Applying an Enterprise Data Model in Government:

Transitioning to a Data-Centric Information System for Child Welfare in the US

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ABSTRACT

We describe the experience of a sample of US state child welfare organizations that are implementing, or deciding to transition, to a new model of information system, now explicitly recommended by the Department of Health and Human Services of the US Federal Government. The new Comprehensive Child Welfare Information System was intended to replace an older problematic model of information management and draws inspiration from enterprise-level data intensive thinking. It promises to enable states to design systems that meet federal reporting requirements and improve case-related and policy decision making.

CCS CONCEPTS

• Social and professional topics~Governmental regulations • Applied computing~E-government

KEYWORDS

Information systems, enterprise data management, child welfare information systems.

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1 Introduction

In the waning days of the Obama Administration, the US Federal Department of Health and Human Services (HHS) launched an ambitious effort to modernize information system technology used by state child welfare agencies by drawing from contemporary thinking about the advantages of newer enterprise-style data-centric models. The information systems used by state child welfare agencies' exemplify a thorny problem for human services information systems in general and perhaps other government information systems as well: these systems were originally put in place to respond to regulatory frameworks and often operate for decades using legacy software and outdated hardware. Thus, the transition to more contemporary models is highly complex and costly. The new system now promoted by HHS was intended to replace an older and historically problematic model of information management, entitled the Statewide/Tribal Automated Child Welfare Information System (S/TACWIS) [9]. The federal standard since 1993, S/TACWIS has also been the subject of consistent criticism since early in its implementation. Indeed only 23 of the 50 states were able to implement systems certified as compliant with its standards (as of 2015). Imposing 90 feature and functional requirements, the S/TACWIS model was envisioned as a single

comprehensive system that was required to encompass all political subdivisions of child welfare services within a state. Although some states attempted to adapt it for case management, it was generally acknowledged to be designed with information storage in mind. Such a system was deemed necessary because the federal government requires states to collect and report information about adoption, foster care, and child abuse to HHS, which then compiles data across states, makes it publicly available, and uses it for policy making [8]. However, S/TACWIS has come to be regarded more negatively as "a means to pile up information and comply with federal reports" that neither accommodated child welfare workers practices nor was it flexible enough to adjust to changes in federal requirements [4].

In contrast, the new model, the Comprehensive Child Welfare Information System, or CCWIS, is seen as "a bold policy initiative" that promises to serve the "next generation of child welfare information systems" [6] and "to spur innovation across the country and stimulate creative solutions that are closely tailored to the local concerns of IV-E [child welfare] agencies" [1]. The new CCWIS model is viewed as having a "laser" focus on data [1] drawing inspiration from modern enterprise-style strategies [3] because it requires, among other attributes, data exchanges with other state agencies and Child Welfare Contributing Agencies (CWCA) also concerned with child welfare, such as the courts, education, and health care. CCWIS is also viewed as a game changer and an opportunity because agencies expect to be able to design systems that both meet federal reporting requirements and support case management in ways that complement each states' unique child welfare business needs and practices.

The rule defining the CCWIS model was adopted in June 2016; subsequently HHS has given state child welfare agencies until the end of July 2018 to declare their intentions to design and implement a CCWIS compliant system. HHS intends to support efforts to become compliant by contributing generously to the costs of developing an approved system design and to its subsequent operational expenses. Despite this, states have been "gun-shy" about taking on a new system design [4], perhaps because, even with this support, the effort promises to cost tens, and in some cases hundreds, of millions of dollars, for a state to produce. It is also the case that, having declared the intention to design a CCWIS compliant model, states that fail to do so may be required to reimburse the federal government for financial support that has been advanced.

Recently, New York State's Office of Children and Family Services contracted CTG UAlbany to facilitate the decision about whether NYS should adopt the new CCWIS model or stay with their current model. As one part of this project, the research team conducted an "environmental scan" focusing on the decision making processes of other states. Members of the team conducted interviews with child welfare decision makers in 12 states about factors related to their decision making and their views of the challenges posed by the novel data-centric components of the CCWIS requirements. In this paper we report on the information distilled from these interviews. The interviews provide us with insight into how government practitioners perceive the benefits, as well as the challenges, of using a data-centric approach to information system design to support the services they offer to children and families. What opportunities do these practitioners view as compelling arguments in favor of a transition? And what are their trepidations and constraints as they consider the new and somewhat uncharted territory that the CCWIS data-centric requirements move them toward?

We begin by describing the recent "enterprise data management" approach and providing some additional historical context to the use of S/TACWIS systems for child welfare, and the problems with them that eventually became apparent. We contrast the characteristics of S/TACWIS systems with those of the new CCWIS model in order to more clearly understand how the models differ. Based on this comparison of information systems, we derived the two research questions posed in this study, and we discuss the methods that we adopted to pursue them. We conclude by reporting that while most states recognize the advantages of moving to a CCWIS compliant system, they have no tested roadmaps to guide their efforts. Indeed, the transition to CCWIS represents a substantial experiment in this new model of information system design.

2 Comparing Information Systems

2.1 Enterprise Data Management

Within the context of information management, focusing on data, rather than technology, is a relatively new perspective. Corporations have long recognized the crippling effects of maintaining disparate information systems, and have sought to develop strategies for integrating data sets, software, and hardware through "enterprise" data management systems that support interoperability between organizational units. Considerable thought has also been devoted to clarifying how best to use this data to support business needs. By "enterprise data management" we refer to a model of information system management in organizations that focuses first and primarily on data, seeking to "manage heterogeneous data sources, validate the quality of data, devise a common data model by integrating information, build analytical and presentation layers, and manage end-to-end metadata in the analytical and presentation layers" [10]. Among other topics, an enterprise perspective foregrounds data, both its quantity and its quality, as a driver of organizational processes, as well as related operations including data standards, data quality management, governance, and security [10]. Following this example, the federal government and certain state governments, have appointed data management leaders to the role of "chief data officer" (CDO) to help lead *organization-wide* data strategies and "….put data on the organization's business agenda and in the minds of other executives and officers" [7].

Unfortunately, the public sector faces considerable challenges in achieving enterprise-level benefits from their myriad troves of data. We know, for example, that although much government data is voluminous, if not big, and increasingly open, this data is

often housed in agency-controlled data siloes, with infrastructures served by outdated hardware and legacy software. Many government units have little or no tradition of cross-agency collaboration and their employees lack training related to data stewardship. Perhaps of most concern is the absence of overarching state-wide strategies for data sharing and integration that might be used to guide efforts to address these daunting issues. Indeed, there are often legal constraints that diminish the possibility of data sharing. Beyond these impediments, it is also worth remembering that the goals of businesses and governments are quite different. Businesses are focused on earning profits by developing and maintaining a competitive edge; government, on the other hand, seeks to promote economic growth, creating the foundation for sustainable development, and respecting ethical and legal relationships between the state and citizen [5, 12].

However, while full benefits may not be obtainable, it is also clear that an enterprise-level data management approach that enables integrating data from multiple government data sources, has much to offer to the public sector. These benefits focus on increasing efficiency and effectiveness, thus saving time and money for taxpayers and making it possible to improve services to citizens [12]. Enterprise-level data management also bears the promise of improving the ability to engage in data-driven decision-making for policy issues. It seems likely that such thinking was on the minds of federal policy architects in moving from the dated attributes of the S/TACWIS model to certain characteristics of enterprise-level data management that are evident in the new CCWIS alternative.

2.2 S/TACWIS vs CCWIS

In 1993 the US federal government passed a law that encouraged states to create a Statewide/Tribal Automated Child Welfare Information System (S/TACWIS). S/TACWIS was heavily subsidized with HHS reimbursing 75% of the costs of planning, design, development and installation of a new system until 1997, at which point the funding was dropped to 50%. In addition, operational costs were reimbursed at a rate of 50%. The S/TACWIS was to be centrally located and used to manage, track, and report on children in the state's child welfare system. S/TACWIS mandated the accomplishment of 51 distinct functional requirements, and was required to be the location of the "official case record."

Despite the generous financial support, states had considerable difficulty implementing the S/TACWIS model, although 47 made the attempt. Reporting on efforts to implement S/TACWIS, the US General Accounting Office (GAO) [11] found that, while states were spending over $2.4B in federal, state, and local funding and recognized the benefits of creating such a system, they were encountering difficulties. As of 2003, 31 states were experiencing delays in their timeframes for completion from 2 months to 8 years as well as difficulties acquiring sufficient state funding to develop the comprehensive features and functionality required by HHS. Some states reported that the monolithic quality of the mandated system was difficult to reconcile with the business practices of their state child welfare program [11]. For example, in New York, as in numerous other, but not all, states, counties are responsible for administering child welfare services and these services are frequently provided by not-for-profit organizations. Designing a uniform system that met the federal requirements as well as the needs of all these organizations was a daunting prospect, leading to failure on the part of some states that were unable to obtain agreement from all of the participating stakeholders. HHS wanted a reporting system, the state wanted a unified case record and reporting system, and the counties and child welfare not-for-profits wanted a case management system.

Further, the GAO [11] found that in most of the states caseworker training was insufficient, which led to inaccurate and incomplete data entry affecting the quality of the data reported to HHS. The GAO also found that caseworker errors in data entry were related to their struggle to balance the time they spent with clients and the time needed for data entry, which could not take place in real-time and was thus frequently late; this produced inaccuracies in the current status of children in care. These problems in data quality were complemented by additional technical challenges in mapping state data elements to federal data elements in reporting to HHS. Although the GAO described significant efforts by HHS to address data issues, they concluded that "most states continue to face challenges providing complete, accurate, and consistent data to HHS" [11]. By 2015, 23 SACWIS certified systems were operational, 17 were still under development and 10 non-SACWIS models were operating [8].

In August 2015, HHS issued a notice of proposed rulemaking (NPRM) related to the development the Comprehensive Child Welfare Information System or CCWIS, in an effort to incorporate changes in technology and enable agencies to exercise more flexibility in building smaller systems that conform more closely to their particular conditions [8]. In contrast to the 90 functional requirements of the S/TACWIS, the CCWIS model ultimately required only 14 elements, including:

- Data exchange: Bi-directional data exchanges with the courts, educational, and other ancillary service providers at the state or local levels in order to provide more complete information about children and families.
- Interoperability and modularity: Changing from a statewide single comprehensive system approach to modular, distributed, reusable, and interoperable technology [1].
- Distributed data entry: States were no longer required to have users directly enter data into the application; they could obtain information from external agencies and provide data to external agencies, thus moving away from "data capture" to a "data maintenance" philosophy as long as a copy of all the data is maintained in CCWIS [1].
- Data quality: A focus on data quality which requires a quality plan and reviews every 2 years as well as the creation of automated functions that

monitor data quality and alert staff to collect, update, or correct data [1].

- Agile software development: States may opt for an approach based on Agile software development methods.
- Non-Duplicated functionality: HHS would not reimburse expenses related to the construction of duplicated functionality, although the presence of duplication would not render the CCWIS non-compliant.

2.3 Choosing an Information System: To Transition or Not

At this time, some states have declared their intentions to transition to a CCWIS and many more are still in the process of assessment. HHS cannot force states to adopt, but the deadline of July 31, 2018 has implications for financial support. Currently, 9 states have communicated that they are in the process of assessment, 20 states have declared their intentions to develop a CCWIS compliant system, and the remaining 21 states have made no declaration regarding their CCWIS intentions (see https://www.acf.hhs.gov/cb/resource/ccwis-status). Considering further those 20 states that intend to transition to a CCWIS, there are two general options for proceeding: (1) The state could opt to use their current system as a foundation and transition to CCWIS compliant requirements, or (2) The state could create an entirely new CCWIS compliant system built by the state or through the purchase of commercial off-the-shelf software. As of January 2018, of the 20 states pursuing CCWIS compliance, 12 decided to pursue entirely new CCWIS systems.

To facilitate New York State's CCWIS decision making, we undertook an environmental scan of other states' decision making process regarding adoption. We sought to understand what factors figured into the decision making of other states. Our interviews were conducted with managers leading the information technology effort as well as managers representing the programmatic interests of the agency. We were guided by the following research questions:

- RQ1: What are the potential benefits that state managers expect to realize through the adoption of CCWIs; what are common themes and differences?
- RQ2: How have state managers responded to the data-intensive requirements for CCWIS compliance; what are the common themes and differences?

3 Methods

We conducted semi-structured interviews with representatives from states about their experiences in the assessment of the CCWIS model and their decision making about whether or not to make the transition. Below we describe how we selected the participating states and the individuals to interview. We then describe the design of the interview protocol and provide some information about the characteristics of the interviews that were produced.

3.1 Selection of States, Interviewees, & Data Analysis

We selected states that had begun the assessment process, or that had made their decisions, by consulting the official web page of HHS's Administration for Children and Families (https://www.acf.hhs.gov/cb/resource/ccwis-status), which recorded the status of each state's CCWIS decision making. At the time of the study design (July 2017) 23 states had started the initial formal CCWIS assessment (9 states) or had already committed to the CCWIS model (14 states). The states with a county administered child welfare system similar to NY's were an important target for the study. For this reason, all the county administered states that were part of the mentioned 23 states were initially selected into the sample. From these, we chose states that had more than five million population in order to be roughly similar to the size and complexity of New York State's system, producing a sample of 12. One state declined to participate; we added one further state on the basis of client interest. We interviewed representatives from the following 12 states: California, Florida, Illinois, Pennsylvania, Georgia, Virginia, Arizona, Indiana, Maryland, Texas, Wisconsin, and Colorado.

Members of our team conducted documentary research to become as familiar as possible with publicly available information (mostly on the web) about each of the 12 states' child welfare information system. As part of this process, we identified the public officials responsible for the state's child welfare systems and/or child welfare information systems and issued invitations to participate in our interviews.

3.2 Designing and Administering the Interview

Our semi-structured interviews covered 19 basic topics complemented by several follow-up questions and prompts. The topics encompassed: (a) the decision process and governance, (b) definition of cost and benefits, (c) stakeholders affected and relationships with the federal agency, (d) CCWIS conceptual design, implementation, and compliance, (e) data exchanges, and (f) data quality aspects. These topics were based on our background research, notes from meetings with the client organization, the requirements of the CCWIS model, and the staff's experience with this kind of project.

The interviews were conducted by telephone and ranged from 45- to 90-minutes duration. The research team (always consisting of at least 2 individuals) took notes during the interview, and, where permission was explicitly granted (8 states), the interviews were recorded and later transcribed. Twenty-one individuals participated in the interviews, 10 of whom were females and 11 males. Ten individuals occupied technical positions (4 of whom were chief information officers for their agency or unit), 8 occupied practice-oriented positions (e.g., deputy directors of the agency, deputy administrators, etc.), and 3 were consultants. Eleven interviewees each representing a

state occupied a position with explicit project management or decision making responsibility related to CCWIS.

Our analytical framework was inductive, employing the constant comparison method of data analysis pioneered by Glaser and Strauss [2]. Each interview was examined to identify responses to our RQs, which we subsequently categorized based on thematic similarity across the entire set of interviews. Space limitations preclude tabulating our results; the categories are presented in bold below.

4 Results of Data Analysis

RQ1 asked about the potential benefits that state managers expect to realize through the adoption of CCWIs and the common themes and differences in their responses. We addressed this question, first, by seeking to confirm where each state was positioned in the process of their decision making. When we interviewed them, 6 of the 11 states (California, Virginia, Pennsylvania, Arizona, Colorado, and Maryland) had already declared their intentions to become CCWIS compliant, or had made affirmative decisions but had not yet formally declared to the Federal Government. The remaining states were in the midst of assessment studies; some of them indicated that they were likely to move toward CCWIS, although final decisions had not been made. None of the states in our study had considered and rejected the possibility of transitioning to the CCWIS model.

Each of the 6 states that had committed to CCWIS at the time of our interview were already in the process of undertaking significant efforts to modernize their child welfare information systems when the CCWIS rule was adopted, quite apart from the changing policy of HHS. Thus, representatives of these states saw that CCWIS could **contribute to their current efforts to modernize**. In some cases, such as Arizona, managers had seen that they could not achieve the advantages they sought for their child welfare program by using S/TACWIS so they were actively attempting to fix or replace it. In some cases, such as that of Maryland, the move to modern child welfare was part of a larger state-wide initiative to move to an inter-agency data platform for agencies related to human services; child welfare was automatically included. Further, all of these state managers were aware of and recognized the value of federal efforts to encourage interoperability and data sharing. Thus they were relatively eager to align their state efforts with the federal initiative, in part to be able to participate in federal cost-sharing and in part simply because they recognized similar goals. Some states were pursuing modernization because they found it increasingly difficult to find qualified personnel who could fix their outdated legacy software systems or were stymied by operating in very old browser-dependent web environments. Two states indicated that they needed to hire staff with more contemporary expertise in order to proceed with their development efforts. For all of these states, the process of CCWIS adoption proceeded smoothly, in some cases barely even requiring a meeting. Some decision makers called it a "no brainer" and moved quickly to discuss with us the further advantages they expected to achieve in making the transition.

It was interesting to note that our interviewees often represented both the technology experts who would implement the transition as well as program representatives familiar with the business needs of child welfare. This fueled discussions about the need to move away from an IT-driven approach in designing the CCWIS and focusing instead on the business and case-centered needs of the child welfare program. Their collaborations were often supported by steering committees or project teams that involved personnel from both sides of the enterprise.

Helping child welfare caseworkers by improving the conditions of their work was the most frequently cited benefit of the transition**.** That assistance takes many forms but they all rest on the fundamental recognition that the technology can be a genuine partner to caseworkers in their work, rather than a record keeping system that prevents them from being in the field. Some states are incorporating mobile access by caseworkers into the development of their applications, foreseeing that this would achieve a "quick win" for their projects and smooth the way for caseworkers' acceptance of other changes in the system (which would require training and some change in work routines). They noted that mobile applications would enable caseworkers to spend more time in the field than in the office by reducing their labor in inputting data.

Most states also accepted the fundamental logic of data-intensive information management, acknowledging that CCWIS would **enable better data-oriented practices**. This included improved data reporting, avoiding data redundancy, generating more accurate and timely information, supporting data sharing between state and local agencies that provide services, and improving decision making related to family and children outcomes as well as that related to business and policy questions.

Finally, at least two states (Virginia and California) anticipated building systems in which **clients could become users** along with child welfare employees, noting that foster children were eager to access photographs from earlier in their lives, and foster parents sought medical records of children entering their families.

To address RQ2 we asked how state managers were responding to the data-intensive requirements for CCWIS compliance and then extracted common themes in their responses. Our interviewees uniformly recognized compelling advantages to be realized in moving to the CCWIS model but had not resolved issues related to data exchange and data quality.

In a few states, child welfare agencies have already begun to exchange data with certain sister agencies or between county and state level organizations, but for the most part they acknowledged **legal constraints on data exchanges**. One state indicated that they had over 1000 data exchange agreements currently in place, although not all were operational or necessarily automated and might still even be conducted on paper. But none of the states believed that technology would be an impediment to establishing such exchanges. Instead, legal

issues regarding confidentiality were recognized as the most important constraint on their ability to exchange data with other agencies providing services to children and families. Some states described contentious discussions with education agencies or boards of education that would not share items of information about issues such as school attendance. Similarly, health agencies need to navigate complex legal constraints that prevent timely information sharing about children. The managers foresee the need to spend considerable time establishing agreements about what specific kinds of information could be shared, over what periods of time, and who would have access. And they anticipate encountering legal roadblocks that might require changes in legislation to address. Only one state had begun the process of involving their attorney general's office in discussions about how to establish desirable data exchanges with other service providers.

If data exchange is seen technically feasible but legally difficult, data quality is regarded as extremely daunting. No state had yet created a data quality plan and only one had begun the process of creating a plan that reflected a clear idea of how to proceed. Most of the states acknowledged that there was no leadership elsewhere in state IT units about data quality that could be used to guide their efforts. It was clear from our interviews that the **creation of data quality plans** was largely uncharted territory in each state's efforts to conceptualize their CCWIS.

Potentially related to both data exchange and quality is the issue of **creating governance structures.** We asked state representatives if they had developed structures, either within the agency or across agencies, to provide a context for CCWIS conceptualization or the discussion of data exchange and quality. The states differed widely in their approaches to governance. Some states viewed governance as the context for discussion about system design and program related decision making, and had created steering committees for this purpose with representatives from multiple stakeholders internal to the agency or including relevant IT representatives. Other states recognized that the creation of data exchanges, and the ability to work with other agencies on data quality issues that now become more problematic because of those exchanges, requires cross-agency governance structures. Only one state had set up a "data council" expected to be the venue for the discussion of these issues.

5 Implications

HHS's endorsement of CCWIS seems to be predicated on the assumption that an enterprise approach to data management is a key enabler for new and innovative uses of data and that systems modeled on this approach are more likely to serve the needs of HHS, and perhaps the states and citizens, than the prior model. Our analysis of RQ1 indicates there is ample agreement on the benefits to be derived from adoption of the CCWIS model. Our interviewees are fully aware of the limitations inherent in their current legal, technical, and structural environments as our data analysis related to RQ2 indicates. The ability to execute legal data exchanges, the uncertainties of creating compliant data quality plans, and the creation of effective governance structures all represent uncharted territory for our interviewees. These uncertainties that can only be fully resolved in future practices. We cannot be sure that our data generalizes to the experience of all states in the U.S., a limitation of our work, but at this time our interviews represent all the data available on this important topic.

It is interesting to note that, while HHS has mandated these new data requirements and they are working closely with states providing advice about how to develop systems likely to be compliant, there is a noticeable absence of roadmaps to success. Indeed, four of the states we interviewed have become HHS "poster children" in webinars and other discussions, where they are used to illustrate how these states have engaged in their decision making and the choices they have made. But there are no proven methods of success, no general criteria for workable structures or collaborations, and, interestingly, very little scholarly attention to the topic. This is in contrast, of course, to the more widely available advice and research related to corporate enterprise data management. Thus, the transition of state child welfare agencies to CCWIS is a grand experiment in the use of data-intensive information management systems. It is, at the same time, a remarkable digital government case study of the US federal government's ability to catalyze data-related innovation at the state level in both technical and legal/social contexts for the purpose of improving the lives of citizens. Digital government scholars stand to learn significant lessons as this case unfolds about the conditions for enterprise data management in government organizations. Indeed one important direction for future research is to conduct a more comprehensive study of states' decisions to transition to CCWIS and their experiences in doing so. As of August 2018, 8 months after our data collection was concluded, a total of 46 states had declared their intention to transition to CCWIS. It thus appears that the US federal government has been successful in persuading states to adopt this particular innovation in enterprise data management; it remains to be seen whether the benefits will be realized and the challenges overcome. A study of this kind could become an important source of data to be used in the development of theory related to innovation in government information systems.

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