Affordable Care Act

Predictive Modeling Challenges and Opportunities for Case Management

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ABSTRACT

Purpose/Objectives: The move to the Accountable Care Organization model of care calls for broad-sweeping structural, operational, and cultural changes in our health care systems. The use of predictive modeling as part of the discharge process is used as a way to highlight just one of the common processes that will need to be transformed to maximize reimbursement under the Accountable Care Organization model. The purpose of this article is to summarize what has been learned about predictive modeling from the population health management industry perspective, to discuss how that knowledge might be applied to discharge planning in the Accountable Care Organization model of patient care, and then to outline how the Accountable Care Organization environment presents various challenges, opportunities, and implications for the case management role.

Primary Practice Setting(s): Hospitals, physician practices.

Findings/Conclusions: The development of predictive models to identify patients at risk for readmission is described and how such models can positively impact the discharge planning process by lowering readmission rates. Examples of the structural, operational, cultural, and case management role changes necessary to maximize the benefits of an Accountable Care Organization are described.

Implications for Case Management Practice: There is a growing need for advanced practice nurses to fill the leadership, resource management, analytical, informatics-based, and organizational development roles that are sorely needed to advance the Accountable Care Organization model of care. Case managers are well-positioned to lend their expertise to the development efforts, but they will need to be educationally prepared for the many advanced practice roles that will emerge as our nation evolves this new system of health care delivery.

Key words: *Affordable Care Act, case management, future trends, predictive modeling*

Interest in and movement toward Accountable Care Organization models (ACOs) have dramatically increased since the passage of the Patient Protection and Affordable Care Act (PPACA) in March of 2010 (U.S. Department of Health and Human Services, 2011a, HealthCare.gov). The hope is that quality of care will increase and costs will decrease. But those results, while anticipated and certainly the primary intent of the PPACA legislation, are far from certain. The big "if" is whether the Centers for Medicare & Medicaid Services (CMS), physicians, payers, and nurse and health administration leaders can work together to dramatically change the culture, processes, and outcome measures characteristic of traditional fee-for-service, "out-the-door-and-no-longer-my-problem" patient care models.

Fisher and Shortell outline the central aims of an ACO as "improving population health, engaging patients in making decisions and managing their care, improving safety and care coordination, guaranteeing compassionate and appropriate end-of-life care, and eliminating waste." But the authors go on to say that these goals will not be possible given current measurement processes that "too often assess individual clinicians and silos of care, focus largely on processes of questionable importance, are imposed as an add-on to current work, and require burdensome chart reviews and auditing or reliance on out-of-date administrative data." The authors further note that the goals cannot be met within an organizational culture that "attributes poor performance to individual failure vs. flawed systems" (2010, p. 1715). The carrot, or

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implied incentive, is that if an ACO can meet certain performance standards and achieves a specified level of savings for an "episode of care," the ACO then shares some of that cost savings.

Indeed, the transformation that is happening right now is calling into question most of what is so ingrained in our operational processes, outcomes measures, and, most importantly, in the cultural norms of most health care systems. Many of our current approaches to performance management are inadequate and plagued by siloed thinking. The mainstay of quality measurement still relies too heavily on measures of questionable importance with hard-to-pull, and even harder-to-analyze, data that frequently arrive too late to be useful for timely management decision making. In addition to these operational challenges, newly developing ACOs are also struggling culturally with the across-patient-care-setting thinking that will become the new cornerstone of the high-quality reimbursement incentives that are part of PPACA rules. Consider one of the many processes of care, for example, discharge planning, to anticipate how PPACA may impose dramatic cultural changes (see sidebar story—Discharge Planning: Present and Future). The lack of reimbursement for 30-day readmission for certain conditions spawns a whole host of new challenges including the need for better ways of anticipating and preventing readmission. Predictive modeling (PM) is an important tool that can be used to determine which patients might be at high risk for coming back through that revolving admissions door.

This article discusses the use of PM as part of the discharge process as a way to highlight just one of the common processes that will need to be transformed to maximize reimbursement under the ACO model. The purpose of this article is to summarize what has been learned about PM from the population health management (PHM) industry perspective, to discuss how that knowledge might be applied to discharge planning in the ACO model of patient care, and then to outline how the ACO environment presents various challenges, opportunities, and implications for the case management role.

WHAT HAS BEEN LEARNED ABOUT PM

Predictive modeling encompasses a wide range of tools used to stratify a population of choice according to its risk of nearly any outcome (Cousins, 2002). Ideally, the goal of PM is to identify at-risk individuals for an undesired outcome for the purpose of intervening with them before the occurrence of adverse events that result in suffering and increased medical cost. In this section, the history of PM for the purpose of at-risk identification in the PHM industry will be summarized in terms of the types of data used and the methods for developing various models. Next, a summary of what has been learned about PM in the PHM industry will be presented that has particular application to the ACO model of care.

Dr. Arlene Ash and her colleagues (Ghali, Hall, Rosen, Ash, & Moskowitz, 1996; Iezzoni, Ash, Coffman, & Moskowitz, 1992; Rosen, Ash, McNiff, & Moskowitz, 1995) pioneered the use of PM for the purpose of identifying high-risk individuals in the early to mid-90s and eventually their work became the foundation of the U.S. Medicare risk adjustment system. Subsequent to that pioneering work, an entire PM industry emerged as various disease and PHM industry vendors needed to identify high-risk individuals as the targets for their coaching, disease, and care coordination services. Along with the PHM vendors, health plans also began their own PM programs to support their in-house disease management efforts. Today, use of various PMs is now standard practice in the PHM and health plan industries, although scholarly discussions continue in terms of what data to use and which models work best and most cost-efficiently.

Most typically, demographic and both medical and pharmacy-based claims data are used as the primary data sources. But survey-based methods have substantially improved the predictive power for a survey's ability to get current information, tap into physical and emotional perceived health information, beliefs and preferences, health behaviours, and readiness to change factors (Meek, Lyon, May, & Lynch, 2000). Various PM development methods, including rules-based models, regression techniques, and neural network modelling, are used, but the most commonly used methods are regression techniques. *Regression analysis* is a set of statistical techniques that model the relationship between an outcome of interest, for example, whether a person is readmitted or not and one or more predictor variables. Regression analysis is also used to understand which among the predictor variables are related to the outcome variable, and to explore the forms or "weights" of these relationships. Both the types of data sources used and the type of PM development method used all have their pros and cons (Meek, 2003a, 2003b; Meek & Citrin, 2005). But the general guiding principle

Present: Mr. Jones, an 86-year-old man, has been hospitalized for the fourth time this year with congestive heart failure (CHF). His clinical examination and laboratory findings, including improved creatinine/glomerular filtration rate (GFR), reduction in weight as evidence of successful diuresis, reduction in need for supplemental oxygen, and improvement in functional status, all indicate that he is ready for discharge. The hospitalist physician writes the discharge order and dictates the discharge note. Laura, RN, his assigned nurse, talks with Mr. Jones about returning to his independent home, with his daughter providing some drop-in care. Laura, RN, reviews the ongoing plan for diuresis and the desired weight range and gives the daughter Mr. Jones' new prescriptions and a laboratory slip to return Mr. Jones at 72 hr postdischarge for repeat electrolytes, blood urea nitrogen, and creatinine/GFR. She also asks the daughter to make an appointment for Mr. Jones to see his cardiologist at 7 days postdischarge. As Laura is talking with Mr. Jones, she notices some continued slight, though improved confusion that Laura attributes to his lack of sleep the night before. Both Mr. Jones and his daughter take all of the instructions, the laboratory slip, and the CHF pamphlet for hospital aftercare, and nod their heads indicating their understanding of all of Laura's instructions. Mr. Jones is discharged in the usual manner after all of the paperwork is completed. A separate department of the hospital makes their customary courtesy call to Mr. Jones 24 hr later and he indicates that he is doing okay, so no further follow-up measures are taken.

Future: Mr. Jones, an 86-year-old man, has been hospitalized for the first time this year with CHF. His clinical examination and laboratory findings, including improved creatinine/GFR, reduction in weight as evidence of successful diuresis, reduction in need for supplemental oxygen, and improvement in functional status, all indicate that he is ready for discharge. The hospitalist physician writes an order for Mr. Jones to receive a discharge consult with the nurse practitioner who handles transitional care coordination for the cardiac unit. John, RN, NP, arranges to sit down with Mr. Jones, his daughter, and Laura, RN, who has been caring for Mr. Jones to talk about returning to his independent home with his daughter providing some drop-in care.

John begins by assessing Mr. Jones clinically and as he does, he notices that Mr. Jones is somewhat confused, although Laura assures John that Mr. Jones is less confused than upon admission and did not sleep well the night before. John pulls up the CHF readmission screening survey and enters all of Mr. Jones' answers in the electronic health record (EHR) with particular attention to his level of self-management skills and his psychosocial support profile. When John submits the survey, the EHR screen shows that Mr. Jones is at risk for readmission due to confusion, continuing need for further diuresis, high-dose diuretic, age, independent living status, and lack of ability for primary caregiver to visit at least once daily. John arranges for Mr. Jones to be registered with the hospital's CHF Management Clinic and talks with Sally, RN, who will arrange the setup of an in-home monitoring device; the clinic will be calling Mr. Jones daily to check on his progress until his status returns to normal risk levels. The daughter indicates that neither she nor Mr. Jones has the upfront monies to pay for his new prescriptions, so John also arranges for the prescriptions to be filled prior to discharge and alerts Sally via the EHR's transitional care plan screen that she needs to coordinate prescription filling with Mr. Jones' insurance company. John and the hospitalist physician then go over the discharge plan and codetermine that, with the plans that have been made, Mr. Jones may be discharged. Mr. Jones is discharged after all of the paperwork is completed. John, NP, makes a call to Mr. Jones 24 hr later and learns that Sally has scheduled his in-home device to be placed later that day and that she has coordinated with the daughter to provide transportation for both Mr. Jones' 72-hr return for laboratory tests, as well as his 7-day postdischarge visit to the cardiologist. Sally has also called the insurance company to arrange for Mr. Jones' medications to be sent via mail order. John, NP, tags his list to check on Mr. Jones after his 7-day postdischarge visit with the cardiologist to determine any unmet needs.

remains to use an operationally practical and cost-effective method that will maximize sensitivity (finding the true positives, e.g., people you predicted would be readmitted that indeed would have been readmitted if you had not found them) on balance with specificity (finding the true negatives, e.g., people you do not want to spend resources on, as they are predicted to be fine and in fact, they are discharged and not readmitted).

These PM methods have not yet infiltrated acute care systems to any significant degree, as historically

there was no reimbursement motive for preventing readmission, until the advent of PPACA. Therefore, not only do predictive models need to be developed for the top conditions not reimbursed upon readmission, but also discharge decisions will require much stronger nurse–physician partnering and case manager–led discharge planning to prevent readmission at the hospital's expense. The other advantage of the acute care ACO environment is that with today's electronic health record technology, the combined use of demographic, clinical findings, and self-reported patient data can all be used as predictors to build highly effective PMs for use in predicting readmission. The development process would be to:

1. Cull the literature for what is known about readmission factors for a specific disease condition as well as general self-care and perceived health factors applicable to all conditions,
2. Develop a readmission screening tool for testing purposes, then to
3. Gather the predischarge test survey and other predictive factor data on a sufficiently large population (typically 15 cases are needed per predictive factor; more is better), then
4. Gather readmission data on the same group of patients (readmitted or not), and then finally to
5. Develop and verify the PMs using regression techniques (see Table 1).

CHALLENGES AND OPPORTUNITIES FOR CASE MANAGEMENT

Case managers are on the front lines every day, making a concerted effort to improve patient outcomes, yet our health care system has historically been reactive, rather than proactive. The structural, operational, and cultural changes required to move from the present to the future are not to be underestimated (see Table 2).

CHALLENGES

Cross-setting thinking is foundational to ACOs, so discharge planning presents both structural and operational challenges. Discharge planning has typically ended when the person got to the appropriate type of facility based on patient needs known at the time of discharge from acute care. Now case managers will need to extend their work into that facility/home to assure that recovery continues. A stronger integration with medical practices will be required so that physicians are eligible for incentives to use PMs in their own practices to head off admissions in the first place and to partner with hospital-based case managers to prevent readmission. Although the future state case study (described in the sidebar) indirectly suggests that involvement of

more specialized personnel is better and more desirable, that may be an unintended consequence of this discussion. Although there are challenges, the ACO model of care presents opportunities for better or more human resource–efficient processes and newly expanded roles for advanced practice nurses.

The emergence of the ACO model of care is also coupled with the rapid deployment of newly developing electronic health record (EHR) and data interoperability technologies that will be the foundation of care delivery as well as the development of fast, effective, and useful analytics for PM and quality measurement in the future. The Health Information Technology for Economic and Clinical Health Act authorizes the federal government to establish programs that promote the use of health information technologies, including EHRs and secure health information exchange (U.S. Department of Health and Human Services, 2011b, HealthIT). Under Health Information Technology for Economic and Clinical Health Act, providers and hospitals can qualify for CMS incentive payments in 2011 and beyond when they adopt certified EHRs and use these technologies to achieve specific objectives under the Final Rule issued by the Department of Health and Human Services Secretary on July 13, 2010, for stage 1 of a series of incremental stages. At this point, the penetration of EHRs is still emerging, but all must meet the stage 1 requirements by 2014. In addition to the need for rapid and sound design of EHRs, health technology experts (Health Management Technology, 2011) call for an even greater need for connectivity and interoperability between all providers across health care systems.

Although the expanding presence of EHRs presents a ready set of electronic data with which to develop PMs, just to do the analytical work to be able to develop these models will be fraught with medical model bias. The inclination will be to look only at disease-based factors, thinking that disease-based factors will be highly predictive, when the PHM industry now has learned that perceived "feeling and functioning" and self-care based factors may be far more important in predicting readmission. Questions related to how one is feeling both physically and emotionally (presence of physical and emotional symptoms and degree of discomfort) and questions that relate to how one is functioning across the mental, physical, personal needs, social, and spiritual dimensions of functioning are also important to assess (Meek et al., 2000).

Another cultural shift is that discharge decisions have historically been physician-determined and ordered. And yet, in the future, a patient's self-care perceptions and both the patient's and family's perceptions of the need for continued nursing assessment and care may be the strongest predictors that put the patients at risk for readmission. Therefore, in the future, a stronger

TABLE 1
Steps to Build PMs for Use in Predicting Readmission

Steps	Activity
1	Assemble analytics team including nurses, physicians, and other care providers knowledgeable about readmission risk for the selected condition.
2	Perform literature review for known readmission factors for selected condition as well as general self-care and perceived health factors applicable to all conditions.
3	Develop a pilot readmission screening tool for testing purposes; send out for content review by clinical experts; pilot test on a small group of patients for clarity and understanding; revise and solidify pilot readmission screening tool questions.
4	Gather the readmission tool data on a sufficiently large population (15 patients to each predictor).
5	Gather 30-day readmission data on the same group of patients (readmitted or not).
6	Develop and verify the predictive model using regression techniques on half of the sample; then using split-half technique, verify the stability of the predictive model on the other half of the sample.
7	Streamline the readmission tool, eliminating unneeded questions. Design and execute the deployment and staff training process on a pilot basis. Learn, readjust, and plan to execute on a wider scale.

Note. PM = predictive modeling.

and more formalized patient–family–physician–nurse partnership may be needed in the discharge decision.

OPPORTUNITIES

With the rapid growth of health information technology and the high likelihood that perceived health and nursing care needs will be strong predictors of readmission, there is a growing need for nurse informaticists with advanced statistical training who can liaison between clinical information needs such as those required by PM and EHR developers. Electronic health records provide a perfect place to capture PM predictor information and to automate the discharge readmission screening survey plus auto-calculation of risk at the patient's bedside. Electronic health records also support better patient follow-up with the potential for automated reminders and key discharge instruction sets, automated prescription ordering, and so forth.

All of these technology changes represent a huge need for development of these predictive models and for nurses to lead these efforts with the patient's perspective in mind. In the past, the patient's perspective has taken a back seat in the discharge decision beyond their clinical data (laboratory tests returning to normal, symptom relief, etc.), but our PM development history in the PHM industry (Meek et al., 2000) suggests that the patient's perceived health, self-care abilities and beliefs, and preferences may largely drive their readmission risk; therefore, models built with these factors in mind may hold more predictive power. One such effort that is now being piloted in

TABLE 2
Shifts in Thinking Required by ACO Models of Care

Current	Future
Responsible for episodes of care	Responsible for population health
Reactive care triggered by acute event	Proactive care triggered by predictive models
Responsible for patients in own care silo	Responsible for patients across care settings
Hospital discharge not directly tied to physicians for follow-up care other than as FYI instructions/reports	Hospital care tied directly to physician follow-up and physicians'/hospitals' share in reimbursement benefits/losses
Physicians' own discharge decisions	Physicians partner with other care providers for discharge decisions
Analytics measures quality and safety parameters retrospectively	Analytics develops predictive models that anticipate and prevent quality and safety problems
Advanced practice nurses have emerging impact on analytics, technology, structural, cultural, and operational processes	Advanced practice nurses colead core health system reforms to move to the ACO model of care
Quality viewed largely as service quality and not tied to reimbursement	Quality and safety measures are tightened, transparent, and tied to reimbursement

Note. ACO = Accountable Care Organization; FYI = for your information.

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100 hospitals across the country is the Care Transitions Program (The Care Transitions Program, 2011). In a validation study (Coleman, Mahoney, & Parry, 2005), the Care Transitions Measure, a 15-item unidimensional measure of the quality of preparation for care transitions, was shown to discriminate between patients discharged from the hospital who did and did not have a subsequent emergency department visit or rehospitalization for their condition. Care Transitions Measure scores were also significantly different between health care facilities known to vary in level of system integration.

Core operational changes to the discharge process and an expanded role for the discharge case manager are also needed. Think of the "readmission screening survey" becoming part of the discharge decision to keep an identified at-risk patient longer or to modify the discharge planning in some way as to lower readmission risk. Think of a transformation in the discharge-planning role with case managers operating as the primary "coach" or quarterback during the phase between acute care and full recovery or, at the very least, recovery during the vulnerable first 30 days. This new case management role calls for a strong base of clinical skills and experience in addition to high-level communication skills, liaison skills, advocacy skills with providers, facilities, and families as well as awareness of and use of social services.

All of this development work across structural, operational, and cultural dimensions is going to call for a large cadre of advanced practice nurses. A recent conversation with a chief nursing officer of a large regional health system (S. McRoberts, personal communication, July 14, 2011) drew attention to the fact that she expects to need 200–250 nurse practitioners and clinical nurse specialists to fill all the leadership and practice positions she anticipates as the system moves to an ACO structure. The system currently employs 50 advanced practice nurses, highlighting the critical need to be creative about how academic–practice partnerships can more rapidly fill this gap.

Not only does the move to an ACO model call for more advanced practice nurses, but those nurses will need to be educationally prepared to lead these system-based changes. Educational programs preparing nurses for the leadership, resource management, analytical, informatics-based, and organizational development roles they will hold will be in the best position to help the nursing profession move boldly forward to be a strong voice and participant in health system reform that has been heralded by the Institute of Medicine (2010).

CONCLUSION

The move to the ACO model of care calls for broad-sweeping structural, operational, and cultural changes in our health care systems. The use of PM as part of the discharge process was used as a way to highlight just one of the common processes that will need to be transformed to maximize reimbursement under the ACO model. Case managers are well-positioned to lend their expertise to the development efforts, but they will need to be educationally prepared for the many advanced practice roles that will emerge as our nation evolves its new system of health care delivery.

The question we all need to ask of ourselves in our various roles is…"How should the move to an ACO change what we do?" To further the discharge-planning example, we do not currently ask the questions now at discharge that could provide the necessary data with which we could develop PMs to prevent readmission. And even if we had a predictive model survey validated and ready to use, we certainly cannot ask these questions in a culture where the patient's physician would not include the result in his or her discharge decision. The at-risk identification from these validated models has to be part of the discharge process. It is hoped that this article generates conversations and increased interest in these types of issues.

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