
OPTIMAL
SOLUTIONS GROUP, LLC

Learning System Data Management (LSDM)

Project Report

August 4, 2014–August 3, 2019

Contributing authors:

Mark Turner
Sabu Mathai
Mark Cimiluca
Nils Franco
Arthak Adhikari
Sidnie Christian
Nasim Aalemi
Yash Kothari

Submitted to:
Department of Health and Human Services
Centers for Medicare & Medicaid Services
7500 Security Boulevard
Baltimore, MD 21244-1850

Contracting Officer's Representative (COR): Tarnisha Boone
Contract No. HHSM-500-2011-00020I – Order No. HHSM-500-T0003

Submitted by:
Optimal Solutions Group, LLC
University Research Park at Discovery District
5825 University Research Court, Suite 2800
College Park, MD 20740

Project Director: Mark Turner

Project Manager: Arthak Adhikari

August 2, 2019

Table of Contents

List of Acronyms

Acronym	Definition
ACO	Accountable Care Organization
ALS	Alternative Learning Systems
API	Application Programming Interface
ARTS	Analysis, Reporting, and Tracking System
ATO	Approval to Operate
AWS	Amazon Web Services
BCG	Blue Canopy Group
BPCI	Bundled Payments for Care Improvement
CFACTS	FISMA Controls Tracking System
CMLN	Cross-Model Learning Network
CMMI	Center for Medicare & Medicaid Innovation
CMS	Centers for Medicare & Medicaid Services
COR	Contracting Officer's Representative
CP	Contingency Plan
CPC+	Comprehensive Primary Care Plus
DDR	Detailed Design Review
DMARS	Data Management, Analysis, and Reporting System
EFT	Electronics File Transfer
ETC	CMS Enterprise Testing Center
FISMA	Federal Information Security Management Act
HCIA	Health Care Innovation Awards
HHVBP	Home Health Value-Based Purchasing
GPRA	Government Performance and Results Act
LDG	Learning and Diffusion Group
LSC	Learning System Contractor
LSDM	Learning System Data Management
OCM	Oncology Care Model
OMB	Office of Management and Budget
OY	Option Year
PIA	Privacy Impact Assessment
PoA&M	Plan of Action and Milestones
Portal	CMS Enterprise Portal
QC	Quality Control
SCA	Security Control Audit
SOP	Standard Operating Procedure
SOW	Statement of Work
SSP	System Security Plan
TA	Technical Assistance

Acronym	Definition
TRB	Technical Review Board
XLC	eXpedited Life Cycle

1. Executive Summary

The (LDG) within CMMI is built on a foundation of improvement science and is responsible for helping model teams develop robust learning systems. These learning systems are designed to enable model teams to develop and implement a process for demonstrating success through continuous quality improvement and to establish a collaborative learning system through which lessons learned and best practices can be shared. With five years' experience developing LDG's main cross-model data repository, the LSDM project recommends the following to hasten the adoption of best practices and create a more transparent, responsive means by which CMS can hold models accountable for providing the best possible learning system to their model participants.

Maintain a single cross-model repository for performance and learning data.

- Ensure continuity in learning system event data platforms to best enable further feature development and to avoid unnecessary costs and delays from building a new system and reintroducing it to varied stakeholders.
- Centralize model participant data beginning from the application process to the final exit survey into a single cross-model repository.
- Prespecify application decision criteria and situate these in a framework of concrete steps to be undertaken over the course of the model.
- Match baseline and follow-up needs assessments provided by model participants to their learning event and Connect community engagement data.
- Continue to link individual engagement data from webinars to the model participants they represent to develop a more nuanced definition of model participant engagement in learning events.
- Link and normalize model performance data so that it can be meaningfully matched to learning system engagement across models.

Further develop feedback mechanisms.

- Continue to standardize feedback mechanisms while providing learning systems the flexibility to innovate and test new feedback measures.
- Complete the process of standardizing the post-event survey and work to identify opportunities to systematically test incremental changes in content as well as offering a strategy to maximize response rates.
- Gather centralized data at the individual- response level to provide additional analytical depth for measuring learning system engagement.
- Develop a strategy of prespecifying learning event goals and targets both from a contractual and a

continuous quality improvement standpoint.

- Identify common measures for needs assessments that would allow CMS to standardize these important tools across models.

Foster knowledge sharing between contractors, model and learning system staff.

- Convene model and learning system staff and contractors to share best practices and identify new lessons learned.
- Following a training-of-trainers paradigm, ensure that both staff and contractors share a single strategic vision for the implementation of learning systems across models.
- Provide a quarterly forum for frank, honest sharing of what has and has not worked to improve model participant and individual attendee engagement in learning system activities.

Redesign GPRA score to better measure model participant engagement.

- Articulate learning objectives for participants across models by incorporating knowledge checks into post event surveys. Moreover, utilizing needs assessment to better identify metrics to measure accurate model participant engagement."-
- Use industry benchmarks to identify the number and kind of actions a model participant needs to have taken to be considered engaged and then construct the GPRA performance measure from the average model participant score across models.
- To increase engagement, track faculty performance and connect it to learning event and Connect engagement data.

2. Introduction and Project Background

This final report serves to document the progress and evolution of the LSDM project and to document achievements and lessons learned. The report contains the following main sections:

- Executive Summary
- Introduction
- Project Milestones Base Year to Option Year Four
- Financial Analysis
- Project Opportunities and Recommendations

Through the Affordable Care Act, the Centers for Medicare & Medicaid Services' (CMS') Center for Medicare & Medicaid Innovation (CMMI) has been charged with developing, testing, and implementing new healthcare models that improve healthcare delivery, lower costs, and provide better health statuses for Medicare and Medicaid beneficiaries and other individuals. The Learning and Diffusion Group (LDG) within CMMI is built on a foundation of improvement science and is responsible for helping model teams develop robust learning systems. These learning systems are designed to enable model teams to develop and implement a process for demonstrating success through continuous quality improvement and to establish a collaborative learning system through which lessons learned and best practices can be shared.

CMMI contracted Optimal Solutions Group, LLC (Optimal) to collect and report data regarding learning events in support of the Government Performance and Results Act (GPRA) metric on learning system engagement. Optimal worked with CMMI to develop and maintain a system to collect the learning activities data from the learning system contractors in previous performance periods and is now focused on providing continuous quality improvement support to LDG and the learning system contractors while continuing to enhance the LSDM data collection system. During the Base Year and first three Option Years, the project was broken into the following tasks:

- Task 1: Project Management
- Task 2: Develop a system for collecting the learning activities data from the learning system contractors assigned to the current CMMI models
- Task 3: Provide both raw and "cleaned" data files to CMMI on a monthly basis
- Task 4: Provide training and technical assistance on obtaining these learning system activities to the CMMI model learning system contractors
- Task 5: Reporting Requirements

In the fourth and final Option Year, tasks 2 and 3 were combined and a new task 3 was assigned which provides support to the LDG Workgroup to inform continuous quality improvement (CQI) initiatives.

3. Project Milestones: Base Year – Option Year 4

The section below highlights key milestones and achievements made throughout the LSDM Project. Please refer to Appendix 2 for more detailed descriptions by year.

Developing and Maintaining a Standard Data Repository

Optimal developed the DMARS data structure after making significant efforts to understand and use cross-model learning system event data collected from model participants. Optimal drew on previous experiences and lessons learned working with learning system event data and engagements with CMMI and model contractors. In the Base Year, Optimal conducted a gap analysis which identified that data standardization at the time of collection was a primary need. Concurrently, Optimal coordinated the collection, coding, and analysis of data to understand the learning systems' existing data collection methods at the outset of the 5-year contract term. Optimal compiled these early data to produce a baseline report for events held from January through July of 2014. Starting in January 2015, Optimal began regular reporting to OMB. During the second Option Year, Optimal compiled quarterly reports in Excel format and calculated reporting measures using standard research tools.

After launching DMARS in September 2017, Optimal improved the efficiency and quality of its data management processes. Through DMARS, Optimal and CMMI began

- Automating data validation checks
- Utilizing a multi-level review checklist for the monthly data report
- Implementing key monitoring tools
- Auditing data recorded in the DMARS database to ensure that it reflected up-to-date information on a monthly basis

The array of tools developed on DMARS has enabled Optimal to identify systematic challenges, whether within or across model learning systems, and to mitigate them through training and technical assistance efforts. For instance, Optimal implemented the Data Log, Error Log, and corresponding dashboards in DMARS as key monitoring tools to track model learning systems' compliance with data submission deadlines and data validation rules. Additionally, Optimal collaborated with LDG to leverage learning system lead expertise to improve data quality assurance through a multi-layered review. This review was streamlined through a dashboard that captures key information and metrics for each event. Optimal also began performing a monthly Quality Control (QC) of the DMARS database against the Master Data File, which had been maintained for contingency planning.

The LSDM project collected data from 17 learning systems monthly. LSDM has received data for 1,186 learning events occurring from January 2015 through June 2017. A total of 126,271 individual model and non-model attendees were reported to have participated in events across 65,802 model participants.

Features and tools included in DMARS allow LDG to quickly assess LSDM performance as a service, DMARS improvements, and learning system-specific trends. With the adoption of the revised data collection template, Optimal revamped its TA Log by incorporating new graphs and figures, providing LDG with the background information required to understand trends in TA volume.

Continuous Improvement of the Data Management, Analysis, and Reporting System (DMARS)

Completion of eXpedited Life Cycle Milestones

Throughout OY4, Optimal continued developing and testing DMARS and advancing through CMS' eXpedited Life Cycle (XLC) process, which involved conducting a Post Implementation Review.

As of June 3, 2019, Optimal is on pace to complete all required eXpedited Life Cycle (XLC) artifacts. Please reference Table I. in Appendix 1 for the submission status of each XLC artifact.

For milestones in the lifecycle of DMARS please reference Table II. in Appendix 1

Continued Development of DMARS

Optimal's developers have continually developed new features for LSDM DMARS. Major focus areas have included (1) access rights management for users and cascading access rights based on data hierarchy, (2) automated data collection through uploads of the Excel-based Data Collection Template, (3) dashboard visualizations that present the learning event data, and (4) data download and report creation modules. Optimal has included a roadmap for future feature development in the proposed licensing agreement.

Other efforts to develop and improve DMARS' functionality include consolidating and replacing Event Attendance and Attendee Profile entity types with Attendee entity type in DMARS 1.4, resulting in faster data imports for contractors. Since DMARS launched with version 0.0 on September 6, 2017, Optimal has issued five major releases to incorporate new features, address bugs and agency recommendations, and restructure the hierarchy of data managed in the system. Change Control Board reviews, Security Impact Assessments, and Development and Testing are conducted with each release.

Optimal maintained a list of change requests that incorporated feedback received via technical assistance (TA) requests, User Acceptance Testing, business meetings, and performance measure discussions with LDG leadership. This list was used to identify and implement high-priority improvements to DMARS, including improved runtimes, data hierarchies, validation techniques, and actionable dashboards.

Continuous Quality Improvement

Overview

During OY 4, the LSDM team took on (CQI) activities. These entailed research and analytics based on the data collected in DMARS, exploiting the dataset's richness and the team's data management practices. Analyses identified promising practices for Learning System events to reach specific audiences, attain higher turnout rates, or increase attendee willingness to act based on the event content. Optimal proposed

initial topics in a memo that circulated within CMMI, and CMMI staff prioritized topics selected based on high relevance to Learning System program design. After receiving approval for a topic, Optimal researchers wrote scripts to merge the multiple datasets harmonized in DMARS.

Actionable recommendations.

Optimal prepared slides, talking points, and technical appendices for each reported analysis, which the LDG Project Manager presented to Learning System staff. Based on best practices for issuing effective recommendations, slides communicate a single "Key Takeaway." This takeaway is an active sentence describing the promising practice, for instance, "Attract attendees who work within a single organization and can enact new policies within that organization." Despite the rigorous methods used to identify promising practices, methods and data analysis are not shown in the slides. Where used, visualizations convey the essential relationship that justifies a promising practice.

Analyses Delivered

Optimal provided LDG with a slide deck of CQI analyses on April 10 and included analyses regarding which model participants attended what events, the potential of improving the likelihood of model participants taking action after attending LDG-sponsored events, and the potential of improving model participant attendance at events. The analyses conducted underlying these slides were as follows:

- Distinct traits of model participants who attended events
- Top-attending model participants
- Event topics that are most popular
- Days of the week with best turnout at events
- Turnout when Continuing Medical Education credits are offered
- How attendees representing many model participants survey responses
- Whether attendee affiliations affect event outputs and attendance frequency

Please see table IV in Appendix 1 for a summary of the findings and recommendations from the compiled CQI slide deck which was submitted .

Optimal has planned analyses to investigate causes of low attendance, repeat attendance, and the attendance of multiple attendees (i.e. teams) to Learning System events.

Combining the LSDM Dataset with Performance Data

Optimal also connected performance data from two learning systems to the LSDM Dataset. Optimal has summarized findings from analyses drawn from this performance data to LDG and will conclude said analyses compiled in a final version in its forthcoming second slide deck.

Optimal received performance data for two CMMI models, Next Generation Accountable Care Organization (NGACO) and Bundle Payments for Care Improvement (BPCI). Performance data for other CMMI models was not available for analysis. Optimal merged NGACO together with learning system event data collected through DMARS and conducted CQI analysis to determine whether attendance of

learning system events was correlated with a change in quality or performance. Specifically, the analysis examines the relationship of Learning System event attendance to the total per beneficiary spending incurred to CMS by the 63 Next Generation Accountable Care Organization model participants (NGACOs), particularly among awardees who entered the model with relatively higher spending. The spending data were adjusted for inflation and were risk-adjusted for the patient population. Preliminary findings for the NGACO low-performers with high baseline per-beneficiary spending (n=16) suggest that the low performers that consistently attended the Learning system program had lower percent increase in spending over time than all other groups of NGACOs.

With the BPCI data, Optimal is examining the relationship between the rates of attendance and the types of events attended by model participants based on their overall performance levels. Until now, no data were available to investigate patterns of both learning system attendance and model-defined performance. This glimpse into underlying patterns of attendance strongly suggest that learning system data should be collected alongside real-time performance data to guide learning system planning and cross-model improvement. Additionally, innovation model participants struggling in the context of the model's payment and improvement may benefit more from learning events which provide technical assistance and share best practices.

Remediation and Continuous Quality Improvement of LSDM Datasets

The data received and managed under LSDM since 2015 continued to be managed and cleaned, however some data fields changed over time upon feedback received from model contractors and CMMI. In short, archived data would not pass the most recent data validation tests applied in DMARS and monthly data review process. Also, some data validation cannot occur at the time of data collection and must instead occur retroactively. A Quarterly Data Report series in the fourth Option Year briefed LDG on Optimal's quarterly data review activity and on proposed next steps to identify and remediate data quality issues.

Summary of Government Performance and Results Act (GPRA)

The Learning System Data Management (LSDM) project collects and reports data on learning events held in the context of Center for Medicare & Medicaid Innovation (CMMI) model learning systems to satisfy Centers for Medicare & Medicaid Services (CMS) and Government Performance Results Act (GPRA) reporting requirements. In OY1, Optimal Solutions Group, LLC (Optimal), coordinated with CMMI to refine the goals of the LSDM project.

The first goal of OY1 was to: Satisfy reporting requirements of the Office of Management and Budget (OMB) per the Government Performance and Results Act (GPRA) requirements, the objectives were to;

- Develop cross-model terminology and data-collection and quality assurance protocol.
- Develop reporting processes and products.
- Establish a technical assistance (TA) and training strategy aimed at educating model teams on data-collection protocol, providing a feedback loop, and ensuring data integrity,

to the ends of satisfying GPRA requirements.

In this context, Optimal refined the interim data collection approach, the data collection tools used in the interim, such as the data dictionary and Data Collection Template, were revised and updated as new learning systems were added throughout the option year. Optimal continued to review the data dictionary and revise definitions and variable values based on CMMI and model contractor feedback. As CMMI introduced alternative learning systems this required a redesign of the data hierarchy. Moreover, additional analyses took part which collected additional learning activity data to address the GPRA engagement metric, such as event participation satisfaction survey results and presenter information.

In OY2, it was decided that: "The GPRA measure tracks the average percentage of model participant organizations that engage in learning events". The aim of DMARS was refined to facilitate GPRA reporting but also to support the LDG's monitoring and support of model learning systems. In this regard, Optimal and CMMI worked together to develop and improve DMARS' functionality, such as including dashboard reports to facilitate data validation and GPRA reporting in real-time.

Based on feedback from learning system contractors and a workgroup of CMMI model learning system leads, the LSDM Data Dictionary underwent a significant redesign in OY2. This redesign was aimed at refining the information collected to 1) align with CMMI Learning System 2.0 principles for standardizing the core functions of learning systems, 2) reduce learning system contractor burden, and 3) improve the quality of the data collected to more accurately calculate the GPRA measure.

The GPRA Performance Metric analyzed attendee data from the perspective of capturing engagement, which entailed learning event participation and other indicators of learning (i.e., measures of interaction, adoption, and application of information obtained through learning). For this OY, Optimal analyzed the data collected to date and reported that there was a clear, improving trend towards meeting the phased-in goal of 59.7 percent targeted model participant attendance. Progress in obtaining agreement from all stakeholders on the definition of a model participant organization for some models (i.e., the correct denominator) seemed to have improved measurement calculations drastically.

In OY3, LDG tested several alternate calculations and definitions to refine the GPRA performance measure and ultimately determined to explicitly define the GPRA denominator, which is the number of model participants "reasonably expected to attend" for each of the following event types; all model participant, action group, affinity group, office hours, and other sub-group. In past calculations, GPRA measured the percentage of model participants attending events divided by invited or targeted participants.

Upon feedback, it was determined that the "target" was not always representative of effort and that the new calculation, which was referred to as GPRA 3.5, should aim to calculate the percentage of model participants attending over participants who are reasonably expected to attend. This calculation allowed a more accurate representation of the work of the Learning System which further allowed early detection signals of improvement or degradation in a process over time. Optimal operationalized the refined performance measure by preparing a GPRA 3.5 training for LDG and the learning system contractors as

well as coordinating with the learning system teams to update data received to date to comply with the refined definitions. Optimal also updated the data collection template and the monthly data validation

checklist to incorporate the revised GPRA 3.5 validation rules.

Providing Technical Assistance

Training

Over the course of the LSDM project, Optimal developed and conducted 38 trainings and or extensive technical assistance calls for CMMI and learning system contractors. Trainings were conducted each time a new model learning system initiated and each time a version of DMARS was released. Ad hoc trainings detailing the LSDM data and collection processes were held as deemed necessary. Appendix 3 provides a detailed record of attendees, learning systems represented, topics covered, and materials distributed, for all trainings conducted by Optimal over the course of the LSDM project. Please reference Table V in Appendix 2 which highlights OY 4 trainings conducted by Optimal through August 2019.

Additionally, for a smooth transition at the end of the contract, Optimal produced a series of short training videos that guide users through topics such as:

- Access to CMS Enterprise Identity Management System (EIDM)
- How to access Innovation center (IC)
- How to Access to DMARS
- How to navigate through the DMARS application tabs

Technical Assistance

Optimal provided Technical Assistance to learning system contractors throughout the data collection and DMARS launch processes. Up until OY 4, Optimal handled all TA requests directly via phone at 1-844-234-3387 or e-mail at LSDMTA@optimalsolutionsgroup.com (LSDMTA Alias). All interactions were logged in JIRA to include the issue category, learning system, requestor's name, issue description, response description, contact mode, type of TA (i.e. initiated by Optimal – Outbound, or initiated by Learning System Contractor – Inbound), and dates and times that the request was initiated, responded to, and resolved. Optimal then used this data recorded in JIRA to submit a Microsoft Excel based TA log that highlighted the most common types of inquiries and the time taken to resolve them (See Appendix 2 - Deliverables Summary for dates submitted). Summaries of helpdesk tickets by issue type and resolution status are detailed in Appendix 3.

In September 2018, CMMI instructed Optimal that all TA requests should be routed through ServiceNow for centralized tracking. The helpdesk phone number was terminated; the LSDMTA Alias became the primary mode of communication between contractors and Optimal. All communication was required to

include the Consolidated Business Operations Support Center (CBOSC) helpdesk for tracking. CBOSC assumed the role of producing the TA log on a weekly basis. Optimal submits the CBOSC generated TA log to CMS ARTS monthly, choosing the most applicable report for the previous month.

4. Financial Analysis of LSDM Project

Lessons Learned

The true costs of the LSDM project are understated as Optimal did not incur the costs of hosting and portions of help desk technical assistance were outsourced. Additionally, Optimal did not charge a software licensing fee which would have significantly increased project costs.

Incurred costs focused on the meeting the requirements under:

- CMS' expedited life cycle and security authorization processes:
  - Optimal's customizable commercial-off-the-shelf (COTS) database application software, Revelo™ was customized to meet the needs of LSDM. LSDM Data Management, Analysis, and Reporting System (DMARS), is a web-based reporting system that facilitated data collection by providing learning system contractors with a central and secure location in which to submit data. The system's customized reporting and dashboard features were enhanced LSDM's reporting capabilities by allowing LDG to analyze data through various perspectives and filter the information to meet its needs. The automated tool had to undergo XLC and security authorization processes but provided the models a secure way to record and maintain accurate data throughput the lifecycle. Specifically, collection of PII required moderate-level FISMA security controls, including CMS-mandated multifactor authentication which added the time spent on security authorization process.
- Continuous monitoring
  - In July 2018, the LSDM SOW was updated to better capture Optimal's role as a leader in LDG's continuous quality improvement efforts and capture other ongoing priorities for LDG more explicitly (e.g. improving data alignment). Key deliverables were also moved across tasks to accommodate a Continuous Quality Improvement (CQI) - specific task. To facilitate CQI, Optimal was tasked to coordinate monthly LSDM Workgroup Meetings to better understand the learning system contractors' needs, to gather feedback on results of data analysis, and identify new opportunities to either facilitate or enhance their work. Optimal also coordinated quarterly LSDM Workgroup Debrief Meetings with the learning system leads to both showcase initiatives that Optimal had undertaken and obtain input from the learning system leads on the utility of these initiatives. Further, Optimal produced ad hoc analysis and reports for LDG and learning system contractors as needed, providing a cross-model view of trends in learning activities and addressing model-specific research questions

- EFT

- DMARS leverages the Enterprise Portal's Electronic File Transfer (EFT) functionality for virus scanning. However, as the DMARS maintainer who is responsible for coordinating troubleshooting efforts and testing the application throughout the process, Optimal has spent considerable effort coordinating with integrated application teams due to increased EFT troubleshooting needs in August and September 2018. Each time an issue is identified with EFT, Optimal had to:
    - Create a ticket with GDIT to reconfigure/restart the Network File System server
    - Prompt the Leidos team at CMS to remount the drive
    - Prompt the EFT team to reconfigure the file transfer
    - Coordinate with GDIT, Leidos, and EFT to reinitiate the previous activities when they do not elicit the expected result.
    - Confirm all previous files were transferred from EFT
    - Test the DMARS data import module to verify that the issue is resolved.

Further, On October 2, the EFT team notified Optimal that it would be migrating its test environments to a new hosting environment. As a result, Optimal had to complete the following activities in both the development and validation
environments to support this architecture change:

- Participate in several meetings with Portal and General Dynamics Information
- Technology (GDIT) in addition to the kickoff meeting held on October
- Coordinate with GDIT and Portal to prepare and submit new firewall request forms to open ports on the respective servers.
- Verify that these changes were implemented successfully through testing.

5. Project Opportunities and Recommendations

Licensing DMARS

On May 8, 2019, Optimal submitted a DMARS Licensing and Configuration Plan to CMMI for its consideration. As a GSA Schedule 70 Contractor and a certified CMMI Level 3 Software Developer, Optimal proposed licensing the DMARS platform to CMMI upon the completion of the LSDM contract on August 3, 2019.

Continued maintenance and security support are critical for the continued operation of the DMARS system as a data collection tool and data repository for LDG. Following the proposed licensing agreement for the DMARS platform, Optimal would (1) provide continued maintenance and updates to DMARS, (2) develop data standards and performance benchmarks, (3) build and launch a centralized webinar platform, and (4)

Update DMARS and Release Plan. Update DMARS, operating on Revelo, version to include updated features for permissions, dynamic reporting, fuzzy matching, and integration of CMMI Tableau license.

LDG Data Standard and Performance Benchmarks. Develop data standards for learning models that encompasses event-level, post-event survey, learning model contextual information (i.e., inclusion / exclusion criteria; targeted participants) data elements. In collaboration with LDG and learning models (via Community of Practice), develop common set and learning model-specific performance metrics and benchmarks.

Centralized Webinar Platform and Unified Post-Event Surveys. Implement a FISMA-compliant centralized webinar platform for all LDG learning models to use. The webinar platform will embed the LDG data standard elements into its workflow such that learning models can schedule events in advance of events and learning model coordinators can customize model-specific or event-specific fields, including post-event surveys. The webinar platform should support webinars that enables up to 500 learning model participants, other federal, and external partners to participate in dynamic and interactive webinars, conference calls, and breakout sessions which support active engagement of attendees and presenters. An API will link the event-level webinar information seamlessly to DMARS; significantly reducing learning models' level of effort.

Consolidated and Comprehensive Reporting. Learning models are currently (and are anticipated to continue) leveraging both live and recorded events to disseminate information to participants. To ensure that CMMI is monitoring learning activities regardless of media, we propose to link to the recorded event information on Connect via an API with DMARS. The standardized reports will reflect the universe of learning events and the model-specific and commonest of performance metrics and benchmarks (see above). To reduce the cost of report development, we recommend that the DMARS leverage CMMI's Tableau enterprise license.

Continuous Quality Improvement. A CQI analysis plan would leverage data from the centralized webinar platform, other CMMI systems (e.g., Connect), as well as other CMMI contractors (see Community of Practice). Ad hoc analyses and quick turn-around studies would be based on the plan-to-study-act framework.

Community of Practice. In coordination with LDG and the other CORs, the contractor would establish a memorandum of understanding with other learning models that would codify the objectives and engagement of the LDG Community of Practice (CoP). As a part of the CoP, the contractor would provide technical assistance, training, and facilitate peer-to-peer learning on the following: LDG data standard, performance benchmarks, centralized webinar platform, CQI lessons learned).

Maintain and Develop a Secure Learning and Diffusion Data and Reporting Platform

To support continued CQI efforts related to LDG learning system engagement, CMMI should continue to

maintain a tailored learning and diffusion data and reporting platform that is sufficiently flexible to collect cross-model data and that can operate within applicable security requirements.

DMARS has successfully served as a flexible, cross-model data repository for model contractors to report their engagement with learning system events. Model contractors are familiar with DMARS and reporting requirements and have regularly engaged with LSDM staff members to introduce them to new features and to work through technical issues they encountered.

DMARS should be a continued resource for LDG and model contractors. In future years, DMARS could be improved to include a broader scope, integration with other CMS systems, a more detailed taxonomy, enhanced reporting, improved usability, and systematic and embedded CQI tools.

Improved functionality for DMARS might involve capturing learning system engagement with offline materials on Portal, and through webinars. By measuring activity via API during webinars (chats, engagement) in addition to attendance, DMARS could provide valuable insights into how to improve events themselves to enrich the supply of information truly demanded by model contractors.

Cross-Model Performance Data Standard for Model Contractors & CMS Support for LDG CQI Data Collection

Future LDG CQI analysis will depend on more complete, granular performance and learning system event data. The LSDM team has created a functional data hierarchy and standard that allows cross-model comparisons of learning system event attendance. However, to map learning system event data to performance data and effectively make intra-model or inter-model comparisons, a cross-model standard for performance data developed with LDG leadership is necessary.

Conversations between the LSDM team and CMMI Model Leads led to the conclusion that no such cross-model standard for performance data currently exists. Furthermore, model contractors are not tasked to collect longitudinal performance data that would facilitate CQI activities and may not be able to do so unless they are adequately resourced and tasked to do so in their scope of work.

Additionally, a training or trainers conference could provide a forum from through which LS contractors and leads, and LDG, could understand cross model goals. Separately, making event data available and open could get third parties interested in linking to it.

Technical Assistance and Monthly Data

The LSDM contract will conclude on August 3, 2019, approximately one week in advance of the regularly scheduled review of monthly data. As discussed, and confirmed with CMMI on May 21, 2019, Optimal will not process any July 2019 data it receives. July 2019 data, and indeed any data received for future months in the DMARS system, must be processed by CMMI or another CMS contractor. Optimal maintains comprehensive standard operating procedures for future operators of the DMARS systems, whether they may be CMMI personnel or CMS contractors. Optimal will work with CMMI before contract conclusion in order to prepare for a smooth transition.

6. Agile Framework

The themes for future improvements to DMARS listed in Table IV of Appendix 1 will inform initiatives, epics, and stories undertaken in the future.[1] These themes could be equally applied to future efforts to improve data collection and analysis.

Through June 2019 and since August 2014, when the LSDM project began in earnest, the project has collected data on 3,788 events, 15,222 model participants, and 189,921 event attendees, across 22 learning systems. The project encountered challenges working with learning systems to identify the appropriate unit of analysis for their model participants and then ensuring that these were connected accurately to the attendees who represented them at learning events. While mitigating these challenges, we identified and eased multiple pain points in the data collection process while at the same time providing CMMI a monthly snapshot of the finalized data with an on-time delivery rate of 90%. In Option Year 4, the LSDM project formalized a process for providing continuous quality improvement analyses with respect to learning system performance. As a result, the project was able to inform LDG about the impact of learning systems on model participant's spending outcomes and providing advice to learning systems for improved outreach to maximize model participant representation at their events.

In the future, Optimal proposes the initiatives and epics, found in Table VII of Appendix 1, to refine and improve data collection, to open new avenues for CQI analyses, and to ensure that DMARS continues to provide an excellent user experience.

[1] Stories, or "user stories," are short requirements or requests written from the perspective of an end user – of the DMARS system, of KPI monitoring reports, or of CQI analyses. Epics are large bodies of work that can be broken down into a number of smaller tasks, called stories. Initiatives are collections of epics that drive towards a common goal.

Appendix 1 – Tables and Figures

Table I: XLC artifacts completion status

Artifact	Status
1. Business Case	Completed
2. Project Charter	Completed
3. Change Control Plan	Completed
4. Requirement Document	Completed Every Release
5. Release Plan	Completed Every Release
6. Risk Register	Completed Annually
7. Test Plan	Completed Every Release
8. Issues List, Action Items, Decisions & Lessons Learned Log	Conducted Internally
9. System Disposition Plan	Completed
10. Implementation Plan	Completed
11. Post Implementation Report	Completed
12. Annual Operation Analysis Report	Not Required
13. Project Close-out Report	Upon Close-Out
14. Operations & Maintenance Manual	Completed
15. User Manual & Training Artifacts	Completed Every Release
16. 508 Product Assessment Package	Completed
17. Project Process Agreement	Completed
18. Records Retention Policy	Completed
19. Business Product/Code	In Progress

Table II: DMARS Milestones

Milestone	Revised Schedule Dates
1. Develop system requirements	16-March-15 through 30-Nov-15
2. Complete preliminary design review of XLC stage gates	26-Aug-15
3. Complete DMARS customization	1-Jul-15 through 2-May-16
4. Complete CFACTS Training	27-Jul-16 through 28-Jul-16
5. Conduct Detailed Design Review	27-Apr-16/21-Sep-16/17-Nov-16
6. Test system on local development environment	16-Oct-15 through 30-Jun-16
7. Access AWS test/development environment	29-Jun-16
8. Begin integration with IC in the test/development environment	6-Oct-16 through 9-Nov-16
9. Conduct testing in test/development environment (functional, end-to-end, user acceptance)	1-Aug-16 through 16-Jun-17
10. Access to AWS validation environment (pre-production)	3-Nov-16
11. Submit security package	29-Jul-16 through 19-Dec-16
12. Begin integration with IC in the validation environment	1-Dec-16
13. Conduct testing in validation environment (system, performance)	26-Jun-17 through 28-Jul-17
14. Section 508 Assessment and reassessments	19-Jan-17 through 1-Jun-17
15. Security control assessment	13-Feb-17 through 17-Feb-17
16. Receive official results from SCA	4-Apr-17
17. Mitigate risks/PO&AM	Ongoing in Monthly Security Audits
18. Integration with IC in the production environment	8-Apr-17
19. Obtain Authorization to Operate (ATO)	13-Jun-17
20. Enable DMARS in the production environment	19-Jul-17
21. Conduct production readiness review	15-Aug-17
22. Conduct operational readiness review	17-Aug-17
23. Conduct production testing (production-ready, monitoring, reliability)	18-Aug-17 through 21-Aug-17
24. Admin users populate data using DMARS	19-Aug-17
25. Launch of system	5-Sept-17
26. Conduct post implementation review	19-Feb-19
27. Conduct annual operational analysis	TBD
28. Conduct disposition review	Upon system disposal

Table III: DMARS Releases

Build	*Release Date*	*Notes*
DMARS 0.0	8/7/2017	*Soft launch*
DMARS 0.0	9/6/2017	*Hard launch*
DMARS 1.0	12/16/2017	*Hard launch*
DMARS 1.1	4/21/2018	*Major changes*
DMARS 1.1	5/9/2018	*Minor changes to accommodate bugs found in testing*
DMARS 1.1	6/17/2018	*Minor changes to accommodate bugs found in testing*

DMARS 1.2	6/28/2018	*Performance improvements*
DMARS 1.3	11/17/2018	*Changes in the data import*
DMARS 1.4	5/4/2019	*Changes in the attendee entity*
DMARS 1.5	7/26/2019	*Changes in the attendee role types and dashboard filters*

Table IV: Key findings and recommendations

Research question	Finding(s)	Recommendation(s)
Who comes to learning events?	1. Nearly 55 percent of model participants in LDG-supported learning systems have never attended a model-wide event. 2. When organizations are isolated geographically (rural) or from other participants (few nearby CMMI attendees) their attendance numbers at learning events are 9 percent higher than the average participant. In other words, geographically isolated participants appear to rely on the learning system more than their urban counterparts.	1. Reach out directly to model participants who have not attended model-wide events to identify barriers to their engagement. 2. To increase collaboration, set up targeted incentives for urban organizations with more local resources to attend events.
What increases the likelihood of model participants taking action after attending an LDG-sponsored learning event?	1. Attendees are 12 percent and 17 percent more likely to act based on what they learn in "learning community" and "assessment and feedback" events, respectively. 2. Attendees who represent multiple model participant (pass-through attendees) demonstrate less engagement and are less	1. Attendees are 12 percent and 17 percent more likely to act based on what they learn in "learning community" and "assessment and feedback" events, respectively. 2. Attract attendees who work within a single organization and can enact new policies within that organization.

	likely to act on the information.	
What about events improves model participant attendance?	1. Attendance is 17 percent higher when events are held on a Monday or Tuesday. 2. Attendance is almost 18 percent higher when Continuing Medical Education credits are offered.	1. Hold more events earlier in the week to attract busy attendees. 2. Offer more events eligible for Continuing Medical Education credit.

Table V: OY 4 training sessions

Learning System(s)	Organization(s)	Date	Topic	Title	Mode of Delivery
AHC; BPCI - A; CJR; CMLN; CPC+ RLN; HHVBP; MDPCP; Pre-Award	Deloitte; Lewin; Mathematica; CMMI	8/2/2019	DMARS	Recorded trainings for all DMARS	Virtual Training Videos
AHC; BPCI - A; CJR; CMLN; CPC+ RLN; HHVBP; MDPCP; Pre-Award	Deloitte; Lewin; Mathematica; CMMI	4/2/2019	DMARS	Learning System Data Management Monthly Data Cycle	Webinar
ACO - AIM; ACO - SSP; AHC; BPCI - A; CJR; CMLN; CPC+ National; CPC+ RLN; HCIA 2; HHVBP;	BAH; CMMI; Deloitte; Lewin; Mathematica; Northrop Grumman	3/21/2019	Data Collection	LSDM Data Collection Template Training	Webinar

MDPCP; MHM; OCM; Pre-Award					
CPC+ National	Booz Allen Hamilton	1/23/2019	Data Collection	CPC+ National Technical Assistance Call	Webinar
MDPCP	CMMI; Lewin	1/3/2019	DMARS; Data Collection	MDPCP On-boarding training	Webinar
ACO - AIM, ACO - CEC, ACO - NGACO, ACO - SSP, ACO - SSP Track 1+, AHC, BPCI - A, CJR, CPC+ RLN, CMLN, HHVBP, MHM, Pre-Award	Booz Allen Hamilton; CMMI; Deloitte; Lewin; Mathematica; TMF	11/13/2018	DMARS; Data Collection	DMARS 1.3 Release and Data Import Best Practices	Webinar
BPCI - A	CMMI; Deloitte; TMF	10/9/2018	DMARS; Data Collection	BPCI-A On-boarding Training	Webinar
Pre-Award	CMMI; Deloitte; TMF	10/3/2018	DMARS; Data Collection	Pre-Award On-Boarding Training	Webinar

Table VI. LSDM Project Themes

Learning System Impact (LSI)

Data Privacy and Security (DPS)

Ease of Use (EU)

Transparency (T)

Continuous Quality Improvment (CQI)

Table II: LSDM Initiatives and Epics

Refine the LSDM Data Collection Process

- Transition to a more granular-level of data collection for the Standard Post-Event Survey.
- Refine GPRA reporting process such that all learning event targeted model participant counts are verifiable across models.
- Redevelop the "Primary Attendee Role" question in consultation with LDG and model contractors.
- Provide learning system contractors the option of using DMARS as their post-event survey data collection tool.

Improve the User Experience of DMARS

- LSDM DMARS dashboards to load data faster by only showing current GPRA year data: The proposed solution will have dashboards show data only for the current GPRA year. The users will have the option to view data across multiple years but not by default.
- Improve initial load time of reports and dashboards by moving permission checks on the database: Moving permission to check who accesses what data will improve the user experience and the speed as it will take less time to fetch records.
- Improve user experience of data import by easily fixing errors within the application UI and need not re-import manually: In case for errors during data import, users will be shown a UI to alter the data imported to fix the issue and save. Once all records are saved, the system will re-import the data automatically rather than users making these changes manually on their computers and re-importing in the system.
- Replace existing entity framework for data import to use a SQL approach this improving speed for data import: Updating the existing entity framework will allow the application to directly get data from the database using SQL query rather than fetching it from the framework.

Convene Model and Learning System Staff and Contractors

- Develop and host conference of Learning System personnel to share document and share best practices with respect to outrach and data collection.
- Continue to provide high quality training and technical support to all LSDM stakeholders.

Improve depth and sensitivity of CQI

- Apply Post-event Survey business practice data to test sensitivity of Net Promoter Score in the context of LSDM data.
- Apply information fathered on the identification, assessment, inclusion, and retention of model participants to improve the depth of CQI and test whether different application processes lead to substantially different LSDM outputs.
- Integrate model participant outcome data as available to enable more complete, rapid-cycle testing tests of the impact of learning systems

Increase DMARS's relevance to stakeholders

- Provide models with a one-stop-shop for model-participant related Key Performance Indicators.
- Enable automatic content delivery in DMARS and develop regular, stakeholder-specific reports for automatic delivery.
- Develop improved custom data viewing tools which will allow users to query LSDM data from the application.
- Move to a more rapid release cycle (more than 3 releases per year) to enable faster response times to change requests from users.

Appendix 2 - Deliverables Summary

Base Year: August 4, 2014–August 3, 2015

Table VI: BY deliverable summary

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
1	Kickoff meeting	Within 2 weeks of date of award	08/18/14	08/15/14

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
1	Weekly status calls	Weekly	Wednesdays at 11:00 AM	08/20/14 08/27/14 09/03/14 09/17/14 09/24/14 10/01/14 10/09/14 10/15/14 10/22/14 10/29/14 11/12/14 11/19/14 12/03/14 12/10/14 12/17/14 01/07/15 01/21/15 01/28/15 02/04/15 02/11/15 02/18/15 03/04/15 03/11/15 03/18/15 03/25/15 04/08/15 04/22/15 04/29/15 05/06/15 05/14/15 05/20/15 05/27/15
1	Develop project plan that defines a systematic approach for LDG to collect the learning activities data from the CMMI models	Draft due 1 month from date of award. Final versions due 2 weeks after comments are received.	Draft 09/04/14 Final TBD	09/04/14 09/16/14 05/20/15
2	Learning system model contractor gap analysis protocol	Draft due 1 month from date of award. Final versions due 2 weeks after comments are received.	Draft 09/04/14 Final TBD	09/04/14 09/23/14

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
2	Develop a SOP for collecting and submitting the learning activities data to CMS	Due 2 months after award	Draft 10/03/14 Final TBD	10/03/14 10/22/14 05/27/15
2	Codebook	Due 2 months after award	Draft 10/03/14 Final TBD	10/03/14 10/22/14
2	Conduct model contractor gap analyses to inform SOPs	Due 4 months after award	12/04/2014	12/04/14
3	Raw data files and clean data files	Monthly once the code book is approved	~~TBD~~ ~~20th of the month starting 2/2015~~ 24th of the month starting 6/2015	02/26/15 03/20/15 04/20/15 05/21/15
3	Baseline learning activities data	Draft 11/07/14 Final 11/14/14	Draft 11/07/14 Final 11/14/14	11/07/14 11/12/14
3	Launch secure learning activities data-collection tool	TBD	TBD	
4	Develop curriculum and training materials on how the models will submit their learning activities data*	Draft due 3 months from date of award. Final versions due 2 weeks after comments are received.	Draft 11/20/14 Final 12/4/2014	11/20/14 12/04/14
4	Conduct trainings	Up to 5 training sessions; 2 per month; 4 months after award	12/11/2014 01/2015 Rest TBD	12/19/14
4	Technical assistance	Ongoing beginning 4 months after award	12/11/14 Ongoing	12/11/14 Ongoing
4	Technical assistance logs	Submit monthly	Beginning 12/2014	02/13/15 03/10/15 04/15/15 05/15/15
4	Technical assistance/training participation data	Submit monthly	Beginning 12/2014	02/17/15 03/10/15 04/15/15 05/15/15

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
5	Monthly progress reports	Due on the 15th of every month	08/15/14 until 09/15/15	08/15/14 09/15/14 10/15/14 11/14/14 12/15/14 01/15/15 02/13/15 03/13/15 04/15/15 05/15/15
5	Annual report*	Due annually on the 15th of June	06/15/15	06/15/15
5	Draft report	Due 2 months prior to completion of the performance period	06/03/19	
5	Final report*	Due 2 weeks prior to the end of contract date	07/20/19	

Option Year 1: August 4, 2015–August 3, 2016

Table VII: OY 1 deliverable summary

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
1	Weekly status calls	Weekly	Wednesdays at 11:00 AM	8/5/15 8/13/15 8/27/15 9/3/15 9/9/15 9/16/15 9/23/15 10/7/15 10/14/15 10/21/15 11/4/15 11/18/15 12/3/15 12/9/15 12/14/15 1/6/16 1/13/16 1/20/16 1/28/16 2/3/16 2/10/16 2/17/16 2/24/16 3/2/16 3/9/16 3/16/16 3/23/16 3/30/16 4/6/16 4/13/16 4/20/16 4/27/16 5/4/16 5/11/16 5/18/16 5/24/16 6/1/16 6/8/16 6/15/16 6/22/16 6/29/16

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
1	Develop a project plan that defines a systematic approach for LDG to collect the learning activities data from the CMMI models	Draft due 1 month from date of award; final version due 2 weeks after comments are received	Draft 9/4/15 Final TBD	9/4/15
2	Codebook	Monthly to model contractors if changes are made	27th day of each month	8/27/15 9/27/15 10/27/15 11/23/15 12/22/15 1/26/16 2/26/16 3/23/16 4/22/16 5/26/16 6/24/16
2	Conduct Preliminary Design Review of the XLC Stage-Gate Reviews	8/26/2015	8/26/2015	8/26/15
2	Business Case	By system launch	By system launch	12/11/15
2	Requirement Documents	By system launch	By system launch	
2	Section-508 Product Assessment Package	By system launch	By system launch	
2	Project Process Agreement	By system launch	By system launch	9/4/15
2	Project Charter	By system launch	By system launch	10/29/15
2	Information Security Risk Assessment	By system launch	By system launch	
2	System Security Plan	By system launch	By system launch	
2	Privacy Impact Assessment	By system launch	By system launch	
2	Conduct Detailed Design Review (DDR) of the XLC Stage-Gate Reviews Follow-up DDR Requested by Technical Review Board	4/27/16 TBD	4/27/16 TBD	4/27/16
2	Release Plan	By system launch	By system launch	
2	Project Management Plan	By system launch	By system launch	
2	Test Plan	By system launch	By system launch	
2	Risk Register	By system launch	By system launch	
2	Contingency Plan	By system launch	By system launch	
2	Implementation Plan	By system launch	By system launch	

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
2	Conduct Production Readiness Review of the XLC Stage-Gate Reviews	TBD	TBD	
2	Conduct Operational Readiness Review of the XLC Stage-Gate Reviews	TBD	TBD	
2	User Manual	By system launch	By system launch	
2	Operations and Maintenance Manual	By system launch	By system launch	
2	Business Code	By system launch	By system launch	
2	Training Plan	By system launch	By system launch	
2	Training Artifacts	By system launch	By system launch	
2	Contingency Test Plan	By system launch	By system launch	
2	Security Assessment	By system launch	By system launch	
2	Submit Authorization Package	By system launch	By system launch	
2	Plan of Action and Milestones	By system launch	By system launch	
2	System Disposition Plan	By system launch	By system launch	
2	Post Implementation Report	Approximately 6 months from launch	TBD	
2	Submit Monitoring Reports	Ongoing post system launch	TBD	
2	Launch secure learning activities data-collection tool	Upon receipt of Approval to Operate from Office of the Chief Information Security Officer	8/1/2016	
3	Raw data files	Monthly once the code book is approved	Due on the 24th day of each month	8/24/15 9/24/15 10/23/15 11/24/15 12/23/15 1/24/16 2/24/16 3/23/16 4/22/16 5/24/16 6/24/16

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
3	Clean data files	Monthly once the code book is approved	Due on the 24th day of each month	8/24/15 9/24/15 10/23/15 11/24/15 12/23/15 1/24/16 2/24/16 3/23/16 4/22/16 5/24/16 6/24/16
4	Develop curriculum and training materials on how the models will submit their learning activities data in the LSDM data-collection tool*	Draft due 2 weeks prior to execution of training based on when new models come on board and changes to the Data Dictionary at that time; final version due 1 week after comments are received	Interim approach materials: Draft 9/23/2015 Final 9/30/2015 System training materials: Initial Draft 12/11/2015 Final TBD	9/23/15 12/11/15
4	Conduct trainings	Up to five trainings on LSDM coding scheme and data-collection tool use	October 2015 November 2015 Rest TBD depending on new learning systems and tool launch	
4	Technical assistance	Ongoing	Ongoing	
4	Technical assistance logs	Submit monthly	Due on the 15th day of each month	8/14/15 9/15/15 10/15/15 11/13/15 12/15/15 1/15/16 2/15/16 3/10/16 4/14/16 5/13/16 6/14/16

Task	Description	Delivery due date	Scheduled due date(s)	Date submitted
4	Technical assistance/training participation data	Submit monthly	Due on the 15th day of each month	8/14/15 9/15/15 10/15/15 11/13/15 12/15/15 1/15/16 2/15/16 3/10/16 4/14/16 5/13/16 6/14/16
5	Monthly progress reports	Due on the 15th of every month	8/15/15 until 9/15/16	8/14/15 9/15/15 10/15/15 11/13/15 12/15/15 1/15/16 2/15/16 3/15/16 4/15/16 5/13/16 6/15/16
5	Annual report*	Due annually on the 15th of June	6/15/16	6/15/16
5	Draft final report	Due 2 months prior to completion of the performance period	6/3/19	
5	Final report*	Due 2 weeks prior to the end of contract date	7/19/19	

Option Year 2: August 4, 2016–August 3, 2017

Table VIII: OY 2 deliverable summary

Task	Description	Delivery Due Date	Scheduled Due Date(s)	Date(s) Submitted
1	Weekly status calls	Weekly	Wednesdays at 11:00 a.m.	8/10/16 8/17/16 8/24/16 8/31/16 9/7/16 9/14/16 9/26/16 9/28/16 10/5/16 10/12/16 10/19/16 10/26/16 11/2/16 11/9/16 11/16/16 11/22/16 12/02/16 12/07/16 12/14/16 1/4/17 1/11/17 1/18/17 1/25/17 2/1/17 2/8/17 2/17/17 2/22/17 2/27/17 3/1/17 3/15/17 3/22/17 3/31/17 4/5/17 4/12/17 4/19/17 4/26/17 5/3/17 5/12/17 5/17/17 5/24/17 5/31/17 6/7/17 6/14/17 6/21/17 6/28/17

Task	Description	Delivery Due Date	Scheduled Due Date(s)	Date(s) Submitted
1	Develop a project plan that defines a systematic approach for LDG to collect the learning activities data from the CMMI models	Draft due 1 month from date of award. Final version due 2 weeks after comments are received.	Draft 9/04/15 Final TBD	
2	Codebook	Monthly to model contractors if changes are made	27th of each month	8/19/16 9/21/16 10/24/16 11/22/16 12/21/16 1/24/17 2/23/17 3/24/17 5/24/17 6/23/17
2	Launch secure learning activities data collection tool	Upon receipt of Approval to Operate (ATO) from Office of the Chief Information Security Officer	July 2017	
2	CMS Expedited Life Cycle (XLC)	As required	Final TBD	
3	Raw data files	Monthly once the code book is approved	Due on the 24th day of each month	8/24/16 9/23/16 10/24/16 11/22/16 12/21/16 1/24/17 2/23/17 3/24/17 5/24/17 6/23/17
3	Clean data files	Monthly once the code book is approved	Due on the 24th of each month	8/24/16 9/23/16 10/24/16 11/22/16 12/21/16 1/24/17 2/23/17 3/24/17 5/24/17 6/23/17
3	Quarterly report	Due the month after the quarter ends	October 2016 January 2017	10/24/16 1/24/17

Task	Description	Delivery Due Date	Scheduled Due Date(s)	Date(s) Submitted
4	Conduct trainings	Up to10 trainings on LSDM coding scheme and data collection tool use and other topics related to LSDM	TBD based on training needs	10/7/16 11/8/16 11/28/16 3/21/17 3/22/17 3/31/17
4	Technical assistance	Ongoing	Ongoing	
4	Technical assistance logs	Submit monthly	Due on the 15th day of each month	8/15/16 9/15/16 10/14/16 11/15/16 12/16/16 1/13/17 2/15/17 2/24/17 3/15/17 4/14/17 5/15/17 6/15/17
4	Technical assistance/training participation data	Submit monthly	Due on the 15th day of each month	8/15/16 9/15/16 10/14/16 11/15/16 12/15/16 1/13/17 2/15/17 2/24/17 3/15/17 4/14/17 5/15/17 6/15/17
5	Monthly progress reports	Due on the 15th of every month	8/15/16 through 9/15/17	8/15/16 9/15/16 10/14/16 11/15/16 12/15/16 1/13/17 2/15/17 3/15/17 4/12/17 5/15/17 6/15/17
5	Annual report	Due annually on June 15	6/15/17	6/15/17

Task	Description	Delivery Due Date	Scheduled Due Date(s)	Date(s) Submitted
5	Draft final report	Due 2 months prior to completion of the performance period	6/3/19	6/03/19
5	Final report	Due 2 weeks prior to the end of the contract date	7/20/19	

Option Year 3: August 4, 2017–August 3, 2018

Due to budgetary constraints, Optimal and CMMI agreed to a reduced level of effort for reporting from the months of April 2018 through July 2018. As a result, a deliverable summary for those months was not created.

Table IX: OY 3 deliverable summary

Task	Description	Delivery due date	Scheduled due date(s)	Date(s) submitted
1	Weekly status calls	Hold weekly	Wednesdays at 11:00 a.m.	8/9/17 8/16/17 8/23/17 8/31/17 9/6/17 9/20/17 9/28/17 10/11/17 10/18/17 10/25/17 11/1/17 11/8/17 11/15/17 11/29/17 12/6/17 12/13/17 12/20/17 1/3/18 1/10/18 1/17/18 1/24/18 1/31/18 2/7/18

Task	Description	Delivery due date	Scheduled due date(s)	Date(s) submitted
				2/12/18 2/21/18 2/28/18 3/7/18 3/14/18 3/21/18 3/28/18
1	Develop a project plan that defines a systematic approach for LDG to collect the learning activities data from the CMMI models	Draft due 1 month from date of award; final version due 2 weeks after comments are received	Draft 9/21/17 Final TBD	9/21/17 1/24/18
2	Codebook	Submit quarterly, per DMARS Release Schedule	August 2017 December 2017 March 2017 June 2017	8/23/17
2	Launch secure learning activities data collection tool	Execute upon receipt of Authority to Operate (ATO) from Office of the Chief Information Security Officer	Soft launch-August 2017[2] Hard launch-September 2017	Soft launch-8/24/17 Hard launch- 9/5/17 DMARS 1.1- 12/18/17 DMARS 1.11-2/5/18
2	CMS XLC	As required	N/A	N/A

[2] Optimal and CMMI agreed to move the soft launch to August 2017, but the official schedule of deliverables reflects a July 2017 launch.

Task	Description	Delivery due date	Scheduled due date(s)	Date(s) submitted
3	Raw data files (Pre-launch only)	Submit monthly	Due on the 24th day of each month	8/24/17
3	Clean data files (Pre-launch) Finalized data in DMARS (Post-launch)	Submit monthly	Pre-launch- 24th of each month Post-launch - 4th of each month[3]	8/24/17
4	Conduct trainings	Hold up to 12 trainings on LSDM data collection and DMARS	TBD based on training needs	8/21/17 9/6/17 11/15/17 12/19/17 12/21/17 1/4/18
4	Training Log	Submit monthly	15th day of each month	8/15/17 9/15/17 10/13/17 12/15/17 1/12/18 2/15/18 3/15/18
4	Technical assistance	Ongoing	Ongoing	
4	Technical Assistance Log	Submit monthly	15th day of each month	8/15/17 9/15/17 10/13/17 11/15/17 12/15/17 1/12/18 2/15/18 3/15/18

[3] CMMI and Optimal agreed to move the due date to account for extra time allocated for learning system contractors' data submissions, and an appropriate due date will be assessed monthly.

Task	Description	Delivery due date	Scheduled due date(s)	Date(s) submitted
5	Monthly progress reports	Submit monthly	15th day of each month	8/15/17 9/15/17 10/13/17 11/15/17 12/15/17 1/12/18 2/15/18 3/15/18
5	Annual report	Due annually on June 15	06/15/18	
5	Draft final report	Due 2 months prior to completion of the performance period	06/03/19	
5	Final report	Due 2 weeks prior to the end of contract date	07/20/19	

Option Year 4: August 4, 2018–August 3, 2019

Table X: OY 4 deliverable summary as of May 1, 2019

Task	Deliverable	Due Date	Submission Date(s)
Task 1			
1.1	Kickoff	2–3 weeks after issuance of new statement of work.	Agenda: 8/23/2018 Meeting: 8/27/2018 Summary: 8/31/2018
1.2	Status calls	Weekly	8/8/2018 8/15/2018 8/22/2018 8/29/2018 9/5/2018 9/26/2018 10/3/2018 10/10/2018 10/17/2018 10/24/2018 10/31/2018 11/7/2018 11/14/2018 11/28/2018 12/4/2018 12/12/2018 12/19/2018 1/2/2019 1/9/2019 1/16/2019 1/23/2019 1/30/2019 2/6/2019 2/13/2019 2/20/2019 2/27/2019 3/6/2019 3/13/2019 3/20/2019 3/27/2019 4/3/2019

Task	Deliverable	Due Date	Submission Date(s)
			4/10/2019 4/17/2019 4/22/2019 5/1/2019 5/8/2019 5/22/2019 5/29/2019 6/12/2019 6/19/2019 6/26/2019 7/3/2019 7/10/2019 7/17/2019 7/24/2019 7/31/2019
1.3	Develop project plan	Draft due 1 month from date of award. Final version due 2 weeks after comments are received.	Draft: 9/4/2018 Final: 9/25/2018
Task 2			
2.1. a	DMARS releases for improved functionality/usability/automation	Fall Winter Spring	Fall - 11/19/2018
2.1. b	Data collection template and data dictionary updates	As needed	9/28/2018 2/6/2019
2.1.c	CMS XLC and system security	As needed	
2.2	Data collected and validated	Due on the 24th of every month.	8/24/2018 9/19/2018 10/22/2018 11/28/2018 1/3/2019 1/23/2019 2/22/2019 3/21/2019

Task	Deliverable	Due Date	Submission Date(s)
			4/24/2019 5/24/2019 6/28/2019 7/24/2019
TA2.3	Data quality reports	Quarterly	11/19/2018
2.4	Online data collection application knowledge transfer and SOP updates	Last month of the contract	
Task 3			
3.1	LSDM meetings and interviews	Monthly	
3.2	Learning system recommendation debriefs	Quarterly	
3.3	Ad hoc reports to support CQI	As needed	11/28/2018 12/14/2018 1/31/2019 2/12/2019 3/4/2019 3/12/2019 4/10/2019
Task 4			
4.1	Conduct trainings	As needed	10/3/2018 10/9/2018 11/13/2018 1/3/2019 1/23/2019 3/21/2019 4/2/2019 5/8/2019
4.2	Training material updates	As needed	10/8/2018 11/15/2018
4.3	SOP updates	As needed, delivered in last month of the contract.	
4.4	Provide TA	As needed	See TA log

Task	Deliverable	Due Date	Submission Date(s)
4.5	TA logs	Due on the 28th of every month.	8/16/2018 9/28/2018 10/29/2018 11/28/2018 1/2/2019 1/31/2019 2/22/2019 3/28/2019 4/29/2019 5/28/2019 6/28/2019 7/29/2019
4.6	TA/training participation report	Due on the 28th of every month.	8/28/2018 9/28/2018 10/22/2018 11/19/2018 12/21/2018 1/31/2019 2/28/2019 3/28/2019 4/29/2019 5/28/2019 6/28/2019 7/29/2019
Task 5			
5.1	Monthly data reports	Due on the 28th of every month.	8/27/2018 9/19/2018 10/22/2018 11/28/2018 1/3/2019 1/23/2019 2/22/2019 3/21/2019 4/24/2019 5/28/2019 6/28/2019 7/26/2019

Task	Deliverable	Due Date	Submission Date(s)
5.2	Monthly progress reports	Due on the 15th of every month.	8/15/2018 9/14/2018 10/17/2018 11/14/2018 12/17/2018 1/15/2019 2/15/2019 3/15/2019 4/12/2019 5/14/2019 6/19/2019 7/15/2019
5.3a	Draft annual report	Due annually on the 15th of June.	N/A
5.3b	Annual report	Due within 15-days of COR comments.	N/A
5.4a	Draft final report	Due 2 months prior to the end of the contract date.	6/3/2019
5.4b	Final report	Due 2 weeks prior to the end of contract date.	8/2/2019

Appendix 3 – Annual Reports, Training Log and Data Collection Template

Previous annual reports, for BY through OY 3, along with the training log and data collection template have been delivered separately with this document in order to maintain 508 compliance