

Value-based Insurance Design:

Barriers to Implementation in Radiology

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Expensive and steadily rising health care costs without a concomitant increase in quality have generated a search for solutions to fund health care in the United States. Recent health care reforms and proposals on the agenda have spurred debate about alternative payment plans for health care. Much of the talk centers on imaging, which is a fast-growing and expensive component of health care. Value-based insurance design (VBID), a “clinically sensitive” means of sharing the cost of health care, has been proposed as a means to control the runaway costs of health care management including diagnostic testing. A corollary of pay-for-performance initiatives in which physician incentives are aligned with evidence-based medical practices, VBID seeks to increase patient incentives to comply with evidence-based health care consumption. We previously reviewed the principles of VBID and provided examples of VBID in practice using diabetes management as a model, as well as suggested some areas in diagnostic testing that lend themselves to VBID benefit design. In this article, we summarize the barriers to implementation and outline potential solutions, with particular regard to radiology.

Key Words: Value-based insurance design; benefits based copays; disease management programs; pay for performance; consumer directed health care; consumer driven health plans.

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Economic theory holds the rationale that the value of insurance arises because it allows people to alleviate the financial burden associated with the risk of illness and because it allows those who become ill to afford care that they would otherwise not be able to purchase (1). In the current system, cost-sharing amounts are constant for a particular service, although the clinical value of the service will vary depending on who receives it. Ideally, uniform copayments would discourage the use of low-value health care but this assumes that patients can distinguish between high- and low-yield therapies. Evidence shows that higher copayments reduce the use of all services, including highly valuable health care services, which could thus result in worse health outcomes (2–4). The concern is also that cost-sharing most adversely affects consumption in low income seniors, who need the health care the most (4). Uniform coinsurance and reference pricing are inherently cost-based rather than value-based incentive mechanisms. Patients pay more for services that cost more, regardless of whether those diagnostic tests or therapies will have a major or minor impact on their health. Patients are not given information to help distinguish between very effective, partially effective, and totally ineffective tests and treatments.

With respect to imaging, Bluestein et al demonstrated that mammography uptake rates were decreased in Medicare patients without supplemental insurance (14.4%), compared to patients with Medicaid supplemental insurance (23.9%), patients with the Medicare screening benefit (36.9%), employer-sponsored supplemental insurance (44.7%), and those with self-purchased supplemental insurance (40.1%) (5). Solanki and colleagues demonstrated negative direct (and to a lesser degree, indirect) effects of cost sharing (copayments, co-insurance, and deductibles) on the number of mammograms in patients belonging to both health maintenance organizations and preferred provider organizations/indemnity plans (6,7). The converse is also true; decreasing copayments was shown by Chernew and colleagues to increase medication adherence within a disease management program in a large employer-based health system (8).

In response to these adverse effects of the current copay system, a benefit-based copay system was advocated by Fendrick and colleagues, in which copayment rates are set based on the value of clinical services, rather than costs (9). The amount of patient cost sharing would be based inversely on expected clinical benefits. This concept was expanded outside prescription drugs to health insurance in general, and the term *value-based insurance design* or VBID emerged (10,11). This VBID system is based on the “medical appropriateness” of the imaging test and is different from a cost-effectiveness exercise.

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BARRIERS TO IMPLEMENTATION OF VBID IN RADIOLOGY

Challenges arising in VBID programs include the collaborative relationship between payers and providers necessary for

short- and long-term program success. The structure of a VBID initiative must be designed to overcome provider resistance, skepticism, and legal challenges. The development and implementation of an effective VBID program and chance of success could be improved with collaboration of payers and providers in the VBID development stages allowing for multidimensional performance initiatives with long-term benefits for each party. These collaborations could foster a sound organizational infrastructure, cooperative culture, and enhanced professional resources vital to the long-term success of VBID programs. Clinicians and radiologists should be involved in program design and implementation, and the use of evidence-based guidelines is imperative. Finally, rigorous follow-up processes should be established with a substantial commitment to information technology support for monitoring and maintaining the program's success.

Despite the advantages of VBID, uptake has not been rapid, which reflects many barriers. With respect to imaging services, there are also some specific barriers.

ECONOMIC BARRIERS

Increased Costs and Inappropriate Utilization

The cost of health care has risen rapidly (largely because of prescription drugs and diagnostic imaging) and there is no slowdown in sight. Health care purchasers are looking for ways to limit cost growth. VBID would involve lowering copayments for some underused high-yield services. This will lead to higher costs to the purchaser, certainly in the initial stages of implementation of VBID. In addition, employer health care programs will not reap the benefits of long-term savings because of improved health as a result of employer turnover. There are also concerns regarding the effects on the patient's health, in that they may underuse essential and nonessential imaging services indiscriminately. Although more of a concern with prescription medications and other recurrent medical expenses, patients with health care spending accounts without other medical insurance, those with high-deductible insurance or those who spend out of pocket for services are more sensitive to the costs of procedures including diagnostic imaging and may forgo elective services such as screening mammography.

Medicare Reimbursements of Inpatient Services

A challenge to much of imaging includes the current method of billing inpatients for the admission rather than for individual services. Medicare pays professional fees on a fee-for-service basis, whereas hospital fees are set by a diagnosis-related group-based prospective payment for the entire admission (12). Medicare introduced this system in 1983, to replace the traditional fee-per-service system in an effort to contain hospital costs (13). Under this inpatient prospective payment system, inpatients are billed based on their diagnosis and not billed for individual imaging services, so VBID will be

difficult to implement in this group. This fact already encourages the ordering of imaging tests on patients before they are discharged, to avoid the patient having to potentially pay out of pocket expenses. This also creates a "loophole" whereby low-yield imaging procedures are not subject to copays, nor is the provider reimbursed. Therefore VBID could not be applied to these inpatient diagnostic imaging encounters.

Similarly, in 2000, the health care financing agency introduced the outpatient prospective payment system. This applies to hospital outpatient departments, community mental health centers, and some rehab services and hospice services (14).

Pay-for-performance increases physician incentives to improve health care. VBID seeks to increase patient incentives to comply with evidence-based health care consumption. For VBID to work, patients must be able to make choices about their health care including clinically sensible but fiscally responsible choices. However, if patients can't make choices about their health care then VBID will be difficult to implement. For instance, inpatients or patients attending the emergency department may have little control over the diagnostic or therapeutic radiology tests ordered by their physician, whereas outpatients may have more control over diagnostic workups and be able to make choices about their care consumption.

Self-Referral and Auto-Referral

Barriers to acquiring evidence on the benefits of imaging services will include physician providers who engage in self-referral. Self-referral occurs when non radiologists have a stake or financial interest in an imaging service (15,16). These physicians are less amenable to adopting appropriateness criteria or imaging guidelines that might ultimately decrease the amount of imaging performed and thus their revenue. An example of this occurs when cardiologists have privileges to report nuclear cardiology studies and therefore they can refer patients to themselves for imaging. Similarly, nonradiologist physicians can acquire imaging equipment (magnetic resonance imaging [MRI], computed tomography [CT], or positron emission tomography [PET]) and put it in their offices, thanks to a loophole in the federal Stark laws called the in-office ancillary services exception (17).

Self-referral is on the rise and utilization of diagnostic imaging studies among self-referring physicians has been demonstrated to be much higher than when they refer to radiologists (18,19). In addition, the rate of increase of noninvasive diagnostic imaging has been shown to be greater among nonradiologists—for example, radionuclide myocardial perfusion imaging increased by 36.3% among cardiologists, compared to 3.7% in radiologists between 1996 and 1998, an almost tenfold difference (20). Nonradiologists argue that self-referral has the benefits of integrated clinical and imaging information, that costs are less when the imaging is performed at an outpatient setting, that patients expect it, that it is less time-consuming and that nonradiologists have the necessary knowledge (21,22). The knowledge of

nonradiologists about imaging tests and their appropriateness will be less than that of radiologists. Nonradiologists are likely to be less amenable to adopting appropriateness criteria or imaging guidelines that might ultimately decrease the amount of imaging performed and thus their revenue.

On the other hand, auto-referral is a term used to describe self-referral amongst radiologists. This occurs when radiologists recommend further imaging tests based on the findings on the current imaging test (22). In one study of 545 consecutive abdominal CTs, further imaging was recommended in 105 (19%) of cases, but on follow-up was only performed in only 32 (6%) of cases, so auto-referral amongst radiologists is less prevalent (23). Another form of self-referral by radiologists derives from free-standing CT or MRI facilities that offer whole body screening through direct to consumer advertising. The false-positive findings generated by these examinations trigger further additional studies (24). It is not surprising that there may be resistance to auto-referral from private practice radiologists, who are partners in their imaging practices. If they feel compelled by guidelines to perform less diagnostic testing or the same tests at longer time intervals, this will directly or indirectly impact profits and their salaries. This should be less of an issue to radiologists practicing within academic settings as their income is not usually directly related to the revenue generated from imaging.

Unintended Incentives

If copayments for all imaging services were reduced, the incentive to use higher value services might be reduced. For example, VBID might discourage use of less advanced imaging test (that answers the diagnostic question) if the copayments for advanced imaging tests (CT or MRI) are also lowered. This concern could be overcome by maintaining a cost advantage to imaging services that are deemed more cost-effective.

PRACTICE BARRIERS

Care and Complexity of Implementation

This will require identification of “high-value” imaging services in the case of the service specific approach (1). In the case of the disease-specific approach, this will require identification of which specific patient groups will benefit from specific imaging services to determine in whom to lower copayments (1). Then, when this information has been obtained, it will have to be made available to a large group of purchasers. In addition, patient eligibility data will have to be transferred from the payers to the point of service, necessitating data transfer and cooperation across organizations.

A portion of costs associated with VBID will include expenditure on additional high-value services used because of lower copays (10). However, savings down the line can be made if VBID services are targeted to high-risk patients with appropriate imaging, such that disease is diagnosed

sooner or complications avoided (10). In addition, further health care savings will be made with improved employee productivity and decreased disability rates. The high yield can be funded by increasing cost-sharing on less appropriate imaging, as modeled by Goldman et al in the case of cholesterol-lowering therapy (25). It is easier to control the adoption of a new technology than to cut back on the use of one that has already been disseminated widely (26).

There is also concern over the number of copay levels (tiers) or frequently changing copays. This was overcome with prescription drugs, so it should be overcome in radiology. One possible way to do this is the use of “smart” order entry systems that couple appropriateness criteria and/or clinical guidelines or decision rules. One study that looked at this measured the impact of presenting real time, evidence-based critiques about the appropriateness of abdominal radiograph (kidneys, ureters and bladder) orders on physician decision-making. The authors found that their intervention identified clinical situations in which kidneys, ureters, and bladder appeared to have a low clinical yield. In response to evidence-based critiques, providers were reluctant to cancel their order, but were more willing to change to different views. However, to reduce the number of inappropriate radiographic studies, stronger incentives or interventions may be required (27).

Lack of Evidence Supporting Value-based Provision of Imaging Services

For VBID to function, detailed research into the evidence behind various imaging approaches will be required to determine “high-value” and “low-value” imaging modalities. Furthermore, the value of each imaging technique in specific patient groups or patients will also have to be determined. Currently, the evidence base for imaging has large gaps. This will take a lot of work on the part of researchers to determine appropriate pathways for imaging test use, and radiology lags far behind general medicine in this regard.

In addition, the current appropriateness criteria that exist in the radiology literature are too general, nonspecific, and vague (28–30). They leave the decision whether to image or not, and which choice of imaging test open to misuse. Radiology needs a large, preferably multicenter (international), multidisciplinary, evidence-based imaging group to meet and research the literature for the best available evidence. From review of the literature, they need to derive dedicated, more directed, or specific guidance pathways/algorithms to specific imaging tests and patient scenarios. However, the development of evidence appropriateness criteria and guidelines is improving and has significantly improved over the last few years. The American College of Radiology Appropriateness Criteria®, which are evidence-based guidelines have been developed to assist referring physicians and other providers in making the most appropriate imaging or treatment decisions. The guidelines are developed by experts in diagnostic imaging, interventional radiology, radiation

oncology, and other specialties, and there are currently more than 160 topics (28). The Royal College of Radiologists in the United Kingdom has recently (2008) updated its guidelines which are significantly expanded compared to the first edition. These guidelines are developed to help clinicians, radiologists, radiographers, and other health care professionals to determine the most appropriate imaging investigation(s) for a wide range of clinical problems. They provide practical guidance based on the best available evidence, together with expert opinion where evidence is lacking or conflicting (29).

A useful investigation is one in which the result (either positive or negative), will alter clinical management and/or add confidence to the clinician's diagnosis. However, a significant number of radiological investigations do not fulfill these aims and may add unnecessarily to patient irradiation. Areas where the wasteful use of radiology could be reduced through the use of appropriateness criteria and guidelines which could link with VBID, are as follows: undertaking investigations when results are unlikely to affect patient management; where the anticipated positive finding is usually irrelevant (eg, degenerative spinal disease); where a positive finding is unlikely; doing the wrong investigation or investigating too early (eg, before the disease could have progressed or resolved) or before results can influence treatment; over-investigating, and repeating investigations which have already been done, such as in an outpatient department, or in the emergency department.

Currently, imaging in venous thromboembolism is one of the few areas within the arena of diagnostic imaging with clear guidelines/imaging algorithm as to who needs imaging, which test is required and when to perform testing (31–33). There is a movement now to seek out the evidence when it comes to imaging. Several radiology authors have written excellent articles on the evidence-based medicine process (34–41), critically appraised topics (42–47), and meta-analyses in the medical and radiology literature (48–52).

Health Information Technology, Data Transfer, and Storage Issues

Radiology consumers cannot be identified like the users of prescription drugs. Integrated claims data may be feasible in disease groups but not with respect to specific imaging services. This will require a robust health information technology structure, which is currently being put into place. Programs that encourage delivery of more effective and efficient care with financial and other incentives are being designed. These include programs that monetarily reward ambulatory care practices for using health information technology. At a basic level they assess use of evidence-based standards of care, maintenance of registries to identify and follow at-risk patients and provision of educational materials to patients. At an intermediate level, they require expansion to electronic systems to maintain electronic health records, electronic decision support and computerized physician order entry of medications and laboratory tests, and at an advanced level, electronic systems that are interoperable with other

systems (53). Electronic medical records and health assessment data (available as part of disease management programs) will increase data exchange capabilities.

Determining who is at risk and therefore who will have the highest risk benefit ratio from various forms of imaging will be complex and comprise a lot of data. There are few data on risk factors at the time of the imaging request (particularly for new outpatients or acute emergency room patients) and these data are not readily available to the billers in the imaging department. Lack of relevant clinical information on radiology request forms could deny some patients appropriate testing when they need it most.

The timeliness of data, accuracy of data, availability of data, requirement to use chart data, exchange of data with other physicians, and small or limited amounts of data are all issues that must be addressed in a comprehensive VBID program. Information technology support systems must be standardized, easy to access, provide real-time data, and produce robust and meaningful data.

The Responsibility Needed to Make Decisions about Appropriate or High-yield Imaging

To determine which patient groups or diagnostic imaging tests are to be targeted for reduced or eliminated copays for diagnostic tests, radiologists would have to be involved in (or in charge of) the decision-making. Many radiologists may feel out of their depth making decisions on matters they may regard as belonging to the realm of internal medicine. Radiologists would have to accept responsibility for decision-making with respect to assessing costs and benefits of services.

Diagnostic imaging research lags far behind internal medicine research when it comes to studies of comparative effectiveness. These barriers could be overcome by involving clinician physicians as well as radiologists in the process of determining high-yield patient groups or imaging tests. In addition, the awarding of bonuses or pay for performance might act as an incentive to radiologists to promote high-yield imaging services in high-yield patient groups.

Adverse Selection

This could occur where only some imaging services are targeted for lower copays and might encourage a disproportionate number of patients with certain risk factors or diseases. This concern could be addressed by implementing the VBID for all imaging services and employees at the same time.

OTHER BARRIERS

Ethical Concerns

The University of Michigan diabetes program, in which participants are charged no copay for certain drugs that control blood sugar, lower blood pressure, cut the risk of heart

and kidney problems, and ease depression, is the first in the nation to be designed specifically to evaluate the impact of targeted copay reduction for preventive medications. To date, improvements in processes (monitoring and preventative care) and outcomes (decreased glycosylated hemoglobin, systolic blood pressure, and cholesterol levels) have occurred (54). The focus of these types of programs is cost reduction and several companies have reduced or waived copays as part of employee health promotion or disease management programs, and at least one has reported cost-savings linked to the effort (55).

However, at this time, the ethical concerns of these programs have not been assessed. The University of Michigan diabetes program does give participants the option to opt out of the program at any time if they choose not to participate and return to their current copayment amounts, while stressing that it is only through the involvement of participants that the program will be effective.

People may object to others being charged less for the same imaging services. Explaining the services to patients and employees will be challenging. Employer eligibility may change over time and they would need to be kept informed. In addition, resistance from unions could be problematic.

This will also require a change in concepts of distributive justice from a libertarian frame of reference in which individuals themselves are responsible for their own health and well-being, and everyone pays for their own individually experienced health care needs, directly or indirectly through private health care insurance, with no duty to contribute to the health care needs of others, and the only task of the state is to make health care services available to meet all individual health care needs to a more utilitarian concept that is based on an economic motive: the available financial means should be used in such a way that the greatest possible health gain for the whole population is achieved. The health gain is evidence based, measured in terms of years of life gained (usually with a correction for quality of life), and the more (average) health gain a specific medical intervention of service provides, the more priority it is given. VBID allows patients to take responsible for their own health and well-being, financed directly or indirectly through private health care insurance but incentivizes patients to consume health care such that the greatest possible health gain for the whole population is achieved. One problem with VBID is that an institution or practice that is doing the right thing but with lower copays, will need to increase fees which may exclude people who then cannot afford the increased fees.

Privacy Concerns

This is a concern in programs that vary by patient or patient groups, in that VBID will request identification of employees with specific conditions or risk factors. The transfer of patient information and communication of data will have to comply with the Health Insurance Portability and Accountability Act regulations.

Encouragement of Fraud

This is a concern as patients and providers may be tempted to misreport information in order to qualify for reduced copayments. In this situation, programs would have to be limited to areas where this type of identifiable information is available electronically to classify patients. As mentioned previously, this is an issue for new patients presenting to outpatients and emergency departments.

Legal Barriers

Legal and regulatory barriers may hinder implementation of VBID programs. The provider of a health service plan could inform an enrolled employee that they are not eligible for imaging under certain circumstances. However, the employee could pay out of their own pocket for the imaging somewhere else and it could reveal a significant finding that would have been missed if imaging had not been performed. If the case went to court, and the plaintiff was successful, this could set a precedent that other health plan providers would then be forced to follow.

The definition of medical necessity is also not a clear-cut case, with newer evidence emerging on a constant basis. Providers of health services plans must balance the need to keep up to date with the evidence (which might necessitate a change in coverage policy) with the need to treat all enrollees equally. To date, to the best of our knowledge, there have been no legal cases pursued in relation to the existing VBID plans.

WHY WE NEED VBID IN RADIOLOGY

Need to Improve the Quality of Health Care

Concerns have been expressed regarding the quality of health care. In radiology there are lost opportunities (and costs) when the wrong imaging is done on patients. Radiologists frequently play no part in deciding what imaging modality to use and when. Radiologists have the background knowledge and training in medical physics and imaging technology, necessary to make the decisions on behalf of patients.

Although financial incentives do indeed motivate significant change, nonfinancial support also promotes quality improvement. Improved quality of care has been achieved by pay for performance (P4P) and disease management initiatives. Pay for performance aims to reduce the gap between actual and recommended care and reward providers who follow selected practices when treating patients with the goal to improve the quality of health care (56). Pay for performance works on the provider side, whereas VBID works on the patient side. The engagement of physicians is critical to the P4P movement, and public reporting heightens physician awareness. The engagement of patients is critical to VBID, and could potentially influence patients who are "resistant" to doing the right thing. Pay-for-performance programs have shown that measurement provides physicians with a new

perspective on their practice and that practices change their processes and delivery systems to meet program standards. VBID programs could provide patients with a new perspective on their disease and the management of the disease, and change their behavior to comply with evidence-based health care consumption processes. Physicians appreciate the consistent requirements for P4P measures. Patients may appreciate the consistent information and management guidelines with respect to their disease that a VBID program provides.

How a VBID program is conducted is just as important as whether it is conducted. It must be based on widely recognized, evidence-based health care and developed in collaboration with physicians and providers.

Need to Curb Health Care Expenses

Health care costs continue to increase at a very high rate with radiology being dubbed the “new pharma.” Attempts to address the cost of care have been made by increasing share paid by beneficiary (consumer-driven health plans and increasing copays at point of service). As previously discussed, this insurance design leads to adverse outcomes if patients uniformly curb utilization rather than select the services with the highest clinical value. Additionally, patients may assign value to services that are not consistent with high-quality clinical care, for example undergoing whole-body screening CT, rather than screening mammogram or colon cancer screening.

Disease management programs are only cost-saving if they the services they encourage are cost saving; this is rarely the case. In addition, patients often have to pay higher copays for these services.

FINANCIAL IMPLICATIONS OF VBID

The driving force behind VBID is to increase use of “high-yield” imaging services. The goal of any health care system is to improve health and not to save money. However the implementation of a VBID service will have financial consequences, especially in the early stages.

Increased Direct Costs Now and Added Value Later

The identification of certain imaging services or patients for lowering copayments (or maintaining then where costs are rising) will mean that insurance companies will have to pay the extra share of costs. In addition, costs will rise as certain high-yield imaging services are increasingly used. The long-term effect is of added value as VBID is targeting high-yield (cost-effective) imaging services that will have positive health benefits down the line.

Savings from Improved Health

The increase in direct costs now should be offset later by savings from improved health as more efficient imaging services are used. The greater the risk of the adverse outcome

and the greater is the cost of the adverse outcome, provided that consumers respond to lower copayments, the greater will be the health benefits gained.

The Targeting Factor

The financial impact of a VBID program will depend on the level and precision of targeting. The better the system is at identifying specific high-yield imaging services or patients who would most benefit, and the more responsive the patients are to lower copayments, the greater is the financial return and the health benefits. For wider implementation of VBID, the added costs will have to be taken into account. One could implement a VBID system that finances the costs of low copay for high-value services through higher copays on lower yield imaging services.

POTENTIAL IMPLEMENTATION OF VBID IN RADIOLOGY

Advanced imaging (CT, MRI, and PET) is used for both patients with confirmed illnesses and increasingly for healthy populations, such as cancer screening. There is considerable debate concerning how to define, measure, and foster high-value applications while limiting applications that offer low value to the patient. Advanced imaging procedures have been embraced by advocates of VBID if these tests offer cost-effective signs of latent cancer (or other serious illness). The use of advanced imaging modalities for screening has been subject to considerable debate about their appropriateness within particular subpopulations (for example, depending on age or history of disease).

Let's consider how VBID could be applied to screening mammography. The American Cancer Society guidelines for the early detection of breast cancer recommend that beginning at age 40, women should have yearly mammograms continuing for as long as a woman is in good health and the US Preventative/Preventive Services Task Force recommends biennial screening mammography for women ages 50 to 74 years and only routine mammograms for women in their forties who are at high risk. An employer or institution could offer women 40 or 50 years of age and older a screening mammography in the effort to encourage early cancer detection with the benefit of no copayment, and a deductible that does not apply to this preventive screening test.

Preauthorization embodies a benefit design component in that it specifies that the insurer will pay all (complete coverage) or part (coverage with consumer cost sharing) if the test is done according to accepted guidelines (57). Reference-pricing principles can be applied to the related issue of what rate should be paid by the insurer for the test and, by extension, what degree of cost sharing should be expected of the patient choosing among alternative providers. Under reference pricing, the insurer would specify a maximum benefit for a test within a specified geographic market (57). As there may be significant variation in procedure costs within

a geographic area (including professional and facility components), the employer could establish a reference-price limit for a particular test. Enrollees would be free to choose their own providers but would pay the difference if their provider charged more than the insurer's benefit limit. Employees using a provider that charged more than the reference amount would pay the difference. These additional payments would not count toward their annual out-of-pocket maximums.

Patients who require more than the routine screening test, such as a call back for extra or spot views or breast ultrasound or lesion drainage or biopsy after a mammogram are not subject to the reference price. Their test is reimbursed at the standard rate, and standard co-insurance applies.

CONCLUSION

VBID is a "clinically sensitive" means of cost-sharing because it recognizes that different imaging services vary in value for different patients and even differ in value for the same patients. By using different copays for different yield imaging services, costs for lower copays on increased use of more efficient imaging services (or indications) can be compensated for by greater copays on less efficient imaging services (or indications). VBID is an exciting prospect in radiology because of the contribution that imaging makes to health care costs in general. We must recognize that there will be barriers to implementation, some of which will be specific to radiology. However, these can be overcome just as they were in other areas of medicine.

REFERENCES

- Kelly AM, Cronin P, Carlos RC. Introduction to value-based insurance design. *J Am Coll Radiol* 2008; 5:1118-1124.
- Gibson TB, Ozminkowski RJ, Goetzel RZ. The effects of prescription drug cost sharing: a review of the evidence. *Am J Manage Care* 2005; 11: 730-740.
- Heisler M, Langa KM, Eby EL, et al. The health effects of restricting prescription medication use because of cost. *Med Care* 2004; 42:626-634.
- Rice T, Matsuoka KY. The impact of cost-sharing on appropriate utilization and health status: a review of the literature on seniors. *Med Care Res Rev* 2004; 61:415-452. Review.
- Blustein J. Medicare coverage, supplemental insurance, and the use of mammography by older women. *N Engl J Med* 1995; 332:1138-1143.
- Solanki G, Schaffner HH, Miller LS. The direct and indirect effects of cost-sharing on the use of preventive services. *Health Serv Res* 2000; 34: 1331-1350.
- Solanki G, Schaffner HH. Cost-sharing and the utilization of clinical preventive services. *Am J Prev Med* 1999; 17:127-133.
- Chernew ME, Shah MR, Wegh A, et al. Impact of decreasing copayments on medication adherence within a disease management environment. *Health Aff (Millwood)* 2008; 27:103-112.
- Fendrick AM, Smith DG, Chernew ME, et al. A benefit-based copay for prescription drugs: patient contribution based on total benefits, not drug acquisition cost. *Am J Manag Care* 2001; 7:861-867.
- Fendrick AM, Chernew ME. Value-based insurance design: aligning incentives to bridge the divide between quality improvement and cost containment. *Am J Manag Care* 2006. 12 Spec no.:SP5-SP10.
- Chernew ME, Rosen AB, Fendrick AM. Value-based insurance design. *Health Aff (Millwood)* 2007; 26:w195-w203.
- Garber AM. Evidence-based coverage policy. *Health Aff (Millwood)* 2001; 20:62-82.
- Diagnosis Related Groups (DRG) and the Medicare Program—Implications for Medical Technology—A Technical Memorandum (Washington, DC: US Congress Office of Technology Assessment OTA-TM-H-17, July 1983).
- Rosenberg, Marjorie A. The impact of the inpatient prospective payment system and diagnosis-related groups: A survey of the literature. *North Amer Actuarial J*. http://findarticles.com/p/articles/mi_qa4030/is_200110/ai_n8959162. Accessed April 3, 2008.
- Levin DC, Rao VM. Turf wars in radiology: the overutilization of imaging resulting from self-referral. *J Am Coll Radiol* 2004; 1:169-172.
- Levin DC, Rao VM. Turf wars in radiology: other causes of overutilization and what can be done about it. *J Am Coll Radiol* 2004; 1:317-321.
- Levin DC, Rao VM, Kaye AD. Why the in-office ancillary services exception to the Stark laws needs to be changed—and why most physicians (not just radiologists) should support that change. *J Am Coll Radiol* 2009; 6:390-392.
- Hillman BJ, Joseph CA, Mabry MR, et al. Frequency and costs of diagnostic imaging in office practice—a comparison of self-referring and radiologist-referring physicians. *N Engl J Med* 1990; 323:1604-1608.
- Hillman BJ, Olson GT, Griffith PE, et al. Physicians' utilization and charges for outpatient diagnostic imaging in a Medicare population. *JAMA* 1992; 268:2050-2054.
- Levin DC, Parker L, Intenzo CM, et al. Recent rapid increase in utilization of radionuclide myocardial perfusion imaging and related procedures: 1996-1998 practice patterns. *Radiology* 2002; 222:144-148.
- Maloney MC, Grajower MM, Burris JF, et al. Frequency and cost of diagnostic imaging in office practice – a comparison of self-referring and radiologist-referring physicians [Letters]. *N Engl J Med* 1991; 324: 1371-1372.
- Alagona P Jr, Cooley DA, Varipapa RJ. Physicians and outpatient diagnostic imaging: overexposed? [Letters]. *AMA* 1993; 269:1633.
- Baumgarten DA, Nelson RC. Outcome of examinations self-referred as a result of spiral CT of the abdomen. *Acad Radiol* 1997; 4:802-805.
- Furtado CD, Aguirre CA, Sirlin CB, et al. Whole-body CT screening: spectrum of findings and recommendations in 1192 patients. *Radiology* 2005; 237:385-394.
- Goldman DP, Joyce GF, Mandic PK. Varying pharmacy benefits with clinical status: the case of cholesterol-lowering therapy. *Am J Manag Care* 2006; 12:21-28.
- Garber A, Goldman DP, Jena AN. The promise of health care cost containment. *Health Aff (Millwood)* 2007; 26:1545-1547.
- Harpole LH, Khorasani R, Fisiko J, et al. Automated evidence-based critiquing of orders for abdominal radiographs: impact on utilization and appropriateness. *J Am Med Inform Assoc* 1997; 4:511-521.
- ACR Appropriateness Criteria. http://www.acr.org/SecondaryMainMenuCategories/quality_safety/app_criteria.aspx.
- The Royal College of Radiologists. Making The Best Use of Clinical Radiology Services. Sixth ed. London, UK: The Royal College of Radiologists, 2008.
- Canadian Association of Radiologists. http://www.car.ca/content.aspx?pg=Stds_Guidelns&spg=Stds_Guidelns&lang=E&ID.
- Scarvelis D, Wells PS. Diagnosis and treatment of deep-vein thrombosis. *CMAJ* 2006; 175:1087-1092. Review. Erratum in: *CMAJ* 2007; 177:1392.
- Wells PS, Anderson DR, Rodger M, et al. Excluding pulmonary embolism at the bedside without diagnostic imaging: management of patients with suspected pulmonary embolism presenting to the emergency department by using a simple clinical model and D-dimer. *Ann Intern Med* 2001; 135:98-107.
- Stein PD, Woodard PK, Weg JG, et al. Diagnostic pathways in acute pulmonary embolism: recommendations of the PIOPED II Investigators. *Radiology* 2007; 242:15-21.
- Malone DE. Evidence-based practice in radiology: an introduction to the series. *Radiology* 2007; 242:12-14.
- Staunton M. Evidence-based radiology: steps 1 and 2—asking answerable questions and searching for evidence. *Radiology* 2007; 242:23-31.
- Dodd JD. Evidence-based practice in radiology: steps 3 and 4—appraise and apply diagnostic radiology literature. *Radiology* 2007; 242:342-354.
- Halligan S, Altman DG. Evidence-based practice in radiology: steps 3 and 4—appraise and apply systematic reviews and meta-analyses. *Radiology* 2007; 243:13-27.
- Maher MM, Hodnett PA, Kalra MK. Evidence-based practice in radiology: steps 3 and 4—appraise and apply interventional radiology literature. *Radiology* 2007; 242:658-670.
- Malone DE, Staunton M. Evidence-based practice in radiology: step 5 (evaluate) —caveats and common questions. *Radiology* 2007; 243: 319-328.

40. Van Beek EJ, Malone DE. Evidence-based practice in radiology education: why and how should we teach it? *Radiology* 2007; 243:633–640.
41. Medina LS, Blackmore CC. Evidence-based radiology: review and dissemination. *Radiology* 2007; 244:331–336.
42. Ryan ER, Heaslip IS. Magnetic resonance enteroclysis compared with conventional enteroclysis and computed tomography enteroclysis: a critically appraised topic. *Abdom Imaging* 2008; 33:34–37.
43. McGrane S, McSweeney SE, Maher MM. Which patients will benefit from percutaneous radiofrequency ablation of colorectal liver metastases? Critically appraised topic. *Abdom Imaging* 2008; 33:48–53.
44. McMahon CJ. The relative roles of magnetic resonance cholangiopancreatography (MRCP) and endoscopic ultrasound in diagnosis of common bile duct calculi: a critically appraised topic. *Abdom Imaging* 2008; 33:6–9.
45. McMahon CJ. The relative roles of magnetic resonance cholangiopancreatography (MRCP) and endoscopic ultrasound in diagnosis of malignant common bile duct strictures: a critically appraised topic. *Abdom Imaging* 2008; 33:10–13.
46. Kerr JM. Small bowel imaging: CT enteroclysis or barium enteroclysis? Critically appraised topic. *Abdom Imaging* 2008; 33:31–33.
47. Shine S. Urinary calculus: IVU vs. CT renal stone? A critically appraised topic. *Abdom Imaging* 2008; 33:41–43.
48. Hamon M, Lepage O, Malagutti P, et al. Diagnostic performance of 16- and 64-section spiral CT for coronary artery bypass graft assessment: meta-analysis. *Radiology* 2008; 247:679–686.
49. Horsthuis K, Bipat S, Bennink RJ, et al. Inflammatory bowel disease diagnosed with US, MR, scintigraphy, and CT: meta-analysis of prospective studies. *Radiology* 2008; 247:64–79.
50. Cronin P, Dwamena BA, Kelly AM, et al. Solitary pulmonary nodules: meta-analytic comparison of cross-sectional imaging modalities for diagnosis of malignancy. *Radiology* 2008; 246:772–782.
51. Robinson C, Halligan S, Taylor SA, et al. CT colonography: a systematic review of standard of reporting for studies of computer-aided detection. *Radiology* 2008; 246:426–433.
52. Peters NH, Borel Rinkes IH, Zuihthoff NP, et al. Meta-analysis of MR imaging in the diagnosis of breast lesions. *Radiology* 2008; 246:116–124.
53. Carlos RC. Value-driven health care: the purchasers' perspective. *J Am Coll Radiol* 2008; 5:719–726.
54. McEwen LN, Hsiao VC, Nota-Kirby EM, et al. Effect of a managed care disease management program on diabetes care. *Am J Manag Care* 2009; 15:575–580.
55. Sidorov J, Shull R, Tomcavage J, et al. Does diabetes disease management save money and improve outcomes? A report of simultaneous short-term savings and quality improvement associated with a health maintenance organization-sponsored disease management program among patients fulfilling health employer data and information set criteria. *Diabetes Care* 2002; 25:684–689.
56. Glickman SW, Peterson ED. Innovative health reform models: pay-for-performance initiatives. *Am J Manag Care* 2009; 15(10 Suppl):S300–S305.
57. Robinson JC. Applying value-based insurance design to high-cost health services. *Health Aff (Millwood)* 2010; 29:2009–2016.