 + B_2$** = average monthly prevalence rate for the *ex post* intervention period, where B_0 and B_2 do not = 0, i.e., B_0 and B_2 are statistically significant. The average monthly prevalence rates during the intervention period would be 105/100,000 clients; i.e., with $B_0 = 60$ and $B_2 = 45$, $105 = 60 + 45$.

V. EVALUATION RESULTS

The two purposes of this intervention evaluation are (1) the tabular compilation of the various prevalence rates, and (2) the assessment of whether the particular educational interventions were associated with increases in testing and diagnoses of the targeted lesser known illnesses. A description of the analyses of these two purposes is presented in two sections. One, the evaluation results are given in detail. Two, since a central question is whether the separate educational interventions increased the testing and diagnoses of these individual illnesses, the first part of the evaluation results is a summary of the findings about the impact of the intervention.

A. SUMMARY OF THE ANALYSIS AND RESEARCH ISSUES

As stated above, the tabular displays present monthly prevalence rates for each lesser known illness over the three periods of the evaluation time frame. One major observation can be drawn from the evidence yielded by the tabular displays. Irrespective of the providers, the different prevalence measures of each lesser known illness manifest a similar behavior pattern. The various prevalence rates are characterized by substantial volatility on a monthly basis within each of the three evaluation periods. For any illness, the sizes of the monthly rates were wide-ranging, with many large swings in value in which the rates varied from zero to large numbers.

The findings, and their concomitant interpretations, derived from the various regression models should be considered within the context of the monthly behavior of the prevalence rates. The statistical results of the estimated models reflect the average value of a prevalence rate across each intervention period. Put differently, the estimates of a regression model for an illness permits the determination of the average or mean values of a selected prevalence rate within each intervention period, irrespective of the monthly values and volatility of the particular prevalence rates with an intervention period.

Moreover, it is important to note that the estimates of the regression models do not indicate causality, but only association. That is, the models do not verify that the educational interventions did produce, or cause, the particular outcomes measured by the prevalence rates. Rather the regression estimates merely show that for the implementation of a particular educational intervention for an illness, the prevalence rates in either the intervention

and *ex post* intervention periods are higher than or equal to the prevalence rates of the *ex ante* intervention period. However, the terminology utilized in the discussion of the evaluation results may convey causality with the use of such terms as impact, determine, produce; but this language is merely verbal conveniences that should be interpreted within the context of association.

On Table 8 at the end of this section, a summary of findings derived from the estimated regression models is reported. The table specifies whether or not a particular educational intervention is associated separately with an increase in higher prevalence rates in the intervention and *ex post* intervention periods than in the *ex ante* period. The brief summary statements provide an overview of the detailed discussions of the next section.

In the table, the following terminology is pertinent:

- A "+" sign indicates that a statistically significant association was confirmed between an educational intervention and either INTA or INTB.
    - With a "+" sign for INTA, the term of "Rates > *Ex Ante* Period" signifies that the prevalence rates in the intervention period (INTA) were greater than the prevalence rates of the ex ante period.
    - With a "+" sign for INTB, the term of "Rates > *Ex Ante* & Intervention Periods" signifies that (a) the prevalence rates in the *ex post* intervention period (INTB) were greater than the prevalence rates of the *ex ante* period, and also (b) the prevalence rates in the *ex post* intervention period (INTB) were greater than the prevalence rate of the intervention period.
- "NO" indicates that a statistically significant association was not verified between an educational intervention and either INTA or INTB.
    - With a "NO" for INTA, the term of "Rates = *Ex Ante* Period" verifies that the prevalence rates of the *ex ante* period and the intervention period are the same.
    - With a "NO" for INTB, the term of "Rates = *Ex Ante* & Intervention periods" indicate that the prevalence rates are the same for the *ex ante* period, the intervention period, and the ex post period. This situation prevails because the there is no statistically significant association between the educational intervention and the prevalence rates of INTA.
    - With a "NO" for INTB, the term of "Rates = *Ex Ante* Period" signifies that the prevalence rates of the *ex ante* period and the *ex post* intervention period are the same, but that the prevalence rates of the intervention period are greater than the ex ante period, indicated by a "+" sign.

HEMOCHROMATOSIS:

Medicaid Professional Services: (where services were provided primarily through physician offices).

1. The educational intervention for hemochromatosis manifested both short-term and long-term effects in the prevalence rates for both testing and diagnosis.

2. The educational intervention resulted in prevalence rates for testing and diagnoses that were higher in the intervention period than the *ex ante* period. Moreover, these prevalence rates in the *ex post* period were not only greater than the *ex ante period*, but they were also higher than the rates of the intervention period.

3. However, the educational intervention was not associated with any of the diagnosis/testing rates (D/T rates). Put differently, the proportion of diagnoses relative to testing in both the intervention and the *ex post* period did not rise above rates of the *ex ante* period. That is, the D/T rates were the same for all three periods in the evaluation time frame.

Medicaid Institutional Services: (where services were provided primarily in a hospital setting).

1. The educational intervention for hemochromatosis resulted in both short-term and long-term effects in not only the prevalence rates for testing and diagnosis but also in the rates for diagnosis/testing (D/T).

2. The educational intervention was associated with prevalence rates for testing and diagnoses and D/T rates that were higher in the intervention period than the *ex ante* period. Moreover, these prevalence rates in the *ex post* period were not only greater than *ex ante* period, but they were also higher than the rates of the intervention period.

3. The findings regarding the D/T rates indicate that the educational intervention was associated with an improvement in the diagnoses of hemochromatosis. Put differently, the proportion of diagnoses relative to testing increased in the intervention period above that of the *ex ante* period. In addition, the values of the D/T rates in the *ex post* period were not only greater than the rates in ex *ante period*, but they also exceeded those in the intervention period.

Christian Care Outpatient Services: (where services were provided primarily through physician offices):

1. The education intervention for hemochromatosis seems to have had a very limited impact through CCOS. Only a short-term effect was realized for testing rates. The rates were greater during the intervention than in the *ex ante* period, but in the *ex post* period the rates reverted to the level of the *ex ante* period.

2. The educational intervention was not associated with the prevalence rates for diagnosis and also the D/T rates. That is, the educational intervention did not increase or improve both of the rates above those in the

ex ante period. That is, prevalence rates for diagnosis and also the D/T rates were the same for the *ex ante* period, the intervention period, and the *ex post* period

CELIAC DISEASE

Medicaid Professional Services (where services were provided primarily through physician offices).

1. The association of the education intervention with the three different prevalence rates parallel that of celiac for this provider.

2. The educational intervention for celiac manifested both short-term and long-term effects in the prevalence rates for both testing and diagnosis.

3. The educational intervention resulted in prevalence rates for testing and diagnoses that were higher in the intervention period than the *ex ante* period. Moreover, these prevalence rates in the *ex post* period were not only greater than the *ex ante* period, but they were also higher than the rates of the intervention period.

4. However, the educational intervention was not associated with any of the diagnosis/testing rates (D/T rates). Put differently, the proportion of diagnoses relative to testing in both the intervention and the *ex post* period did not rise above rates of the *ex ante* period. That is, the D/T rates were the same for all three periods in the evaluation time frame.

Medicaid Institutional Services: (where services were provided primarily in a hospital setting).

1. The educational intervention resulted in increases in the prevalence rates for testing in the intervention and *ex post* periods. These findings indicate that the intervention had both short-term and long–term effects. The prevalence rates in the intervention period were higher than the *ex ante* period, and the prevalence rates in the *ex post* period were greater than the intervention period.

2. The educational intervention did not have a short–term impact on diagnosis prevalence rates; thus the rates had the same average value in the *ex ante* and intervention periods.

3. However, the educational intervention did have a long term effect on the prevalence rates for diagnosis. That is, the diagnoses rates did increase due to educational intervention in the *ex post* period, with rates higher than the rates in both the *ex ante* and intervention periods which had the same average values.

4. Finally, the educational intervention was not associated with any of the diagnosis/testing rates (D/T rates). Put differently, the proportion of diagnoses relative to testing in both the intervention and the *ex post* period did not rise above rates of the *ex ante* period. That is, the D/T rates were the same for all three periods in the evaluation time frame.

Christian Care Outpatient Services: (where services were provided primarily through physician offices):

1. The educational intervention appears to have no association for any of the prevalence rates. A regression model was not tested because there were only a few observations. Only 14 diagnoses were found, of which three were conducted directly for the testing for celiac disease over the evaluation time frame. Thus the average value for each particular prevalence rate measure was the same for all periods.

LYME DISEASE

Medicaid Professional Services: (where services were provided primarily through physician offices).

1. Neither short-term nor long-term effects of the educational intervention were confirmed for any of the prevalence rate measures. The educational intervention was not associated with any increase in prevalence rates for testing, diagnoses and diagnoses/testing in the intervention and *ex post* intervention periods. Thus the average values for each particular prevalence rate measure were the same for all periods.

Medicaid Institutional Services: (where services were primarily provided in a hospital setting).

1. The educational intervention resulted in an increase testing and diagnoses and D/T ratio only during the intervention period, indicating short-term effects of the intervention. For each of the particular prevalence measures, the average value of the rates during the intervention were higher than the corresponding rate in the *ex ante* period.

2. The educational intervention did not induce a long term effect. It did not result in increases in testing, diagnoses, and D/T rates in the *ex post* period. Thus no long–term effects of the intervention were verified. Therefore, for any particular prevalence measure, the value of the rates in the *ex post* intervention period were the same value as the corresponding rates of the *ex ante* period.

Christian Care Outpatient Services: (where services provide primarily through physician offices):

1. The educational intervention is only associated with prevalence rates for testing in both the intervention and *ex post* intervention periods. Thus there are both short-term and long-term effects of the intervention on testing. The prevalence rates in the intervention period were higher than the rates in the *ex ante* period. Also, the average values of the prevalence rates for testing were higher in the *ex post* period than *ex ante* period, with the rates in *ex post* period manifesting greater values than the rates in the intervention period.

2. There appears to be no association of the educational intervention with either the prevalence rates for diagnoses and diagnoses/testing. Thus no short-term or long-term effects were confirmed for either measure. Concomitantly, for each particular measure, the average values of the rates were the same or equal across all three evaluation periods.

1. Conclusions

Several interrelated observations and considerations can be made regarding the evaluation of the three lesser known illnesses. Some observations pertain mainly to the value and pattern of prevalence rates and their compilation. Other observations are applicable primarily to the statistical analyses of the expected association of the educational interventions and changes in prevalence rates.

As described in detail above, the tabular display shows that the prevalence rates for all lesser known illnesses, -- irrespective of the provider, -- reveal considerable volatility on a monthly basis within each of the three evaluation periods. It is not immediately obvious why such monthly variability occurs. One possible explanation of the monthly variability of rates could be the data collection procedure employed for compiling the monthly rates. The testing conducted to determine a diagnosis of an illness involved the application of a series of tests over some months and then the rendering of a concomitant (positive or negative) diagnosis. With respect to the data for the present evaluation, designation of testing for a particular month (to compile monthly prevalence rate) entailed the recording of the incidence of a test for the month of the initial test. Thereafter the confirmed diagnosis was then assigned to the month of the initial test. However, while such data recording could produce some inaccuracies in the monthly assignments of testing and diagnosis incidences, only considerable erroneousness in reporting for data compilation would account for substantial differences in monthly values found in the present evaluation. Given the monthly aggregate measures of prevalence rates, the structure of the data employed for the present evaluation -- (which is discussed below) -- does not allow assessment of the bases for the variability in prevalence rates. Further research is required that should have a twofold foci. One is determining whether the monthly reports are merely artifacts of the reporting mechanism, perhaps driven by billing requirements. Two, an investigation should be directed at the extent to which institutional service delivery factors (e.g., rule, regulation and procedure of medical and administrative service units), the behavioral dimensions of physicians' activities, and the behavioral dimensions and characteristics of clients contribute to the initiation of testing for LKIs.

There is an additional issue related to the volatility pattern of the prevalence rate data. The monthly variability of rates makes it difficult to discern, with substantial assurance, any trend in the testing and diagnoses of the illnesses. In particular, given the wide monthly swing in values in the rates, the volatility hinders the determination whether prevalence rates will be characterized by an upturn, a downturn, or leveling off after the *ex post* period.

An ancillary issue also exists regarding the data for constructing the prevalence rates. A test (actually a series of clinical tests) to diagnoses a lesser known illness may serve multiple purposes and may render a diagnosis for illness other than the illness for which the test was conducted. For example, in the present evaluation, for CCOS, 11 Celiac diagnoses were found to be confirmed from tests undertaken for determining other illnesses. More generally, given the aggregate structure of the evaluation data, it is unknown for the three providers the extent to which diagnoses were recorded for a test(s) directly pursued for a particular lesser known illness or whether the diagnoses were a byproduct of the test(s). Conversely, the test for a particular lesser known illness could have

yielded diagnoses for other illnesses. If so, the test would have produced an (external) benefit to patients who could be treated for the diagnosed illness. This issue of the correspondence between test and diagnosis could be resolved through a patient chart analyses that, as discussed below, would require a different set of data based on individual patients.

A seemingly obvious expectation of the present research is that Medicaid Institutional Services would manifest higher levels of testing, diagnoses, and D/T ratios (though not necessarily greater impacts of the education intervention) than the other two service providers. The basis of this expectation is that the service delivery of Medicaid Institutional Services occurs through hospital and clinic setting for which there are two implications. First, the medical bases for a patient's admission to a hospital is likely to be related to a suspected illness, and the testing is merely a consequence if the admission. Second, prior to the admission to a hospital, a patient may have been subject to testing for an LKI, and the concomitant treatment in the hospital is a follow-up to previous knowledge of a health problem involving an LKI. Third, once admitted to the hospital, a patient is "captive" to medical personnel, and the hospital has facilities for testing; consequently, there may be a strong impetus to utilize clinical tests. The expectation of higher three prevalence rates, however, is not supported for all three lesser known illnesses. The evidence provides mixed results, as shown by the following table that summarizes the regression results.

TABLE 6

COMPARISON OF PREVALENCE RATES FOR MEDICAID INSTUTIONAL SERVICES (MIS), WITH CHRISTIANA CARE OUTPATIENT SERVICES (CCOS) AND MEDICAID PROFESSIONAL (MPS) SERVICES

DISEASE	TESTING RATES	DIAGNOSIS RATES	D/T RATES
Hemochromatosis	MIS < CCOS MIS > MPS	MIS > CCOS & MPS	MIS > CCOS & MPS
Celiac Disease	MIS = MPS, MIS > CCOS	MIS > CCOS MIS < MPS	MIS < MPS MIS < CCOS
Lyme Disease	MIS > CCOS & MPS	MIS < CCOS MIS < MPS	MIS > CCOS & MPS

Shaded area indicates that the prevalence rates of MIS exceed the rates of both MPS and CCOS.

A second expectation can be derived from the educational interventions. A central purpose of the educational interventions was to stimulate the testing and diagnoses of the three lesser known illnesses. Evaluation of the achievement of this objective involved consideration of whether the testing and diagnosis of an illness had increased among the clientele of the various medical service delivery providers. From a methodological standpoint, the evaluation entailed a determination, through the testing regression models, of whether the educational interventions were associated with higher prevalence rates for testing and diagnoses in the intervention and ex post intervention periods. A third prevalence rate of diagnoses as a proportion of testing, the diagnoses/testing rates (D/T), was added to the statistical analyses of the evaluation. The D/T rates have three very important, and intertwined, implications for the determining the effectiveness of educational interventions in inducing higher

prevalence rates for testing and diagnoses. First, were the educational interventions associated with increases in diagnoses (D) relative to testing (T), which is reflected by the D/T rates? Second, what was the levels or values that was realized by the D/T rates? Third and concomitantly, do the realized D/T rates represent sufficient gains for the amount of effort allocated to patient testing and diagnoses?

The following table summarizes the findings presented in the section of "Evaluation Results". The statistical analyses yielded mixed results about the association of educational interventions with the various D/T rates, with inconsistent impacts across providers and across illnesses. The educational interventions yielded "favorable" results only with Medicaid Institutional Services by which the educational interventions were associated with higher D/T rates for the three lesser known illnesses. (For Lyme disease, however, there is only a short-run effect and not a long run impact). These finding add support to the arguments raised above about the role of the hospital setting in testing and consequent diagnoses.

TABLE 7

SUMMARY OF AVERAGE MONTHLY DIAGNOSIS/TESTING RATES FOR ALL ILLNESSES AND PROVIDERS

Provider	***Ex Ante* Intervention Period**	**Intervention Period**	***Ex Post* Intervention Period**
		HEMOCHROMATOSIS	
Medicaid Professional	1.4% of all tests	1.4% of all tests	1.4% of all tests
Medicaid Institutional	2.4% of all tests	5.4% of all tests	6.0% of all tests
CCOS	0.3% of all tests	0.3% of all tests	0.3% of all tests
		CELIAC DISEASE	
Medicaid Professional	2.6% of all tests	2.6% of all tests	2.6% of all tests
Medicaid Institutional	0.2% of all tests	0.2% of all tests	2.2% of all tests
CCOS	NA	**NA**	NA
		LYME DISEASE	
Medicaid Professional	3.8% of all tests	3.8% of all tests	3.8% of all tests
Medicaid Institutional	2.2% of all tests	5.4% of all tests	2.2%.of all tests
CCOS	0.02% of all tests	0.02% of all tests	0.02% of all tests

NA = not applicable. A regression model was not tested because there were only a 14 observations with positive rates, and only for three of them were tests conducted directly for celiac disease.

The educational interventions did not induce increases in positive diagnoses relative to testing for Hemochromatosis and Lyme disease by both Medicaid Professional Services and Christian Care Outpatient Services despite a large quantity of testing by these two providers. (The exception is Celiac disease where the educational intervention did not have any decipherable influence to undertake clinical testing for the illness by CCOS physicians. This outcome poses an interesting research question regarding the reasons for such physician behavior). A large amount of testing and the resultant small D/T ratios are not only applicable to Medicaid Professional Services and CCOS, but also Medicaid Institutional Services even though the educational interventions enhanced the D/T ratios corresponding to this provider.

This seemingly low productivity of testing raises two conjoined health service and thus "policy intervention" issues. First, the low yield of the D/T ratios means that there is a low predictive value for testing. As a consequence, it can be suggested that the clinical manifestations of symptoms that prompt physicians to order tests to detect an illness should be refined to improve the bases for subjecting patients to medical evaluation. Second, and correlatively, the low yield of the D/T ratios indicates that considerable financial resources have been employed for testing without producing very much positive outcomes in the form of positive diagnoses. (As stated above, there could be external benefits of providing diagnoses for other illnesses with the test of LKI). Continuation of the level of testing that would likely occur under the present guidelines involves the acceptance as appropriate that the value of the compensatory health benefits of the treated patients is greater in value than the costs of testing for all patients, and the treatment costs of patients diagnosed with the illness. Such an assumption is unlikely to be warranted given the lack of data and evaluation results on the value of health benefits of diagnosed patients.

The statistical analyses of the educational interventions encountered several difficulties.

1. The research design has several limitations that pertain to the evaluation time frame
    - The estimates of the *ex post* period may be confounded to some extent by the fact that the clinical guidelines that were posted on the MSD website remained on the website since this initial publication and thus were available through the *ex post* intervention period.
    - The intervention period for Lyme disease was short, only eight months, and could lead to underestimation of the impact of the intervention during this limited time frame.
    - The evaluation of the association between the educational intervention and Lyme disease could be confounded. Health care information about Lyme disease had wide popular dissemination several years before the Delaware educational intervention was launched; consequently, both the medical profession and the public could have had considerable awareness of the illness. Nevertheless, the intervention could be viewed as providing an "additional" impetus for conducting testing beyond the level that would have been undertaken without the intervention, and this activity could be captured by the regression models.
    - The present statistical analysis addressed the evaluation of the impact of the educational interventions rather simply and crudely. The regression models were specified with dummy

variables (INTA and INTB) to verify the association of the educational intervention with higher prevalence rates in the intervention and *ex post* intervention periods. More generally, the regression models to conduct the evaluations did not offer much explanation of the educational interventions. For all models, the adjusted R^2 was small indicating that the intervention dummy variables (INTA and INTB) did not account for much of the variation in the levels of prevalence rates. For some prevalence rates of some illnesses, however, the models were very adequate because the rates did not change very much in the intervention and *ex post* intervention periods.

2. The specification of the regression equations only as ANCOVA models with INTA and INTB has some limitations:

    - The regression models did not evaluate the potential cumulative intensity of the intervention effort. In general, the interventions were structured so that the guidelines were developed and published in an initial year and the academic detailing was conducted in the subsequent year. Each previous step could have a cumulative effect on subsequent steps which results in expansion of the scope of dissemination. As such, each additional step represents enhanced the activity to disseminate the clinical guidelines to physicians.

    - The regression specification is a static approach that does not allow for any dynamic actions by physicians. Any potential feedback from the results of testing through the confirmation of diagnoses was not incorporated in the regression models. More specifically, physicians could have adjusted the ordering of tests due to receiving favorable or unfavorable confirmation about diagnoses. The hypothesis is that as testing proceeded physicians have learning curve whereby they react to information about positive or negative diagnoses by increasing or decreasing the subsequent ordering of tests.

    - As stated, with the specification of the regression models with INTA and INTB only, other variables may have been omitted. Potentially relevant variables could add explanations as to why prevalence rates have changed or not and contribute to a refinement of the estimates of the impacts of the educational intervention. Some of the leading contenders as explanatory independent variables are type of physician, geographical location of service, the gender, age, and, and family history of patients, and reasons for ordering tests, and reasons for hospital admission of patients.

    - Much of this information could be extracted from patients' charts. Such an extraction could be arduous if the charts are not included in an electronic information system. However, the major implication of using patient data is that the methodology of the evaluation would shift to more disaggregated level of data based on individual patients. In turn, this shift in methodological focus would require that any regression model employed to evaluate the impact an educational intervention would require data be obtained for <u>all</u> clients within a

medical care service delivery system. Such data would allow the determination of whether patients tested for an illness are different in social characteristics and health and medical profiles than those patients not selected for testing.

TABLE 8. ASSOCIATION OF INTERVENTION WITH RATES

HEMOCHROMATOSIS

Intervention Measure	Medicaid Professional Services			Medicaid Institutional Services			Christiana Care Outpatient Services (CCOS)		
	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates
INTA Intervention Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	NO Rates = *Ex Ante* Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	+ Rates > Than *Ex Ante* Period	+ Rates > *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period
INTB *Ex Post* Intervention Period	+ Rates > *Ex Ante* &Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* Period	+ Rates > *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period

CELIAC DISEASE

Intervention Measure	Medicaid Professional Services			Medicaid Institutional Services			Christiana Care Outpatient Services (CCOS)		
	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates
INTA Intervention Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	NO Rates = *Ex Ante* Period	+ Rates > *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	*	**	**
INTB *Ex Post* Intervention Period	+ Rates > *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* and Intervention Periods	NO Rates = *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	+ Rates > *Ex Ante* & Intervention Periods	*	**	**

LYME DISEASE

Intervention Measure	Medicaid Professional Services			Medicaid Institutional Services			Christiana Care Outpatient Services (CCOS)		
	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates	Testing (T) Rates	Diagnosis (D) Rates	D/T Rates
INTA Intervention Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	+ Rates > *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period
INTB *Ex Post* Intervention Period	NO Rates = *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	NO Rates = *Ex Ante* Period	+ Rates > *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* & Intervention Periods	NO Rates = *Ex Ante* & Intervention Periods

***+** indicates that a statistically significant association was confirmed.*
***NO** indicates that a statistically significant association was not confirmed.*
** indicates that a regression model was not tested because there were only a very few observations (i. e., 3).*
*** indicates that a regression model was not tested because there were only a very few observations; only 14 diagnoses were found, of which three were from direct testing for celiac disease.*

B. DETAIL ANALYSES

The evaluation results will be presented in separate sections for each LKI: (1) Hemochromatosis, (2) Celiac disease and (3) Lyme disease. The same format is followed for each LKI. First, a discussion of the findings is provided in the following order (a) the prevalence rates of testing for an LKI, (b) the prevalence rates for diagnosis, and (c) the diagnosis-testing ratio. Second, because of large volume of evidence for each LKI, the tabular displays, estimated regression models, and graphs are shown as a group following each analysis without commentary. This grouping of material is for "readers' perusal and verification of the discussion of findings.

1. Evaluation Of Hemochromatosis

Table 9 provides a profile of various prevalence dimensions of hemochromatosis presented for the three service delivery organizations over the entire evaluation time frame.

TABLE 9

SUMMARY OF HEMOCHROMATOSIS SERVICES

Summary Description	Medicaid - Professional	Medicaid - Institutional	Christiana Care Outpatient Services
No. of Tests	19,532	63,110	5,831
No. of Clients Tested	8,985	9,121	2,557
Avg. Tests/Client	2.17	6.92	2.28
No. of Diagnoses	242	521	22
Diagnosis/Testing Rates (%)	2.7	5.7	0.9

No.= all tests and diagnoses

Prevalence Rates of Testing for Hemochromatosis

The prevalence rates of testing for hemochromatosis measure, on a monthly basis, the number of unique individuals who were tested for the illness per 100,000 clients.

1. In general, Medicaid professional and institutional service delivery organizations had substantially lower levels of testing of clients than CCOS throughout the entire evaluation period. This difference does not mean that there was a greater impact of the educational intervention.

    - In the *ex ante* period, CCOS had a tenfold higher rate of testing than the other two providers.

        - Medicaid professional services had monthly prevalence rates for testing ranging between 34.1 and 123.9 per 100,000 clients.

        - Medicaid institutional services had monthly prevalence rates for testing ranging between 26.0 and 95.7 per 100,000 clients.

        - CCOS manifested monthly prevalence rates for testing between 456.1 per 100,000 clients and 1,209.1 per 100,000 clients.

- In both the intervention and *ex post* intervention periods, the CCOS rate of testing was four to five times larger than both Medicaid providers. These smaller differences in these two periods indicate that testing by Medicaid services had increased considerably after the *ex ante* intervention period.

    - Medicaid professional services had monthly prevalence rates for testing with a range between 74.5 and 240.6 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 163.3 and 327.0 per 100,000 clients in the *ex post* intervention period.

    - Medicaid institutional services had monthly prevalence rates for testing with a range between 73.0 and 223.5 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 163.3 and 327.0 per 100,000 clients in the *ex post* intervention period.

    - CCOS manifested monthly prevalence rates for testing ranging between 600.5 and 1,472.3 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 517.3 and 1,113.2 per 100,000 clients in the *ex post* intervention period. This range of rates indicates that CCOS had a substantially high volume of testing in the *ex ante* intervention period.

2. The estimated statistical models are consistent with this view. The intervention had a similar impact on both Medicaid service delivery organizations; these effects differed from the impact of the intervention on CCOS.

    - For both Medicaid professional and institutional service delivery, the regression models confirm that both INTA and INTB are statistically significant variables with positive signs; for CCOS, only INTA is verified as statistically significant with a positive sign.

    - For both the Medicaid services, the findings indicate that the educational intervention was associated with an increase in the testing of clients for hemochromatosis during the intervention period and in the *ex post* intervention period. The educational intervention appears to have had a long-term impact with the prevalence rates higher in the *ex post* period than even the intervention period. Compared with the intervention period, the level of testing in fact increased considerably in the *ex post* intervention period

    - For CCOS, the educational intervention was associated with an increase in testing only during the intervention period; in the *ex post* intervention period, the level of testing reverted to the prevalence rate of the *ex ante* intervention period.

    - It must be recognized that CCOS had conducted a high level of testing prior to the intervention so that any increases above the base *ex ante* period would have to be substantial in order for the intervention to have a significant effect.

- The average monthly prevalence rates for testing for hemochromatosis per 100,000 clients, -- derived from the estimated equations, -- for the three evaluation periods is given in the following table.

TABLE 10

AVERAGE MONTHLY PREVALENCE RATES OF TESTING FOR HEMOCHROMATOSIS PER 100,000 CLIENTS

Provider	*Ex Ante* Intervention Period B_0	Intervention Period $B_0 + B_1$	*Ex Post* intervention Period $B_0 + B_2$	Adjusted R^2
Medicaid Professional	66 per 100,000 clients	170 per 100,000 clients	250 per 100,000 clients	.68*
Medicaid Institutional	49 per 100,000 clients	176 per 100,000 clients	253 per 100,000 clients	.78*
CCOS	730 per 100,000 clients	973 per 100,000 clients	730 per 100,000 clients**	.24*

**The F-Values of all the equations were statistically significant at the .0001 level.*
***The coefficient B_2 was not statistically significant; thus the prevalence rates are not different in value than that given by the intercept coefficient B_0.*

3. Irrespective of the impact of the intervention, the graphs of the monthly prevalence rates of testing reveal two dimensions about provider activities:

   - The rate of testing fluctuated widely on a monthly basis for all service providers. Medicaid institutional services maintained the most consistent testing rates (the least undulation) per month while the variation in the level of testing was very much wider for CCOS over the evaluation period compared to both Medicaid services.

   - Despite the monthly fluctuations in prevalence rates for testing of both Medicaid services, the prevalence rates manifest an upward trend through the entire evaluation time frame with rates rising (and the statistical results show a long-term effect in the *ex post* period). However, even with wider fluctuations, the CCOS shows a rise in monthly prevalence rates in the intervention period but there was a considerable decline in the prevalence rates in the *ex post* intervention period that resulted in prevalence rates similar to that of the *ex ante* intervention period.

Prevalence Rates for Diagnosis of Hemochromatosis

The prevalence rates of diagnosis for hemochromatosis measure, on a monthly basis, the number of unique individuals who were diagnosed with the illness per 100,000 clients.

1. In the *ex ante* intervention period, diagnoses were virtually non-existent for all three service providers, despite that testing was undertaken in each month of the period by all providers.

   - For Medicaid professional services, only a few positive diagnoses were made in three of the 10 months prior to the intervention.

- For Medicaid institutional services, only a few positive diagnoses occurred in two separate months out of the 10 months prior to the intervention.

- For CCOS, only one diagnoses occurred prior to the intervention.

2. The monthly prevalence rates of diagnoses rose for all providers in the intervention and *ex post* intervention periods.

    - Medicaid professional services had monthly prevalence rates for diagnosis of hemochromatosis ranging between 0.0 and 13.5 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 0.0 and 15.6 per 100,000 clients in the *ex post* intervention period.

    - Medicaid institutional services had monthly prevalence rates for diagnosis ranging between 0.0 and 20.0 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 4.8 and 20.0 per 100,000 clients in the *ex post* intervention period.

    - CCOS manifested monthly prevalence rates for testing with a range between 0.0 and 27.0 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 0.0 and 53.0 per 100,000 clients in the *ex post* intervention period.

    - While CCOS had a larger range in monthly prevalence rates for the testing of hemochromatosis, as well as the highest monthly values, CCOS prevalence rates for diagnosis reveal (a) few diagnoses (less than 22 occurred over the intervention and *ex post* intervention periods), (b) more sporadic occurrences that were characterize by many months without any positive diagnosis being realized, and (c) some wide variation in the monthly rates which had positive diagnoses. In fact, CCOS reported diagnoses in only 6 of the 36 months of the intervention period, and 8 of the 20 months of the *ex post* intervention period. The rates of Medicaid professional and institutional service delivery organizations manifested more stability in their occurrence and values per month, and only a few months without diagnoses.

3. Even with these differences in the pattern of prevalence rates among the three providers, the statistical models indicate that the prevalence rates of each service organization changed with the educational intervention.

    - For all three service delivery organizations, the regression models confirm that both INTA and INTB are statistically significant variables with positive signs.

    - The findings indicate that the educational intervention resulted in an increase in the diagnoses of clients for hemochromatosis during the intervention period and in the *ex post* period.

- The educational intervention appears to have had a long-term impact with the prevalence rates higher in the *ex post* period than even the intervention period.

4. The average monthly prevalence rates for testing for hemochromatosis per 100,000 clients -- derived from the estimated equations, -- is given in the following table.

TABLE 11

AVERAGE MONTHLY PREVALENCE RATES OF DIAGNOSIS FOR HEMOCHROMATOSIS PER 100,000 CLIENTS

Provider	*Ex Ante* Intervention Period B_0	Intervention Period $B_0 + B_1$	*Ex Post* intervention Period $B_0 + B_2$	Adjusted R^2
Medicaid Professional	0 per 100,000 clients**	4 per 100,000 clients	7 per 100,000 clients	.28*
Medicaid Institutional	2 per 100,000 clients	10 per 100,000 clients	16 per 100,000 clients	.44*
CCOS	3 per 100,000 clients**	3 per 100,000 clients**	3 per 100,000 clients**	0.0***

**The F-Values were statistically significant at the .0001 level.*
***The coefficients were not statistically significant; thus the values are the mean value of the periods.*
****The F-Value was not statistically significant.*

- The graphs of the monthly prevalence rates for diagnosis reveals two dimensions about provider activities.

  - The rates of diagnoses fluctuated monthly for all service providers. The prevalence rates of Medicaid professional and institutional services varied monthly with different values for positive diagnoses, while the rates of CCOS moved on monthly bases between values of positive diagnoses and of zero value for months with no diagnoses reported.

  - With the monthly fluctuations in their prevalence rates of diagnosis, both Medicaid services manifest a rise in monthly prevalence rates in the intervention and the *ex post* intervention periods. However, in the last three months of the latter period, there is an indication of a decline in the prevalence rates. With respect to CCOS, however, with even wider fluctuations, the prevalence rates through the entire evaluation time.

The Diagnosis-Testing Rates For Hemochromatosis

The prevalence rates of diagnosis/testing for hemochromatosis measure the proportion of diagnoses confirmed on a monthly basis compared with the number of individuals tested for hemochromatosis in the same month.

1. For all three provider services, the tabular displays indicate that there was considerable volatility in the monthly values of the prevalence rates in each of the three intervention periods. The values of rates were characterized by positive values in many and months and a value of zero also for many months.

2. Table 12 present the statistical findings regarding the association of the educational intervention with HEMO_DT.

   - Neither INTA nor INTB were confirmed as statistically significant independent variables for the diagnosis/testing rates of both Medicaid professional services and CCOS. Thus there was neither a short-run or long-run association of the rates with the educational intervention.

     - The average value of the diagnosis/testing rates for Medicaid professional services and CCOS remained constant throughout the three evaluation periods.

     - On average, throughout each intervention period, Medicaid professional services manifested 4.7 times as many diagnoses for the number of tests conducted in a month than CCOS. That is, the average value of diagnoses/tests rates were 0.3% for CCOS compared to 1.4% for Medicaid professional services.

   - Both INTA and INTB were verified as statistically significant variables in the model for Medicaid institutional services. In the *ex ante* institutional period, Medicaid institutional manifested a diagnoses yield of 2.4% for testing. This yield rose to a level of 5.4% during the intervention period, indicating that more testing produced an increase in the number of diagnoses per test. In the *ex post* intervention period, the positive result increased to level of 6.0%.

   - Medicaid institutional services were the most productive service organization.

     - Both short-run and long-run impacts appear to have been realized through the educational intervention.

     - Throughout the entire evaluation period, Medicaid institutional services manifested much higher level of diagnoses for the amount of tests than the other two services. In the *ex ante* intervention period, Medicaid institutional services realized 1.7 times diagnoses for their monthly tests than Medicaid professional services and 8 times CCOS; the magnitude during the intervention period was greater with the differences of 3.9 times than Medicaid professional services and 16.2 times larger than CCOS. The differences were even higher -- 4.3 times and 20 times -- in the *ex post* intervention period

3. The difference in diagnoses yields for testing among the medical providers aside, the diagnoses/testing rates indicate low productivity across all services.

4. This small number of positive confirmations of diagnoses relative to the number of tests indicates that many financial resources have been expended to obtain limited results.

TABLE 12

AVERAGE MONTHLY DIAGNOSIS/TESTING RATES FOR HEMOCHROMATOSIS

Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	1.4% of all tests***	1.4% of all tests***	1.4% of all tests***	.03*
Medicaid Institutional	2.4% of all tests	5.4% of all tests	6.0% of all tests	.13**
CCOS	0.3% of all tests***	0.3% of all tests***	0.3% of all tests***	.00*

**The F-Value was not statistically significant.*
***The F-Value was statistically significant at the.002 level.*
****None of the coefficients are statistically significant.*

HEMOCHROMATOSIS REGRESSION MODELS

FIGURE 2. CCOS HEMOCHROMATOSIS TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Hemochromatosis Testing Ratio**
Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	807917	403958	11.94	<.0001
Error	66	2233240	33837		
Corrected Total	68	3041156			

Root MSE	183.94827	R-Square	0.2657
Dependent Mean	874.77223	Adj R-Sq	0.2434
Coeff Var	21.02813		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**730.29618**	**58.16955**	**12.55**	**<.0001**
Intervention	**Intervention**	**1**	**244.34225**	**65.56073**	**3.73**	**0.0004**
Ex Post	After	1	42.19018	70.15512	0.60	0.5496

FIGURE 3. CCOS HEMOCHROMATOSIS DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Hemochromatosis Diagnosis Ratio**
Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	246.49949	123.24975	0.85	0.4300
Error	66	9515.57519	144.17538		
Corrected Total	68	9762.07469			

Root MSE	12.00731	R-Square	0.0253
Dependent Mean	6.13054	Adj R-Sq	-0.0043
Coeff Var	195.86034		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	2.74650	3.79704	0.72	0.4720
Intervention	Intervention	1	2.89249	4.27951	0.68	0.5015
Ex Post	After	1	5.74896	4.57941	1.26	0.2138

FIGURE 4. CCOS HEMOCHROMATOSIS DIAGNOSES/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Hemochromatosis Diagnoses/Testing Ratio**

Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00037054	0.00018527	1.01	0.3697
Error	66	0.01211	0.00018342		
Corrected Total	68	0.01248			

Root MSE	0.01354	R-Square	0.0297
Dependent Mean	0.00693	Adj R-Sq	0.0003
Coeff Var	195.30470		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.00370	0.00428	0.86	0.3903
Intervention	Intervention	1	0.00220	0.00483	0.45	0.6507
Ex Post	After	1	0.00644	0.00517	1.25	0.2169

FIGURE 5. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Hemochromatosis Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	327740	163870	144.33	<.0001
Error	75	85155	1135.40391		
Corrected Total	77	412895			

Root MSE	33.69576	R-Square	0.7938
Dependent Mean	190.99361	Adj R-Sq	0.7883
Coeff Var	17.64235		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**49.75571**	**10.65553**	**4.67**	**<.0001**
Intervention	**Intervention**	**1**	**127.09618**	**12.00945**	**10.58**	**<.0001**
Ex Post	**After**	**1**	**203.67732**	**12.25424**	**16.62**	**<.0001**

FIGURE 6. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Hemochromatosis Diagnosis Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1475.42312	737.71156	30.90	<.0001
Error	75	1790.47964	23.87306		
Corrected Total	77	3265.90277			

Root MSE	4.88601	R-Square	0.4518
Dependent Mean	10.79195	Adj R-Sq	0.4371
Coeff Var	45.27455		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1.52313	1.54509	0.99	0.3274
Intervention	**Intervention**	**1**	**8.17484**	**1.74141**	**4.69**	**<.0001**
Ex Post	**After**	**1**	**13.56447**	**1.77691**	**7.63**	**<.0001**

FIGURE 7. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS DIAGNOSIS/TESTING RATIO

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Hemochromatosis Diagnosis/Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.01003	0.00502	6.62	0.0023
Error	75	0.05685	0.00075804		
Corrected Total	77	0.06689			

Root MSE	0.02753	R-Square	0.1500
Dependent Mean	0.05249	Adj R-Sq	0.1273
Coeff Var	52.45045		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**0.02376**	**0.00871**	**2.73**	**0.0079**
Intervention	**Intervention**	**1**	**0.03033**	**0.00981**	**3.09**	**0.0028**
Ex Post	**After**	**1**	**0.03610**	**0.01001**	**3.61**	**0.0006**

FIGURE 8. MEDICAID PROFESSIONAL HEMOCHROMATOSIS TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Hemochromatosis Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	282338	141169	82.97	<.0001
Error	75	127613	1701.50767		
Corrected Total	77	409951			

Root MSE	41.24934	R-Square	0.6887
Dependent Mean	189.15425	Adj R-Sq	0.6804
Coeff Var	21.80725		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**66.27772**	**13.04419**	**5.08**	**<.0001**
Intervention	**Intervention**	**1**	**104.27471**	**14.70161**	**7.09**	**<.0001**
Ex Post	**After**	**1**	**184.71631**	**15.00127**	**12.31**	**<.0001**

FIGURE 9. MEDICAID PROFESSIONAL HEMOCHROMATOSIS DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: Medicaid Professional Hemochromatosis Diagnosis Ratio
Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	360.38786	180.19393	16.01	<.0001
Error	75	844.10504	11.25473		
Corrected Total	77	1204.49290			

Root MSE	3.35481	R-Square	0.2992
Dependent Mean	4.98119	Adj R-Sq	0.2805
Coeff Var	67.34954		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.58827	1.06088	0.55	0.5809
Intervention	**Intervention**	**1**	**3.73012**	**1.19568**	**3.12**	**0.0026**
Ex Post	**After**	**1**	**6.60109**	**1.22005**	**5.41**	**<.0001**

FIGURE 10. MEDICAID PROFESSIONAL HEMOCHROMATOSIS DIAGNOSIS/TESTING RATIO

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Hemochromatosis Diagnosis/Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00170	0.00085084	2.24	0.1131
Error	75	0.02843	0.00037908		
Corrected Total	77	0.03013			

Root MSE	0.01947	R-Square	0.0565
Dependent Mean	0.02607	Adj R-Sq	0.0313
Coeff Var	74.68040		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.01400	0.00616	2.27	0.0258
Intervention	Intervention	1	0.01322	0.00694	1.91	0.0605
Ex Post	After	1	0.01458	0.00708	2.06	0.0429

HEMOCHROMATOSIS GRAPHS

FIGURE 11. CCOS HEMOCHROMATOSIS TESTING

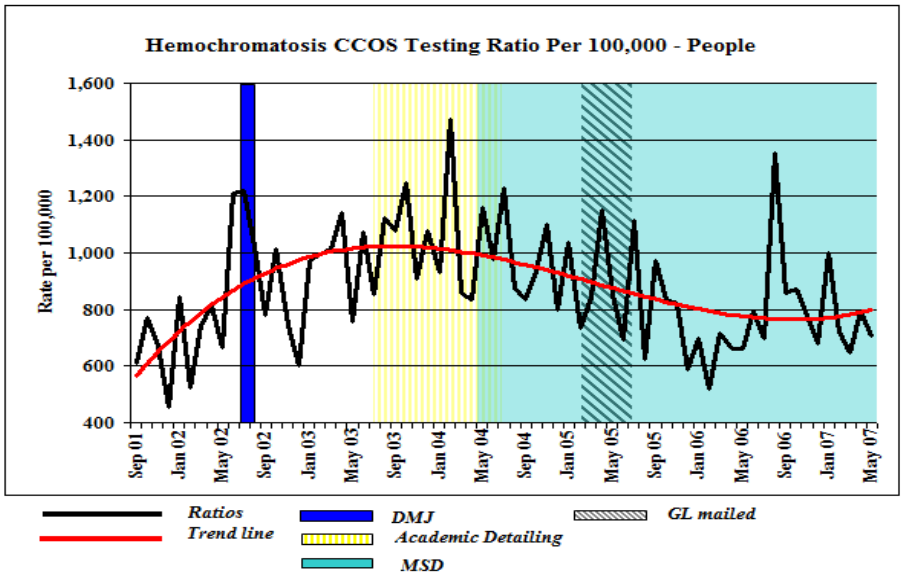


FIGURE 12. CCOS HEMOCHROMATOSIS DIAGNOSIS

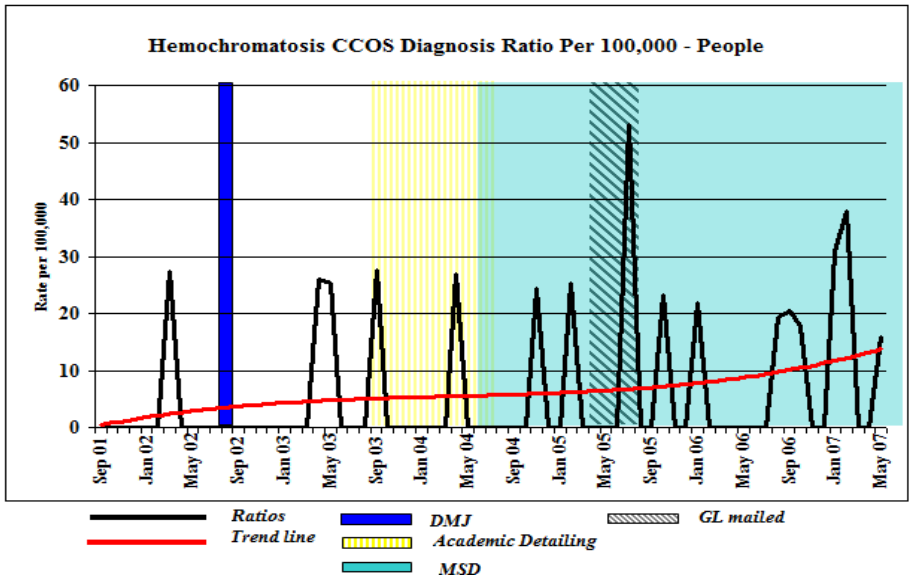


FIGURE 13. CCOS HEMOCHROMATOSIS DIAGNOSES/TEST

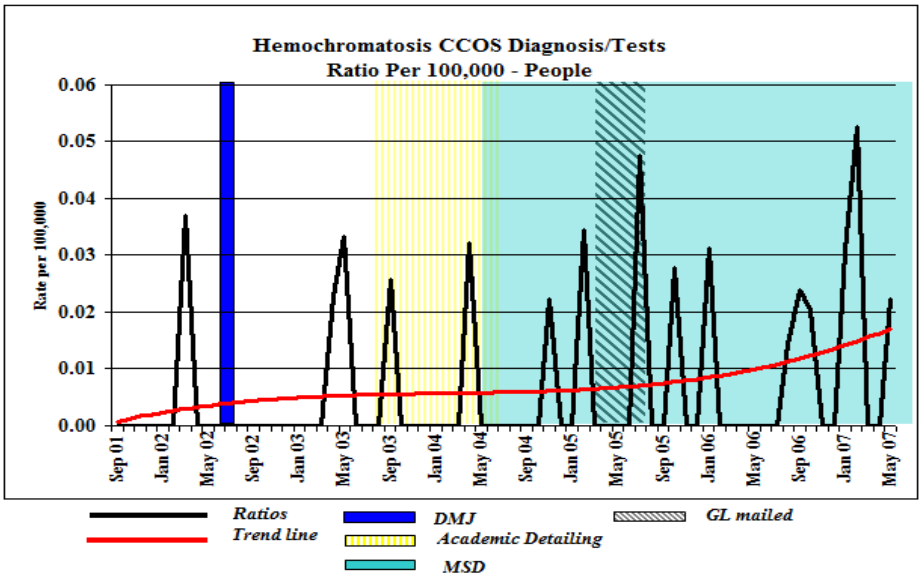


FIGURE 14. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS TESTING

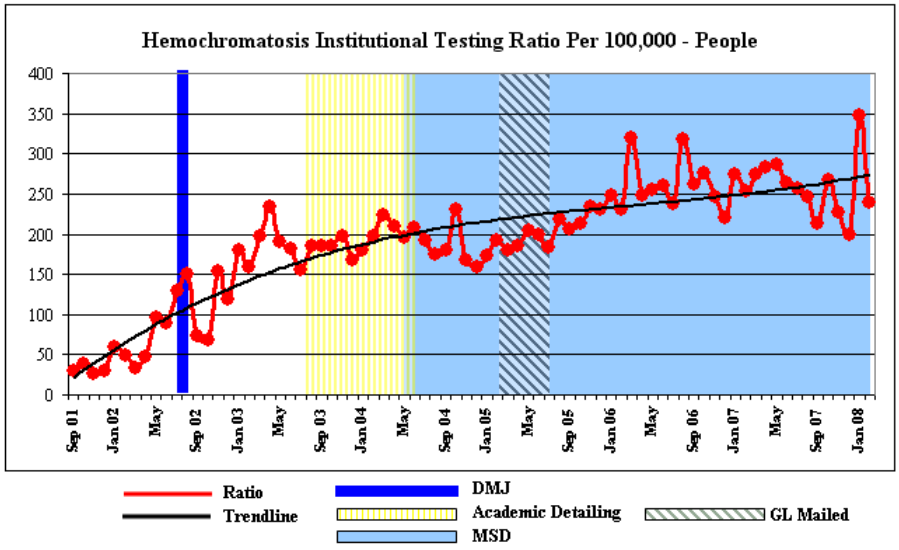


FIGURE 15. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS DIAGNOSIS

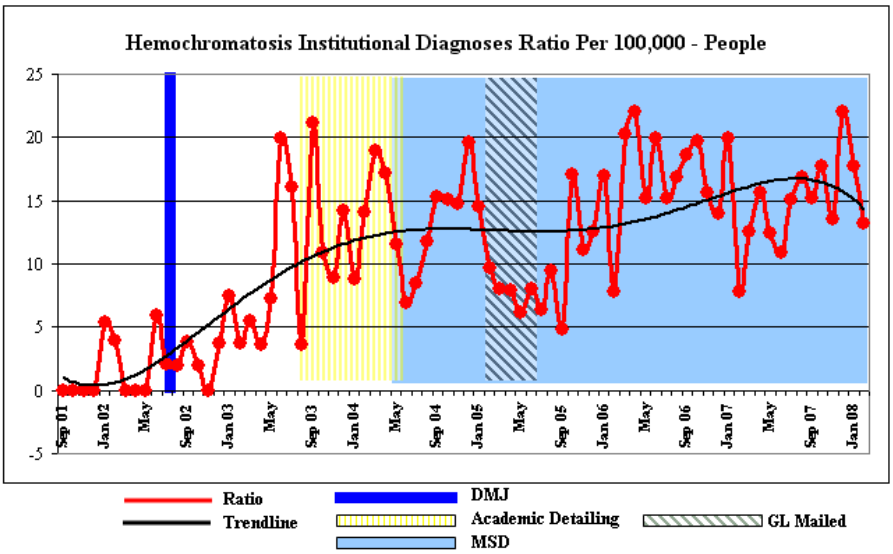


FIGURE 16. MEDICAID INSTITUTIONAL HEMOCHROMATOSIS DIAGNOSES/TEST

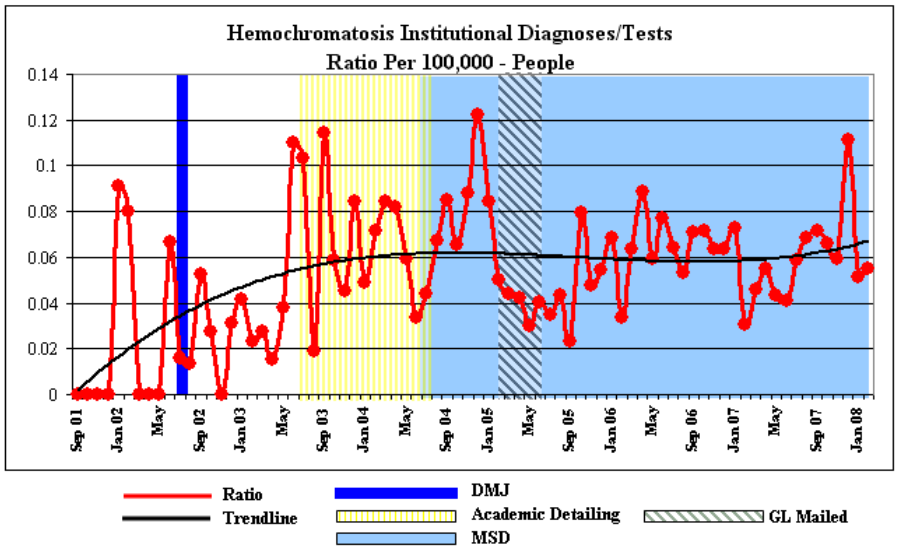


FIGURE 17. MEDICAID PROFESSIONAL HEMOCHROMATOSIS TESTING

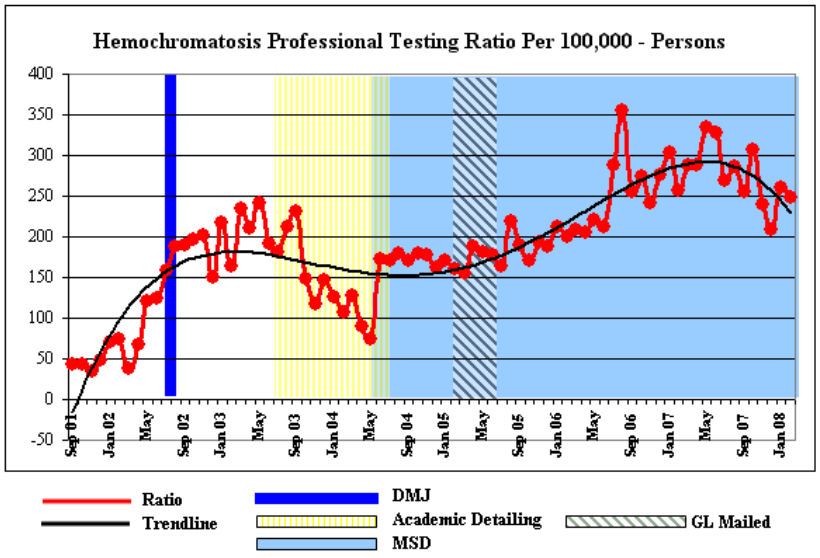


FIGURE 18. MEDICAID PROFESSIONAL HEMOCHROMATOSIS DIAGNOSIS

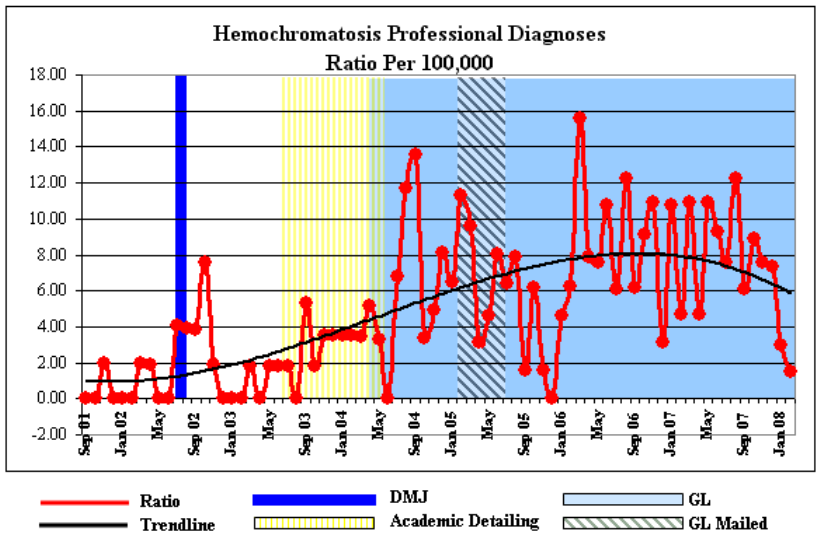
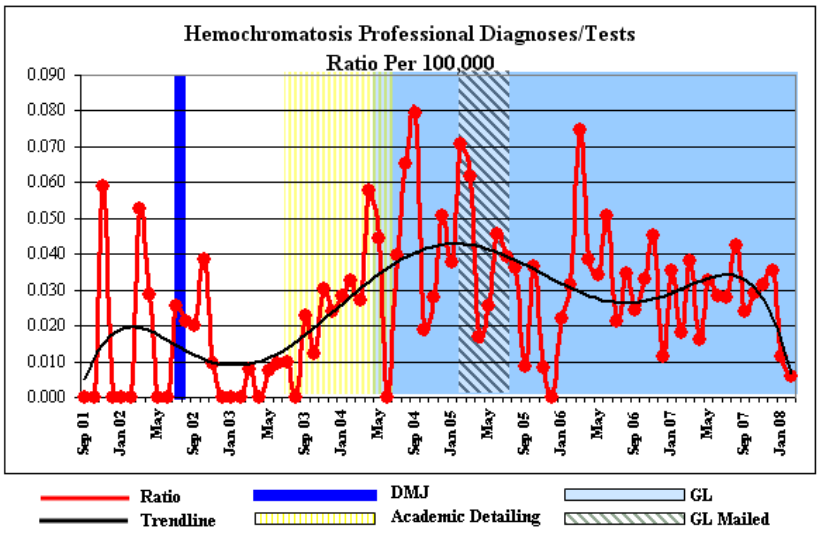


FIGURE 19. MEDICAID PROFESSIONAL HEMOCHROMATOSIS DIAGNOSES/TESTING



HEMOCHROMATOSIS TABLES

TABLE 13.

CCOS HEMOCHROMATOSIS - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
		Monthly Rates												Annual
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Pre Intervention	2001									608.5	771.1	671.5	456.1	626.8
	2002	843.1	524.9	741.6	810.2	667.0	1209.1							799.3
Intervention	2002							1221.7	1022.3	780.3	1012.8	741.4	600.5	896.5
	2003	974.6	996.3	1015.5	1143.5	757.0	1072.3	854.1	1121.8	1075.9	1246.5	910.4	1075.6	1020.3
	2004	933.3	1472.2	855.9	836.5	1159.7	978.6	1228.5	876.8	835.9	937.0	1100.0	800.0	1001.2
	2005	1036.4	736.6	843.6	1149.9	853.5	691.8							885.3
Post Intervention	2005							1113.2	625.0	974.3	832.9	820.4	588.7	825.8
	2006	698.5	517.3	715.4	659.1	662.6	796.0	695.8	1352.4	857.8	873.0	779.8	677.1	773.7
	2007	999.4	719.4	648.2	792.4	709.1								773.7
	2008													

TABLE 14.

CCOS HEMOCHROMATOSIS - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
		Monthly Rates												Annual
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Pre Intervention	2001									0.0	0.0	0.0	0.0	0.0
	2002	0.0	0.0	27.5	0.0	0.0	0.0							4.6
Intervention	2002							0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2003	0.0	0.0	0.0	26.0	25.2	0.0	0.0	0.0	27.6	0.0	0.0	0.0	6.6
	2004	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	24.4	0.0	4.3
	2005	0.0	25.4	0.0	0.0	0.0	0.0							4.2
Post Intervention	2005							53.0	0.0	0.0	23.1	0.0	0.0	12.7
	2006	21.8	0.0	0.0	0.0	0.0	0.0	0.0	19.3	20.4	17.8	0.0	0.0	6.6
	2007	30.8	37.9	0.0	0.0	15.8								16.9
	2008													

TABLE 15.

CCOS HEMOCHROMATOSIS – RATIO OF DIAGNOSES/TESTS														
		Monthly Rates												Annual Average
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.000	0.000	0.000	0.000	0.000
	2002	0.000	0.000	0.037	0.000	0.000	0.000							0.006
Intervention	2002							0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2003	0.000	0.000	0.000	0.023	0.033	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.007
	2004	0.000	0.000	0.000	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.005
	2005	0.000	0.034	0.000	0.000	0.000	0.000							0.006
Post Intervention	2005							0.048	0.000	0.000	0.028	0.000	0.000	0.013
	2006	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.024	0.020	0.000	0.000	0.007
	2007	0.031	0.053	0.000	0.000	0.022								0.021
	2008													

TABLE 16.

MEDICAID INSTITUTIONAL HEMOCHROMATOSIS - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
		Monthly Rates												Annual Average
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									29.1	38.6	26.0	29.8	30.9
	2002	59.3	49.2	33.5	47.8	95.7	88.5							62.3
Intervention	2002							128.8	149.9	73.0	68.2	152.9	118.8	115.3
	2003	180.1	158.6	196.7	234.9	189.9	181.5	155.6	185.0	185.2	184.4	197.4	168.4	184.8
	2004	180.3	197.2	223.5	209.8	195.3	207.1	191.3	174.2	179.5	230.8	167.6	159.8	193.0
	2005	172.8	192.8	180.0	185.7	204.3	198.3							189.0
Post Intervention	2005							184.1	218.5	205.6	213.9	233.7	231.3	214.5
	2006	248.2	230.8	319.4	248.7	255.8	259.5	237.0	317.7	261.8	276.4	246.9	220.9	260.3
	2007	274.4	253.0	273.9	283.5	286.4	263.5	256.9	245.8	212.4	267.7	227.7	198.4	253.6
	2008	347.2	239.3											293.2

TABLE 17.

MEDICAID INSTITUTIONAL HEMOCHROMATOSIS - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
		Monthly Rates												Annual
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Pre Intervention	2001									0.0	0.0	0.0	0.0	0.0
	2002	5.4	3.9	0.0	0.0	0.0	5.9							2.5
Intervention	2002							2.0	2.0	3.8	1.9	0.0	3.7	2.2
	2003	7.5	3.7	5.5	3.6	7.2	20.0	16.1	3.6	21.2	10.8	8.9	14.2	10.2
	2004	8.8	14.1	18.9	17.2	11.6	7.0	8.5	11.7	15.2	15.0	14.8	19.6	13.5
	2005	14.5	9.7	8.0	7.9	6.1	8.1							9.0
Post Intervention	2005							6.4	9.5	4.8	17.1	11.1	12.6	10.2
	2006	17.0	7.8	20.3	22.0	15.1	20.0	15.2	16.8	18.6	19.7	15.6	14.0	16.8
	2007	19.9	7.8	12.5	15.6	12.5	10.8	15.1	16.8	15.2	17.7	13.6	22.0	15.0
	2008	17.7	13.2											15.5

TABLE 18.

MEDICAID INSTITUTIONAL HEMOCHROMATOSIS - # OF PEOPLE DIAGNOSED/TESTS PER MONTH RATIOS														
		Monthly Rates												Annual
Period	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Pre Intervention	2001									0.0000	0.0000	0.0000	0.0000	0.0000
	2002	0.0909	0.0800	0.0000	0.0000	0.0000	0.0667							0.0396
Intervention	2002							0.0159	0.0132	0.0526	0.0278	0.0000	0.0313	0.0234
	2003	0.0417	0.0235	0.0278	0.0154	0.0381	0.1100	0.1034	0.0192	0.1143	0.0588	0.0450	0.0842	0.0568
	2004	0.0490	0.0714	0.0846	0.0820	0.0593	0.0336	0.0442	0.0673	0.0849	0.0652	0.0882	0.1224	0.0710
	2005	0.0841	0.0504	0.0442	0.0424	0.0301	0.0407							0.0486
Post Intervention	2005							0.0348	0.0435	0.0234	0.0797	0.0476	0.0544	0.0472
	2006	0.0683	0.0338	0.0634	0.0886	0.0592	0.0769	0.0641	0.0529	0.0710	0.0714	0.0633	0.0634	0.0647
	2007	0.0726	0.0309	0.0457	0.0549	0.0435	0.0412	0.0588	0.0683	0.0714	0.0663	0.0596	0.1111	0.0604
	2008	0.0511	0.0552											0.0531

TABLE 19.

MEDICAID PROFESSIONAL HEMOCHROMATOSIS - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									43.6	42.7	34.1	47.8	42.0
	2002	70.1	82.4	37.4	66.9	121.6	123.9							82.4
Intervention	2002							159.4	187.3	190.1	197.1	201.9	150.4	181.0
	2003	217.6	191.1	234.9	209.6	240.6	190.6	180.7	211.7	231.1	148.3	117.4	147.1	191.1
	2004	125.5	144.6	127.2	89.4	74.5	172.3	171.0	179.2	171.0	178.9	177.5	161.4	144.6
	2005	171.1	172.0	154.5	187.2	181.2	177.3							172.0
Post Intervention	2005							163.3	218.5	189.6	170.5	192.3	188.8	187.2
	2006	211.2	245.7	208.8	204.7	221.0	211.9	288.7	354.4	255.6	274.9	242.2	275.4	245.7
	2007	303.5	280.4	288.0	288.2	334.7	327.0	269.0	287.0	254.9	306.2	239.8	208.7	280.4
	2008	260.0	254.1											254.1

TABLE 20.

MEDICAID PROFESSIONAL HEMOCHROMATOSIS # OF PEOPLE DIAGNOSED RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0	0.0	2.0	0.0	0.5
	2002	0.0	0.0	2.0	1.9	0.0	0.0							0.6
Intervention	2002							4.1	3.9	3.8	7.6	1.9	0.0	3.6
	2003	0.0	0.0	1.8	0.0	1.8	1.8	1.8	0.0	5.3	1.8	3.6	3.5	1.8
	2004	3.5	3.5	3.4	5.2	3.3	0.0	6.8	11.7	13.5	3.3	4.9	8.2	5.6
	2005	6.5	11.3	9.6	3.1	4.6	8.1							7.2
Post Intervention	2005							6.4	7.9	1.6	6.2	1.6	0.0	4.0
	2006	4.6	6.2	15.6	7.9	7.6	10.7	6.1	12.2	6.2	9.1	10.9	3.1	8.4
	2007	10.7	4.7	11.0	4.7	10.9	9.3	7.6	12.2	6.1	8.9	7.5	7.3	8.4
	2008	3.0	1.5											2.2

TABLE 21.

MEDICAID PROFESSIONAL HEMOCHROMATOSIS PERSONS DIAGNOSED/TESTED RATIOS														
		Monthly Rates												Annual Average
Period	Year	Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0000	0.0000	0.0588	0.0000	0.0147
	2002	0.0000	0.0000	0.0526	0.0286	0.0000	0.0000							0.0135
Intervention	2002							0.0256	0.0211	0.0202	0.0385	0.0093	0.0000	0.0191
	2003	0.0000	0.0000	0.0078	0.0000	0.0075	0.0095	0.0099	0.0000	0.0229	0.0122	0.0303	0.0241	0.0103
	2004	0.0282	0.0328	0.0270	0.0577	0.0444	0.0000	0.0396	0.0654	0.0792	0.0187	0.0278	0.0505	0.0393
	2005	0.0377	0.0707	0.0619	0.0168	0.0254	0.0455							0.0430
Post Intervention	2005							0.0392	0.0362	0.0085	0.0364	0.0083	0.0000	0.0214
	2006	0.0219	0.0313	0.0746	0.0385	0.0342	0.0507	0.0211	0.0345	0.0242	0.0331	0.0452	0.0113	0.0350
	2007	0.0354	0.0182	0.0380	0.0162	0.0326	0.0284	0.0281	0.0426	0.0238	0.0290	0.0314	0.0352	0.0299
	2008	0.0114	0.0059											0.0086

2. Evaluation Of Celiac Disease

Table 22 provides a profile of various prevalence dimensions of celiac disease presented for the three service delivery organizations over the entire evaluation time frame.

TABLE 22 SUMMARY OF CELIAC DISEASE SERVICES			
	Medicaid - Professional	**Medicaid – Institutional**	**Christiana Care Outpatient Services**
No. of Tests	3,039	6,452	3
No. of Clients Tested	1,658	2,088	3
Avg. Tests/Client	1.83	3.09	1.00
No. of Diagnoses	107	168	14
Diagnosis/Testing Rates (%)	6.5	8.1	NA
No. = all tests and diagnoses; NA = not applicable.			

Prevalence Rates of Testing for Celiac Disease

The prevalence rates of testing for celiac disease measure, on a monthly basis, the number of unique individuals who were tested for the illness per 100,000 clients.

Both Medicaid professional and institutional service delivery organizations had substantially higher levels of testing for celiac disease than CCOS throughout the entire evaluation period. In fact, as the tabular compilations shows, the prevalence rates for testing for both Medicaid services exceed CCOS by more than tenfold. CCOS only conducted three, (i.e., = 3) tests over the evaluation period compared to the 1,658 of Medicaid professional services and 2,088 for Medicaid institutional services. The 14 diagnoses for celiac exceed the number of the three tests are due to the fact that test conducted for other medical conditions revealed a diagnosis of celiac disease.

1. The prevalence rates of testing for celiac disease by the two Medicaid providers show the following behavior:

    - During the *ex ante* intervention period, Medicaid professional services had monthly prevalence rates for testing ranging between 2.0 and 33.6 per 100,000 clients. These rates manifested considerable volatility.

    - During the *ex ante* intervention period, Medicaid institutional services had monthly prevalence rates for testing ranging between 21.and 17.7 per 100,000 clients but manifested less fluctuation than Medicaid professional services.

    - Medicaid professional services had monthly prevalence rates for testing ranging between 9.9 and 69.1 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 29.4 and 74.7 per 100,000 clients in the *ex post* intervention period.

- Medicaid institutional services had monthly prevalence rates for testing ranging between 7.6 and 77.5 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 39.6 and 87.7 per 100,000 clients in the *ex post* intervention period.

2. These monthly ranges of prevalence rates for testing for celiac over the different evaluation periods indicates (a) similarity of both Medicaid service delivery organizations, (b) an increase in testing rates in intervention period, (c) and even greater rates in the *ex post* intervention period.

- The estimated statistical models are consistent with these observations. The intervention had an identical impact on both Medicaid service delivery organizations. A regression model was not tested for CCOS because there were too few, only three, observations.

- For both Medicaid professional and institutional service delivery, the regression models confirm that both INTA and INTB are statistically significant variables with positive signs.

- For both the Medicaid services, the findings indicate that the educational intervention was associated with an increase in the testing of clients for celiac during the intervention period and in the *ex post* period.

- The educational intervention appears to have had a long-term impact with the prevalence rates higher in the *ex post* period than even the intervention period. Compared with the intervention period, the level of testing in fact increased considerably in the *ex post* intervention period for both Medicaid providers.

- The average monthly prevalence rates for testing for celiac disease per 100,000 clients -- derived from the estimated equations, -- is given in the following table.

TABLE 23

AVERAGE MONTHLY PREVALENCE RATES OF TESTING FOR CELIAC DISEASE

Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	16 per 100,000 clients	32 per 100,000 clients	44 per 100,000 clients	.27*
Medicaid Institutional	16 per 100,000 clients	32 per 100,000 clients	44 per 100,000 clients	.27*
CCOS**	NA	**NA**	NA	NA

**The F-Values were statistically significant at the .0001 level.*
NA = not applicable. A regression model was not tested because there were only a very few observations (i.. e., 3).

3. Irrespective of the impact of the intervention, the graph of the monthly prevalence rates for testing reveals several dimensions about Medicaid provider testing activities.

    - The rate of testing fluctuated monthly for both Medicaid service providers. Medicaid institutional services realized the most consistent (least undulating) behavior per month in testing while the variation on the level of testing was very much wider for CCOS over the evaluation period than both Medicaid services. Nevertheless, given the total volume of testing by both providers, the average monthly rates over the intervention and *ex post* intervention periods are virtually identical (as indicated by the estimates of the regression coefficients).

    - Despite the monthly fluctuations in prevalence rates for testing of Medicaid professional services, the prevalence rates manifest undulating behavior through the entire evaluation time frame, with the rates at the end of the *ex post* intervention period showing an upturn in testing. Medicaid institutional services manifest a different pattern in prevalence rates of testing. With less volatility in monthly rates, there was a slight upward trend within the intervention period, and an apparent leveling off of the monthly rates at approximately same value in the *ex post* intervention period.

Prevalence Rates of Diagnosis for Celiac Disease

1. The prevalence rates of diagnosis for celiac disease measure, on a monthly basis, the number of unique individuals who were tested for the illness per 100,000 clients.

    - The monthly prevalence rates of diagnoses indicate more variation for the Medicaid providers than CCOS in the intervention and *ex post* intervention periods.

    - Medicaid professional services had monthly prevalence rates for diagnosis of celiac disease ranging between 0.0 and 7.1 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 0.0 and 9.2 per 100,000 clients in the *ex post* intervention period.

    - Medicaid institutional services had monthly prevalence rates for diagnosis ranging between 0.0 and 10.3 per 100,000 clients in the intervention period, and monthly prevalence rates for testing ranging between 0.0 and 18.2 per 100,000 clients in the *ex post* intervention period.

    - For Medicaid professional service delivery, 37% of the months (11 out of 30 months) in the intervention period did not yield any positive diagnoses, thus the prevalence rates were zero. However, the amount of fluctuations between zero and positive prevalence rates over the months of the intervention period was 57% (17 out of 30 months) for Medicaid institutional services. Even though the two providers had similar values in the prevalence rates with

positive diagnoses, the differences in the months without diagnoses may be the bases of the statistical results of the regression models.

- What is very noteworthy is in the *ex post* intervention period of both Medicaid providers, there is consistency across the months in the reporting of positive diagnoses, with only a few months without positive results. However, the Medicaid institutional services manifested prevalence rates of diagnosis of approximately five times than the rates of Medicaid professional services.

2. The estimated statistical models confirm that the prevalence rates of the two Medicaid providers were different over the evaluation period.

    - For Medicaid professional services both INTA and INTB were statistically significant variables with positive signs. These estimates indicate that the educational intervention resulted in an increase in the diagnoses of clients for celiac during the intervention period and in the *ex post* period.

    - However, the differences in the prevalence rates in intervention and *ex post* intervention periods appear to be rather limited. On average, only two diagnoses per 100,000 clients occurred on a monthly basis during the intervention implementation, while the monthly average after the intervention rose to three diagnoses per 100,000 clients.

    - For Medicaid institutional services, only INTB was a statically significant variable. Thus the implementation of the educational intervention was not associated with any real increase in diagnosis of celiac disease among clients.

    - But a more sizable increase occurred in the *ex pos*t intervention period where the monthly average rates of diagnoses across the period was 6 per 100,000 clients. These prevalence rates of Medicaid institutional services were twice the size of the prevalence rates of Medicaid professional services for the corresponding time frame.

    - The educational intervention appears to have had a slight long-term impact with the prevalence rates higher in the *ex post* period than even the intervention period.

TABLE 24 AVERAGE MONTHLY PREVALENCE RATES OF DIAGNOSIS FOR CELIAC DISEASE PER 100,000 CLIENTS				
Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	0 per 100,000 clients	2 per 100,000 clients	3 per 100,000 clients	.11*
Medicaid Institutional	0 per 100,000 clients***	0 per 100,000 clients***	6 per 100,000 clients	.28**
CCOS**	NA	**NA**	NA	NA

**The F-Value was statistically significant at the .005 level.*
***The F-Value was statistically significant at the .0001 level.*
****The coefficients B_0 and B_1 were not statistically significant.*
NA = not applicable. A regression model was not tested because there were only a very few observations; only 14 diagnoses were found, of which three were from direct testing for celiac disease.

- The graphs of the monthly prevalence rates for diagnosis show the following behavior about the Medicaid providers' activities.
    - The prevalence rates of Medicaid professional and institutional services varied very widely on monthly bases with different values for positive diagnoses throughout the intervention and *ex post* intervention periods.
    - There appears to be no consistent upward or downward trend over the evaluation period in the rates of diagnosis reported by either Medicaid provider. However, for Medicaid professional services, in last six months of *ex post* intervention period there was a decline in the prevalence rates. With respect to Medicaid institutional services, the last six month show a decline and then another rise.

The Diagnosis-Testing Rates for Celiac Disease

The prevalence rates of diagnosis/testing for celiac disease measure the proportion of diagnoses confirmed on a monthly basis compared with the number of individuals tested for celiac disease on a monthly basis.

1. A regression model was not conducted for CCOS since only 14 diagnoses were ascertained over the evaluation period, and only three of the diagnoses were directly attributable to the testing of celiac disease.
2. Neither INTA nor INTB were confirmed as statistically significant independent variables for the diagnosis/testing rates of Medicaid professional services. No short-run and long run impacts of the educational intervention were discovered.

- The value of the diagnosis/testing rates for Medicaid professional services remained constant throughout the three evaluation periods. Although considerable volatility in the monthly rates occurred, the average values over the months in each of the three periods were the same at 2.6% diagnoses in each month for all the monthly tests conducted.

3. However, with respect to Medicaid institutional services, only INTB was verified as a statistically significant variable.

    - While no short-run run effect of the educational intervention was confirmed, a long-run impact was documented.

    - In both the *ex ante* intervention and intervention periods, on average only 0.2% of all tests yielded positive results.

    - This productivity rose to 2.2% in the *ex post* intervention period.

4. Nevertheless, Medicaid professional services had larger prevalence rates than Medicaid institutional services despite the positive impact of the latter in the *ex post* intervention period. In fact, on a monthly basis there were 13 times as many diagnoses for the number of tests by Medicaid professional services compared Medicaid institutional services in both *ex ante* intervention and intervention periods.

5. The difference in diagnoses yields for testing among the medical providers aside, the diagnoses/testing rates indicate low productivity across all three service providers.

6. This small number of positive confirmations of diagnoses relative to the number of tests indicates that many financial resources have been expended to obtain limited results.

TABLE 25

AVERAGE MONTHLY DIAGNOSIS/TESTING RATES FOR CELIAC DISEASE

Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	2.6% of all tests***	2.6% of all tests***	2.6% of all tests***	.03*
Medicaid Institutional	0.2% of all tests***	0.2% of all tests***	2.2% of all tests	.20**
CCOS	NA	**NA**	NA	NA

**The F-Value of the equation was not statistically significant.*
***The F-Value of the equations was statistically significant at the .0001 level.*
****The coefficients were not statistically significant.*
NA = not applicable. A regression model was not tested because there were only a 14 observations with positive rates, and only for three of them were tests conducted directly for celiac disease.

CELIAC REGRESSION MODELS

FIGURE 20. MEDICAID INSTITUTIONAL CELIAC TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Celiac Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6204.07009	3102.03505	15.47	<.0001
Error	75	15034	200.45885		
Corrected Total	77	21238			

Root MSE	14.15835	R-Square	0.2921
Dependent Mean	34.95953	Adj R-Sq	0.2732
Coeff Var	40.49926		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**16.08371**	**4.47726**	**3.59**	**0.0006**
Intervention	**Intervention**	**1**	**16.54427**	**5.04616**	**3.28**	**0.0016**
Ex Post	**After**	**1**	**27.74761**	**5.14901**	**5.39**	**<.0001**

FIGURE 21. MEDICAID INSTITUTIONAL CELIAC DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Celiac Diagnosis Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	442.93668	221.46834	16.33	<.0001
Error	75	1017.33378	13.56445		
Corrected Total	77	1460.27047			

Root MSE	3.68299	R-Square	0.3033
Dependent Mean	3.41017	Adj R-Sq	0.2847
Coeff Var	108.00043		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.19672	1.16467	0.17	0.8663
Intervention	Intervention	1	1.68650	1.31265	1.28	0.2028
Ex Post	After	1	6.07253	1.33941	4.53	<.0001

FIGURE 22. MEDICAID INSTITUTIONAL CELIAC DIAGNOSIS/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Celiac Diagnosis/Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00548	0.00274	10.64	<.0001
Error	75	0.01932	0.00025765		
Corrected Total	77	0.02480			

Root MSE	0.01605	R-Square	0.2209
Dependent Mean	0.01490	Adj R-Sq	0.2002
Coeff Var	107.70883		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.00222	0.00508	0.44	0.6628
Intervention	Intervention	1	0.00785	0.00572	1.37	0.1740
Ex Post	After	1	0.02253	0.00584	3.86	0.0002

FIGURE 23. MEDICAID PROFESSIONAL CELIAC TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Celiac Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6204.07009	3102.03505	15.47	<.0001
Error	75	15034	200.45885		
Corrected Total	77	21238			

Root MSE	14.15835	R-Square	0.2921
Dependent Mean	34.95953	Adj R-Sq	0.2732
Coeff Var	40.49926		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	16.08371	4.47726	3.59	0.0006
Intervention	Intervention	1	16.54427	5.04616	3.28	0.0016
Ex Post	Ex Post	1	27.74761	5.14901	5.39	<.0001

FIGURE 24. MEDICAID PROFESSIONAL CELIAC DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Celiac Diagnosis Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	51.19696	25.59848	5.49	0.0059
Error	75	349.44926	4.65932		
Corrected Total	77	400.64622			

Root MSE	2.15855	R-Square	0.1278
Dependent Mean	2.24897	Adj R-Sq	0.1045
Coeff Var	95.97922		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.38794	0.68259	0.57	0.5715
Intervention	**Intervention**	**1**	**1.75880**	**0.76932**	**2.29**	**0.0251**
Ex Post	**After**	**1**	**2.58339**	**0.78501**	**3.29**	**0.0015**

FIGURE 25. MEDICAID PROFESSIONAL CELIAC DIAGNOSIS/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Celiac Diagnosis/Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.04465	0.02232	2.31	0.1066
Error	75	0.72597	0.00968		
Corrected Total	77	0.77062			

Root MSE	0.09838	R-Square	0.0579
Dependent Mean	0.07978	Adj R-Sq	0.0328
Coeff Var	123.32133		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.02625	0.03111	0.84	0.4015
Intervention	Intervention	1	0.07345	0.03507	2.09	0.0396
Ex Post	After	1	0.04702	0.03578	1.31	0.1928

CELIAC GRAPHS

FIGURE 26. MEDICAID INSTITUTIONAL CELIAC TESTING

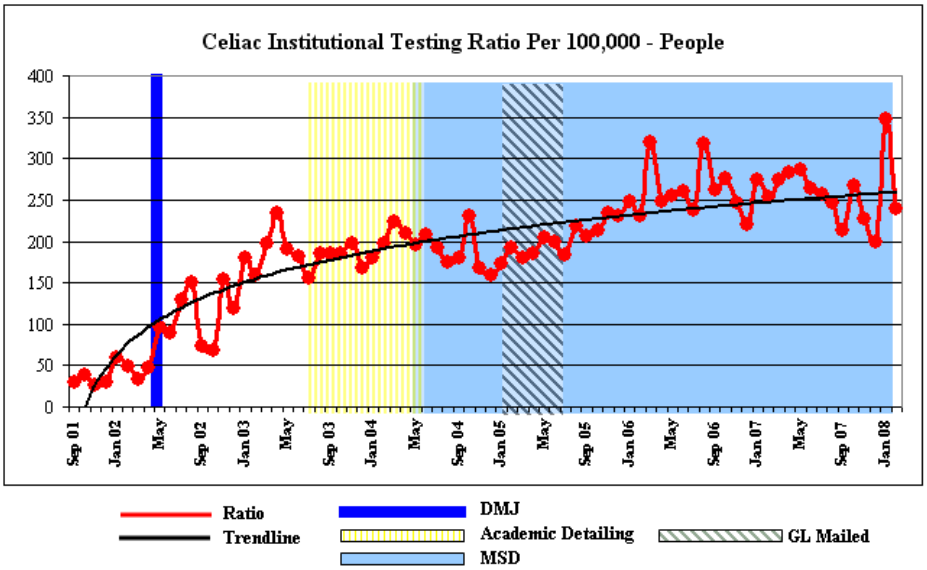


FIGURE 27. MEDICAID INSTITUTIONAL CELIAC DIAGNOSIS

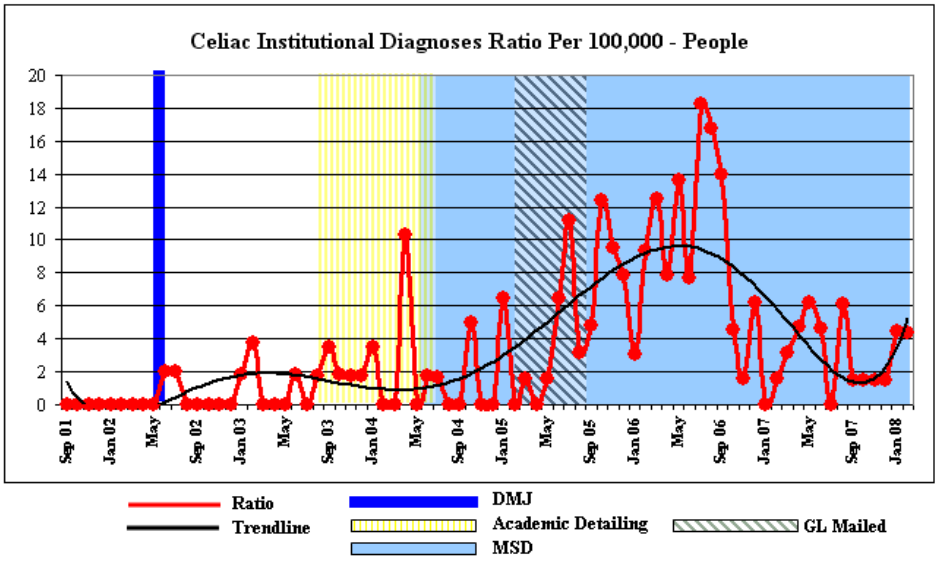


FIGURE 28. MEDICAID INSTITUTIONAL CELIAC DIAGNOSIS/TESTING

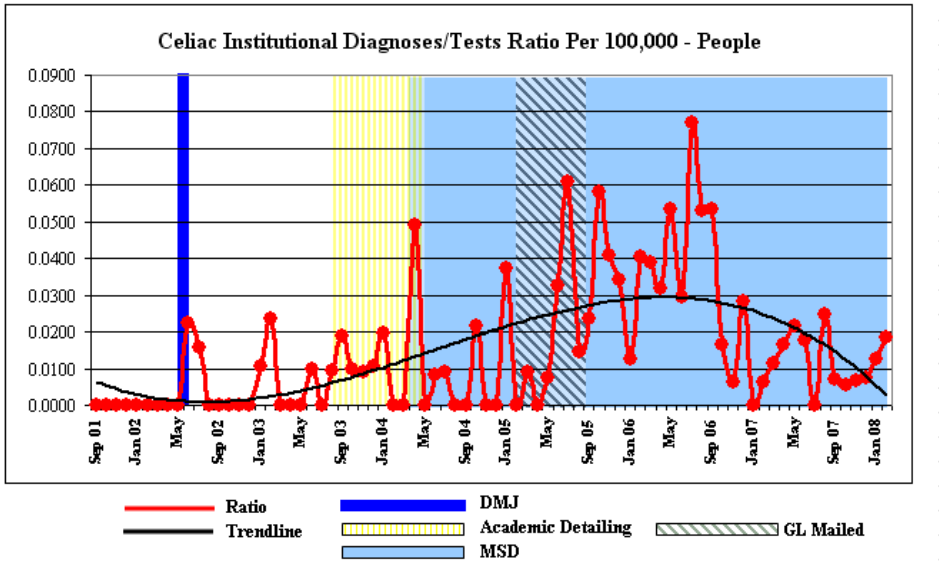


FIGURE 29. MEDICAID PROFESSIONAL CELIAC TESTING

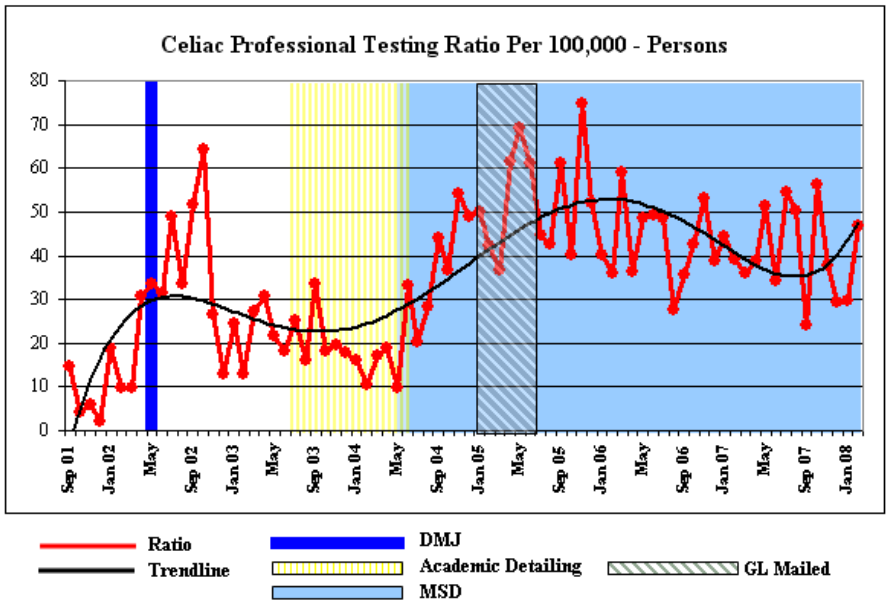


FIGURE 30. MEDICAID PROFESSIONAL CELIAC DIAGNOSIS

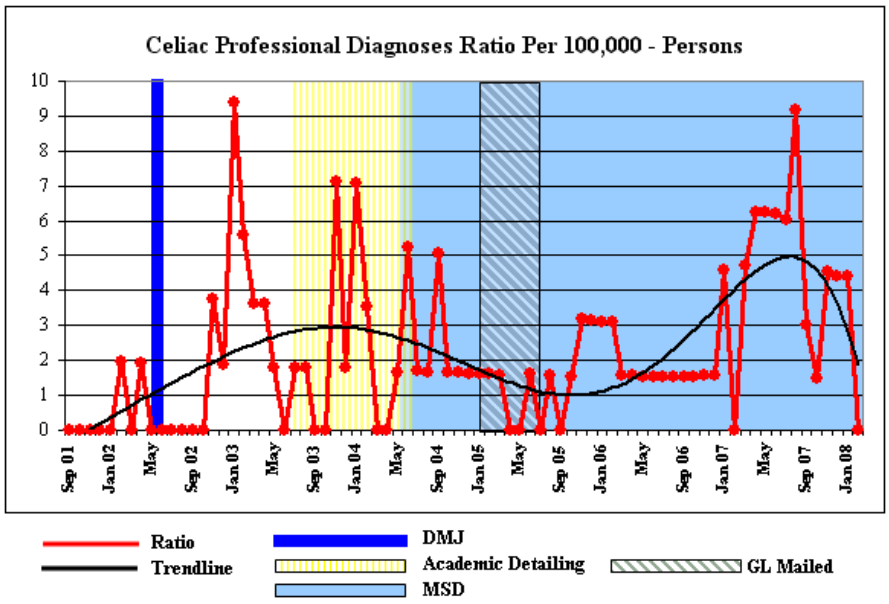
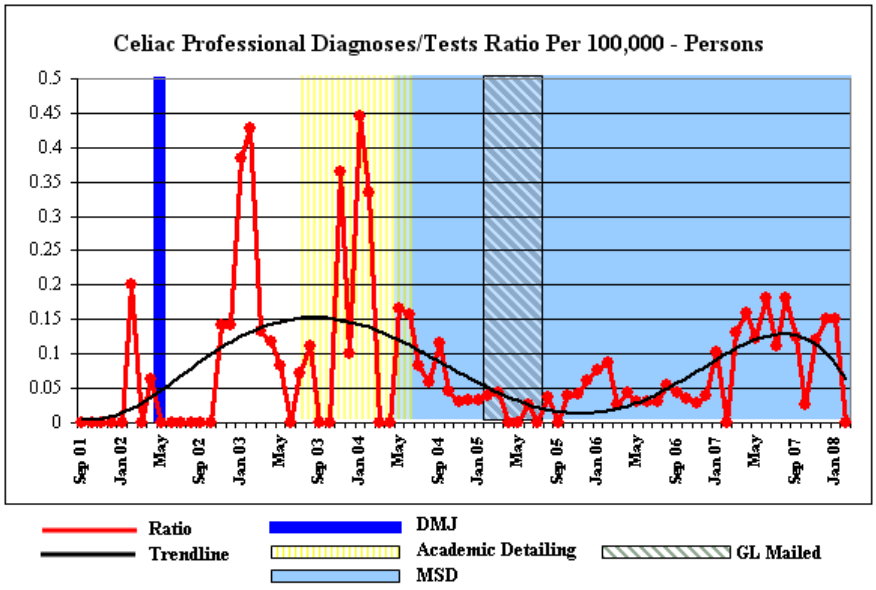


FIGURE 31. MEDICAID PROFESSIONAL CELIAC DIAGNOSIS/TESTING



CELIAC TABLES

TABLE 26.

MEDICAID INSTITUTIONAL CELIAC - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									2.1	10.2	8.0	4.0	6.1
	2002	16.2	17.7	5.9	3.8	10.3	13.8							11.3
Intervention	2002							24.5	27.6	13.4	7.6	22.6	16.7	18.8
	2003	28.1	22.4	27.3	34.3	25.3	34.5	39.4	32.0	42.3	32.5	33.8	42.5	32.9
	2004	37.1	28.2	49.8	46.4	34.8	48.7	35.6	43.5	35.6	61.9	44.4	48.9	42.9
	2005	77.5	47.0	60.5	61.4	73.7	56.4							62.8
Post Intervention	2005							48.0	69.7	69.1	77.5	68.4	40.9	62.3
	2006	64.8	65.5	71.7	80.3	60.5	58.4	45.6	55.0	38.7	54.7	59.4	51.3	58.8
	2007	49.1	59.3	87.7	57.6	66.9	62.0	58.9	58.0	44.0	68.0	49.8	44.1	58.8
	2008	68.0	39.6											53.8

TABLE 27.

MEDICAID PROFESSIONAL CELIAC - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.00	0.00	0.00	0.00	0.00
	2002	0.00	0.00	0.00	0.00	0.00	1.97							0.33
Intervention	2002							2.04	0.00	0.00	0.00	0.00	0.00	0.34
	2003	1.88	3.73	0.00	0.00	0.00	1.82	0.00	1.78	3.53	1.81	1.78	1.77	1.51
	2004	3.54	0.00	0.00	10.32	0.00	1.74	1.69	0.00	0.00	5.02	0.00	0.00	1.86
	2005	6.46	0.00	1.59	0.00	1.54	6.45							2.67
Post Intervention	2005							11.21	3.17	4.82	12.40	9.54	7.87	8.17
	2006	3.08	9.36	12.47	7.87	13.62	7.68	18.23	16.80	13.94	4.56	1.56	6.22	9.62
	2007	0.00	1.56	3.13	4.67	6.23	4.65	0.00	6.11	1.52	1.48	1.51	1.47	2.69
	2008	4.43	4.40											4.42

TABLE 28.

MEDICAID INSTITUTIONAL CELIAC - # OF PEOPLE TESTED/DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									*nd*	*nd*	*nd*	*nd*	*nd*
	2002	*nd*	*nd*	*nd*	*nd*	*nd*	45.00							7.50
Intervention	2002							63.00	*nd*	*nd*	*nd*	*nd*	*nd*	63.00
	2003	96.00	42.50	*nd*	*nd*	*nd*	100.00	*nd*	104.00	52.50	102.00	111.00	95.00	87.88
	2004	51.00	*nd*	*nd*	20.33	*nd*	119.00	113.00	*nd*	*nd*	46.00	*nd*	*nd*	69.87
	2005	26.75	*nd*	113.00	*nd*	133.00	30.75							75.88
Post Intervention	2005							16.43	69.00	42.67	17.25	24.50	29.40	33.21
	2006	80.50	24.67	25.63	31.60	18.78	33.80	13.00	18.91	18.78	60.67	158.00	35.50	43.32
	2007	*nd*	162.00	87.50	60.67	46.00	56.67	*nd*	40.25	140.00	181.00	151.00	135.00	96.37
	2008	78.33	54.33											66.33

TABLE 29.

MEDICAID PROFESSIONAL CELIAC - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									14.5	4.1	6.0	2.0	6.7
	2002	18.9	9.8	9.8	30.6	33.6	31.5							22.4
Intervention	2002							49.1	33.5	51.8	64.4	26.4	13.0	39.7
	2003	24.4	13.1	27.3	30.7	21.7	18.2	25.0	16.0	33.5	18.1	19.6	17.7	22.1
	2004	15.9	10.6	17.2	18.9	9.9	33.1	20.3	28.5	44.0	36.8	54.2	48.9	28.2
	2005	50.1	42.1	36.6	61.4	69.1	61.3							53.4
Post Intervention	2005							44.8	42.8	61.1	40.3	74.7	51.9	52.6
	2006	40.1	35.9	59.2	36.2	48.4	49.1	48.6	27.5	35.6	42.5	53.1	38.9	42.9
	2007	44.5	39.0	36.0	38.9	51.4	34.1	54.4	50.4	24.3	56.2	37.7	29.4	41.4
	2008	29.5	47.0											38.3

TABLE 30.

MEDICAID PROFESSIONAL CELIAC - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0	0.0	0.0	0.0	0.0
	2002	0.0	2.0	0.0	1.9	0.0	0.0							0.6
Intervention	2002							0.0	0.0	0.0	0.0	3.8	1.9	0.9
	2003	9.4	5.6	3.6	3.6	1.8	0.0	1.8	1.8	0.0	0.0	7.1	1.8	3.0
	2004	7.1	3.5	0.0	0.0	1.7	5.2	1.7	1.7	5.1	1.7	1.6	1.6	2.6
	2005	1.6	1.6	1.6	0.0	0.0	1.6							1.1
Post Intervention	2005							0.0	1.6	0.0	1.6	3.2	3.1	1.6
	2006	3.1	3.1	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.8
	2007	4.6	0.0	4.7	6.2	6.2	6.2	6.0	9.2	3.0	1.5	4.5	4.4	4.7
	2008	4.4	0.0											2.2

TABLE 31.

MEDICAID PROFESSIONAL CELIAC - # OF PEOPLE TESTED/DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									*nd*	*nd*	*nd*	*nd*	0.0
	2002	*nd*	5.0	*nd*	16.0	*nd*	*nd*							3.5
Intervention	2002							*nd*	*nd*	*nd*	*nd*	7.0	7.0	2.3
	2003	2.6	2.3	7.5	8.5	12.0	*nd*	14.0	9.0	*nd*	*nd*	2.8	10.0	5.7
	2004	2.3	3.0	*nd*	*nd*	6.0	6.3	12.0	17.0	8.7	22.0	33.0	30.0	11.7
	2005	31.0	26.0	23.0	*nd*	*nd*	38.0							19.7
Post Intervention	2005							*nd*	27.0	*nd*	26.0	23.5	16.5	15.5
	2006	13.0	11.5	38.0	23.0	32.0	32.0	32.0	18.0	23.0	28.0	34.0	25.0	25.8
	2007	9.7	*nd*	7.7	6.3	8.3	5.5	9.0	5.5	8.0	38.0	8.3	6.7	9.4
	2008	6.7	*nd*											3.3

3. Evaluation Of Lyme Disease

Table 32 provides a profile of various prevalence dimensions involving Lyme disease according to the three service delivery organizations over the entire evaluation period.

TABLE 32

SUMMARY OF LYME DISEASE SERVICES

	Medicaid - Professional	Medicaid - Institutional	Christiana Care Outpatient Services
No. of Tests	20,342	54,628	631
No. of Clients Tested	15,976	26,792	586
Avg. Tests/Client	1.27	2.04	1.08
No. of Diagnoses	956	643	53
Diagnosis/Testing Rates (%)	6.0	2.4	9.0

No.= all tests and diagnoses

Prevalence Rates of Testing for Lyme Disease

The prevalence rates of testing for Lyme disease measure, on a monthly basis, the number of unique individuals who were tested for the illness per 100,000 clients.

Appraisal of the educational intervention for Lyme disease requires two caveats to be made. First, the intervention period encompassed a short time frame of nine months. Second, unlike hemochromatosis and celiac disease, there has been substantial public knowledge about Lyme disease prior to the intervention evaluated here.

1. The prevalence rates of testing for Lyme disease of the three medical providers manifest different patterns and levels. Medicaid professional and institutional service delivery organizations had substantially higher rates of testing than CCOS, with two to five times greater depending upon various periods of the evaluation the time frame. Moreover, the impact of the educational intervention has been considerably different for all three providers.

    - In the *ex ante* intervention period:

        - Medicaid professional services had monthly prevalence rates for testing ranging between 79.3 and 849.0 per 100,000 clients.

        - Medicaid institutional services had monthly prevalence rates for testing ranging between 66.5 and 737.9 per 100,000 clients.

        - CCOS manifested monthly prevalence rates for testing between 60.8 per 100,000 clients and 464.1 per 100,000 clients.

2. In both the intervention and *ex post* intervention periods:

a. Medicaid professional services had monthly prevalence rates for testing ranging between 346.5 and 456.1 per 100,000 clients in the intervention period, and manifested monthly prevalence rates for testing with a range between 299.5 and 549.4 per 100,000 clients in the *ex post* intervention period.

b. Medicaid institutional services had monthly prevalence rates for testing ranging between 588.2 and 647.6 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 530.5 and 746.0 per 100,000 clients in the *ex post* intervention period.

c. CCOS manifested monthly prevalence rates for testing ranging between 171.7 and 491.0 per 100,000 clients in the intervention period, and monthly prevalence rates for testing with a range between 96.7 and 270.5 per 100,000 clients in the *ex post* intervention period.

3. This considerable monthly variation of prevalence rates of each service provider hinders a clear determination of whether the providers undertook different levels of testing before and after the intervention.

4. The estimated statistical models supply some clarity about the impact the educational intervention.

- For Medicaid professional service delivery, the regression model is not statistically significant; thus both INTA and INTB are not statistically significant variables. Put differently, the educational intervention was not associated with testing rates during the intervention period and in the *ex post* intervention period. A conclusion is that the testing rates, on average, are the same before, during and after the intervention.

- For Medicaid institutional services, the findings indicate that the educational intervention was associated with a considerable increase in the testing of clients for Lyme disease during the intervention period and in the *ex post* period. The educational intervention appears to have had a long-term impact, with the prevalence rates higher in the *ex post* period than even the intervention period. Compared with the intervention period, the level of testing in fact increased slightly in the *ex post* intervention period

- For CCOS, the educational intervention is associated with an increase in testing during the intervention period; however, in the *ex post* intervention period, the level of testing fell substantially below the prevalence rate of the *ex ante* intervention period.

- The average monthly prevalence rates for testing for Lyme disease per 100,000 clients for the three evaluation periods is given in the following table.

TABLE 33				
AVERAGE MONTHLY PREVALENCE RATES OF TESTING FOR LYME DISEASE PER 100,000 CLIENTS				
Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	452 per 100,000 clients*	452 per 100,000 clients*	452 per 100,000 clients*	0.0[a]
Medicaid Institutional	491 per 100,000 clients	627 per 100,000 clients	659 per 100,000 clients	.18[b]
CCOS	208 per 100,000 clients	271 per 100,000 clients	134 per 100,000 clients	.13[c]

**The F-Value was not statistically significant; thus the values are the mean value of the periods.*
[a] The F-Value was not statistically significant.
[b] The F-Value was statistically significant at the .0003 level.
[c] The F-Value was statistically significant at the .003 level.

5. The graphs of the monthly prevalence rates of testing reveals several dimensions about provider activities:

   - The regression for Medicaid professional services, which indicates that the monthly average is the same throughout the entire evaluation period, masks the very wide fluctuation in the value of testing rates in the *ex ante* intervention period. When the educational intervention was implemented, the variation in testing rates was reduced considerably to a small range throughout the remainder of the evaluation period. In addition, it must be noted that the testing rates declined consecutively in the last few months of the evaluation period.

   - The regression for Medicaid institutional services also obscures both the wide fluctuations and rising trends of testing rates in the *ex ante* intervention period. However, midway through the *ex ante* intervention period the testing rates had similar to those rates in the intervention and *ex post* intervention period.

   - The regression of CCOS does mirror the "changing" trends of the rates of testing. However, there was considerable monthly fluctuation in the rates across all the periods encompassed by the evaluation.

Prevalence Rates of Diagnosis for Lyme Disease

The prevalence rates of diagnosis for Lyme disease measure, on a monthly basis, the number of unique individuals who were diagnosed with the illness per 100,000 clients.

1. In the *ex ante* intervention period, the prevalence rates for the diagnoses of Lyme disease were high for all three service providers.

- Over the *ex ante* time frame, Medicaid professional services and CCOS had monthly prevalence rates of similar levels and approximately two times in value than Medicaid institutional services.

- The monthly prevalence rates also varied widely for each of the three providers.

- Medicaid professional services had monthly prevalence rates for diagnosis of Lyme disease ranging between 0.0 and 46.02 per 100,000 clients.

- While Medicaid institutional services had monthly prevalence rates for diagnosis ranging between 0.0 and 73.95 per 100,000 clients, only a few monthly rates were greater than 21.27 per 100,000 clients. Most monthly rates measured the prevalence of diagnoses at 10 per 100,000 clients or less.

- CCOS manifested monthly prevalence rates for testing with a range between 0.0 and 109.02 per 100,000 clients. For CCOS service delivery, 46% of the months (25 out of 54 months) in the *ex ante* intervention period did not yield any positive diagnoses; thus the prevalence rates were zero. Excluding the "outlier" of 109.02 per 100,000 clients, the positive monthly prevalence rates ranged between 23.1 and 55.2 per 100,000 clients.

2. The estimated statistical models confirm that the educational intervention is associated with very limited changes in the prevalence rates of diagnoses for Lyme disease, with only Medicaid institutional services manifesting any changes due to the intervention.

    - For both Medicaid professional services and CCOS organization, neither INTA nor INTB were verified as statistically significant variables. Thus the implementation of the educational intervention was not associated with any increases in the prevalence rates of diagnoses. That is, the level of diagnoses by both organizations is virtually identical throughout the three evaluation periods.

    - For Medicaid institutional services, only INTA was verified as a statistically significant variable with a positive sign. These estimates indicate that the number of diagnoses for Lyme disease per 100,000 clients increased during the intervention period. More specifically, the prevalence rates rose from 9 per 100,000 client in the *ex ante* intervention period to a sizeable 33 diagnoses per 100,000 during the period in which the intervention was implemented. However, in the *ex post* intervention period the prevalence rate returned to the level of the *ex ante* intervention period.

    - The prevalence rates of diagnoses rendered by Medicaid institutional services were almost double that of the CCOS and Medicaid professional services in the intervention period but one half of these two services in the *ex ante* and *ex post* periods.

TABLE 34				
AVERAGE MONTHLY PREVALENCE RATES OF DIAGNOSIS FOR LYME DISEASE PER 100,000 CLIENTS				
Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	18 per 100,000 clients	18 per 100,000 clients[a]	18 per 100,000 clients[a]	.00*
Medicaid Institutional	9 per 100,000 clients	33 per 100,000 clients	9 per 100,000 clients[b]	.35**
CCOS**	17 per 100,000 clients	17 per 100,000 clients[a]	17 per 100,000 clients[a]	.00*

**The F-Value of the equation was not statistically significant.*
***The F-Values of all the equations were statistically significant at the .0001 level.*
[a] *The coefficients B_1 and B_2 were not statistically significant; thus their value is zero and they are not different in value than that of the intercept coefficient B_0.*
[b] *The coefficient B_2 was not statistically significant; thus its value is zero and it s not different in value than that of the intercept coefficient B_0.*

The Diagnosis-Testing Ratios for Lyme Disease

The prevalence rates of diagnosis/testing for Lyme disease measure the proportion of diagnoses confirmed on a monthly basis compared with the number of individuals tested for Lyme disease on a monthly basis.

1. Neither INTA nor INTB were confirmed as statistically significant independent variables for the diagnosis/testing rates of Medicaid professional services and CCOS.

    - Therefore the educational intervention did not produce increases in diagnoses relative to the number of tests administered in either the short-run (during the intervention period) or the long-run (the *ex post* intervention period).

    - The prevalence rates for diagnoses/testing remained constant for Medicaid professional services and CCOS throughout the three evaluation periods, although there was considerable volatility in the values of rates per months in each of the three periods.

2. However, INTA, but not INTB, was verified as a statistically significant variable in the model for Medicaid institutional services.

    - Thus the education intervention was associated with a short-run change in productivity but no long-run effects.

- In the *ex ante* period, Medicaid institutional services manifested a 2.2% yield in diagnoses for Lyme disease testing. Productivity rose significantly to a level of 5.4%. In the *ex post* intervention period, the prevalence rates reverted to the values of 2.2% of the *ex ante* intervention period.

3. Despite the positive effect of the educational intervention for Medicaid institutional services, overall Medicaid professional services was the most productive medical unit in yielding diagnoses for the number of test conducted.

7. The difference in diagnoses yields for testing among the medical providers aside, the diagnoses/testing rates indicate low productivity across all services.

8. This small number of positive confirmations of diagnoses relative to the number of tests indicates that many financial resources have been expended to obtain limited results.

TABLE 35

AVERAGE MONTHLY DIAGNOSIS/TESTING RATIOS FOR LYME DISEASE

Provider	***Ex Ante* Intervention Period B_0**	**Intervention Period $B_0 + B_1$**	***Ex Post* intervention Period $B_0 + B_2$**	**Adjusted R^2**
Medicaid Professional	3.8% of all tests***	3.8% of all tests***	3.8% of all tests***	.03*
Medicaid Institutional	2.2% of all tests***	5.4% of all tests	2.2%.of all tests***	.19**
CCOS	0.01% of all tests***	0.01% of all tests***	0.01% of all tests***	.00***

**The F-Value of the equation was not statistically significant.*
***The F-Value of the equations was statistically significant at the .0002 level.*
**** The coefficients were not statistically significant; thus there values are not different than that of the intercept coefficient B_0.*

LYME REGRESSION MODELS

FIGURE 32. CCOS LYME TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Lyme Testing Ratio**
Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	133760	66880	6.21	0.0034
Error	66	710674	10768		
Corrected Total	68	844433			

Root MSE	103.76794	R-Square	0.1584
Dependent Mean	202.63984	Adj R-Sq	0.1329
Coeff Var	51.20807		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**208.67699**	**16.20583**	**12.88**	**<.0001**
Intervention	Intervention	1	63.82563	34.05796	1.87	0.0654
Ex Post	**After**	**1**	**-73.90444**	**30.58783**	**-2.42**	**0.0185**

FIGURE 33. CCOS LYME DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Lyme Diagnosis Ratio**
Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	212.74976	106.37488	0.21	0.8108
Error	66	33369	505.59075		
Corrected Total	68	33582			

Root MSE	22.48535	R-Square	0.0063
Dependent Mean	17.76493	Adj R-Sq	-0.0238
Coeff Var	126.57154		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	17.24049	3.51162	4.91	<.0001
Intervention	Intervention	1	-1.67540	7.37998	-0.23	0.8211
Ex Post	After	1	3.51820	6.62804	0.53	0.5973

FIGURE 34. CCOS LYME DIAGNOSES/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **CCOS Lyme Diagnoses/Testing Ratio**

Number of Observations Read 69
Number of Observations Used 69

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	2.127498E-8	1.063749E-8	0.21	0.8108
Error	66	0.00000334	5.055907E-8		
Corrected Total	68	0.00000336			

Root MSE	0.00022485	R-Square	0.0063
Dependent Mean	0.00017765	Adj R-Sq	-0.0238
Coeff Var	126.57154		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.00017240	0.00003512	4.91	<.0001
Intervention	Intervention	1	-0.00001675	0.00007380	-0.23	0.8211
Ex Post	After	1	0.00003518	0.00006628	0.53	0.5973

FIGURE 35. MEDICAID INSTITUTIONAL LYME TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Lyme Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	494309	247155	9.24	0.0003
Error	75	2005200	26736		
Corrected Total	77	2499509			

Root MSE	163.51145	R-Square	0.1978
Dependent Mean	566.35601	Adj R-Sq	0.1764
Coeff Var	28.87079		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**491.35287**	**25.53620**	**19.24**	**<.0001**
Intervention	**Intervention**	**1**	**136.77728**	**53.66654**	**2.55**	**0.0129**
Ex Post	**After**	**1**	**168.35670**	**41.49141**	**4.06**	**0.0001**

FIGURE 36. MEDICAID INSTITUTIONAL LYME DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Institutional Lyme Diagnosis Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6127.20711	3063.60356	21.82	<.0001
Error	75	10531	140.40843		
Corrected Total	77	16658			

Root MSE	11.84941	R-Square	0.3678
Dependent Mean	13.63705	Adj R-Sq	0.3510
Coeff Var	86.89129		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**9.70406**	**1.85057**	**5.24**	**<.0001**
Intervention	**Intervention**	**1**	**24.71434**	**3.88913**	**6.35**	**<.0001**
Ex Post	After	1	0.40805	3.00681	0.14	0.8924

FIGURE 37. MEDICAID INSTITUTIONAL LYME DIAGNOSIS/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: Medicaid Institutional Lyme Diagnosis/Testing
Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.01352	0.00676	9.81	0.0002
Error	75	0.05166	0.00068884		
Corrected Total	77	0.06518			

Root MSE	0.02625	R-Square	0.2074
Dependent Mean	0.02522	Adj R-Sq	0.1863
Coeff Var	104.07725		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	**Intercept**	**1**	**0.02244**	**0.00410**	**5.47**	**<.0001**
Intervention	**Intervention**	**1**	**0.03276**	**0.00861**	**3.80**	**0.0003**
Ex Post	After	1	-0.00705	0.00666	-1.06	0.2935

FIGURE 38. MEDICAID PROFESSIONAL LYME TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Lyme Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	22982	11491	0.50	0.6070
Error	75	1715140	22869		
Corrected Total	77	1738122			

Root MSE	151.22344	R-Square	0.0132
Dependent Mean	440.71737	Adj R-Sq	-0.0131
Coeff Var	34.31302		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	452.82498	23.61713	19.17	<.0001
Intervention	Intervention	1	-49.62043	49.63345	-1.00	0.3207
Ex Post	After	1	-13.95794	38.37330	-0.36	0.7171

FIGURE 39. MEDICAID PROFESSIONAL LYME DIAGNOSIS RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Lyme Diagnosis Ratio**
Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	328.76597	164.38299	1.02	0.3647
Error	75	12061	160.80829		
Corrected Total	77	12389			

Root MSE	12.68102	R-Square	0.0265
Dependent Mean	20.18235	Adj R-Sq	0.0006
Coeff Var	62.83222		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	18.24760	1.98044	9.21	<.0001
Intervention	Intervention	1	3.53621	4.16207	0.85	0.3982
Ex Post	After	1	4.33905	3.21784	1.35	0.1816

FIGURE 40. MEDICAID PROFESSIONAL LYME DIAGNOSIS/TESTING RATIO REGRESSION

The REG Procedure
Model: MODEL1
Dependent Variable: **Medicaid Professional Lyme Diagnosis/Testing Ratio**

Number of Observations Read 78
Number of Observations Used 78

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00345	0.00172	2.28	0.1097
Error	75	0.05682	0.00075757		
Corrected Total	77	0.06027			

Root MSE	0.02752	R-Square	0.0572
Dependent Mean	0.04478	Adj R-Sq	0.0321
Coeff Var	61.46614		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.03856	0.00430	8.97	<.0001
Intervention	Intervention	1	0.01559	0.00903	1.73	0.0886
Ex Post	After	1	0.01191	0.00698	1.71	0.0922

LYME GRAPHS

FIGURE 41. CCOS LYME TESTING

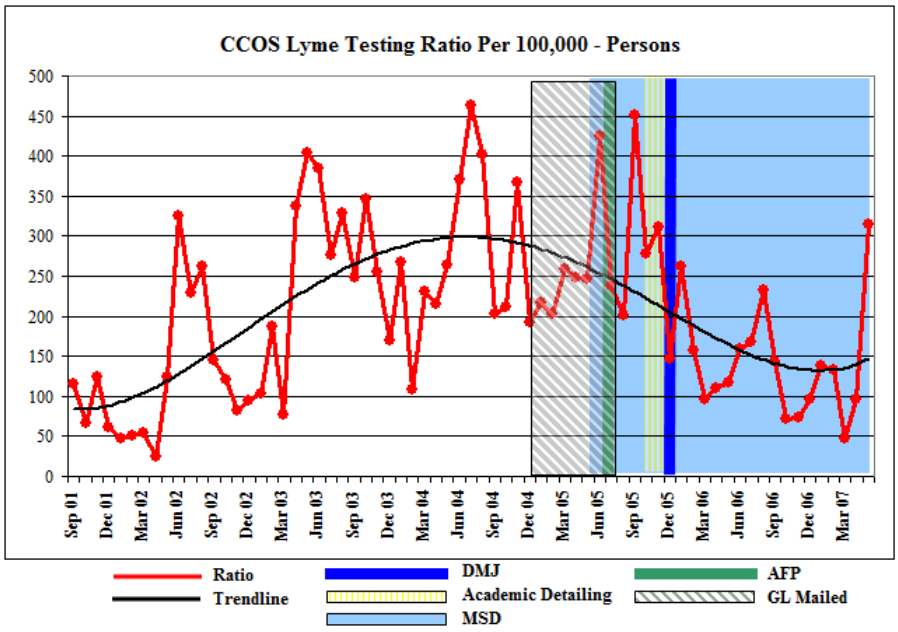


FIGURE 42. CCOS LYME DIAGNOSIS

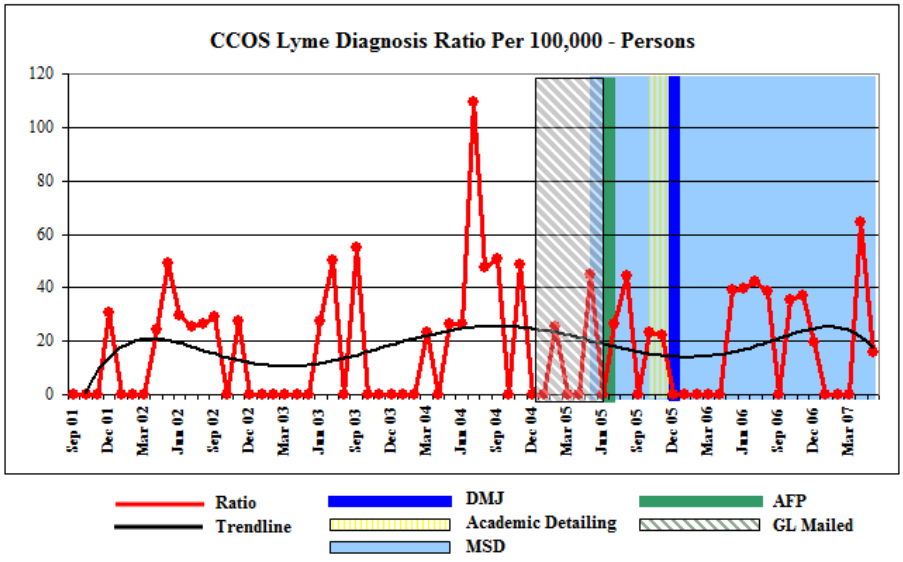


FIGURE 43. CCOS LYME DIAGNOSIS/TEST

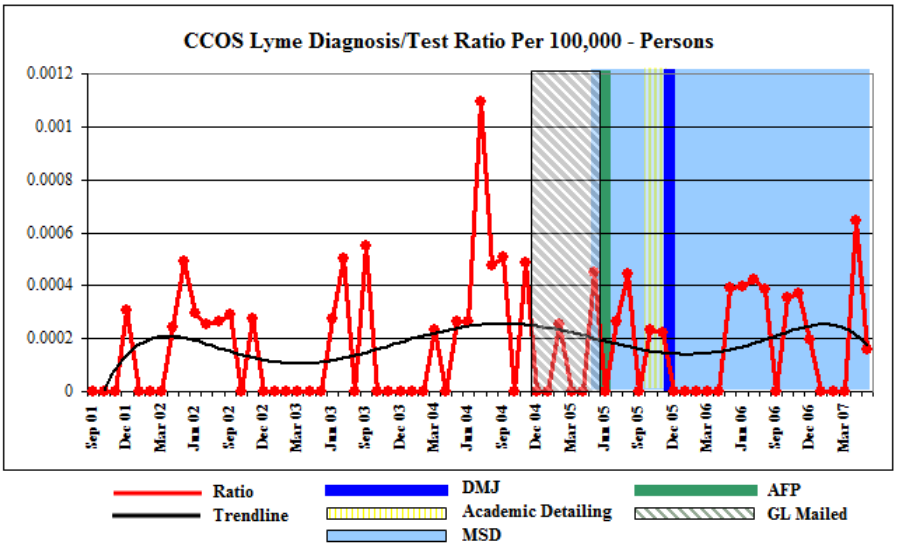


FIGURE 44. MEDICAID INSTITUTIONAL LYME TESTING

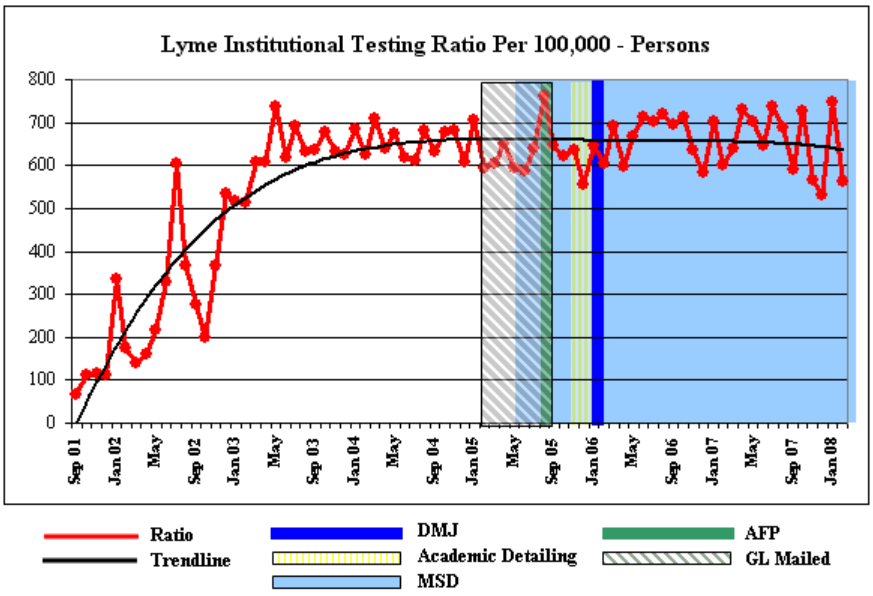


FIGURE 45. MEDICAID INSTITUTIONAL LYME DIAGNOSIS

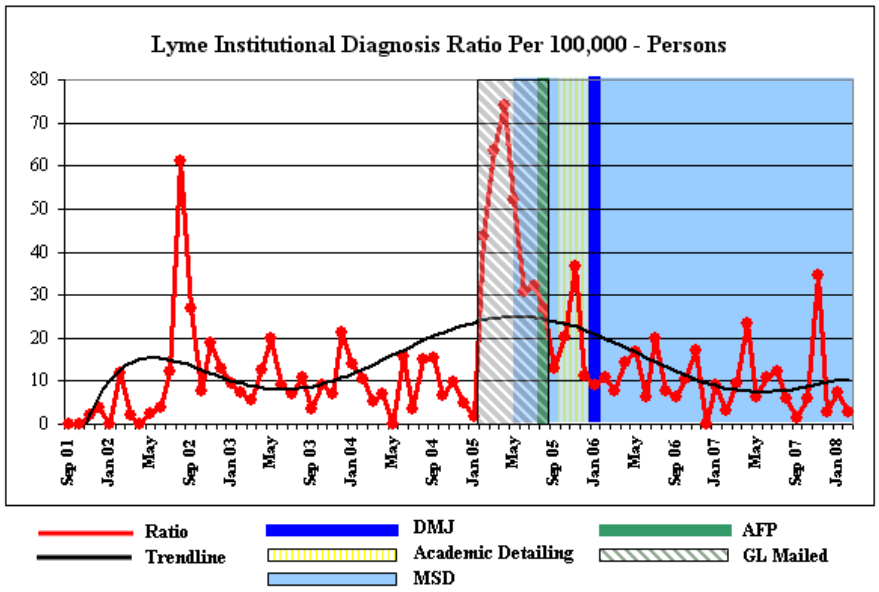


FIGURE 46. MEDICAID INSTITUTIONAL LYME DIAGNOSIS/TESTS

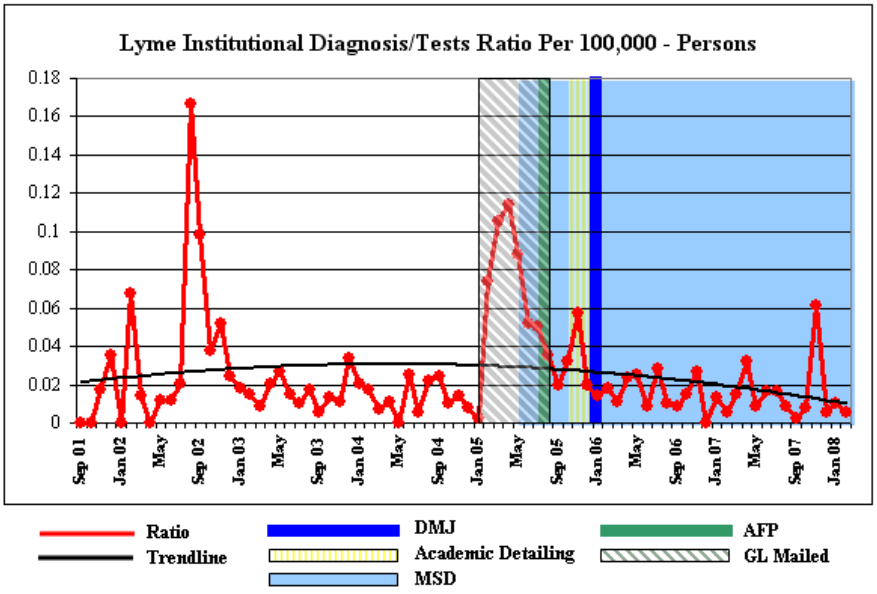


FIGURE 47. MEDICAID PROFESSIONAL LYME TESTING

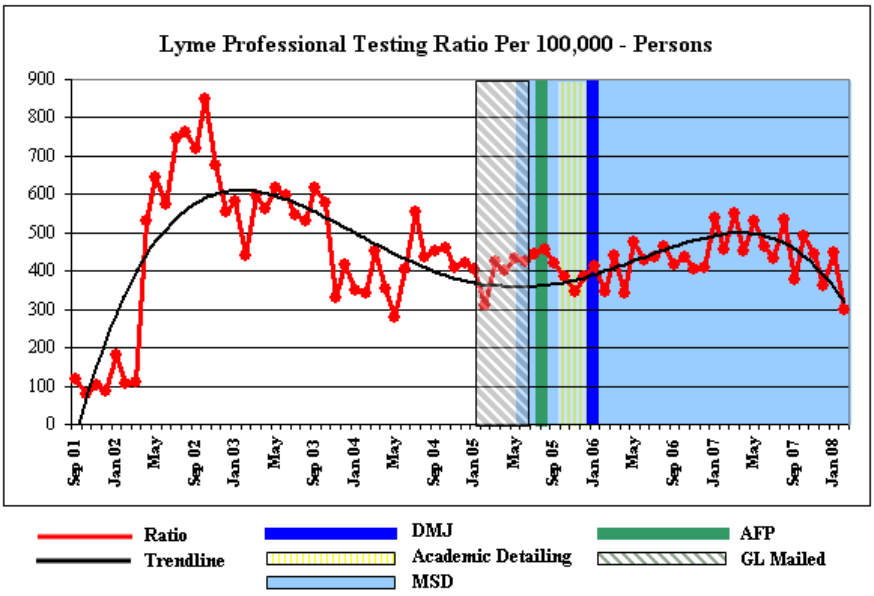


FIGURE 48. MEDICAID PROFESSIONAL LYME DIAGNOSIS

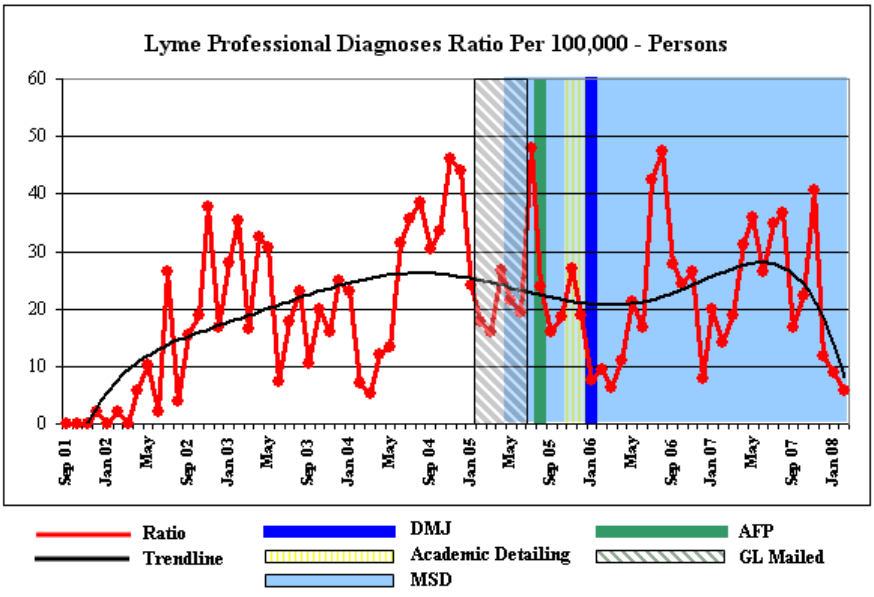
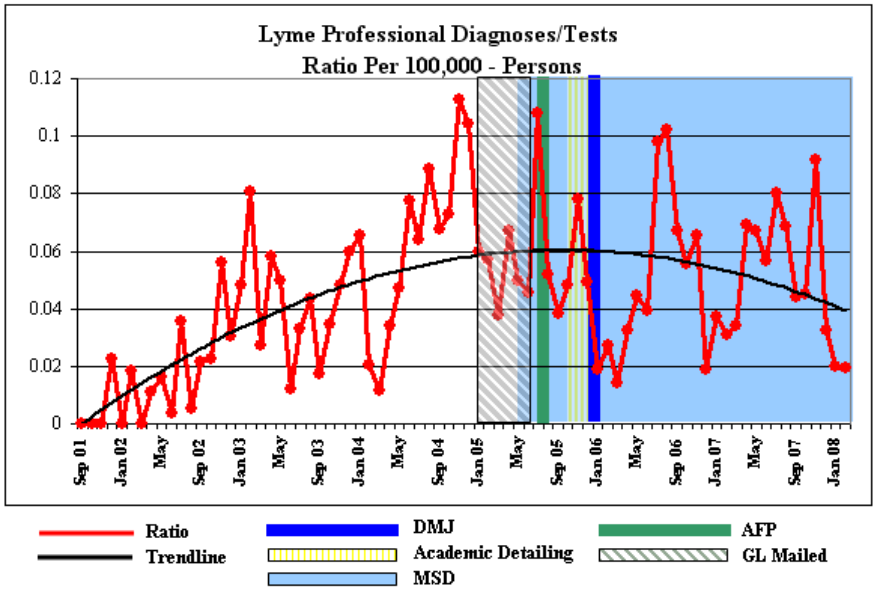


FIGURE 49. MEDICAID PROFESSIONAL LYME DIAGNOSIS/TESTS



LYME TABLES

TABLE 36.

CHRISTIANA CARE LYME - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									144.9	66.1	223.8	60.8	123.90
	2002	70.3	50.0	54.9	24.6	123.5	383.4	254.5	288.3	173.4	120.6	82.4	94.8	143.39
	2003	102.6	186.8	76.2	337.8	454.2	384.9	276.3	328.3	275.9	346.3	256.0	169.8	266.26
	2004	266.7	109.1	231.3	215.9	263.6	370.3	464.1	450.2	228.0	210.8	366.7	193.1	842.41
	2005	265.1	228.6	259.6	270.6									255.97
Intervention	2005					269.5	491.0	238.5	267.9	451.5	277.6	376.9	171.7	318.09
	2006	305.6												305.61
Post Intervention	2006		224.9	96.7	109.8	116.9	159.2	168.7	270.5	143.0	106.9	74.3	96.7	130.63
	2007	138.4	132.5	47.4	113.2	362.4								158.79
	2008													

TABLE 37.

CHRISTIANA CARE LYME - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0	0.0	0.0	30.4	7.60
	2002	0.0	0.0	0.0	24.6	49.4	29.5	25.5	26.2	28.9	0.0	27.5	0.0	17.62
	2003	0.0	0.0	0.0	0.0	0.0	27.5	50.2	0.0	55.2	0.0	0.0	0.0	11.08
	2004	0.0	0.0	23.1	0.0	26.4	26.4	109.2	47.4	50.7	0.0	48.9	0.0	27.67
	2005	0.0	25.4	0.0	0.0									6.35
Intervention	2005					44.9	0.0	26.5	44.6	0.0	23.1	22.2	0.0	20.17
	2006	0.0												0.00
Post Intervention	2006		0.0	0.0	0.0	39.0	39.8	42.2	38.6	0.0	35.6	37.1	19.3	20.97
	2007	0.0	0.0	0.0	64.7	15.8								16.09
	2008													

TABLE 38.

CHRISTIANA CARE LYME - # OF PEOPLE DIAGNOSED/TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0000	0.0000	0.0000	0.0003	0.0001
	2002	0.0000	0.0000	0.0000	0.0002	0.0005	0.0003	0.0003	0.0003	0.0003	0.0000	0.0003	0.0000	0.0002
	2003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0005	0.0000	0.0006	0.0000	0.0000	0.0000	0.0001
	2004	0.0000	0.0000	0.0002	0.0000	0.0003	0.0003	0.0011	0.0005	0.0005	0.0000	0.0005	0.0000	0.0003
	2005	0.0000	0.0003	0.0000	0.0000									0.0001
Intervention	2005					0.0004	0.0000	0.0003	0.0004	0.0000	0.0002	0.0002	0.0000	0.0002
	2006	0.0000												0.0000
Post Intervention	2006		0.0000	0.0000	0.0000	0.0004	0.0004	0.0004	0.0004	0.0000	0.0004	0.0004	0.0002	0.0002
	2007	0.0000	0.0000	0.0000	0.0006	0.0002								0.0002
	2008													

TABLE 39.

MEDICAID INSTITUTIONAL LYME - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									66.48	111.73	114.19	113.43	101.46
	2002	334.39	175.17	139.74	160.54	217.24	328.52	605.01	366.74	274.53	198.99	366.14	532.93	308.33
	2003	517.66	513.15	606.35	608.90	737.97	619.08	692.26	631.61	635.01	676.20	631.39	625.71	624.61
	2004	684.16	624.98	708.21	639.63	673.77	617.96	611.27	679.94	631.57	678.92	680.41	608.07	653.24
	2005	705.56	594.49	605.28	648.24									638.39
Intervention	2005					592.84	588.46	638.81	760.12	645.87	623.11	635.86	556.90	630.25
	2006	647.59												647.59
Post Intervention	2006		603.63	693.37	596.67	665.98	714.03	703.47	721.02	695.49	712.31	636.03	583.38	665.94
	2007	703.66	599.63	638.63	728.96	702.03	644.70	737.44	687.05	590.29	727.68	566.98	530.45	654.79
	2008	746.03	563.83											654.93

TABLE 40.

MEDICAID INSTITUTIONAL LYME - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.00	0.00	2.00	3.98	1.50
	2002	0.00	11.81	1.97	0.00	2.59	3.93	12.26	61.12	26.88	7.58	18.87	13.00	13.33
	2003	9.38	7.46	5.46	12.65	19.90	9.08	7.16	10.68	3.53	9.04	7.11	21.27	10.23
	2004	14.14	10.56	5.16	6.88	0.00	15.67	3.39	15.07	15.24	6.69	9.86	4.89	8.96
	2005	1.61	43.74	63.71	73.95									45.75
Intervention	2005					52.22	30.63	32.02	26.92	12.85	20.15	36.56	11.01	27.80
	2006	9.25												9.25
Post Intervention	2006		10.92	7.79	14.17	16.65	6.14	19.75	7.64	6.20	10.63	17.19	0.00	10.64
	2007	9.20	3.12	9.39	23.36	6.23	10.85	12.09	6.11	1.52	5.92	34.68	2.94	10.45
	2008	7.39	2.94											5.16

TABLE 41.

MEDICAID INSTITUTIONAL LYME - # OF PEOPLE DIAGNOSED/TESTED PER MONTH RATIOS														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.0000	0.0000	0.0175	0.0351	0.0132
	2002	0.0000	0.0674	0.0141	0.0000	0.0119	0.0120	0.0203	0.1667	0.0979	0.0381	0.0515	0.0244	0.0420
	2003	0.0181	0.0145	0.0090	0.0208	0.0270	0.0147	0.0103	0.0169	0.0056	0.0134	0.0113	0.0340	0.0163
	2004	0.0207	0.0169	0.0073	0.0108	0.0000	0.0254	0.0055	0.0222	0.0241	0.0099	0.0145	0.0080	0.0138
	2005	0.0023	0.0736	0.1053	0.1141									0.0738
Intervention	2005					0.0881	0.0521	0.0501	0.0354	0.0199	0.0323	0.0575	0.0198	0.0444
	2006	0.0143												0.0143
Post Intervention	2006		0.0181	0.0112	0.0237	0.0250	0.0086	0.0281	0.0106	0.0089	0.0149	0.0270	0.0000	0.0160
	2007	0.0131	0.0052	0.0147	0.0321	0.0089	0.0168	0.0164	0.0089	0.0026	0.0081	0.0612	0.0055	0.0161
	2008	0.0099	0.0052											0.0076

TABLE 42.

MEDICAID PROFESSIONAL LYME - # OF PEOPLE TESTED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									118.41	79.23	102.17	87.56	96.84
	2002	180.68	106.28	108.25	531.29	643.96	574.42	746.04	763.06	719.92	849.02	675.66	553.36	537.66
	2003	581.43	438.51	599.06	560.11	618.59	597.29	545.58	530.19	615.61	576.76	330.81	416.55	534.21
	2004	350.03	343.30	450.37	352.48	279.77	403.85	555.40	435.43	452.09	459.86	407.59	422.22	409.37
	2005	403.64	311.01	423.70	399.64									384.50
Intervention	2005					431.58	424.02	445.08	456.07	419.33	384.41	346.54	383.85	411.36
	2006	413.22												413.22
Post Intervention	2006		346.27	439.40	341.63	473.75	428.42	434.54	464.38	415.12	435.89	406.31	407.59	417.57
	2007	536.56	457.53	549.41	450.15	532.36	464.93	432.19	534.38	377.85	492.52	444.84	360.00	469.39
	2008	446.14	299.53											372.84

TABLE 43.

MEDICAID PROFESSIONAL LYME - # OF PEOPLE DIAGNOSED PER MONTH RATIOS PER 100,000														
Period	Year	Monthly Rates												Annual Average
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Pre Intervention	2001									0.00	0.00	0.00	1.99	0.50
	2002	0.00	1.97	0.00	5.73	10.34	1.97	26.57	3.94	15.36	18.95	37.75	16.71	11.61
	2003	28.13	35.45	16.39	32.52	30.75	7.26	17.89	23.13	10.58	19.89	16.01	24.82	21.90
	2004	22.98	7.04	5.16	12.04	13.24	31.33	35.56	38.52	30.48	33.44	46.02	44.02	26.65
	2005	24.22	17.82	15.93	26.75									21.18
Intervention	2005					21.50	19.35	48.03	23.75	16.07	18.60	27.02	18.88	24.15
	2006	7.71												7.71
Post Intervention	2006		9.36	6.23	11.02	21.19	16.89	42.54	47.35	27.88	24.30	26.57	7.78	21.92
	2007	19.93	14.05	18.78	31.15	35.80	26.35	34.76	36.64	16.69	22.19	40.71	11.76	25.73
	2008	8.86	5.87											7.37

TABLE 44.

MEDICAID PROFESSIONAL LYME - # OF PEOPLE DIAGNOSED/TESTED PER MONTH RATIOS PER 100,000														
Period	**Year**	**Monthly Rates**												**Annual Average**
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	
Pre Intervention	**2001**									*nd*	*nd*	*nd*	44.00	44.00
	2002	*nd*	54.00	*nd*	92.67	62.25	292.00	28.08	193.50	46.88	44.80	17.90	33.11	86.52
	2003	20.67	12.37	36.56	17.22	20.12	82.25	30.50	22.92	58.17	29.00	20.67	16.79	30.60
	2004	15.23	48.75	87.33	29.29	21.13	12.89	15.62	11.30	14.83	13.75	8.86	9.59	24.05
	2005	16.67	17.45	26.60	14.94									18.92
Intervention	**2005**					20.07	21.92	9.27	19.20	26.10	20.67	12.82	20.33	18.80
	2006	53.60												53.60
Post Intervention	**2006**		37.00	70.50	31.00	22.36	25.36	10.21	9.81	14.89	17.94	15.29	52.40	27.89
	2007	26.92	32.56	29.25	14.45	14.87	17.65	12.43	14.58	22.64	22.20	10.93	30.63	20.76
	2008	50.33	51.00											50.67