U.S. Department of Health and Human Services
Centers for Medicare & Medicaid Services
Center for Medicare & Medicaid Innovation

Environmental Scanning and Program Characteristics Database

Task 5: ESPC Final Report

Contract Number: HHSM-500-2006-00007I

February 5, 2014

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SECTION 1: PROJECT OVERVIEW

The Centers for Medicare & Medicaid Services (CMS) awarded the Environmental Scanning and Program Characteristics (ESPC) Database contract to IMPAQ International, LLC (IMPAQ) on March 31, 2010, using funds from American Recovery and Reinvestment Act (ARRA) of 2009. The ESPC contract required the development of two products: the ESPC Database and an analytic study using the information from the ESPC Database in conjunction with other data. This document is the final report for the contract. Section 1 provides an overview of the project. Section 2 and Appendix A provide the steps taken in developing the ESPC Database. Section 3 and Appendix B provide a summary of the methods used and the results of the analytic study.

1.A Overview of ESPC Database

The ESPC Database contains state-level environmental factors and program characteristics for Medicaid and the Children's Health Insurance Program (CHIP); it does not contain any person-level data. The database is intended to facilitate cross-state analyses by providing easy access to program characteristics (e.g., eligibility parameters, benefit design) and environmental factors (e.g., population demographics, health status, provider availability) that may result in variations in outcomes for the populations enrolled in Medicaid and CHIP. These variations must be controlled for in cross-state analyses in order to obtain unbiased estimates of the effects of policies and other variables of interest.

Information from the database can be linked to the Medicaid Analytic eXtract (MAX) files to support comparative effectiveness research (CER) and other program and policy studies. The database also serves as a stand-alone data source to help meet the increased need for interstate analyses stemming from health reform implementation. Potential users of the database include policymakers and researchers conducting CER, program evaluations, and other policy studies for Federal and state agencies, medical institutions, professional societies, advocacy organizations, and industry.

The ESPC Database contains data for the 50 states and the District of Columbia, was developed in Microsoft Access, and features a user-friendly interface that enables searching and exporting of the data and related documentation. Because primary data collection was outside the scope of the contract, all data included in the database are from existing sources, most of which are publicly available (e.g., Federal agency Web sites and publications of private institutions).[1] As a result, although the most recent version of the database has over 1,600 variables, some researchers may find that the database does not include particular information of interest. In addition, the ESPC team did not validate the data and thus we cannot guarantee its accuracy. All data are state-level and cover the time period from 2005 to the latest available date.

[1] For data that are not in the public domain, we obtained permission from the data-holding organizations for their inclusion.

1.B Overview of Analytic Study

The ESPC Database contract included a task to conduct an analytic study that used the ESPC Database in combination with the MAX files to illustrate the value of the ESPC Database for interstate analysis. After discussing potential topics with CMS, we investigated the use of antipsychotic drugs among children in Medicaid.

An environmental scan of the topic of antipsychotic drug use highlighted two major areas of interest for researchers and policymakers. The first was the increasing use of second-generation antipsychotic drugs, also known as atypical antipsychotics, among children over the past 15 to 20 years. The second area was the large racial and ethnic disparities observed in antipsychotic drug utilization. Based on this information, we developed an empirical approach and an analytic data set to explore these questions. We investigated antipsychotic drug utilization rates and explored how utilization differs across states, over time, and by child characteristics such as age, gender, race and ethnicity, and eligibility group.

We first used the ESPC Database to choose eight suitable study states (Alabama, Louisiana, North Carolina, New Hampshire, Illinois, Iowa, Oklahoma, and Colorado). We then developed an analytic file that combined data from several sources, including the MAX Person Summary and Prescription Drug files, the ESPC Database, and the First Databank database. Analyses to examine longitudinal patterns in the use of antipsychotic drugs, disparities in antipsychotic drug use across race/ethnicity groups, and differences in antipsychotic drug use across various strata (eligibility group, gender, states, age group) were conducted using unadjusted prevalence rates, fixed-effects regression, survival analyses (Kaplan-Meier estimates and proportional hazard model), and pooled ordinary least squares (OLS) regressions. The analyses indicated that antipsychotic drug utilization increased from 2005 through 2008 and plateaued in 2009. Based on our analysis, we concluded that the plateau in 2009 is likely the result of a change in the Medicaid population rather than a change in providers' propensity to prescribe antipsychotic drugs or Medicaid eligibles' preferences for treatment with antipsychotic drugs. We also found differences in antipsychotics use across racial/ethnic groups, with White children having the highest antipsychotic drug use, followed by African Americans, Asians, and Hispanics. These differences persist even when we controlled for other confounding factors.

As a way of disseminating information on the usefulness of the ESPC Database, we developed two manuscripts focusing on longitudinal changes in antipsychotic drug use and disparities in the use of antipsychotic drugs. These manuscripts have been submitted to peer-reviewed journals.

SECTION 2: ESPC DATABASE

In this section, we provide an overview of the ESPC Database design process, the production and redesign cycle, dissemination activities for the database, and maintenance and updating of the database in the future. In Appendix A, we provide additional information on the content and functionality of ESPC Database 3.0, the most recent version.

2.A ESPC Database Design

Year 1 Database Design Report

In the first project year (April 1, 2010–March 31, 2011), we produced the Year 1 Database Design report. The report described the proposed (a) content (variables, their descriptions, data years to be included, data sources, organization of the database using topic and subtopic areas), (b) function (e.g., search features, metadata available to database users, exporting functions), and (c) states to be included in the prototype database. The team selected variables based on brainstorming sessions and discussions with staff from CMS, Census Bureau, Centers for Disease Control and Prevention, Assistant Secretary for Planning and Evaluation, Agency for Healthcare Research and Quality, and Medicaid researchers. The team proposed user interface features based on our experience in searching for and extracting data from publicly available databases as well as discussions with CMS. The team proposed five states to be included in the prototype database: Alaska, California, Louisiana, New Jersey, and Pennsylvania. Prototype states were chosen to be diverse in terms of CHIP program type (Medicaid expansion, separate, combination), enrollment and spending levels, managed care penetration, and other characteristics (e.g., presence of waivers, benefits, optional services).

First Technical Expert Panel Meeting

In consultation with CMS, the team identified and recruited a technical expert panel (TEP) composed of five individuals knowledgeable about state-level data and Medicaid research. All TEP members were offered an honorarium and reimbursement for travel expenses for in-person ESPC meetings. U.S. Department of Health and Human Services (HHS) stakeholders were also invited to the TEP meetings. The TEP and HHS stakeholder group were intended to provide oversight and direction during the database design phase in year 1 and subsequent redesign cycles.

In July 2010, the team held the first TEP meeting to provide an overview of the ESPC Database project and presented the major elements of the Year 1 Database Design Report. The attendees made the following recommendations for the initial database design:

1. The main focus of the database should be Medicaid program characteristics variables rather than environmental factors.

2. All variables should have an associated time frame that indicates the precise period to which the data refer (e.g., as of June 30, fiscal year, calendar year).
3. Each variable should have associated metadata fields that indicate the eligibility group and the type of service to which the variable refers.
4. Program characteristics should include eligibility rules, services offered, service limitations, payment methodology, enrollment, cost sharing, and other variables important to policy analysis.
5. When program characteristics are complex, have numerous caveats, or cannot be easily reduced to numbers or indicator variables, the database should include narrative descriptions and explanations of the variables.

Prototype Database and Second TEP Meeting

Based on the TEP's recommendations, IMPAQ and RTI revised the Year 1 Database Design Report. The team then developed the ESPC Prototype Database, which had a fully functioning user interface and included data from the five prototype states. IMPAQ and RTI presented the prototype database at the second TEP meeting, in October 2010. The TEP and other stakeholders provided feedback on the ESPC user interface. Following the meeting, the team revised the user interface based on the TEP's suggestions and began production of the first complete version, ESPC Database 1.0.

2.B ESPC Database Production and Redesign

Production of ESPC Database 1.0

Following the finalization of the ESPC Database's initial design and approval of the prototype database, the project team moved into the database production phase of the ESPC contract. Production involved:

- Gathering data for the variables identified in the Year 1 Database Design Report
- Providing variable names, variable descriptions, timeframes, eligibility category, benefit type, and other metadata for each variable
- Quality checking all data
- Quality checking all variables and associated metadata
- Importing data and metadata into the ESPC database
- Testing all user interface functions
- Developing and updating the ESPC User Guide
- Presenting the database to the TEP and other stakeholders at the rollout meeting
- Preparing 508 testing materials and participating in 508 testing at CMS

- Supporting CMS as needed during the release process.

ESPC Database 1.0 included 869 variables, which were organized into 68 unique topic/subtopic area designations, 12 eligibility groups, and 46 service types. The data for version 1.0 were gathered from 15 sources. The project team presented version 1.0 to the TEP and other stakeholders at a virtual rollout meeting in April 2011.

Once finalized, the project team began the 508 compliance testing process. For the user interface, the testing process required the development of a test plan, participation in user testing at CMS, and revision of the user interface if necessary. The test plan is a series of steps that walks the tester through a use case (e.g., searching for variables, selecting variables, selecting states and dates for export, exporting data). During the testing session, a visually impaired volunteer tester uses screen reader software to execute the steps in the test plan as a testing supervisor notes whether the user interface effectively interacts with the screen reader to allow the tester to complete the use case. The results of the test are provided in a document that indicates whether the user interface successfully passed each step in the test plan. Any failures require revision of the interface. ESPC Database 1.0 and the accompanying User Guide cleared Section 508 compliance review at CMS and were made publicly available on the CMS website from November 2011 through June 2012.

Redesign and Production of ESPC Database 2.0

During project years 2 (April 1, 2011–March 31, 2012) and 3 (April 1, 2012–March 31, 2013), the ESPC team produced versions 2.0 and 3.0 of the ESPC Database. Each production cycle was preceded by a design phase divided into three stages. First, the team produced a draft design report. Next, the team presented these recommendations for database enhancements to the TEP at in-person meetings. Finally, based on TEP feedback, the team revised and finalized the design reports.

Based on additional feedback provided by attendees at the version 1.0 rollout meeting in April 2011 as well as discussions among project team members and with CMS, we developed the Year 2 Database Design Report, which was submitted to CMS in June 2011. The ESPC team held a TEP meeting in July 2011 to review the design report, which we finalized based on feedback provided at the meeting. Between August 2011 and March 2012, we implemented the changes laid out in the Year 2 Database Design report and presented ESPC Database 2.0 at a rollout meeting in April 2012.

ESPC Database 2.0 enhanced the version 1.0 user interface in the following ways:

1. A data source name was added to the variable selection list. This permitted users to filter variables by data source.
2. A variable units metadata field was added to the database to clarify how numeric variables were expressed.
3. The default directory for saving exports was set to the most recent directory used.

4. The default state selection was set to "No States" rather than "All States," and the drop-down menus for state selection were replaced with checkboxes.
5. A confirmation page was added for data export selections to require users to review variable, state, and date selections prior to export.
6. The way in which the date range criteria select data elements for export was changed to allow inclusion of variables with missing begin or end dates.

In addition, the team augmented the content of version 1.0 by including more recent data for the variables already in the database and adding program characteristics variables. The additional variables came from a number of sources: the MACStats tables (Medicaid and CHIP Payment and Access Commission, www.macpac.gov/macstats), the Charting CHIP publications (National Academy for State Health Policy, www.nashp.org/publication/charting-chip-iv); National Summary of State Medicaid Managed Care Programs (CMS, www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/DescStateProg.html); the MAX Validation Tables (CMS, www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MAX-Validation-Reports.html); the Kaiser Family Foundation's State Health Facts website (kff.org/statedata/) and Medicaid benefits database (kff.org/data-collection/medicaid-benefits/); and the Medicaid Model Data Lab project (CMS). The team also completely populated the service type metadata field and reorganized the service type designations by collapsing some services into broader categories.

The team then began production of version 2.0. The steps for version 2.0 production were identical to those followed for version 1.0, except that production also included making the necessary changes to the user interface. ESPC Database 2.0 included 1,394 variables, which were organized into 104 unique topic/subtopic combinations, 18 eligibility groups, and 26 service types. The data for version 2.0 were gathered from 20 sources.

During the version 2.0 database rollout meeting, held in April 2012, the team reviewed the changes and new features in version 2.0 and demonstrated the functionality of the database. Once finalized, the team then prepared materials for 508 compliance testing, participated in testing at CMS, and made any changes required by the CMS testers. Version 2.0 and its accompanying User Guide, posted to the CMS website on July 10, 2012, are available at http://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/Medicaid_CHIP_ESPC.html.

Redesign and Production of ESPC Database 3.0

Redesign and production of ESPC Database 3.0 was similar to that of version 2.0. Based on feedback received during the rollout meeting in April 2012, a brainstorming session, and discussions with CMS, the team developed the Year 3 Database Design Report. IMPAQ and RTI presented the design report to the TEP and other stakeholders at the annual TEP meeting, held in July 2012. Based on TEP feedback, the team revised the design report.

ESPC Database 3.0 enhanced the version 2.0 user interface in the following ways:

1. Redesigned the Introduction page to make the form more compact.
2. Updated the Variable Search form by adding data source as a search criterion, adding a Boolean operator for keyword searches, relocating the 'Clear Search Criteria' button, moving the variable report and export options to a separate form, and adding a button to access the new "Topic/Subtopic Logic Document."
3. Added the existing Data Availability field to the Select Variables from List form.
4. Enabled the user to navigate among the Search Variables, Select States and Dates, and Export Data to File forms without returning to the Main Menu.
5. Allowed the user to browse the data prior to data export.

ESPC Database 3.0 also improved upon the content of version 2.0 by:

1. Optimizing the database's topical organization. This increased the number of topic/subtopic combinations represented in the database.
2. Updating the data for existing variables and including additional variables in the database.

ESPC Database 3.0 included 1,612 variables, which are organized into 263 unique topic/ subtopic combinations, 30 eligibility groups, and 45 service types. The complete list of all variables included in version 3.0 is provided in a separate document entitled, "ESPC 3.0 Variable List." The data for version 3.0 were gathered from 20 sources. The team held a combined database rollout/TEP meeting in June 2013.

Appendix A contains additional information on the interface design for version 3.0; an overview of the code used to implement the user interface and the location of that code in the database; a description of the basic job stream executed by the database; the database's entity-relationship diagram; and the data dictionary for the database. Although the material in Appendix A reflects the ESPC Database 3.0 user interface, much of this information is applicable to versions 1.0 and 2.0.

Once version 3.0 was finalized, the project team prepared materials for 508 compliance testing, participated in testing at CMS, made the changes required by the CMS testers, and passed 508 compliance review.

2.C Dissemination Activities

The TEP, CMS, and other stakeholders indicated that the ESPC Database is a useful resource for researchers considering cross-state differences in Medicaid programs and the effects of those differences on important outcomes. Thus, the ESPC team engaged in several dissemination activities intended to educate potential users of the database on its availability and utility in conducting Medicaid research. Because dissemination activities were not explicitly included in

the ESPC contract, we did not set aside funds for these activities. However, IMPAQ leveraged its AcademyHealth institutional membership to support dissemination efforts. To disseminate information on versions 1.0 and 2.0, IMPAQ submitted announcements to the AcademyHealth quarterly newsletter, which provided general background on the database and the URL from which users could download the database.

In addition, IMPAQ presented information on the ESPC Database at health policy conferences. During the 2011 AcademyHealth Annual Research Meeting (ARM), IMPAQ provided ESPC-related printed materials at the Innovation Station (a conference-sponsored facility at which conference participants could browse the Internet and learn about innovative tools available to support research). During the 2012 ARM, IMPAQ provided printed materials and also conducted a database demonstration at the Innovation Station. In addition, we presented the ESPC Database and gave a demonstration as part of a panel titled "Getting the DIRT [Data for Innovation, Research, and Transparency] on Medicare and Medicaid Public Use Files." At the 2013 ARM, IMPAQ presented two analytic studies that demonstrate the utility of the ESPC database. Finally, at each ARM, the IMPAQ booth in the exhibition hall displayed printed materials on the ESPC Database.

2.D Features of the ESPC Database to Support Future Releases

This section describes several features of the ESPC Database that facilitate data updates, incorporation of additional database content, and database maintenance. We also provide guidance on updating the database.

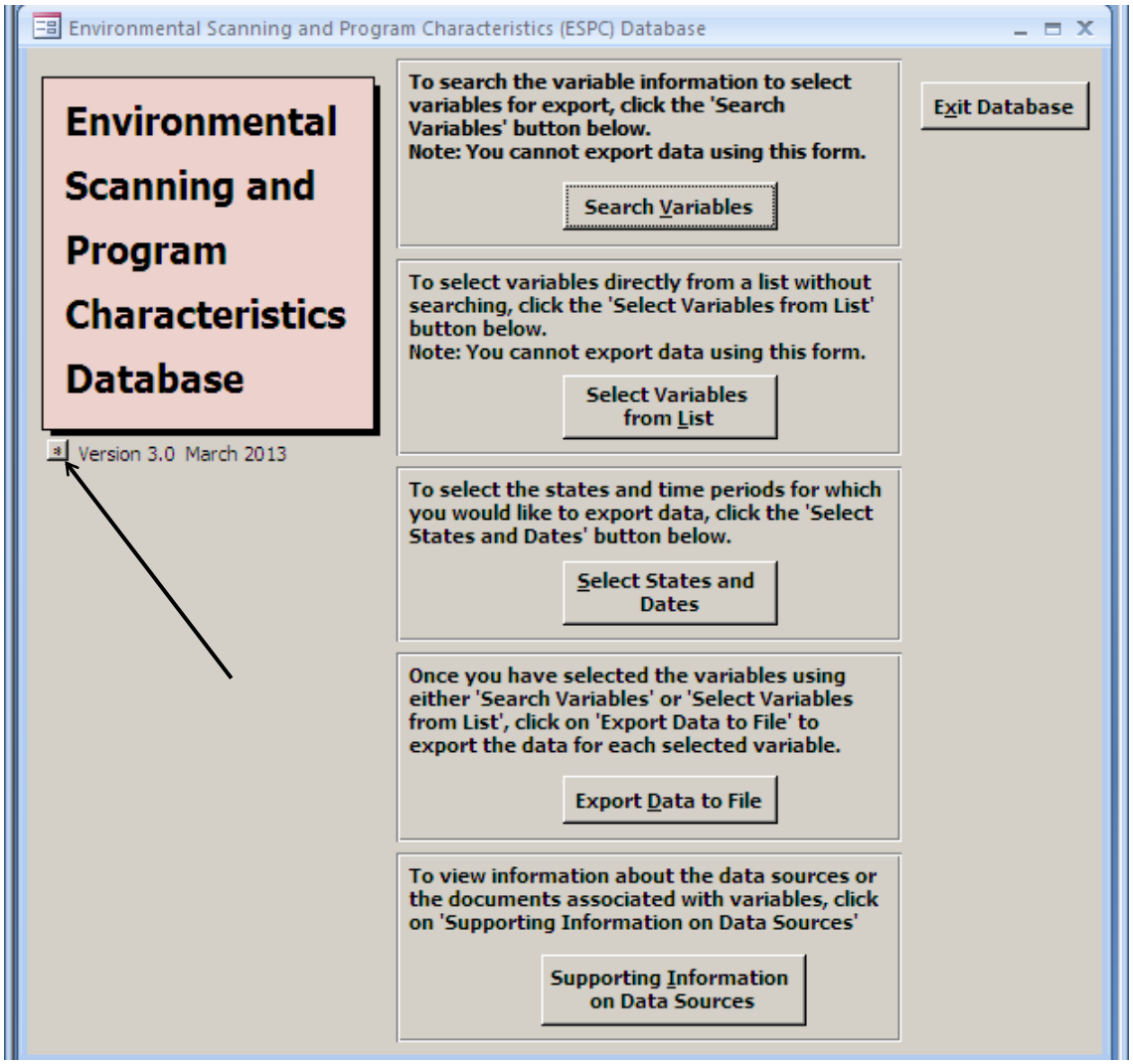
Revising or Adding Database Content

To produce the ESPC Database efficiently during the years after the end of the contract, the user interface includes maintenance forms and tools for revising or adding new data to the database. Data entry forms allow users to enter or modify data directly in the database's various tables, including the variables table and its supporting tables, the state programs table, the locations table, the program characteristics table, and the location data table.

In addition, we provide a tool that allows the user to import data, in a specified format, by clicking a button and choosing the file to be imported. Also, experienced MS Access users can create custom queries to modify or add data to the database.

To access the maintenance forms, there is a small button with an asterisk on the Main Menu to the left of the version number under the title block. This button is indicated with an arrow in Exhibit 1. To prevent end users from accidentally opening the maintenance forms, a specific key sequence is required to activate the button. To activate the button, depress the 'Alt' key and right-click on the button.

Exhibit 1: ESPC 3.0 Main Menu with Maintenance Form Button Indicated



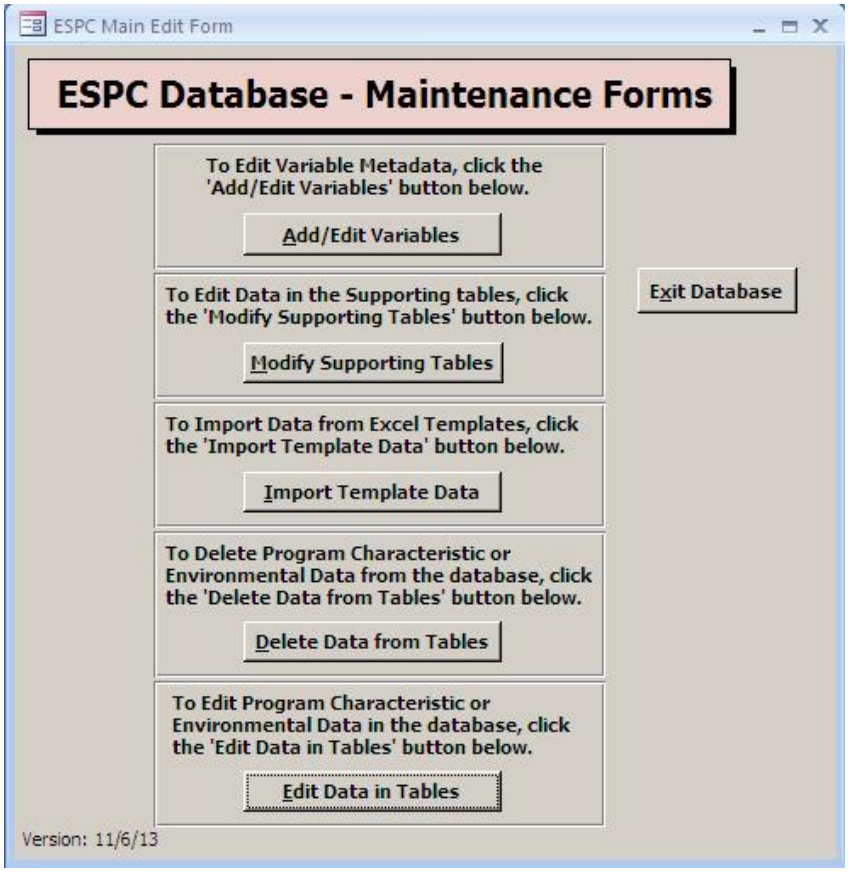
The ESPC Database Maintenance Forms main menu will open, as shown in Exhibit 2. It may open behind the regular Main Menu, so the user may need to click on it to bring it forward. The maintenance main menu has five buttons:

- Add/Edit Variables – opens a form that provides a search form to find existing variables in order to edit their metadata, and an 'Add Variable' button, which opens a form to add a new variable.
- Modify Supporting Tables – opens a form that provides buttons to open forms to edit or add records in each of the supporting and lookup tables.
- Import Template Data – opens a form that enables the user to import Excel template files containing electronic data into the ESPC Database. There is also a 'Download Templates' button that opens another form from which the user can view and download

the Excel template files used to import data. There are three types of templates: environmental, program, and program waivers.

- Delete Data from Tables – opens a form that enables the user to select a specific variable and time period, and then click a button to delete associated data from the database.
- Edit Data in Tables – opens a form that enables the user to select a specific variable and time period and then click a button to open a form from which the user can modify the values in the database.

Exhibit 2: Maintenance Forms Main Menu



One of the most time-consuming aspects of importing new data into the ESPC Database is arranging the data into the format required by the import templates. Simple tables can be cut and pasted into the templates, but three data sources have specific formats that require more involved data manipulation:

- Kaiser Family Foundation Biennial Medicaid Benefits Database (kff.org/data-collection/medicaid-benefits/) – These data were provided in an Access database, which we used to develop queries that exported to Excel the necessary data in the template

format. Assuming that the format of the Kaiser database remains the same in future years, the same queries can be reused for updates provided by the Foundation.

- Mathematica Waiver Crosswalks (www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/MAXGeneralInformation.html) – The Crosswalks are Excel files that require state program names to be matched to existing names or added as new state programs. The waiver data also require the waiver type and waiver ID to differentiate among programs within a state that have the same program name, but different characteristics. Program begin and end dates are updated in the state programs table with each new data file.
- Medicaid Managed Care Summary Report (www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MedicaidDataSourcesGenInfo/DescStateProg.html) – The Summary Reports were provided in an Access database with a complex data structure that required significant preprocessing to combine multiple responses into fewer variables. The Summary Reports also require that state program names be matched to existing names or added as new state programs. After completing preprocessing, the data can be exported to Excel in the required template format. As in the case of the biennial Medicaid Benefits Database, queries can be reused for each new Managed Care Summary Report data file (assuming that the structure of future Summary Report databases remains the same).

As mentioned previously, the user can also create custom queries in the ESPC Database to add data directly to the tables. However, the code that imports data from the data templates has built-in error checking routines that may make imports from the templates more efficient overall.

Finalizing the ESPC Database

When a new version of the database is ready to be submitted to CMS for approval, 508 compliance review, and posting to the CMS website, it is advisable to first compact the database to recover any unused space. A final step after 508 clearance but prior to posting the database is to create a runtime package of the database using the MS Access developer tools.

Upgrades from the current version of the ESPC Database (Access 2007) to more recent versions of MS Access should be straightforward. If Microsoft does not provide a direct conversion process, then a new database in the most recent version of Access can be created and the tables, queries, forms, reports, and modules can be imported from the old version. The development team should test the database to verify that all code still works in the new software version. Any failures should be corrected by adjusting the code. Internet searches generally yield documentation on changes made in the most recent software version and any modifications required to ensure that the database is fully functional.

SECTION 3: ANALYTIC STUDY

3.A Background

The ESPC Database contract included a task to conduct two analytic studies using the information from the ESPC Database in conjunction with other data. The team selected the MAX data to illustrate the value of the ESPC database.

The first study describes trends in the use of antipsychotic drugs among children enrolled in Medicaid. According to a 2011 study based on a nationally representative sample, the number of antipsychotic medications prescribed by doctors during visits increased from 6.2 million in 1995 to 16.7 million in 2008.[1] Other studies indicate that this trend may also be occurring for psychotropic medications other than antipsychotics and may apply to vulnerable populations. A 2011 GAO report examined the use of psychotropic medications among Medicaid-enrolled children in five states (Florida, Massachusetts, Michigan, Oregon, and Texas) and found that hundreds of children received prescriptions for concomitant use of five or more psychotropic medications even though there is no supporting evidence for such regimens.[2] A recent Kaiser Family Foundation report noted that atypical antipsychotics are increasingly being prescribed by physicians for a variety of disorders for which they are not FDA-approved, including "anxiety, attention-deficit disorder, sleep difficulties, behavioral problems in toddlers and dementia."[3] Our central questions are: How have antipsychotic drug utilization rates changed over time from 2005 through 2009 (the most recent available data)? What factors drive the changes observed over time?

The second study examines racial and ethnic disparities in antipsychotic drug utilization among children enrolled in Medicaid. The 2001 Surgeon General's Report on Mental Health concluded that there are serious disparities in mental health service utilization across racial and ethnic groups in the general population despite similar prevalence rates of mental health disorders.[4] A limited number of studies have reported similar disparities for children. Overall, these studies have concluded that minorities, especially Hispanics, have a much lower level of mental health service utilization compared to White children.[5,6] Experts have indicated that more analyses are needed to explain the observed disparities. Specifically, these experts have pointed to the importance of generating data on the disparities in use of antipsychotics disaggregated by demographic categories or specific conditions.[7] This research avenue is particularly relevant for Medicaid populations because Medicaid data provide race and ethnicity identifiers, whereas commercial insurance data generally do not. Our central questions are: How do antipsychotic drug utilization rates differ by race and ethnicity? Do disparities in race and ethnicity remain after controlling for changes in children's characteristics (e.g., demographics and Medicaid eligibility basis)?

3.B Data and Methods

Data Sources

Data sources for our study include the ESPC Database, the MAX Person Summary (PS) file, the MAX Prescription Drug (RX) file and the First Databank. The PS file, which contains one record per Medicaid eligible per year, reports demographic, eligibility, enrollment, and summary utilization information. The RX file contains one record for each paid drug claim. Drugs in the RX file were identified by a National Drug Code (NDC). We used the First Databank database, which includes a crosswalk from the NDC to drug type, to identify antipsychotic drugs. Finally, we used the ESPC Database, which houses state-level information on Medicaid and CHIP program characteristics and selected environmental factors. We gathered data from these sources for calendar years 2005–2009 to develop an analytic database.

We used the ESPC Database to select study states. A limitation of the MAX data system is that it may not have complete claims information for children in capitated managed care plans. Therefore, to ensure a representative sample of children in the study states, we selected states with only small percentages of children with full benefits who were also enrolled in comprehensive managed care (i.e., an HMO, HIO, or PACE). Sixteen states had virtually no Medicaid child enrollees with full benefits enrolled in comprehensive managed care (less than 0.5 percent) in 2008.

Prescription drug claims may not be included in the MAX files if they are adjudicated outside the main claims processing system or otherwise stored or processed separately from other claims. Therefore, to identify states whose prescription drug claims might be incomplete, we compared the values of two prescription drug utilization variables across the states: the percentage of full-benefit fee-for-service (FFS) child enrollees with at least one prescription drug claim, and the average FFS drug spending per full-benefit FFS child enrollee. Among the 16 states that met the criterion of low enrollment of children in comprehensive managed care, Alaska, Idaho, Montana, North Dakota, and Utah also had relatively low prescription drug utilization. However, because these states are mostly frontier states, this low utilization may be more related to limited access to health care than to missing data. Nevertheless, because this study does not focus on access to care, we excluded these states. Additionally, we excluded Maine because it did not have a fully functional (Medicaid Management Information System) MMIS and was therefore unable to accurately report its claims data.

We sought study states that represented varied geographic locations; thus, we considered Census region in our selection process. Of the remaining 10 states, five are in the Southeast, two in the Northeast, and one each in the Southwest, Midwest, and West. Three additional states have low rates of full-benefit child enrollees in comprehensive managed care: Iowa has only 2.3 percent, Illinois 9.4 percent, and Colorado 11.7 percent. These states also have a considerable number of children enrolled in full-benefit Medicaid and were added to the study. We dropped the two Southeastern states with the fewest full-benefit child enrollees (Arkansas and Mississippi) and also South Dakota, Vermont, and Wyoming, which have relatively small

Medicaid child populations. The list of states was thus narrowed to eight potential study states: three in the Southeast (Alabama, Louisiana, North Carolina), one in the Northeast (New Hampshire), two in the Midwest (Illinois, Iowa), one in the Southwest (Oklahoma), and one in the West (Colorado).

Finally, as of June 2007, 17 states guaranteed at least 12 months of Medicaid coverage to qualifying children. This feature minimizes churning in Medicaid—the tendency for families to frequently move in and out of coverage as their eligibility changes due to fluctuations in family income and family structure.[8] The team was better able to investigate antipsychotic prescription fills among Medicaid-covered children the longer the durations of their enrollment. For this reason, a disproportionate number of the selected states have guaranteed coverage. Alabama, Illinois, Iowa, Louisiana, and North Carolina all have 12-month guaranteed eligibility for Medicaid-enrolled children.

We transformed the MAX RX files (one for each state and each year) from a claim-level file to a child-year-level file. This procedure resulted in a database containing one record per child for each year that the child was eligible for Medicaid. To accomplish the transformation, we created a set of dichotomous variables, indicating whether or not any antipsychotic drug prescriptions were filled for each child in each of the study years. Using the PS file, we prepared another child-year-level file that contained all individual-level information for the selected study states. The file included age group, race/ethnicity, basis of eligibility, and service utilization summaries. The race/ethnicity variable classifies children into five categories: White, African American, Native American/Alaska Native, Asian, Hispanic (including the designations Hispanic or Latino; and Hispanic or Latin and one or more races), and Hawaiian/multiracial (including native Hawaiian/Other Pacific Islander and one or more races). The age group variable classified children into the following age categories: 2–4 years, 5–11 years, 12–14 years, 15–17 years, and 18–20 years. The basis of eligibility variable was constructed by grouping the categories in the PS file into seven categories: blind/disabled, foster care, poverty, medically needy, Section 1931 (families eligible for Medicaid because they would have received Aid to Families with Dependent Children), other, and unknown. The prepared PS file also retained several service utilization variables, including claim counts for the following services: inpatient hospital, inpatient psychiatric facility, physicians, outpatient hospital, targeted case management, and psychiatric services.

We then created a comprehensive analytic file by merging the child-year data from the prepared PS and RX files. We also constructed an income eligibility limit variable based on information available in the ESPC Database. Next, we applied exclusion criteria at the child-year level. We restricted the sample by excluding records corresponding to individuals under the age of 2 or over the age of 20. We also excluded dual-eligible individuals, undocumented immigrants, and children with limited benefits. To further address the issue of churning, we required that in a particular year: (a) a child was eligible for at least 8 months; or (b) a child with fewer than 8 months of eligibility had ineligibility spells lasting no more than 2 consecutive months. The churning adjustment excluded 5,281,769 child-years. After applying all of these criteria, the study sample included 17,259,423 child-years (5,843,711 children).

Methods

The results presented in this report are based on unadjusted prevalence rates stratified by states, pooled ordinary least squares (OLS) regressions, and regressions with child fixed-effects. Unadjusted prevalence rates are used to provide an overall picture of antipsychotic use. These rates were calculated as the ratio of the number of children who had a prescription filled (either new or refill) during the year to the total number of children in the same year. We used regressions with fixed-effects to estimate the effect of time on utilization while controlling for all observable and unobservable time-invariant child characteristics. The fixed-effects regression parameter estimates can be interpreted as "Holding everything else constant, how much more likely is it that a child will have an antipsychotic fill in 2007 (or some other study year after 2005) relative to 2005?" We also used pooled OLS regressions to study the effect of racial/ethnic groups on antipsychotic prescription probability. Because race and ethnicity are time-invariant characteristics, a fixed-effects approach was not feasible. Pooled OLS regressions combine all child-year observations and treat them as independent data points. By controlling for several covariates in the regressions, pooled OLS allowed us to minimize confounding bias concerns. We conducted robustness checks using alternative techniques, including unadjusted antipsychotic prescription rates stratified by several covariates (such as race/ethnic groups and year), Kaplan-Meier failure rates for antipsychotic prescription, and proportional hazard models for antipsychotic prescription. The results of these additional models (not presented) are consistent with the results and interpretations in this report.

3.C Results

Descriptive results

The mean value of the indicator for any antipsychotic prescription shows that only 2 percent of the child-years in the sample had an antipsychotic prescription fill. Physician services were most common, having 3.3 claims per child per year, followed by psychiatric services, with 3.0 claims per child per year.

The size of the child Medicaid population varied across states. Illinois accounted for 32 percent of records, followed by North Carolina (19 percent), and Louisiana (17 percent). The sample contained similar proportions of African American and White children (37 percent and 38 percent, respectively), followed by Hispanics (15 percent), unknown race (6 percent), Native American/Alaska Native (2 percent), Asian (1 percent), and other (less than 1 percent). Children 5–12 years old represented 41 percent of records, the largest single age group, followed by children 2–4 years old (22 percent), 12–15 years old (14 percent), 15–18 years old (14 percent), and 18–20 years old (9 percent). Male children accounted for roughly half (49.7 percent) of the child-year records.

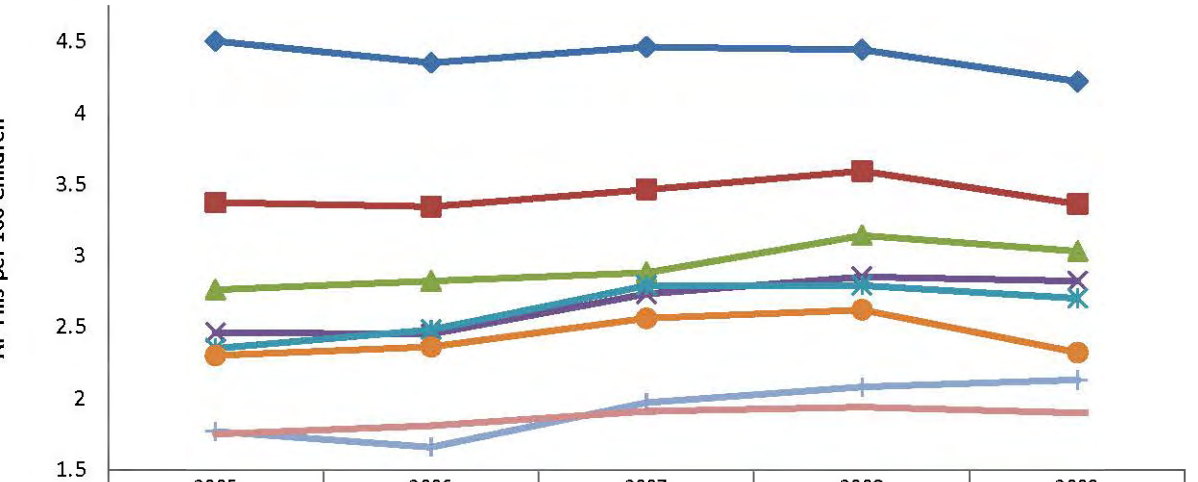
Most children were eligible based on poverty status (75 percent), followed by Section 1931 (13 percent), blind/disabled (5 percent), foster care (4 percent), and other (3 percent). The mean income limit value shows that, on average, across states and years, the income eligibility limit

was approximately 147 percent of the federal poverty level. The year indicators show that although observations are roughly equally distributed over the years, there is a slight increasing trend. Also, the number of eligible Medicaid children increased at a much higher rate in 2009 (9.3 percent) than during the period 2006–2008 (average of 3.3 percent per year). This result may have been due to changes in eligibility criteria and/or the economic downturn.
Summary statistics for all variables included in the analytic file are provided in Exhibit B1 in Appendix B.

Study 1: Antipsychotics Utilization Over Time

Exhibit 3 shows antipsychotic drug utilization rates by state. Overall prevalence rates displayed a wide dispersion across states, ranging from 1.87 to 4.39 per 100 children. In general, antipsychotic drug prevalence increased from 2005 to 2008 but decreased in 2009. Louisiana was the only state that experienced a slight increase in 2009.

Exhibit 3: Rates of Antipsychotic Drug Fills per 100 Medicaid Children, 2005–2009



	2005	2006	2007	2008	2009
IA	4.5	4.35	4.46	4.44	4.22
NH	3.37	3.34	3.46	3.59	3.36
OK	2.76	2.82	2.88	3.14	3.03
NC	2.46	2.45	2.73	2.85	2.82
AL	2.35	2.48	2.79	2.79	2.7
CO	2.3	2.36	2.56	2.62	2.32
LA	1.77	1.66	1.97	2.08	2.13
IL	1.75	1.81	1.91	1.94	1.9

Note: Average antipsychotic drug prevalence rates per 100 children over entire sample period were as follows: Alabama: 2.62; Colorado: 2.42; Iowa: 4.39; Illinois: 1.87; Louisiana: 1.92; New Hampshire: 3.42; North Carolina: 2.67; and Oklahoma: 2.93.

Antipsychotic drug use rates stratified by gender, age, and racial/ethnic categories (not reported) showed patterns similar to those shown in Exhibit 3. Only children aged 18–20 years and African American children of any age displayed an increasing trend in antipsychotic drug

use that continued beyond 2008. This finding suggests that the factors leading to the increasing trend in antipsychotic drug use up to 2009 affected practically all children, regardless of their sociodemographic characteristics.

However, we identified substantial variation by eligibility group. Three eligibility groups—medically needy, Section 1931, and poverty—displayed a decrease or a plateau in 2009, whereas the other three eligibility groups—blind/disabled, foster care, and other—showed increasing trends throughout the sample period.

Exhibit 4 presents the results from two regressions with fixed-effects at the child level. The first two columns correspond to a regression that uses an indicator for any antipsychotic prescription as the dependent variable, and year indicators and time-varying covariates as independent variables. The regression shows that there is a significant increasing trend in use that persists over the 2005–2009 study period; all year indicators are positive and statistically significant at $p<.001$, and parameter estimates for 2006 through 2009 are monotonically increasing. Since the reference year is 2005, positive values for subsequent years can be interpreted as a larger probability of antipsychotic prescription, holding every time-invariant (observed or unobserved) and every observed time-varying factor constant. The coefficient of 0.0027 for 2006 indicates that, on average, a child observed in 2006 was 0.27 percentage points more likely to have an antipsychotic prescription in that year than she was in 2005.

Because all values must be compared to the reference year 2005, the one-year incremental effects must be calculated separately based on the difference between the coefficients for that year and those for the previous year. These calculations yield annual incremental effects of 0.27, 0.38, 0.27, and 0.24 percentage points for 2006, 2007, 2008, and 2009, respectively. This implies an average annual incremental effect of 0.32 percentage points. At the end of the 5-year period, the estimated cumulative effect is equal to the 2009 coefficient, 1.26 percentage points. We included inpatient psychiatric services and outpatient psychiatric services as covariates in the regression; both are positively and significantly associated with likelihood of antipsychotic prescription. The last two columns of the table present the results of the regression that has an indicator for any psychiatric service utilization as the dependent variable. Calculations analogous to those described above indicate that the average incremental effect of an additional year on the likelihood of psychiatric service use is 1.0 percentage point. This regression controls for antipsychotic prescription status, which is positively associated with likelihood of psychiatric service use.

Exhibit 4: Fixed-Effects Regressions with Any Antipsychotic Prescription and Any Psychiatric Services Use as Dependent Variables

	Any Antipsychotic Prescription	Any Antipsychotic Prescription	Any Psychiatric Services	Any Psychiatric Services
	Coefficient	S.E.	Coefficient	S.E.
Age: [Reference: 2-4 years old]				
5-11 years old	0.0005	0.0001	0.0101***	0.0004
12-14 years old	0.0001	0.0002	0.0099***	0.0006
15-17 years old	-0.0022**	0.0003	0.0032***	0.0008
18-20 years old	-0.0128***	0.0004	-0.0582***	0.0010
Year [Reference: 2005]				
2006	0.0027***	0.0000	0.0076***	0.0002
2007	0.0065***	0.0001	0.0168***	0.0003
2008	0.0102***	0.0001	0.0272***	0.0003
2009	0.0126***	0.0001	0.0400***	0.0004
TOS 01 (Inpatient Hospital) Count	0.0046***	0.0002	-0.0099***	0.0006
TOS 04 (Inpatient Psychiatric Facility) Count	0.0133***	0.0004	0.0024***	0.0002
TOS 08 (Physicians) Count	0.0012***	0.0000	0.0061***	0.0000
TOS 11 (Outpatient Hospital) Count	0.0001	0.0000	0.0031***	0.0001
TOS 31 (Targeted Case Management) Count	0.0014***	0.0001	0.0078***	0.0001
TOS 53 (Psychiatric Services) Count	0.0007***	0.0000	--	--
Any Antipsychotic fill	--	--	0.2610***	0.0013
Income Limit	-0.0000***	0.0000	-0.0005***	0.0000
Constant	0.0144	0.0004	0.1410	0.0013

Notes: N=15,774,603 child-years in 5,396,160 groups. * p<0.05, **p<0.01, *** p<0.001. TOS: type of service.

Study 2: Demographic Disparities

Exhibit 5 presents the results of two pooled OLS regressions (linear probability models). The first two columns present the probability model of antipsychotic prescription status on demographic characteristics and other covariates. The next two columns present the probability model of Any Psychiatric Services on the same set of characteristics and covariates (except for the Any Antipsychotic Prescription and Any Psychiatric Services Use indicators). The Any Antipsychotic Prescription model shows that White children (reference category with a coefficient set to 0) have higher antipsychotic fill probability. Holding everything else constant, in comparison to White children, the probability of having an antipsychotic fill is 1.8 percentage points lower for African Americans, 1.5 percentage points lower for Native American/Alaska Natives, 2.0 percentage points lower for Asians, 1.8 percentage points lower for Hispanics, and

1.3 percentage points lower for Hawaiian/Multiracial children. All race/ethnicity estimates are statistically significant at p<.001.

The Any Psychiatric Services model uses an indicator for any psychiatric services set to unity if the child received psychiatric services during the year and zero otherwise. Whites (reference category with coefficient set to zero) are more likely to receive psychiatric services than any other racial/ethnic group, followed by Hawaiian/Multiracial, African Americans, Native Americans/Alaska Natives, Hispanics, and Asians, who are the least likely to receive psychiatric services. The racial/ethnic disparities are larger for Any Psychiatric Services compared to the Any Antipsychotic Prescription model. An example worth noting is the case of Asian children: holding everything else constant, Asians are 6.6 percentage points less likely to receive any psychiatric services than are Whites.

Exhibit 5: Pooled OLS Regressions with Any Antipsychotic Prescription and Any Psychiatric Services Use as Dependent Variables

	Any Antipsychotic Prescription	Any Antipsychotic Prescription	Any Psychiatric Services	Any Psychiatric Services
	Coefficient	S.E.	Coefficient	S.E.
Age: [Reference: 2–4 years old]				
5–11 years old	0.0152***	0.0001	0.0107***	0.0011
12–14 years old	0.0267***	0.0002	0.0355***	0.0002
15–17 years old	0.0274***	0.0002	0.0389***	0.0003
18–20 years old	0.0224***	0.0002	-0.0212***	0.0004
Male	0.0118***	0.0001	0.0255***	0.0002
Year [Reference: 2005]				
2006	0.0003***	0.0001	0.0059***	0.0002
2007	0.0014***	0.0001	0.0131***	0.0002
2008	0.0026***	0.0001	0.0220***	0.0002
2009	0.0016***	0.0001	0.0329***	0002
Race [Reference: White]				
African American	-0.0180***	0.0001	-0.0245***	0.0002
Native American/Alaska Native	-0.0149***	0.0004	-0.0283***	0.0008
Asian	-0.0201***	0.0003	-0.0663***	0.0007
Hispanic	-0.0178***	0.0001	-0.0375***	0.0003
Hawaiian/Multiracial	-0.0130***	0.0009	-0.0225***	0.0015
Income Limit	-0.0000	0.0000	-0.0006***	0.0000
Eligibility [Reference: Blind/Disabled]				
Section 1931	-0.0874***	0.0006	-0.0805***	0.0008
Foster Care	-0.0236***	0.0009	0.0521***	0.0011
Poverty	-0.0910***	0.0006	-0.1054***	0.0007
Medically Needy	-0.0936***	0.0011	-0.1078***	0.0020

	Any Antipsychotic Prescription	Any Antipsychotic Prescription	Any Psychiatric Services	Any Psychiatric Services
	Coefficient	S.E.	Coefficient	S.E.
Other	-0.0839***	0.0006	-0.0938***	0.0009
Unknown	-0.0934***	0.0066	-0.1424***	0.0111
State [Reference: AL]				
CO	0.0086***	0.0003	-0.0522***	0.0006
IA	0.0190***	0.0004	-0.0530***	0.0006
IL	0.0055***	0.0002	0.0064***	0.0004
LA	0.0032***	0.0003	-0.0323***	0.0006
NC	-0.0046***	0.0002	0.0120***	0.0005
NH	-0.0001	0.0006	0.1351***	0.0012
OK	0.0061***	0.0003	0.0546***	0.0007
TOS				
TOS 01 (Inpatient Hospital) Count	0.0034***	0.0003	-0.0159***	0.0006
TOS 04 (Inpatient Psychiatric Facility) Count	0.0307***	0.0006	0.0087***	0.0003
TOS 08 (Physicians) Count	0.0017***	0.0000	0.0072***	0.0001
TOS 11 (Outpatient Hospital) Count	0.0002***	0.0000	0.0034***	0.0001
TOS 31 (Targeted Case Management) Count	0.0018***	0.0000	0.0141***	0.0001
TOS 53 (Psychiatric Services) Count	0.0014***	0.0000	—	—
Any Antipsychotic Fill	—	—	0.4617***	0.0011
Constant	0.0800***	0.0007	0.2428***	0.0010

Notes: N=15,772,272, *** p<0.001.

3.D Discussion and Conclusions

Antipsychotics Utilization Over Time

Past studies have found a persistent increasing trend in antipsychotic use among children.[9-11] The unadjusted rates reported in this study confirm an increasing trend in antipsychotic prescription rates among Medicaid children during the period from 2005 to 2008. Although the states included in this study were not chosen to be nationally representative, this result was confirmed across practically all study states, demographic groups, and eligibility basis categories. As other studies have noted, increases in the rate of antipsychotic use have important implications. First, the health consequences of the prescription of antipsychotics for off-label use are concerning; some studies have questioned the safety and effectiveness of off-label atypical antipsychotic use.[12] Second, given that antipsychotics are among the most costly drug classes for Medicaid programs,[13] the cost-effectiveness of antipsychotic prescription is questionable, especially when the health consequences are unclear and alternative treatments such as therapy exist. Third, atypical antipsychotics are known to have important adverse

metabolic effects, especially weight gain,[14] and Medicaid-enrolled children are already at higher risk for obesity. By showing how robust these trends in antipsychotic use are across demographic groups, this study provides additional evidence about the magnitude of each of these problems. Importantly, our results also show an increasing trend in psychiatric service use not explained by the increase in antipsychotic use. Future studies should consider the possibility that both trends are driven by the same causes.

This study also shows that the increasing trend in antipsychotic prescription ended in 2008; in aggregate, the rate of antipsychotic fills decreased in 2009. We found that the change in trend in 2009, although common across most states and demographic groups, occurred in only half of the eligibility groups; the medically needy, Section 1931, and poverty categories display a plateau in 2009. For the other three categories—blind/disabled, foster care, and other— the increasing trend continued. A possible interpretation of these findings is that a new pattern in antipsychotic prescription emerged in 2009. For instance, the concerns voiced by experts through academic channels and the media may have resulted in lower levels of antipsychotic prescription for children. However, other explanations are also plausible. The descriptive statistics in this study demonstrate that the number of eligible Medicaid children increased at a much higher rate in 2009 (9.3 percent) than from 2006 to 2008 (average of 3.3 percent per year). This aligns well with the fact that between 2008 and 2009, multiple states relaxed their eligibility criteria.[15] If the newly enrolled children in 2009 had fewer psychiatric or behavioral problems than current enrollees, then the 2009 decrease in antipsychotic prescription may not reflect a lower propensity among physicians to prescribe antipsychotics, but rather a change in the population mix. In this case, the reduction in the antipsychotic fill rate would be an artifact of an expanded denominator rather than the result of behavioral change by providers or by the children and their families. Also, it might imply that the concerns raised by researchers have resulted in reduced antipsychotic use.

The results from the fixed-effect regressions favor the interpretation that the 2009 decrease was due to a change in the population mix rather than a behavioral change. As the results show, the year indicator coefficients from this model are all positive and statistically significant —not only for the period from 2005 to 2008, but also for 2009. Because fixed-effects estimates are mainly identified through within-child variation, the coefficients can be interpreted as the average change that would result if the same child were followed over time. In other words, because the year coefficients increase monotonically over time, the same child would be more likely to fill an antipsychotic prescription in 2009 compared to 2008 and any other year prior to 2009. Any reduction in the antipsychotic propensity in 2009 must therefore result from a change in the population mix.

In sum, our analyses suggest that the considerable dip in antipsychotic prescription observed among Medicaid children in 2009 does not result from changes in the behavior of providers or children and their families. Rather, it is the result of a change in the child Medicaid population. The most immediate policy recommendation is to educate providers, children, and their families about the safety concerns related to antipsychotic drugs that researchers have raised. Also, our findings that the upward trend has continued and that a substantial proportion of

children receive antipsychotic prescriptions unaccompanied by psychiatric services are concerning. Previous studies have found that up to 75 percent of children on antipsychotic drugs received these medications for off-label use.[16] Policymakers might consider providing incentives to encourage better monitoring of children who are prescribed antipsychotic drugs and also to provide complementary treatment.

Demographic Disparities

The 2001 Surgeon General's Report on Mental Health concluded that there are serious disparities in mental health service utilization across racial/ethnic groups in the general population despite similar prevalence rates of mental health disorders.[4] A limited number of studies have reported similar results for the child population. Overall, these studies have concluded that racial/ethnic minorities, especially Hispanic children, have a much lower level of mental health service utilization compared to White children.[5,6] Similar findings have been reported in studies focused primarily on the use of psychotropic medications, which include antipsychotics. For instance, there is evidence that White children have consistently higher prevalence rates of psychotropic medication use compared to other racial/ethnic groups, especially African Americans, Hispanics, and Asians.[7, 17-20]

The means by which a child is referred to or enters into the mental health service system may influence racial/ethnic differences in mental health service utilization and AP use, as well as a child's adherence to treatment recommendations. A study found that African-American youth were more likely to be referred to mental health services by child welfare and juvenile justice systems and less likely to be referred by schools than were White youth.[21] Hispanics were more likely than Whites to be referred to mental health services by family and less likely to enter services through a mental health agency or school. Contact with the juvenile justice system may be a negative predictor of mental health service use. [22] Also, among Medicaid-enrolled children, African-American children with schizophrenia were less likely to adhere to antipsychotic treatment regimens than were Whites, and Whites with depression were more likely to receive antidepressants than were African-Americans.[23]

Our unadjusted rates are consistent with these findings. We found substantial disparities in antipsychotic prescription across racial/ethnic groups among Medicaid-enrolled children throughout the 2005–2009 study period. White children had consistently higher antipsychotic prescription rates; Asian and Hispanic children had much lower cumulative incidence rates compared to other groups. Antipsychotic drug utilization rates among African Americans fell between those of Whites and Asians and Hispanics. These descriptive results were formally tested using OLS regression analysis.

The pooled OLS regression analysis reported in this study shows that the disparities persist after controlling for a large number of covariates that may be confounded with race/ethnicity in the rate calculations, including state, year, age group, gender, eligibility category, and number of services received. Holding everything else constant, Asians are 2.0 percentage points less likely, and Hispanics 1.8 percentage points less likely, to receive an antipsychotic prescription than are

Whites (p<.001 for all results). Importantly, since the regression controls for the number of psychiatric services received by the children, we may conclude that the higher use of antipsychotics among Whites is not driven by a higher use of mental health services (parameter estimates for race/ethnicity dummies remain statistically significant in the presence of the psychiatric services use variable).

The regression model with psychiatric services as the dependent variable shows that there are also statistically significant (p<0.001) disparities in the use of psychiatric services across race/ethnicity groups. Because this model controls for the use of antipsychotics, we can conclude that White children's higher use of psychiatric services is not driven by their more prevalent use of antipsychotics. Altogether, the regressions suggest that Whites are more likely to have any mental health treatment (either pharmacological or therapeutic), and that these two treatment types do not necessarily accompany each other. This important finding implies that a cultural explanation based on a higher acceptance of pharmacological treatment among Whites is unlikely, because that argument fails to explain the fact that Whites also display higher utilization of psychiatric services.[24] We cannot, however, discard the possibility that the lower utilization of any treatment by racial/ethnic minorities might result from a more pronounced distrust of the mental health care system. Such an explanation would be based on a higher aversion to both pharmacological treatments and therapeutic treatments.

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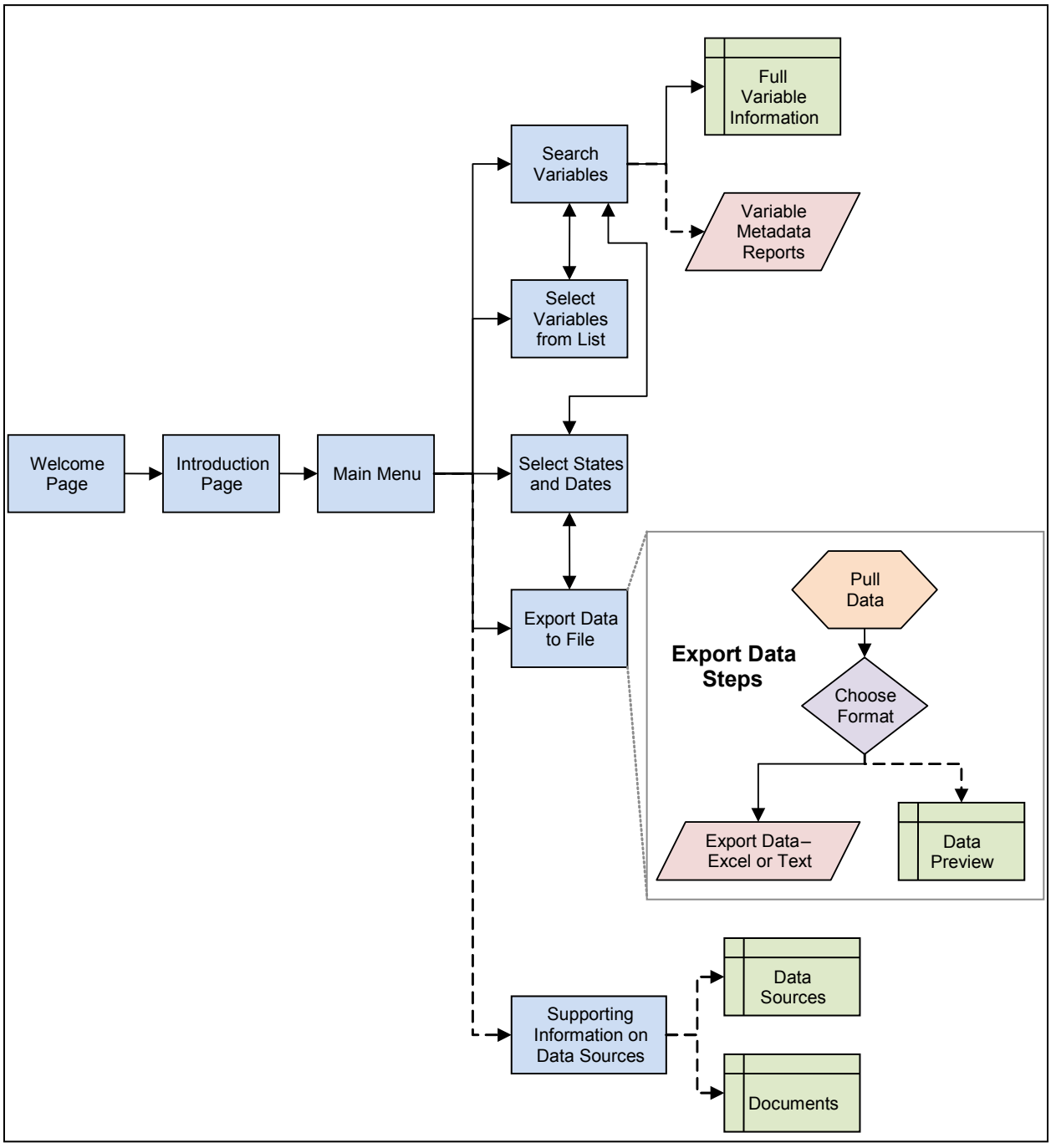
APPENDIX A: ESPC DATABASE DESIGN

This appendix is intended to assist database programmers in understanding the design of the ESPC Database user interface. We first provide an overview of the user interface, including a system flowchart. Next, in the interface code overview, we describe how we used Structured Query Language and Visual Basic to develop the interface, and also provide the locations of code in the database. We also describe the major job stream, selecting and exporting data, implemented by the interface. The entity relationship diagram gives an overview of the various tables included in the ESPC Database and how they relate to one another. Finally, we include a data dictionary listing all tables and the variables.

A.1 Interface Design

The primary purpose of the ESPC Database user interface is to assist users in searching the variable metadata to identify the data to be extracted from the database, select the desired states and time frames, and export the data from the database. To fulfill these requirements, the user interface uses the built-in forms application in Microsoft Access. The system flowchart shown in Exhibit A1 depicts the overall layout and flow of the user interface forms. The plain squares, in blue, represent the basic forms used in the interface; the bordered squares, in green, represent forms where actual data stored within the database are viewed; and the parallelograms, in pink, represent forms from which data are exported. The export data steps enclosed in the box represent the steps to export data provided on the Export Data to File form. The lines between the objects indicate the paths from which each form can be accessed: the solid lines indicate the typical paths used to perform the basic functions to identify and export data, and the dashed lines indicate the paths to access optional information.

Exhibit A1: ESPC User Interface System Flowchart



When the application first opens, the Welcome Page appears. This page is simply a title form with a 'Begin' button to continue to the Introduction Page. The Introduction Page displays some background information on the database and an 'ESPC Database' button to continue to the Main Menu of the interface, from which all of the other forms are accessed.

The Main Menu contains five buttons that correspond to the five blue squares with arrows from the Main Menu in the system flowchart.

- The 'Search Variables' button opens a search form on which users can enter criteria to search the variable metadata. Once they enter their search criteria, they can either view the resulting variables in the Full Variable Information form or the Search Variables from List form. From either form, users can view the variable metadata and select variables for which they wish to export data. Users also have the option to open the Variable Metadata Reports form from which variable metadata can be viewed or printed in report format or can be exported to Excel or tab-delimited text files. There is also a 'Proceed to Select States and Dates' button that enables users to go directly to the Select States and Dates form without returning to the Main Menu.
- The 'Select Variables from List' button opens the same Search Variables from List form that is opened from the Search Variables form, but all variables in the database will be listed instead of those filtered by the search criteria. The user can scroll through this list and select variables. There is also a 'Go To Search Variables' button that enables the user to go directly to the Search Variables form without first returning to the Main Menu.
- The 'Select States and Dates' button opens a form from which users can select the states and date range from which they wish to export data. This form also has buttons to proceed directly to the Export Data to File form, or return directly to the Search Variables form.
- The 'Export Data to File' button opens a form that contains the steps for exporting the data for the selected variables, states, and date range (described further in Section C of this appendix). On the form, there is also a 'Return to Select States and Dates' button that enables the user to return directly to the Select States and Dates form without first returning to the Main Menu.
- The 'Supporting Information on Data Sources' button opens a form with two buttons: 'View All Data Sources' and 'View All Documents.' The 'View All Data Sources' button opens a form listing all of the data sources included in the ESPC Database, together with information on each data source. The 'View All Documents' button opens a form that allows the user to review all of the documents that are associated with various variables.

The Export Data to File form contains multiple steps for exporting data from the ESPC Database. These steps are shown in the Export Data Steps box on the system flowchart. Because the user has previously selected the variables, states, and date range for export, the first step in the export process is to pull the data for the selected variables in preparation for export. The next step is to select the format in which the data will be exported: standard or long. The standard format uses the variable names as column headers; the long format has variables names as row headers. The final step is to export the data as an Excel file or a tab-delimited text file. There is also an option to preview the data in either the standard or long format.

A.2 Interface Code Overview

The ESPC Database is implemented using Microsoft Access database software. The Access database file contains the user interface, all the data tables and code related to the interface. The user interface was implemented using the built-in forms package in Access. Two types of code are used to implement the functionality of the user interface forms: Microsoft Access Structured Query Language (SQL) and Visual Basic 6.5, also known as Visual Basic for Applications (VBA). The code can be found in four locations in the database file:

- Queries use SQL code to select data from the data tables. Queries can be used by forms, reports, or modules. To view the SQL code, the queries can be opened in design view or SQL view. Design view provides a graphic representation of the SQL code while SQL view is the basic SQL text code. Some queries, such as union queries, can only be opened in SQL view.
- Forms use VBA to implement functionality such as opening or closing a form when a button is clicked. This VBA is stored directly with the form and can be viewed by clicking the 'View Code' menu option when a form is open in design view.
- Reports use VBA to implement functionality such as returning a message to the user when there are no data to display in the report. This VBA is stored directly with the report and can be viewed by clicking the 'View Code' menu option when a report is open in design view.
- Modules use VBA to implement functions or processes that can be called from any of the forms. These are common functions such as exporting files or more complex processes that are easier to manage if stored separately from the forms that call them. The code can be viewed by opening the modules in design view.

A.3 Job Stream

There is one major job stream implemented by the ESPC Database user interface: export data of interest to the user from the database for the states and time frame requested.

This job stream is implemented by the user interface in the following steps:

1. Using the variable metadata, the user identifies the variables of interest.
    - The user enters search criteria on the Search Variables form to filter the variables, and then views the resulting variables and their metadata to select those of interest. Users can choose variables either from the Full Variable Information form or the Select Variables from List form.
    - Alternatively, the user selects variables directly from the Select Variables from List form without first filtering the variables by using search criteria.

2. Using the Select States and Dates form, the user selects the states for which data will be exported.

3. Using the Select States and Dates form, the user enters a date range for which data will be exported.

The following steps are illustrated in Exhibit A1 in the Export Data Steps box.

4. On the Export Data to File form, the user clicks a button to pull the data for the selected variables. In preparation for export, the interface populates a table using data from the main database tables.

5. Also on the Export Data to File form, the user selects the format for the exported data: standard or long. The standard format, selected by default, uses the variable names as column headers, and the long format uses variable names as row headers.

6. The user optionally previews the data to be exported by clicking a button on the Export Data to File form. The format of the previewed data depends on the format selected in the previous step.

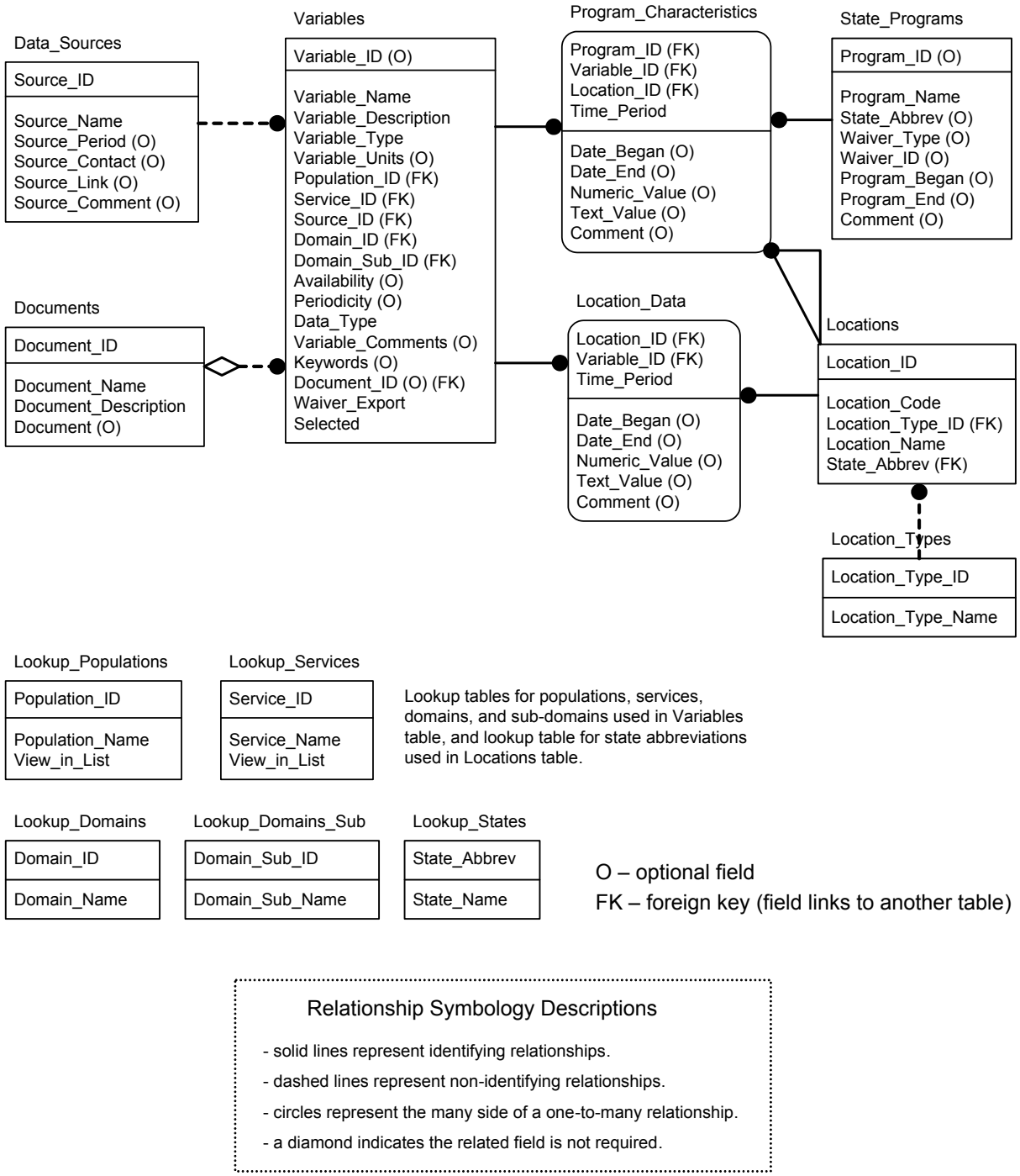
7. Finally, the user clicks on either the 'Export Data to Excel File' or the 'Export Data to Text File' button to export the data, together with the associated variable metadata, to an Excel file or tab-delimited text file as indicated by the user.

A.4 Entity Relationship Diagram

This section provides the entity relationship diagram for the ESPC Database 3.0. The diagram provides a graphic representation of the overall database design and may be helpful for database programmers. The diagram displays each table, the keys for each table, fields within each table, and the relationships among tables.

ESPC Database Entity Relationship Diagram

Exhibit A2: Entity Relationship Diagram



Relationship Symbology Descriptions

- solid lines represent identifying relationships.
- dashed lines represent non-identifying relationships.
- circles represent the many side of a one-to-many relationship.
- a diamond indicates the related field is not required.

A.5 Data Dictionary

This section provides the data dictionary for ESPC Database 3.0. For each table in the database, the dictionary provides a description of the table, the fields included in the table, and information about each field (data type, field length, and field description).

Data_Sources			
Description: Information about the sources of data			
Field Name	**Type**	**Size**	**Description**
Source_ID	Long Integer	4	Unique numeric data source Id
Source_Name	Text	150	Data source name
Source_Period	Text	100	Date source time period
Source_Contract	Text	150	Data source contact information
Source_Link	Memo	0	Data source web link
Source_Comment	Memo	0	General data source comment

Table: Documents			
Description: Documents containing additional information about the variables/characteristics			
Field Name	**Type**	**Size**	**Description**
Document_ID	Long Integer	4	Unique numeric document Id
Document_Name	Text	100	Name given to document
Document_Description	Text	255	Description of document
Document	Long Binary	0	Actual document blob

Table: Location_Data			
Description: Data that pertain to each variable for each location			
Field Name	**Type**	**Size**	**Description**
Location_ID	Long Integer	4	Location Id associated with each value
Variable_ID	Long Integer	4	Variable Id associated with each value
Time_Period	Text	25	Time period associated with each value (e.g., "2000" or "May 2005")
Date_Began	Date	8	Date value for the begin date of the time period over which the data is valid
Date_End	Date	8	Date value for the end date of the time period over which the data is valid
Numeric_Value	Double	8	Numeric value
Text_Value	Text	255	Text value
Comment	Text	255	General data point comment

Table: Location_Types			
Description: Locational/geographic types contained in the database			
Field Name	**Type**	**Size**	**Description**
Location_Type_ID	Long Integer	4	Unique numeric location type Id
Location_Type_Name	Text	15	Location type name (e.g., "state" or "county")

Table: Locations			
Description: List of geographic locations in the database			
Field Name	**Type**	**Size**	**Description**
Location_ID	Long Integer	4	Unique numeric location Id
Location_Code	Text	25	Location code such as state fips or county fips codes
Location_Type_ID	Long Integer	4	Location type Id associated with each location (linked to Location_Types table)
Location_Name	Text	150	Location name
State_Abbrev	Text	2	State abbreviation associated with each location

Table: Program_Characteristics			
Description: Data that pertain to each characteristic for each program			
Field Name	**Type**	**Size**	**Description**
Program_ID	Long Integer	4	Program Id associated with each value
Variable_ID	Long Integer	4	Variable Id associated with each value
Location_ID	Long Integer	4	Location Id associated with each value
Time_Period	Text	25	Time period associated with each value (e.g., "2000" or "May 2005")
Date_Began	Date	8	Date value for the begin date of the time period over which the data is valid
Date_End	Date	8	Date value for the end date of the time period over which the data is valid
Numeric_Value	Double	8	Numeric value
Text_Value	Text	255	Text value
Comment	Text	255	General data point comment

Table: State_Programs			
Description: List of State Programs in the database			
Field Name	**Type**	**Size**	**Description**
Program_ID	Long Integer	4	Unique numeric program Id
Program_Name	Text	100	Program name
State_Abbrev	Text	2	State abbreviation to which program applies
Waiver_Type	Text	2	MAX waiver type
Waiver_ID	Text	2	MAX waiver ID (needed to provide unique combination for each program)
Program_Began	Date	8	Date program began
Program_End	Date	8	Date program ended (if applicable)
Comment	Text	255	General program comment

Table: Variables			
Description: List of variables that describes what is being measured for each program or location			
Field Name	**Type**	**Size**	**Description**
Variable_ID	Long Integer	4	Unique numeric variable Id
Variable_Name	Text	55	Variable name
Variable_Description	Text	255	Variable description
Variable_Type	Text	50	Variable type - one of "Environmental" or the program options, "Medicaid", "Medicaid & CHIP", "CHIP", "MCHIP", or "SCHIP"
Variable_Units	Text	50	Variable units (thousands, dollars, etc.)
Population_ID	Long Integer	4	Population Id (eligibility group) associated with each variable
Service_ID	Long Integer	4	Service Id associated with each value
Source_ID	Long Integer	4	Data source Id associated with each variable (linked to Data_Sources table)
Domain_ID	Long Integer	4	Unique Id of associated domain (topic area)
Domain_Sub_ID	Long Integer	4	Unique Id of associated sub-domain (subtopic area)
Availability	Text	255	Data availability of time
Periodicity	Text	255	Periodicity of data
Data_Type	Text	10	Data type - one of "text" or "numeric"
Variable_Comments	Memo	0	General variable comments
Keywords	Text	255	Keywords associated with variable - used in string search along with description
Document_ID	Long Integer	4	Document Id associated with each variable (linked to Documents table)
Waiver_Export	Boolean	1	If true, then data will be exported using a separate export query to include the additional program information
Selected	Boolean	1	If true, then variable has been selected for extraction

Lookup Tables

Table: Lookup_Domains			
Description: Lookup table of variable domains (topic areas)			
Field Name	**Type**	**Size**	**Description**
Domain_ID	Long Integer	4	Unique domain Id
Domain_Name	Text	50	Variable domain (topic area)

Table: Lookup_Domains_Sub			
Description: Lookup table of variable sub-domains (subtopic areas)			
Field Name	**Type**	**Size**	**Description**
Domain_Sub_ID	Long Integer	4	Unique sub-domain Id
Domain_Sub_Name	Text	51	Variable sub-domain (subtopic area)

Table: Lookup_Populations			
Description: Lookup table of populations (eligibility groups)			
Field Name	**Type**	**Size**	**Description**
Population_ID	Long Integer	4	Unique population Id
Population_Name	Text	50	Population name (eligibility group)
View_in_List	Boolean	1	If true, then population selection will be displayed in drop down lists

Table: Lookup_Services			
Description: Lookup table of services			
Field Name	**Type**	**Size**	**Description**
Service_ID	Long Integer	4	Unique service Id
Service_Name	Text	50	Service name
View_in_List	Boolean	1	If true, then service selection will be displayed in drop down lists

Table: Lookup_States			
Description: Lookup table of state abbreviations - provides a lookup function for the State_Abbrev			
Field Name	**Type**	**Size**	**Description**
State_Abbrev	Text	2	Two character state abbreviation
State_Name	Text	50	State name

APPENDIX B: ESPC ANALYTIC STUDY SUMMARY STATISTICS

Exhibit B1: Analytic File Summary Statistics

Variable/Description	Mean	Standard Deviation
Any Antipsychotic Prescription	0.0239	0.1527
Service Counts		
Inpatient Hospital	0.0432	0.2809
Inpatient Psychiatric Facility	0.0229	0.6627
Physicians	3.2932	5.9274
Outpatient Hospital	1.2311	4.0101
Targeted Case Management	0.6780	3.5033
Psychiatric Services	3.0321	22.8037
State		
Alabama	0.0990	0.2987
Colorado	0.0573	0.2324
Iowa	0.0487	0.2153
Illinois	0.3198	0.4660
Louisiana	0.1725	0.3778
North Carolina	0.1877	0.3904
New Hampshire	0.0173	0.1304
Oklahoma	0.0986	0.2981
Race/Ethnicity		
White	0.3849	0.4866
African American	0.3670	0.4820
Native American/Alaska Native	0.0195	0.1381
Asian	0.0113	0.1057
Hispanic	0.1547	0.3616
Hawaiian/Multiracial	0.0049	0.0699
Unknown	0.0577	0.2331
Age		
2-4 years old	0.2244	0.4172
5-12 years old	0.4070	0.4913
12-15 years old	0.1443	0.3513
15-18 years old	0.1367	0.3436
18-20 years old	0.0876	0.2827
Male	0.4965	0.5000
Female	0.5035	0.5000
Eligibility Group		
Blind/Disabled	0.0528	0.2236
Section 1931	0.1318	0.3383
Foster Care	0.0351	0.1841
Poverty	0.7469	0.4348
Medically Needy	0.0019	0.0435
Other	0.0314	0.1743
Unknown	0.0000	0.0051
Income Eligibility Limit (Percent FPL)	147.08	37.73
Year		
2005	0.1852	0.3885
2006	0.1925	0.3943
2007	0.1943	0.3957
2008	0.2044	0.4033
2009	0.2235	0.4167

Notes: n=17,259,423 child-years.