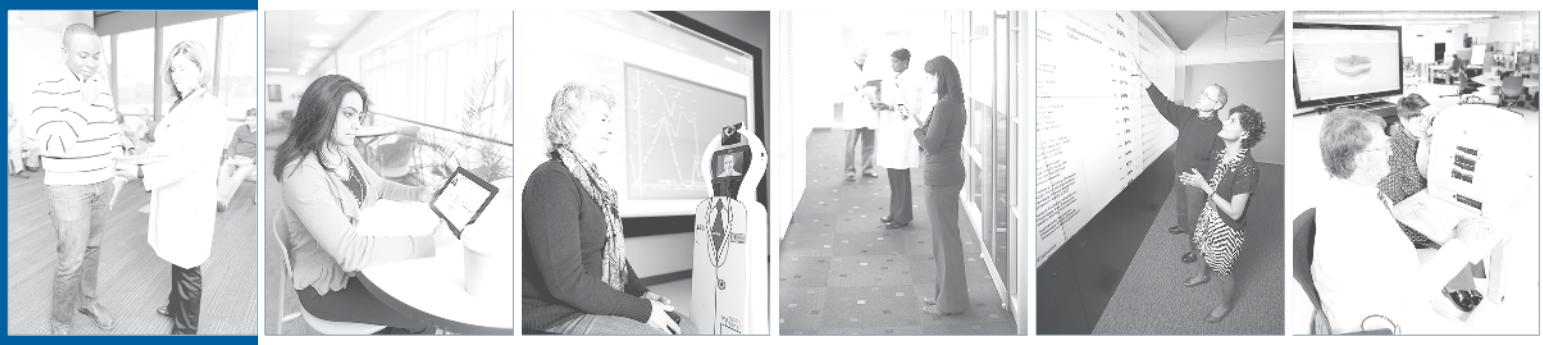
Health | *Transformation*

Information Technology for Bundled Payment



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Foreword

The Centers for Medicare & Medicaid Services (CMS) requested that The MITRE Corporation (MITRE) create a resource document to help organizations evaluate their information technology (IT) capabilities as they consider participating in a bundled payment (BP) program. Toward that end, MITRE worked with The Brookings Institution's Engelberg Center for Health Care Reform (Brookings) to conduct a comprehensive environmental scan of peer-reviewed journal articles, white papers, and publicly available evaluation reports from past BP pilots, and interviewed experts and thought leaders in the community. This *Information Technology for Bundled Payment* document consolidates this information, and presents a discussion of IT capabilities associated with BP success.

MITRE and Brookings gratefully acknowledge the valuable consulting contributions of the following experts during the preparation of this document:

- Gilbert D'Andria, GM & Vice President of B2B and Payor Technologies, MedAssets
- Len Felgner, Chief Operating Officer, Health Management Advisors, Inc.; Board Member and Senior Associate, Rockburn Institute
- Jackie Gisch, Director – Care Management, Aurora Health Care
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Executive Summary

Bundled payment (BP) has the potential to drive improvements in health care outcomes and lower costs while maintaining quality of care. A bundled payment provides a single payment to multiple providers for an entire episode of care, that is, treatment for a specific medical condition during a set period. The BP payment amount is predetermined; financial rewards flow to providers who generate savings that are realized during the course of the patient's treatment, possibly involving care across multiple care providers and settings. BP may thus incentivize care redesign; hold provider teams accountable for clinical costs, quality, and outcomes; and reward better care coordination. By contrast, traditional fee-for-service (FFS) payment, which reimburses a provider for each service performed, rewards providers based on the volume of services provided, rather than the efficiency and quality of those services.

Success in the BP environment requires changes to several types of functions that are typically supported at least in part by information technology (IT):

- Bundle Construction/Pricing
- Billing and Payment Distribution
- Care Redesign
- Reporting and Quality Monitoring

This document offers a review of IT strategies that can help organizations optimally perform the four functions described above in the BP environment. An initial step toward BP is to create and price a bundle. Organizations should design and price their bundle based upon a robust analysis of two to three years of historical price and cost data. The resulting bundle should be priced so that it is attractive to payers, and allows the organization to generate a profit through projected savings.

Once a bundle has been created, billing and payment systems must be modified to allow providers to be paid by the entity receiving the lump sum. The design of the registration process should confirm the appropriateness of new patients for one or more bundle programs in place. Once patients are identified, organizations can suspend the typical adjudication process for them for the duration of the bundle and initiate the appropriate bundle billing, claims, and distribution processes. In order to test their billing and payment systems, some organizations may elect to conduct a simulation to assess their readiness for BP.

Care redesign is a primary objective of BP. Some care redesign may not require IT investment; however, certain IT capabilities may prove useful for process support and data access, communications, and analytics. The use of electronic health records may also prove beneficial to support robust care redesign. Due to the importance of care redesign, Appendices B and C present a discussion of some non-IT drivers of care redesign.

Reporting and quality monitoring are important to ensure consistent quality of care. These activities support internal and external quality assurance, and drive internal quality improvement. Both reporting and quality monitoring activities benefit from robust, IT-supported analysis of data from many sources.

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1. Introduction

The concurrent pursuit of reduced health care costs and improved health care quality in the United States has sparked a number of health care reform activities. Some involve delivery system reorganization, such as accountable care organizations (ACO) or patient-centered medical homes (PCMH), to help coordinate health services or emphasize primary care services and prevention.[1,2] These models involve care redesign and are grounded in evidence-based medicine or best practices. They all focus on some aspect of modifying payment systems to incentivize desired provider practices, such as pay for performance, or bundling health care services, which is our area of focus in this document.

A bundled payment (BP) provides a single, predetermined amount of money for treatment by one or more providers during an entire episode of care.[3] An episode of care is the treatment of a specific medical condition during a set period of time. The concept of "episodes of medical care" is not new, and has been a topic in the literature at least as far back as 1967.[4]

A bundled payment provides a single, predetermined amount of money for treatment by one or more providers during an entire episode of care.

BP offers many advantages over the current fee-for-service (FFS) payment model, which compensates providers for individual services. FFS rewards volume of services provided rather than quality of care, which can create provider incentives that are misaligned with those of both payers and patients.[5] A BP organization is distinct from an ACO: while the latter also employs a shared savings strategy, it generally targets care for a specific population rather than a set of diagnosis groups.[6] When a BP's lump payment is linked appropriately to outcomes and other quality measures, it makes the entire treatment team more accountable for an episode's cost, quality, and outcome, and therefore, aligns financial incentives for hospitals and physicians, who currently operate under different financial pressures. BP also provides incentives to reduce waste and care defects through better coordination and consideration of financial ramifications of individual care decisions. BP offers the opportunity for providers to share in the savings obtained from eliminating duplication of services and improving care coordination. It can drive care delivery changes and ensure commensurate rewards to successful organizations.

The Centers for Medicare & Medicaid Services (CMS) has been exploring the use of BP in demonstrations for some time, including the Acute Care Episode (ACE) demonstrations currently under way in several locations.[7] More recently, CMS proposed a new BP initiative—the Bundled Payments for Care Improvement (BPCI).[8] Efforts like the BPCI and ACE encourage communication and collaboration among different providers to achieve better patient care, eliminate duplicative or unnecessary treatment, and achieve savings for the Medicare program, to the benefit of all parties involved. BPCI and ACE are just two examples of BP trials, which currently involve both private and governmental payers.

A transition to BP presents both opportunities and risks to care providers who previously generated revenue and income based on the volume of services provided.[9,10] In order to capitalize on the opportunities and avoid the risks, an organization should carefully evaluate its core capabilities and strengths using markers for success in BP. One set of markers relates to functions often supported by information technology (IT). While not every IT solution is applicable to every organization or circumstance, careful attention to health information technology (HIT) options can provide considerable leverage for organizations seeking to implement BP.[11,12]

1.1. Purpose

This Information Technology for Bundled Payment document is one of a series of CMS-authorized documents on certain key topics that are important for BP arrangements:

- Contracting For Bundled Payment
- Implementing Bundled Payment: A Case Study of Crozer-Keystone Health System
- Moving Toward Bundled Payments – Physician Leadership as a Core Competency: A Case Study of Aurora Health Care
- Improvements in Care-Transitions: A Case Study of St. Luke's Hospital

The purpose of this Information Technology for Bundled Payment document is to help organizations assess whether they possess certain IT capabilities associated with successful BP implementation, and to suggest strategies for achieving those capabilities.

1.2. Capabilities Recommended for BP Participation

Participation in BP requires significant changes to several functions that are often supported at least in part by IT. At the outset, an organization must construct and price a bundle, requiring a robust analysis of a large volume of data. Billing and payment systems, which are typically electronic, must be modified to accommodate the receipt and distribution of bundled payments. Care delivery must be redesigned in a way that generates savings and maintains quality, and this may depend in part on IT capabilities such as electronic health records (EHR). In addition, reporting and quality monitoring systems, which may also be electronic, should be used to reinforce desired provider practices and outcomes.

The four functions of bundle construction/pricing, billing and payment, care redesign, and reporting and quality monitoring are strongly inter-related, and successful transition to the BP environment likely will require some modification to each one. In some cases, organizations may be able to achieve desired functionality without extensive IT sophistication. In other cases, organizations may be able to use their existing IT capabilities and make minor additional investments to achieve functionality in each area. Many organizations that are successful in BP have realized substantial benefits from investing in IT to obtain certain capabilities.

Organizations considering BP arrangements are likely to use a combination of internal development, third-party tool acquisition, and outsourcing to fill in any gaps in their existing capabilities. In many cases, third-party tool and service providers may assist care providers in bridging any IT capability gaps to achieve BP participation. Third-party vendor support may help some organizations transition to BP more rapidly because internal development of these capabilities can be slow and highly resource intensive. The recent Medicare ACE demonstration projects successfully used third-party vendors to transition their outsourced pricing and payment distribution to a BP model.[13]

1.3. Document Organization

The following four sections explore BP-related competencies and IT strategies associated with success for each of the BP functions. Section 2 focuses on bundle construction and pricing, Section 3 discusses billing and payment distribution, Section 4 addresses care redesign, and Section 5 concentrates on reporting and quality. Additional information about care redesign that is not specific to IT is presented in Appendices B (Formal Process Refinement Examples) and C (Champions and Teams as Enablers of Care Redesign).

2. Bundle Construction/Pricing

One of the first steps necessary for participation in a BP arrangement is defining the bundle. To do this, an organization must select an episode of care, which is the set of services and time period to be included in the bundle. Bundle definition rests upon determining an episode trigger and end point, which patients and providers will be included in the bundle, and what factors (such as comorbidities) would cause a patient or service to be removed from the bundle.

A key second step in preparation for BP is to determine a price for the bundle. The price typically must be low enough to be attractive to payers, costing less than the typical set of FFS payments for the episode. It must, however, also be sufficiently high to ensure adequate compensation to the care providers.

Geisinger Health Systems' "ProvenCare" Program is a BP success story that illustrates one method of configuring and pricing bundles of care.[14,15] Geisinger initially focused on

the coronary artery bypass graft (CABG) procedure, conducting a detailed analysis of case rates based on extensive medical and billing records to determine the cost of care.[16] Geisinger then built on the analysis of case rates using layered data based on a detailed examination of the probability and cost of readmissions group (based on a 2-year comparison) due to potentially avoidable defects in care. Geisinger then established its "ProvenCare" program, offering CAGB and all related post-discharge care for 90 days at a fixed price. The fixed price includes a 50-percent share of the historical cost of post-operative readmissions, which provides a reservoir of potential profits that could be realized from improvements in care.[17] It is important to note that accurate and complete historical data was essential to this approach; gaps or inaccuracies in the historical data (e.g., readmissions rates and typical costs thereof) may have significant repercussions.

Most but not all bundles to date have focused on acute care episodes. This may be because chronic care introduces additional considerations in bundle design as chronic care is less likely to have defined beginning and end points, durations, and well-established clinical best practices and guidelines. Chronic conditions are also more likely to have wide ranges of severity, and a higher prevalence of significant comorbidities that can complicate bundle components and pricing.[18,19] Associating treatments with an episode of chronic care for the foregoing reasons may be more complicated than the equivalent process in acute care bundles.[20] These complications may affect analyses of resource utilization and financial expenditure, introducing additional complexity to the comparison of risk-adjusted performance for treatments and providers and the generation and use of quality metrics.[21]

Whether for a chronic or acute episode of care, meaningful bundle construction and pricing require a robust analysis of historical cost and price data. The following subsections discuss the basic types of data that are critical to support bundle creation and pricing, and then present some IT strategies that have helped organizations obtain and analyze the data.

2.1. Types of Data Needed for Bundle Construction/Pricing

Some experts suggest that a minimum of two or three years of claims data (assembled and aggregated) will be helpful, if not obligatory, for successful bundle creation.[22, 23] This data may be obtained internally, externally (e.g., provided by Medicare as part of BPCI entry),[24] or some combination thereof.

Data should illuminate not only the price traditionally paid for various services, but also their actual cost. There is an indisputable link between bundle price and cost of care.[25] Furthermore, the cost of an episode relates to the amounts and types of resources used, as well as the price paid for each unit.[26] Accurately measuring the cost of care requires diligence in following a number of concrete steps, and this is applicable to both BP and ACO programs.[27] Establishing a baseline financial capability requires both analytic competencies and the data that underlies these statistical analyses. Data can be used to identify bottlenecks and variations in care that reduce efficiency, increase costs, or affect outcomes. Prospective participants will gain great advantage by effective management and use of a variety of data resources.

Methods to account for routine and complication-associated costs may be considered as part of effective pricing schemes.[28] Participants may also be interested in examining the effects of risks on pricing since risk can introduce considerable variation into both treatments and costs. IT systems that assist with managing the case mix and correctly assessing situational financial implications specific to the patient may be helpful in this regard.

The first tasks relevant to bundle construction pricing (and, in turn, BP participation) are the identification and pricing of episode bundles. Participants may construct episode-pricing models manually or by using one or more tools. Illness classification and procedural inclusion are relevant in constructing episodes. Effective episode construction depends on the accuracy and completeness of the underlying data, including:

- Patient diagnoses and comorbidities
- Dates, types, and costs of services
- Patient and provider identifiers[29,30]

These data are available in most hospital IT systems.

2.2. IT Strategies for Bundle Construction/ Pricing

To support these bundle construction pricing activities, the participating organization will need the necessary capabilities of storing, managing, and analyzing the underlying financial source data (e.g., claims), supported by systems and personnel in place to develop and refine statistical models. In addition, there may be requirements specific to individual BP programs, such as the need to map episode components to Medicare Diagnosis-Related Group (DRG) codes in the Medicare BPCI program.[31] A further complication for cooperating organizations that participate together in bundles is the way different organizations handle differential categorization of some expenses, making cross-comparisons more difficult.[32]

. . . data integrity may be one of the most significant factors in influencing physician behavior

Capturing and effectively using a combination of data types represents a more desirable level of functionality to support bundle creation pricing.[33,34] Personnel at the Aurora Health Care case study[35] site indicated that data integrity may be one of the most significant factors in influencing physician behavior. One strategy to produce usable data is to redesign existing data warehouses to improve retrieval dynamics and periodically re-cluster the data. Geisinger Health Systems, for example, clusters financial, clinical, and billing data together a single data warehouse called a data cube.[36] The data cube enables physicians and administrators to locate trends and associations among various nonlinear factors.

Episode groupers are specialized software for episode building and illness classification, and may offer great value in the process of bundle creation.[37] Episode groupers create episodes of care from administrative electronic data by sifting through millions of claims for reimbursement submitted to a health care payer by health care providers and reconstructing the data into instances of specific patients receiving care for specific conditions.[38] These products may also incorporate risk adjustments to cost models and support analysis of resource utilization and financial expenditure. Episode grouper tools also support the generation and comparison of individual provider performance ratings, which may be helpful in care redesign.[39,40]

Groupers are useful tools for creating and pricing bundles, although one may operate without them, provided there are sufficient analytic and/or IT capabilities in place to perform similar tasks. Groupers would also be less necessary for configuring bundles for small pilots, though this may be more applicable for demonstration purposes than for an organization-wide rollout. For prospective participants who choose to use Episode groupers, at least two viable commercial products are currently available: the Thompson Medstat Medical Episode Grouper (MEG) and the OPTUMInsight's® Symmetry Episode Treatment Groups (ETG). Other commercial products will likely enter this space as demand increases. Public domain software may also become available in the short term, perhaps as soon as January 2012.[41] These community-wide products will likely be joined by functionally equivalent, proprietary, in-house tools generated within the participant community and public domain options.[42]

The MEG and ETG systems include at least 600 categories of health conditions, facilitating assignment of claims into appropriate episodes.[43] Comparative analyses of these two products indicate that they may present slightly divergent outputs using the same underlying claims data.[44,45] This is likely a result of the underlying algorithm engines of these products, which are not fully disclosed. Public domain groupers are expected to show greater algorithmic transpar-

ency,[46] but may also produce different results. The impact of these differences is not well established.

The two proprietary episode grouper software programs mentioned above bundle claims into episodes based on procedure and/or diagnosis codes. Another approach is the PROMETHEUS program, which bases payment and performance measurement on episodes defined using diagnoses and clinical practice guidelines for appropriate services.[47] The program develops an evidence-informed case rate (ECR), which is a single, risk-adjusted payment (prospective or retrospective) given to providers across inpatient and outpatient settings to care for a patient diagnosed with a specific condition—in effect defining the episode of care. Payment amounts are determined by the resources required to provide care as recommended in well-accepted clinical guidelines.[48] This model calls for a portion of the payment to be withheld and re-distributed based on provider performance on measures of clinical process, outcomes of care, and patient experience with care received.

A recent study of three PROMETHEUS pilot sites found that while physician champions received significant value from PROMETHEUS as a measurement tool, they experienced significant delays in payment system implementation. These delays were described as a product of the complexity of the model and the fact that it builds on existing complex health care systems and relationships.[49] In addition, according to a RAND report, most experts professed a strong preference for episodes that cut across multiple settings because of the incentives created for care coordination.[50] These experts also expressed concern about how to approach patients with multiple chronic conditions, favoring a holistic approach to episodes focused on individual diseases.[51] Providers should carefully analyze the risks and potential benefits of BP within the context of their individual circumstances. CaroMont Health, in conjunction with Blue Cross Blue Shield of North Carolina, was the first participant in a PROMETHEUS pilot for knee replacement. CaroMont Health's participation shows that a health system's modest size need not be an impediment to BP participation.

3. Billing and Payment Distribution

Effective billing is a critical capability for all care providers. Participation in BP may introduce additional complexities to the billing process that require attention. Some experts have noted that one of the major obstacles to successful participation in a BP program is the challenge of receiving and appropriately dividing payments.[52] BP encompasses many distinct payment situations that merit careful planning.

While not a component of billing or payment, patient registration in the BP program is critical to the financial processes. The design of the registration process should confirm the appropriateness of new patients for one or more bundle programs in place. Once patients are identified, organizations can suspend the typical adjudication process for them for the duration of the bundle and initiate the appropriate bundle billing, claims, and distribution processes.

The following subsections explore the factors that determine billing and payment distribution requirements for BP, and introduce the option of using billing payment simulations to assess readiness for BP.

3.1. Billing and Payment Distribution Requirements

Participants should consider how to optimize billing and payment systems for bundling claims and distributing proceeds according to the specifics of the bundles supported and according to the terms of their contracts with other care providers.[53] As described below, an appropriate approach will depend on factors such as how care is coordinated across providers and settings, whether payment is retrospective or prospective, whether the episode in question is chronic or acute, how quality measures are integrated, and what type of billing and payment systems are already in place.

Depending on the terms of the BP program(s), participants may need to cover more than one bundle type or model simultaneously or coordinate billing among a variety of physician and non-physician providers. It is advisable that participants optimize their support systems to operate effectively under these circumstances. For example, the

ACE demonstration program projects showed hospitals use IT in a variety of ways to change process and operations. All hospital leaders reported that their organizations required billing system adjustments and all reported using clinical data warehousing tools to combine financial data with data from the case management software program.[54] However, only two hospitals used an electronic platform with computerized physician order entry (CPOE) and clinical decision alerts, and unlike their counterparts that rely on paper order sets, only these two hospitals were able to look at the details of the efficacy of specific care sets through the electronic order sets.[55] Given these results, one expert concluded that…

> …full automation using clinical IT tools is essential to fully realize the operational changes required for bundled payment to succeed. Geisinger's experience suggests that real success will come only when a hospital has completed the roll-out of clinical documentation and CPOE tools, and its physicians are using and understanding those tools. All of this is not to say that bundled payment cannot be managed with paper processes—only that success with this approach will be limited.[56]

EHRs can be helpful in alerting and steering physicians towards best-practices through real-time alerts and flow sheets

There is a clear difference in financial operational needs for prospectively paid vs. retrospectively paid BP models. For example, the ability to handle "no-pay" claims with CMS as part of the recent prospective Bundled Payment for Care Improvement model would entail careful planning and may require substantial billing system modifications.[57] The BPCI prospective payment model would also necessitate the establishment of one participant as primary coordinator for cost-of-care negotiations, expense reconciliation, and disbursement of payments.[58,59,60] On the other hand, processing purely private prospective payment bundles may be more straightforward, even when operating across organizational boundaries. Both prospective and retrospective BP payment models, whether with public or private payers, will require some modification to existing billing and payment systems, and organizations planning to engage in BP will need to plan accordingly.

BPs that combine acute and post-acute treatment represent a major step forward for ensuring effective patient care, but may also entail more complex coordination between providers.[61] In these cases, participating providers' exchange of billing information may become more complicated, and may consequently demand more substantive changes to systems that support these activities, including those related to disbursements. Participants may need to cover a variety of physician and non-physician provider arrangements and scenarios, including complexities that may result from financial intersections between participating providers. Some degree of financial systems integration may be beneficial to alleviate these complexities, circumstances permitting.

It has been suggested that as episode of care (or capitation) payment structures proliferate, it may also be possible to greatly simplify the billing structures that support them.[62] When quality of outcome, not quantity or type of services provided, is the major driver of value and profits for providers, there may be a natural shift of resources away from billing infrastructure, which itself should produce savings to the health care system.[63] Replacement of these systems with EHRs may be realized when payments are no longer connected to specific services.[64] Nevertheless, most organizations will experiment on a small scale with a few bundles prior to initiating any large-scale changes to current systems. Small-scale pilots provide an excellent opportunity for organizations to identify the challenges and benefits of BP implementation.

In some cases, existing payment distribution arrangements will be sufficiently facile to support the optimization of care and the receipt and distribution of bundled payments; how-

ever, many providers may need to invest in additional IT resources. In other words, the more complex cases, such as those involving gainsharing among many types of providers across numerous settings, the more participant organization may need additional capabilities in place to translate the contents of one or more BP contract agreements accurately for effective operation—especially payment distribution—within existing or newly developed billing and payment systems or processes.[65] Participants may need to provide these capabilities to cover a variety of physician and non-physician provider arrangements and scenarios, depending on the specifics of the bundle in question. The payment distribution arrangement must also govern the distribution of profits, including those from gainsharing, when applicable. This may be accomplished through IT systems or manual reconciliation. Although manual reconciliation can require significant effort, several BP pilots have used it successfully.[66]

3.2. Billing and Payment Simulations

As an intermediate step between the status quo and small-scale or full-scale adoption of BP, organizations may consider the use of "virtual bundles." This is a reconciliation process that distributes rewards or recoups overages after individual providers have received their payments separately through conventional means.[67] "Simulated participation," the use of independent, parallel IT systems to mimic the operations of actual participants, may be another appropriate intermediate step for organizations considering BP participation. This would typically consist of mimicking both bundle price point determination and subsequent billing and payment distribution activities. Simulated participation can help to quickly and comprehensively identify weak points in an organization's ability to participate effectively, including gaps in data completeness and correctness, effectiveness in cost and risk modeling analytics, physician payment attribution and disbursement, or other areas. Prospective participants may choose to follow this process, despite the costs of maintaining separate systems to support both, to help mitigate the risks of premature entry into BP.

The Crozer-Keystone Health System used this simulation process successfully at the case study site. Crozer-Keystone found simulated participation quite helpful for identifying areas for improvement prior to entry into BP.[68] CaroMont Health also used simulation as part of their knee replacement BP program planning.[69]

4. Care Redesign

BP programs are most likely to be financially sustainable when supported by efficient and comprehensive care redesign.[70] If participants are unable to change processes and behaviors within the care delivery environment as part of care re-engineering, they will be less able to meet quality targets at or below the cost of bundle and thus succeed clinically and financially. To thrive in this market space, participants should seek to attain and improve certain IT competencies and capabilities, including the following:

- Process support and data access
- Communications
- Analytics

Organizations that address these issues, whether through IT or otherwise, increase their chance of BP success. Two markers of institutional success in adopting IT and other changes are (1) formal process re-engineering strategies and (2) organizational leadership, including physician engagement. While these two markers are not IT specific and thus not discussed at length in this text, Appendix A presents examples of formal process redesign use for care re-engineering, and Appendix B provides a detailed discussion of the importance of organizational leadership for care re-engineering.

The topic of EHRs is, in many cases, closely related to care redesign. The following subsection addresses this topic briefly. The remainder of Section 4 presents requirements and IT strategies related to process support and data access, communications, and analytics elemental to care redesign.

4.1. Electronic Health Records

One tool that may be useful to achieve care redesign objectives is the EHR.[71,72] There are notable success stories regarding the use of EHRs in an effective care redesign pro-

gram. As an example, leadership at Geisinger Health Care realized that human error can result in unintended adverse outcomes and that EHRs can be helpful in alerting and steering physicians towards best-practices through real-time alerts and flow sheets. These tools help to automate best practices and make it easier for physicians to do the right thing more reliably and consistently. Therefore, Geisinger modified its EHR systems to include flow sheets to track key clinical elements, and real-time alerts to inform providers if a step was incomplete.[73,74,75] The standardized processes enabled by EHRs have helped reduce variability and duplication (and thus costs), while improving outcome.[76,77,78,79]

In the context of care redesign, chronic care again warrants special mention. Geisinger has extended its bundling activities to management of chronic diseases, such as diabetes. Geisinger applied an "All or None" method, in which an EHR must show that a patient received all bundle elements to be counted as a success. This method showed an improved (intermediate) outcome primarily by effectively incentivizing providers to comply with the full spectrum of measures.[80] Similarly, the Veterans Health Administration (VHA) has used VistA, its open source EHR tool, to help establish and monitor best practices in care for diabetes, a common chronic condition among the veteran population.[81,82,83] Provider accountability and adherence to approved guidelines were key components of this reform in both cases, which produced drastic improvements in care delivery and results.[84,85,86]

Even the most advanced and integrated EHRs do not presently provide a solution for many facets of care re-engineering, and therefore, these EHRs are at most only a part of the necessary solution.[87,88] In fact, one subject matter expert indicated that up to four bundles could be run simultaneously without use of EHRs; beyond that, the expert believed that increased labor costs would overwhelm any possible savings.[89] The impact of skilled labor costs on the overall cost of providing health care can be considerable.[90]

4.2. Process Support and Data Access

Effective clinical process support is a hallmark of successful BP participation. Indeed, there is growing consensus that process, rather than simply tasks, must be the central tenet of care redesign.[91] A focus on process implicitly places the needs of the patient on par with the provider, while a focus on tasks encourages both variability and increased utilization.[92,93] Some experts believe that the selection of clinical decision support systems (CDS) should follow, and not precede, the establishment of a comprehensive CDS plan.[94]

The mapping and implementation of best-practice processes into EHR flow sheets, or equivalent alternative technology solutions, involves considerable upfront outlay of resources. This investment may pay considerable dividends in reducing variability and duplication—and thus costs—while improving outcomes. Having an EHR system in place also better enables the development, use, and iterative refinement of electronic workflows that track critical data elements and ensure rigorous adherence to standard operating procedures. Organizations are more likely to achieve effective care redesign when they adopt revised care guidelines as an explicit goal, and proceed in full compliance with those revised care guidelines. Physicians are more likely to adopt processes when the processes are first mapped out and then EHRs are later brought in to automate those processes. In these cases, the IT helps the physicians do what they have already decided was best.

Access to high-quality evidence and data presented in a user-friendly way is of considerable value at the point of care

Kaiser Permanente sought to provide clinical decision support, and it expanded its EHR functionality to do so. In order to identify and support efforts to engage in systematic improvements in the health care delivery process, Kaiser created KP HealthConnect, an information continuity tool. Kaiser has found "that access to the EHR in the exam room

helped to promote compliance with evidence-based guidelines and treatment protocols, eliminate duplicate tests, and enable physicians to handle multiple complaints more efficiently within one visit."[95] In addition, Kaiser sought to engage patients in their own care and drive better health outcomes, so it implemented a robust online patient health portal.

Paulus, et al. and several of our team interviews described a recent example of EHR-enabled care redesign at Geisinger Health Systems. Geisinger identified the following primary steps for EHR-enabled care redesign:

- The deconstructed best practices are mapped onto the existing processes in EHR flow sheets, and all redundant or unnecessary steps are purged
- The remaining best-practice steps are introduced into the process flow to ensure full coverage
- All applicable steps are automated, including use of order sets and alerts, to increase efficiency

Concurrent with these IT-related processes, Geisinger Health Systems established appropriate metrics and rigorously tracked them to ensure that both the methods and the outcomes were as expected.[96] It is advisable to pilot new workflows prior to a full rollout, as Geisinger does. This combination of re-engineering and monitoring shows great potential for reforming the delivery of health care.

Provider behavior is another key factor in BP process support and data access. By incorporating feedback mechanisms, such as alerts, providers gain a helpful, IT-facilitated tool for modifying physician behavior. Using various alert tools, organizations can implement these feedback mechanisms outside EHR systems, but this approach requires resources. Chaudhry, et al. report an excellent example of the impact of alerts, reviewing the role of HIT, including EHRs, in the prevention of adverse drug effects and improvement of correct dosing.[97] Geisinger's experience demonstrates similar beneficial effects.[98,99,100]

Access to high-quality evidence and data presented in a user-friendly way is of considerable value at the point of care (POC), provided it can be incorporated within existing workflows without undue disruption.[101] Many types of clinical information systems can provide POC information; however, those that tie in to EHRs can provide a superior variety of granular information from existing historical collections and ongoing clinical activities in the care continuum, and may thus present a clearer picture of the patient's status in real time.[102,103] This would support both better coordination and adoption of best practices, and likely improve outcome.[104] The Aurora Health Care case study suggested that having accurate quality metrics available in electronic systems was crucial for physician engagement and leadership of the transformation process.[105] Caution should be exercised in this area, however, because the wrong data can drive clinical decisions and change clinical practice in ways that diminish patient care.[106]

4.3. Communications

Systems or processes that enable secure data sharing and are capable of supporting care coordination among members of the care team will be a necessary, or at least very desirable, component of care redesign. The seamless sharing of patient records becomes critical for maintaining quality and efficiency of services, especially when the sharing crosses organizational boundaries.[107] One cannot overstate the value of coordination and collaboration to the quality of care and the reduction of defects in care. Kaiser Permanente, for example, considers information continuity a key component of care coordination, and has invested substantially in health IT to ensure that this is well enabled.[108] Care coordination across sites was also a key feature of the Veterans Administration's Diabetes program.[109] James Walker, Chief Health Information Officer at Geisinger Health Systems and executive director of Geisinger's EHR Safety Institute, notes that developing and implementing IT solutions that recapitulate the very paper-based processes they aim to replace does little to harness the teamwork-enabling capabilities of IT, and should be avoided.[110]

Non-EHR enablers of this coordination could include many options, including use of the Direct Project Protocol to send and receive medical information securely.[111] Because Direct can link EHR to EHR, as well as individual to individual, it may fill many communication gaps. Health Information Exchanges (HIE), now proliferating throughout the United States, may play a similar role. These exchanges

offer an entry point to a considerable IT infrastructure for sharing patient data across organizational boundaries.[112] For this reason, some stakeholders have expressed the belief that HIEs play a vital role in promoting quality, cost effectiveness, and safety of care delivery, and may be critical for ensuring that programs are able to capture the relevant outcome data.[113] Various state, regional, and community HIEs will soon be broadly available, enabling considerable choice for providers interested in accessing these clinical data sharing services.[114] Some HIEs also include "EHR-lite" functionality or services as part of their offering.[115]

Patient registries are a source of information that can facilitate the development of best practices and care redesign. One study suggests that registries that provide outcome data to both practitioners and the public can enable medical professionals to engage in continuous learning and to identify and share best clinical practices.[116] Outcome data transparency resulted in improved health outcomes, often at lower cost. According to the authors, "if the United States had a registry for hip replacement surgery comparable to one in Sweden that enabled reductions in the rates at which these surgeries are performed a second time to replace or repair hip prostheses, the United States would avoid $2 billion of an expected $24 billion in total costs for these surgeries in 2015."[117]

4.4. Analytics

Analytics, which includes the creation and refinement of statistical models, helps to drive, inform, and revise care redesign. Analytics transforms data from multiple sources, such as EHRs and financial systems, into useful information. The ability to generate useful information is a strong complement (and possible precursor) to reporting activities.

Those seeking to implement BP should develop their baseline analytic capability to generate meaningful information from both patient and population-level data. Analytics should enable the necessary disaggregation to pinpoint cases representing best practices and the greatest opportunities to make corrections. A lack of sophistication, effectiveness, and use of analytic tools may have significant negative repercussions for BP participants.[118]

Effective analytics may demand substantial resources, including statisticians, epidemiologists, and statistical programmers for generating and iteratively refining analytic models and algorithms tailored to the specifics of the participant's organization. Commercial Off-the-Shelf (COTS) analytic tools are available to increase the analytic rigor of modeling costs, risks, and quality in the health care setting.[119] In addition, third-party organizations may bring a higher degree of analytic sophistication to participants with only limited initial expertise in these areas. These third-party organizations may provide more comprehensive packages of "big data analytics" solutions.

Participants should examine their capacity to implement the process transformations, as well as deploy and maintain the necessary systems, data sets, and tools at their site. Successful completion of these activities will require a broad set of skills and disciplines, including traditional IT staff as well as high-skill knowledge workers such as statisticians and epidemiologists. Statistical programmers who define, implement, and refine analytic models and algorithms are of particular value in this arena. The relative skill levels of these staff may play a considerable role in the outcome of participation.[120]

5. Reporting and Quality Monitoring

Both reporting and quality monitoring are requirements designed to ensure that patient care improves, or at least does not suffer with the introduction of BP. A great deal of data —both clinical and financial—will provide important information on reporting and quality monitoring, some of which will be for internal and external use.

Reporting is generally an external function that fulfills an oversight responsibility, and may entail public disclosure of performance on various quality metrics. Some BP programs explicitly state that organizations may be removed if their quality of care decreases during their participation.[121] Reporting addresses a wide array of activities critical for care redesign and operation within the BP environment. These activities include the assessment and disclosure of clinical quality and resource utilization, and evaluating practitioner and provider performance. Reporting entails the regular production use of appropriate analytic tools

and routines in service of these objectives. EHRs are effective enablers of reporting because of their efficient capture of relevant data. Multi-site reporting activities depend on data exchange between systems, whether achieved through interoperability or bulk exchange.

In addition to collecting data required for reporting purposes, an organization should seek to collect many other data points and metrics to help their providers meet their publicly reported metrics/benchmarks. An organization will need to monitor data points of interest (as close to real time as possible) and feed that data back in actionable formats to providers to help them perform better (also in as close to real time as possible) to enable quality improvement efforts.

Organizations may perform analyses at both the patient and physician levels for cost, quality, and utilization as part of their iterative care redesign activities. Using dashboards to assist with monitoring quality and resource usage may be helpful.[122] A key finding of the data analysis performed at the Veterans Health Administration was that site-to-site variability, rather than physician-to-physician variability, was the major contributor to process and outcome variance in diabetes care.[123]

Before BP operations begin, participants should develop appropriate reporting metrics and methods (e.g., quality monitoring using scorecards), which often include such topics as reductions in complications, outcome measures, and patient satisfaction.[124] Ineffective metrics selection can be deleterious to care reform efforts. Effective reporting systems provide opportunities to both improve performance by identifying deficiencies for further scrutiny, and recognize best practices that inform and drive process re-engineering in care delivery.[125] For example, groupers (see subsection 2.2) may facilitate performance comparisons across different entities, which may be useful for optimizing multi-site episodes.[126,127] Robust reporting systems provide the capability to establish feedback loops among the wide range of participants within the BP care team, and these feedback loops can reinforce participants' common commitment to the larger goal of care improvement.

Appendix A. Acronyms

ACE	Acute Care Episode
ACO	Accountable Care Organization
BOOST	Better Outcomes for Older adults through Safe Transitions
BP	Bundled Payments
BPCI	Bundled Payments for Care Improvement
CABG	Coronary Artery Bypass Grafting
CIO	Chief Information Officer
CMO	Chief Medical Officer
CMS	Centers for Medicare & Medicaid Services
COTS	Commercial Off-the-Shelf
CPOE	Computerized Physician Order Entry
DRG	Diagnosis-Related Groups
ECR	Evidence-Informed Case Rate
EHR	Electronic Health Record
ETG	Episode Treatment Groups
FFS	Fee for Service
HIE	Health Information Exchange
HIT	Health Information Technology
IQR	Inpatient Quality Reporting
IT	Information Technology
MEG	Medical Episode Grouper
PCMH	Patient-Centered Medical Homes
POC	Point-of-Care
STAAR	State Action on Avoidable Rehospitalizations
VHA	Veterans Health Administration

Appendix B. Formal Process Refinement Examples

Numerous examples demonstrate the value of process re-engineering to health care operations, including the mix of techniques used by Geisinger Health Systems (e.g., Lean, Six Sigma) during bundle construction and process re-engineering. Additional examples include Project BOOST (Better Outcomes for Older adults through Safe Transitions)[128,129] and Project STAAR (State Action on Avoidable Rehospitalizations).[130,131] Both projects focused on reducing rehospitalization rates by refining details of the discharge process to help diminish the high costs and impacts of readmissions. These projects address a particular problem for Medicare, which shows a 20 percent readmission rate for all hospital events within 30 days of discharge, presumably due in large part to ineffective "handoffs" from hospital to post-hospital care.[132]

Project BOOST attempted to remedy the high rate of rehospitalization among Medicare patients by defining and propagating best practices in the discharge process to improve "transition of care" from hospital to home. Project BOOST enlisted the intervention of an expert group and rolled out a series of training sessions for hospital staff; the project provided ongoing support through electronic means (e.g., listservs, a community Web portal, and webinars).[133] These efforts generated a 21 percent reduction of 30-day, all-cause readmissions among participating sites, while simultaneously increasing patient satisfaction.[134]

Project STAAR offered strategic guidance, support, and technical assistance to hospitals and teams across the care continuum to improve transitions in care, thereby reducing potentially avoidable rehospitalization events.[135] By creating a "robust learning community," Project STAAR made improvement of the care process a joint responsibility.[136] The project identified best practices that successful teams used in pre-discharge needs assessment and post-discharge engagement. These practices included detailed data collection and robust analysis[137] and were made available to other groups across the program. The practices also help highlight the value of educational components of care redesign on overall success.

As a vanguard in bundle design and implementation, Geisinger Health Systems has established, vetted, and iteratively improved the process by which care is systematically re-engineered to improve both efficiency and outcome. This has drastically reduced the time needed for the care re-engineering team to perform their work, moving from one bundle per 11 months to 4–5 bundles per year.[138] The first bundle related to their CABG (coronary artery bypass graft) care redesign. Others, such as the "All or None" method related to diabetes, came later. Each care redesign followed a similar process, which is described above in Section 4.2.

Appendix C. Champions and Teams as Enablers of Care Redesign

Organizations that have active and enthusiastic leadership participation by executives or other upper-level managers may find it easier to re-engineer care and participate in BP programs. When executives align an organization's vision with the BP program goals, that organization should be able to collect and use appropriate data resources effectively, as well as implement the necessary infrastructural changes. When executives champion these potent changes, they can provide significant momentum to achieve the needed upgrades to health IT systems and delivery capabilities. There are several options for developing executive-level champions and leadership teams to accomplish care redesign.

One option is the creation of an IT Champion, formally defined as a "manager who actively and vigorously promotes their personal vision for using IT, pushing the project over or around approval and implementation hurdles."[139] An IT Champion is typically the Chief Information Officer (CIO), whose presence and role may greatly facilitate such activities as system integration across departments and organizations. The efforts of other high-level IT leaders may contribute similar influence and effect on an organization. The literature demonstrates that the engagement of organization leaders in the reform process can pay significant dividends.

A Chief Medical Officer (CMO) may generate similar advantages as a champion for care transformation. This is especially true where there are concerns about providing the correct type and level of data to modify physician behavior effectively. Although CMOs and IT Champions operate in related areas, their domains are sufficiently separate that they may be able to operate synergistically. Nurse leadership may play a related, if not identical, role.[140]

Care redesign experts note the high value of physician engagement and leadership at all levels of the transformation process. Aurora Health Care found that physician buy-in was a critical advantage at the Aurora Case Study site;[141] Aurora Health Care considered the emergence of "physician champions" a vital precondition for success in their journey toward participation in bundled payments.

The Crozer-Keystone study site similarly lauded the role of physician champions in care redesign.[142] Kaiser Permanente deems physician champions a key factor in care redesign.[143]

In addition to the recognized organizational value of the executive leaders, multifunctional teams are essential to the successful implementation of care process re-engineering. These teams may require a wide variety of personnel and skill sets; the nature and composition of these transformational teams should be determined by specific organizational needs and circumstances. For example, as part of a typical care transformation process, Geisinger Health Systems has physician assistants shadow and record all relevant activities of clinicians as they perform their duties related to a proposed bundle. These teams work in concert with bodies of senior clinicians who deconstruct detailed, evidence-based clinical care guidelines published by professional societies into individual actionable parts.[144] These clinical care actions are then mapped onto health IT systems such as electronic health records by informatics professionals or IT staff. Once the missing processes are added, the redesigned care flow sheet is completed. The Crozer-Keystone case study demonstrates a related example in which a health economist on the analytics team helps facilitate the transformation. Some organizations may choose to obtain the services of individuals with combined health care and informatics capabilities to optimize re-engineering activities.

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