

Background paper on the Conceptual Framework for Measuring the Medical Care Economic Risk*

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INTRODUCTION AND BACKGROUND

In the paper below we focus on how to incorporate medical risk into a measure of poverty. We consider the advantages of a separate index versus incorporating medical risk into a single index of poverty; we address the appropriate unit of observation arguing that medical risk is best measured at the individual level and then aggregated; we argue for the need to go beyond average expenditures since risk at its core refers to expenditures in the tail; we discuss the issue of over and under utilization and how to incorporate insurance coverage into resources. We briefly discuss data needs, focus on methodology and argue for a prospective measure. In the end our goal is to improve how we measure poverty since without including medical care needs, poverty measurement will be increasingly inaccurate.

Purpose of a Poverty Measure

Why a measure of Poverty? It tells us how we as a nation (or other unit of organization) are doing in terms of deprivation. It serves as a way to both measure our success in avoiding deprivation and the effectiveness of public policies (and private ones) in influencing deprivation. It provides us one measure of economic well-being. A poverty measure can be absolute or relative. In this country we use an absolute standard that has not changed since originally designed. In most other developed countries

a relative measure is used such as 40-60 percent of median income. Here we focus only on a measure that focuses on economic or material well-being. Some argue for a broader measure that encompasses other aspects of deprivation such as exclusion. This might be particularly useful when focusing on health as persons with certain chronic conditions or disabilities might in fact face more isolation. Nevertheless, that is not the focus of this paper. Our task here is to address an already complex issue: how to capture medical risk for purposes of more accurately capturing deprivation.

A measure of poverty serves to identify those in need of assistance by helping us set up eligibility standards for programs targeted at those with insufficient resources. It serves as motivation to design policies to reduce deprivation. And it serves as a potential measure of the effectiveness of public policies in alleviating deprivation. It allows us to compare across groups within the population defined by age, family structure, race/ethnicity, health or disability status and geography; and it can provide us with information on the dynamics of deprivation or poverty by providing trends over time.

Review of Current Poverty Measure and Core Issues with It

The current poverty measure has two components, a set of poverty thresholds or lines specific to family size and a definition of family income that is to be compared to the threshold(s). The thresholds originated with the work of Mollie Orshansky who based her thresholds on multiplying the cost of a minimum adequate diet for families of various sizes and then multiplying this value by a factor of three. The minimum adequate diet is from the U.S. Department of Agriculture's Economy Food Plan; the factor of three was based on a 1955 survey by that department. The thresholds are updated annually so that the real value of the thresholds has remained unchanged since 1963¹. A families' before-tax money income is compared to these thresholds to calculate whether or not a family's income is above or below the poverty threshold. These thresholds have been the federal government's official

¹ While the real value has remained the same, relative to median family income, the threshold has fallen from 48 percent of family income in 1963 to 28 percent in 2005. (Smeeding, 2006)

statistical measure of poverty since 1969. The official poverty rate is calculated using the Current Population Survey, March. It is calculated for the nation as a whole, for subgroups of the population and for geographical areas. It is used to determine eligibility for needs based public sector programs.

In 1992 the National Academy of Sciences convened a study panel at the request of Congress to conduct a comprehensive examination of poverty measurement in this country. They released their report in 1995 (*Measuring Poverty: A New Approach.*) In 2004 the Committee on National Statistics held a follow-up workshop to review the panel's recommendations and to recommend alternative poverty measures that would be regularly reported. The issue of how to handle health care needs and expenditures was one of the issues addressed by both.

Both reports came to the following conclusion: The core problem with the official poverty measure is that it does not provide an accurate picture of the extent of economic poverty, the trend in economic poverty or differences among population subgroups or geographic areas.

The current measure does not reflect core consumption needs (food, clothing, shelter, health care) in the threshold or adequately capture economic resources since it only measures pre-tax monetary income. Nor does it capture true differences in costs by differing family sizes and composition; so-called economies of scale or equivalence scale issues. It does not take geographic differences in prices into account (think of heating and cooling needs for example). With respect to medical care needs and insurance coverage, the current measure does not take into account:

- The extent of medical care costs or the variation in these costs across the population that reflect real differences in rates of illness and disability,
- Differences in medical care coverage (health insurance) ,
- Rising costs of that insurance and required copayments, nor
- Rising health care costs as a share of both family budgets and the economy more generally.

Together, these deficiencies mean that important public policies such as SNAP, housing vouchers, publicly provided health insurance and changes in taxes are not captured. Beyond these deficiencies the official measure does not reflect the changing standard of living of most Americans. Thus, rather than a comprehensive measure of economic well-being, the official poverty measure is a very narrow concept that is not influenced by real changes in public policy or changes in relative prices of core consumption items.

2011 Release of Supplemental Poverty Measure

The supplementary poverty measure is designed to provide an improved understanding of the economic well-being in the U.S. and to measure the influence of public policies on the low-income population. It is not expected to replace the official poverty line. (Replacing the official poverty line raises issues of equity across groups currently eligible for federal needs based programs as well as issues of politically sensitive nature such as official responsibility for an increase in measured poverty that might occur with an improvement in measurement.)

The Supplemental poverty measure is still in a research stage even though it was initially in the President's FY 2011 budget that would have allowed the measure to become operational. The resource side of this measure is to include not only money income but also in-kind benefits (SNAP, WIC, free and reduced price school lunches, housing subsidies and home energy assistance) minus taxes (or adding tax credits), and subtracting out work expenses and out-of-pocket medical expenses. It uses the three-parameter equivalence scale proposed by the NAS panel² and is to adjust for differences in cost of

² The three parameter scale is equal to $(adults + \alpha * children)^\beta$ where α varies between .5 and .8 and β varies between 0.6 and 0.7; in the SPM β is set equal to 0.7 while $\alpha = .5$ for two parent families but .8 for the first child in a single parent family.

shelter across geographical areas. The threshold is to be set at the 33rd percentile of the food, clothing, shelter and utility needs for all families with two children.³

The medical out-of-pocket expenditures (MOOP) are to be based upon questions added to the Current Population Survey Annual Social and Economic Supplement. In these questions respondents are to report expenditures on medical care insurance premiums and fees that the family paid out-of-pocket, including prescription drugs and provider co-payments. According to Short (2011), these expenditures are particularly large for children and elderly with preliminary evidence that subtracting MOOP from income increases the SPM poverty rate for the elderly by approximately 7 percentage points (p. 8). This increase is an indication of the (increasing) importance of medical expenditures in this country and their importance in a correct calculation of poverty.

INCORPATING MEDICAL CARE NEED INTO THE MEASUREMENT OF POVERTY

Insufficient treatment of medical care need (and resulting expenditures) in the poverty measure has increasingly challenged its validity over time. While the poverty measure arguably did not capture the full importance of the medical need – poverty relationship in the early decades of its use, the sheer growth of medical care expenditures as a proportion of domestic spending has likely exacerbated the real effect of this problem on the measurement of poverty outcomes. Spending on medical care

³ This description of the SPM is from: Short, K. (2011, June 3). The supplemental poverty measure: Examining the incidence and depth of poverty in the U.S. taking account of taxes and transfers. Available:

http://www.census.gov/hhes/povmeas/methodology/supplemental/research/WEA2011.kshort.071911_2.rev.pdf

[August 2, 2011].

increased from 5 percent of GDP in 1965 to roughly 17.6 percent in 2010; moreover, it is projected to increase to 19.8 percent of GDP by 2020.⁴

In the section that follows, we review recent changes in poverty methods that strengthen the capacity of measurement to capture the real effect of medical expenditures on poverty. While change in the treatment of medical expenditures under the Supplemental Poverty measure is an important component of this process, it is not the only relevant step. We suggest that recognition of the need for an index that captures the extent of medical care economic risk faced by members of society is an important step forward in documenting the full relationship between medical care need and poverty.

Treatment of Medical Care Need in the Supplemental Poverty Measure

The challenge in poverty measurement with respect to medical care need has not been identifying the problem, but rather determining the best methods to resolve it. Experts have long recognized the need to improve measures of medical need and (medical) resource availability (for ex. Smeeding, 1982); however, the actual assignment of an individual's poverty status on the basis of these measures introduces a number of conceptual and technical considerations that are not easily resolved. These include:⁵

- The non-fungible nature of medical benefits: incorporating a non-fungible benefit into the resource component of the poverty measure poses a technical challenge. Specifically,

⁴ The 1965 estimate is reported by the Congressional Budget Office (2008, p. 3); the forecast for 2010 and projections to 2020 are from the Office of the Actuary (2011, p. 1).

⁵ We summarize these issues briefly, the reader is directed to Moon (1993) and Citro and Michael (1995) for detailed review of these and other measurement considerations. As well, we wish to credit workshop participants for drawing greater attention to the conceptualization of both the medical care burden and medical care risk constructs. The distinction between these two constructs, and the treatment of their relationship to poverty, has important conceptual and methodological implications for the development of the MCER index.

assignment of benefit values for an insurance holding to the resource component of the measure would incorrectly treat unused benefits as disposable income.

- Large variation in medical need: Given the large variation in medical need across the U.S. population, a large number of thresholds would be required to adequately capture that variation and the subsequent poverty effects for those with insufficient resources.
- Whether an individual holds sufficient insurance against the risk of medical care need, and whether an individual held sufficient resources to provide for observed medical need (ex-post) are two different questions. Similarly, a retrospective measure of medical care need is different from a measure of medical care need that an individual *might* experience over a future period. A measure taken retrospectively is a measure of experienced burden, while the latter measure must necessarily incorporate some consideration of the uncertainty surrounding future consumption needs. Thus, methodology aside, we must resolve the question of whether it is conceptually correct to assign poverty in the case of an uncertain outcome (e.g. medical risk).

The study panel convened by the National Academy of Sciences served an important role in moving poverty research from recognition of these problems towards identification of actionable solutions. Specifically, in their 1995 report, the Panel advocated the development of a two-index approach to poverty measurement. The first index would exclude medical care needs from the thresholds, and medical care benefits from resources. Meanwhile, subtraction of medical care expenditures (premiums and out-of-pocket spending or MOOP) from the measure of family resources would, to some degree, capture the influence of medical circumstance on a family's available resources (Recommendation 4.2). In its current form, the Supplemental Poverty Measure adopts this recommendation.

In addition, Recommendation 4.3 of the Panel called for formation of a new measure (the second index) to quantify the economic impact of medical care risk:

Appropriate agencies should work to develop one or more 'medical care risk' indexes that measure the economic risk to families and individuals of having no or inadequate health insurance coverage. However, such indexes should be kept separate from the measure of economic poverty (Citro and Michael, 1995, p. 225).

The effect of this two index approach on resolving these technical and conceptual challenges can be understood as follows:

- The fungibility problem is resolved by considering the value of medical benefits in a separate index.
- Observed expenditures are a proxy for the economic burden a family experiences due to medical need (notably, variability of this measure is not limited by technical considerations).
- Under the first index, poverty is not assigned on this basis of a risk-based, or uncertain, outcome. The conceptual treatment of medical risk is left to the second index.

While this paper focuses on the conceptual and practical development of the second index, recognition of the contents and purpose of the original and supplemental poverty measures is not inconsequential to this task. Specifically, we stress that a measure of medical care (economic) risk does not capture poverty as it is traditionally defined. In both the original and supplemental measures, poverty is understood conceptually as a static outcome. Rather, a measure of medical care economic risk is rooted in the conceptual understanding that the relationship between poverty and health is in fact dynamic.

Why Do We Need a Measure of Medical Care Economic Risk (MCER)?

In the section that follows, we address the value of designing a formal measure to document the relationship between medical care risk and poverty. Four arguments are presented below.

- ***Reducing Health Expenditure Risk is an Important Component of Eliminating Poverty***

The suggestion that poverty and health are dynamically related alludes to the old question: does poor health cause poverty, or does poverty cause poor health? Irrespective of the assignment of cause and effect in this relationship, research in the field of poverty suggests that breaking this cycle is crucial to moving individuals and communities out of poverty. In practice, the consideration of medical care out-of-pocket expenditures under the SPM reflects the measurement of medical care economic burden and its point-in-time impact on poverty. We suggest that an important aspect of poverty policy is not only to minimize the number of individuals in poverty, but also to minimize the risk of transitioning into poverty. The SPM is a static measure that cannot capture this effect. In contrast, a measure of medical care economic risk can assess the effectiveness of policies designed to meet this objective.

- ***Prospective Assessment of Health Need Results in Misclassification of Poverty Status***

There is an important distinction between medical care need and most other basic needs considered under the poverty measure. In most cases, the core consumption needs of similarly structured families do not exhibit substantial variability. When this is the case, it is reasonable to estimate the amount of resources a family might require to maintain a basic standard of living. In the case of medical care, we observe a high degree of variability in actual need over the course of a year and across years. Thus, while we might be able to assign an estimate of expected expenditure to members of a given group (e.g. risk class), this value can be a very poor representation of the actual experience of any one individual within the group.

As previous researchers have noted (e.g. Moon, 1993; Citro and Michael, 1995), this can lead to misclassification if the poverty measure relies on this estimate as a valid (prospective or retrospective) indicator of health need. A particular example is the use of poverty guidelines to determine eligibility for means-tested programs. If program eligibility is assessed annually or even monthly and we apply a prospective estimate of medical need, then real variability in need (relative to the predicted value assigned at the beginning of the assessment period) will result in misclassification.

Importantly, in the case of medical expenditures, the difference between expected and observed need can be quite large if an individual does not hold insurance. In the case of prospective assessment, a measure of medical care economic risk can help to identify those who might end up in poverty due to medical expenses. Recognition of this risk might be a relevant determinant in how we structure and apply programmatic interventions under poverty policy.

- ***Reduction of Health Care Need is a Public Objective and the Design of Public Policy in the U.S.***

The presence and scope of U.S. public insurance programs, as well as the tax treatment of employer-sponsored health benefits, demonstrate an existing public interest in supporting the well-being of those who experience medical need. Subsidies directed at eliminating health care need might take the form of a prospective arrangement (e.g. premium subsidies) or they might take the form of direct payment for services. While safety net mechanisms serve a crucial role in the United States health system, the dominant U.S. policy model is to promote prospective arrangements.

If U.S. policy views subsidized risk protection (e.g. insurance) as a ‘first best’ solution to tackling the health and financial consequences of medical need, then absence of a formal method to quantify medical care economic risk and to assess the effectiveness of subsidies directed towards reducing this risk is problematic. In the absence of such a measure, it is difficult to objectively evaluate the effectiveness of current policies, or to evaluate the need for and potential impact of policy change.

- ***Public Insurance Programs and Subsidies toward Purchasing Coverage Have an Economic Cost, and an Economic Benefit***

We consider two sources of value arising from health insurance⁶. First, we note the traditional argument that a risk-averse individual purchases insurance because of the utility gain resulting from

⁶ Insurance may have an additional value that we do not explicitly consider here: insurance coverage may increase consumption of preventive services that may decrease risk of high medical expenditures. An example would be early detection of certain cancers or treatable heart conditions.

movement out of uncertainty and into a state of certainty (or reduced uncertainty) with respect to wealth. Second, we highlight the work of Nyman (2004), who argues that in part, the value of health insurance arises from its transfer of 'income' from the healthy to the ill.

We observe moral hazard If the benefits of insurance enable a sick individual to consume more services than he or she would have consumed in the absence of insurance. However, Nyman suggests that in some instances, it is possible for this moral hazard to be efficient. It is welfare increasing if, with a direct transfer of money to cover the cost of the service (instead of service coverage), the individual (whose resource set is expanded by the transfer) is now willing to pay more for this service than dollars transferred to cover the actual cost. Given this argument, Nyman suggests that the provision of premium subsidies may increase social welfare, particularly if society is altruistic (benefits when individuals in medical need receive access to services).

Applying these concepts to our context, let us take the case of two individuals each living at 101% FPL, both of whom incurred no medical care expenditures over the past year. At the start of the previous year, before the outcome of no health expenditures is realized, one of these individuals is handed insurance coverage for which the premium is fully subsidized. *Ceteris paribus*, were these two individuals equally well-off over the past year? We suggest that the answer to this question is no.

First, if both individuals were risk-averse than the individual holding the insurance policy experienced a gain in utility from reduction of uncertainty. Second, in the event of illness, this insurance policy essentially extends the (medical care specific) resources available to the covered individual. Thus, the individual holding the insurance policy has not only gained protection against the risk of losing present wealth but also protection against the risk of incurring an expense (or forgoing a needed service) that he or she cannot reasonably afford or repay in the first place.

Finally, we note that in the case of Medicare and Medicaid (and even employer-sponsored insurance) public dollars subsidize the cost of coverage. In the case that an individual with subsidized

coverage becomes ill, these dollars have partially financed the pool that extends the availability of resources (perhaps beyond his or her current wealth) to cover medical care expenses. We suggest that it is relevant to consider the cost of these public subsidies, but also the value of this insurance holding when evaluating poverty (and health) policy.

The NAS panel considered multiple approaches to incorporating medical care need into the measurement of poverty (see for example: Moon, 1993 and Citro and Michaels, 1995). While the panel considered the merits of designing a single measure of poverty that could reflect the importance of medical care needs, they ultimately advocated a two index approach to achieving this objective. We argue that this split approach is superior to a combined approach; it allows us to capture both the medical care burden, and medical care risk perspectives in poverty measurement. In making this recommendation we note the loss of simplicity offered by a single measure and recognize that for policy purposes, the need for simplicity may dominate the wish for greater accuracy. Even in this view we still recommend the calculation of a separate Medical Care Economic Risk index to capture current and changing medical risk as a separate and important indicator of well-being and indeed deprivation.

The Importance Moving Forward in the Design of a MCER Index

Throughout this paper, we argue that current methodologies fall short of sufficiently recognizing the relationship between medical need and poverty. While the Supplemental poverty measure makes important strides in this direction, capturing the full dynamic of this relationship requires a measure of Medical Care Economic Risk. While medical care economic risk is distinct from a measure of realized economic burden, it is an important (and we believe necessary) complement to the information captured in the SPM. The renewed focus on this topic coincides with a number of important public policy actions that demonstrate the relevance of the issues addressed in this Workshop.

Specifically, the use of measures of affordability and medical risk under the new health care law (e.g. ACA) demonstrates the relevance of these concepts in popular policy dialogue, and calls attention

to the need for standardized conceptualization and measurement of these constructs. The impending release of the Supplemental Poverty Measure similarly demonstrates policy interest in expanding the robustness of poverty assessment.

Entitlement reform, beyond that instituted in the health care law, is increasingly a focal point of policy debate. The potential for substantive reform of the Medicare and Medicaid programs introduces new uncertainties regarding access to, and the extensiveness of medical risk protection in the United States. Growth in national medical spending and changing trends in underlying population morbidity will inevitably require difficult policy choices. As we move forward, the United States is in great need of open and informed dialogue concerning the value of medical spending and the public role in medical risk protection. The creation of a standardized measure of MCER can provide the general population and policymakers a baseline from which to understand and engage in difficult policy choices.

While the most basic application of the suggested risk index includes descriptive reporting of population burden and distribution of MCER, valuable extensions of this application are possible. Examples of feasible applications include: (1) Assessing and monitoring the effectiveness of public programs at achieving medical risk protection; and (2) Directing policies to reduce and prevent poverty and its health consequences. A well-formed measure should reflect the importance of coverage access, coverage take-up, and coverage structure in mitigating the economic effects of medical circumstance.

In the sections that follow, we identify considerations that are central in the development of this measure, review previous measurement suggestions and outline a basic framework for moving forward. Unfortunately there is no very simple way to capture medical risk: insurance coverage differs, new treatments and hence expenditures continuously change, there is both under and over usage and there is a trade-off between detail and accuracy and feasibility of approach.

CRITERIA FOR DEVELOPMENT OF A MEDICAL CARE ECONOMIC RISK INDEX

This section identifies a number of primary design factors that must be addressed during the development of the MCER index. In addressing each of these issues, we suggest criteria that developers might introduce as they contemplate the appropriate structure of the index. We begin with a review of relevant design criteria outlined in the 1995 NAS Panel report, followed by an overview of Doyle's (1997) criteria for index development. In the final section, we expand on some of these previous discussions, and highlight additional design components that require substantive Panel focus.

Design Recommendations from the 1995 Panel

Criteria specified by in the 1995 NAS Panel report include that the index reflect prospective assessment of medical risk and that the index produce a family-level measure of medical care economic risk.⁷ Given that risk is a notion typically quantified and applied in an ex-ante or prospective context, we recommend that the MCER index be designed as a risk-based assessment of the potential economic impact of medical need.

To clarify this assertion, we address the concept of risk as it relates to health. Vate and Dror (2002) define health risk as “any situation in which the health status of an individual—or group of individuals—is exposed to possible deterioration” (p. 125). Notably, this delineates a circumstance where the eventual outcome experienced by an individual or group is not known with certainty. We interpret the call for a risk-based index to imply that MCER development should focus on the possible health related expenditures (outcomes) that a family might experience, rather than an emphasis on evaluating known expenditures.

Applying an actuarial framework to this context, it is appropriate to think of an individual's (family's) potential annual claim amount (e.g. total 'loss') as a random variable, tied only to a limited set of members' characteristics. As such, the quantification of medical expenditure risk might entail fitting

⁷ See Doyle (1997) section A, “Issues resolved by the NAS recommendation” for an overview of the Panel's treatment of these issues.

probability distributions at the cell-level to the empirical distribution of losses observed in the base data source.⁸ Risk assessment would occur at the cell-level, where all cell members are assigned the same probability distribution as a representation of potential (and uncertain) future outcomes.⁹ Operationally, this assessment might occur prospectively (before the outcome is known), or retrospectively (e.g. what might have occurred, despite the known outcome).

We recommend a family-level unit of analysis, where the definition of family unit conforms to the definition applied under the Official Poverty Measure, or the definition introduced under the Supplemental Poverty Measure.¹⁰ The Interagency Technical Working Group on Developing a Supplemental Poverty Measure recommended that the family unit include “all related individuals who live at the same address, any co-resident unrelated children who are cared for by the family (such as foster children), and any cohabiters and their children” (U.S. Census Bureau, 2010, p. 4). In its current form, the official poverty measure also adopts a family unit of analysis; however the definition of family is restricted to birth, marriage or adoption based relationships with a reference person (Provencher, 2011).

Selection of a family unit of analysis is not without precedent. For example, Banthin and Bernard (2006) design a family unit measure for underinsurance; similarly poverty measures examined by Doyle, Beauregard and Lamas (1993) and Handel’s (2010) cost model are specified at the family level. We highlight two criteria we see as important for the selection of analytic unit: (1) Ease of comparability with the official or supplemental poverty measure; and (2) Alignment with medical insurance and service purchasing decisions. We believe either of these measures is reasonably sufficient in meeting

⁸ As defined by Klugman, Panjer and Willmot (2008): “An actuarial model is an attempt to represent an uncertain stream of future payments (p. 9). The reader is directed to Klugman, Panjer and Willmot, specifically chapter 2, for further clarification on the application of probability models in actuarial exercises.

⁹ This approach is adopted in Handel (2010).

¹⁰ We address aggregation of the risk measure from the individual-level to the family-unit in later section.

these criteria. A detailed review and comparative assessment of these and alternative unit definitions is found in Provencher (2011).

Doyle (1997) Criteria

We provide a brief overview of each Doyle criterion below. Many of these topics are addressed in greater depth under Additional Recommendations.

- **Index Must Reflect Risk**

The index should capture risk of incident health events alongside current health status in measurement.

- **Index Must Reflect Resource and Medical Need**

The index should include sufficient treatment and measurement of insurance adequacy, access to subsidized care and affordability. Specifically, this criterion requires the specification of some “benefit standard against which a person’s insurance plan could be compared to determine its adequacy.” As well, Doyle suggests that determination of insurance adequacy reflect individual need characteristics. In the absence of adequate insurance, access to subsidized care should “be viewed as a substitute for insurance.” Finally, consideration of affordability requires some decision on the “acceptable level of risk” where “being above it classifies someone as inadequately insured.” Three guidelines are given for defining this level: the level of acceptable risk should be income sensitive, it should also reflect “the amount of nonmonetary resources at the disposal of the individual,” and finally it should reflect “necessary nonmedical or uncovered costs incurred” (such as travel or relocation expenses necessary to access needed care, etc.).

- **Index Must be Quantifiable**

The final index must include some method of quantifying the risk threshold, the prospective value of an insurance plan, the cost of an insurance offer and the value of the plan benefits.

- **Index Requires Well-Defined Accounting Period**

A prospective or retrospective assessment period, including its length, should be clearly defined.

- **Index is defined by Available Data**

The index should be based on available data sources, or “modest extensions of current data collections.” The data source should include “determinants of medical utilization and expenditures”, information on income and assets, and sufficient information to infer access to subsidized coverage or care. As well, data should be “timely, comprehensive, routinely available and accessible.” In selection of data source, it also relevant to consider how the MCRI might be coordinated with economic poverty measures.

Additional Recommendations

In this section, we evaluate in greater depth a number of core design elements, including: the measurement of medical risk, valuation of medical resources and the definition of affordability.

Measuring Medical Expenditure Risk

We divide the measurement of medical care risk into three phases: selecting a set of explanatory health risk factors, defining appropriate medical coverage, and modeling the relationship between risk characteristics and expenditure outcomes.

Classifying Health Risk. An important early step in index development should include the introduction of a standard method of classifying individual health risk, based on the presence (or absence) of risk factors.¹¹ The World Health Organization’s description of this term clarifies its conceptualization in our own context: “A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury.”¹² While it is possible to conceptualize economic risk and utilization decision-making at the family-level, health itself is traditionally an attribute of the individual. Similarly, we might expect the measurement of health risk to be most informative at the individual-level. Accordingly, we suggest that developers begin by specifying a measure of individual medical

¹¹Throughout this paper, we use the term ‘risk characteristic’ interchangeably with the term ‘risk factor.’

¹²World Health Organization. Health topics: Risk factors. Available http://www.who.int/topics/risk_factors/en/ [August 9, 2011].

expenditure risk that is ultimately aggregated to form a family-level measure of expenditure risk. In addition, we suggest that index developers either rely on an existing risk adjustment model to form an appropriate system of risk classification, or develop a simplified risk model that is informed by the current state of knowledge in this field.

Over recent decades, research in the area of predictive modeling and risk adjustment has contributed substantially to the measurement of individual-level (prospective and retrospective) risk. Numerous risk adjustment packages designed at research institutions or through private entities are currently marketed or available for public use. A comparative analysis of the predictive accuracy of these packages is found in Winkelman and Mehmud (2007). Each of these models introduces a unique approach to classifying health risk which typically entails identifying a base set of clinically meaningful risk variables (adjusters), or defining a set of mutually exclusive actuarial cells.

Procedurally, under an individual-level approach to adjustment, weights developed in an underlying risk model are combined with risk factor information to form an individual measure of expenditure risk.¹³ Each cell or combination of adjusters should capture individuals with similar expected cost experience, where one adjustment category might reflect a range of ages, a grouping of diagnosis codes, or a particular diagnosis combination. All models evaluated in Winkelman and

¹³ Typically weights are developed using an external base sample to specify an appropriate risk model; however, users of software products are often given the option to calibrate these weights to their specific population or sample. For further discussion of model calibration see Winkelman and Mehmud (2007). For further discussion of model development, see Kronick et al. (2000), and Pope et al. (2004), which detail the development of the Chronic Disability and Illness Payment System (CDPS) and the Centers for Medicare and Medicaid Hierarchical Condition Categories (CMS-HCC) model, respectively.

Mehmud, for example, rely on a minimum of demographic and diagnosis code information to form adjusters or actuarial cells.¹⁴

The adjustment literature also evaluates the predictive strength of numerous other risk factors, including survey collected variables such as perceived health (simple single measure, SF36 etc.), functional health status (ADLS, IADLS), self-reporting of chronic conditions, lifestyle, employment, education, driving ability, marriage circumstance, geographic and others, van de Ven and Ellis (2000) review the early development of this branch of literature. In recent literature, Ellis and McGuire (2007) examine the predictiveness of prior year charges, DCG/HCC diagnoses, and ‘covered charges’ by DCG/HCC, place of service, physician specialty and type of services.

It is important to distinguish between two modeling objectives in this field. Much of the adjustment literature focuses on modeling individual risk, where models are designed exclusively to compute risk-related premium subsidies in a regulated market context.¹⁵ Many models developed in light of this purpose exclude valuable predictive information from the explanatory side of a model if it is too difficult to collect, or if linking subsidies to these factors reduces efficiency incentives in the marketplace. In the adjustment context, these considerations, e.g. appropriateness of incentives and feasibility, are central considerations in model selection (van de Ven and Ellis, 2000, p. 780).¹⁶ In contrast, some developers of modeling software offer a second type of model designed to identify high-

¹⁴ Some models use additional inputs such as pharmacy codes, procedure information, laboratory results, prior expenditures and even information from health risk assessments, factors unlikely to be used for the MCRI tied to poverty since the data requirements might limit the timeliness of the measure.

¹⁵ Van de Ven and Ellis (2000) conduct an extensive review of the early development of this field. While the particular application of these models, namely to “set subsidies to consumers or health plans to improve efficiency and equity,” does not fit our objective, the core operational function of these models, namely to “calculate the expected health expenditures of individual consumers over a fixed interval of time” fits with our objective (p. 758).

¹⁶ A third criterion is fairness (van de Ven and Ellis, 2000).

risk cases that might benefit from care management. Models designed for this purpose are not limited by the same constraints introduced in the former circumstance, and may employ a broader set of predictors and achieve a greater level of predictive accuracy.

While developing the MCER index, we are most interested in the approach taken under this second type of model. Models designed to meet the first modeling objective traditionally include age, gender, diagnosis information and enrollment information as risk variables. We suggest that the risk modeling adopted for the MCER index incorporate additional risk variables if these information types are currently available or reasonably collectable. For example, the MCER index might additionally incorporate information on self-reported health, ADLS, IADLS, socioeconomic information (educational attainment, race/ethnicity, income, etc.), and lifestyle (smoking, obesity, etc.). While utilization and prior expenditure information are additionally available, these data are impacted by insurance status and should be excluded or introduced with great care.

The chosen classification system should reflect current best practices in prospective risk assessment, to the extent that data limitations (sample size and variable collection) and other feasibility considerations (e.g. cost, complexity and timeliness) permit the achievement of this objective. Limits in the types of data available may necessitate the exclusion of important predictor variables from a final model of health risk. In addition, feasibility considerations might limit the number of risk factors included in the classification of health risk. Developers might find it advantageous to rely on an existing model to define a universe of risk types if a high level of refinement is desired in the classification of risk. Finally, a feasible classification of health risk should also consider the difficulty introduced by moving from an individual measure of health risk to a family level MCER index. Considering these criteria, we outline suggested classification structures in Appendix A.

The Definition of Appropriate Medical Care Coverage. It is highly recommended that the risk measure adopted in the index reflect expenditure risk under a standardized basket of medical care services. The

use of a standardized basic benefits package is not unprecedented in the literature. Specifically, Short and Banthin (1995) adopt benefit standards from the Federal Employee Health Benefits (FEHB) plan and the Health Security Act proposed during the Clinton Administration. As noted by Kahlinosky and Kohler (2004), Wolfe suggests computing medical care need against a “minimum bundle” of “health care services needs,”¹⁷ while Banthin has similarly suggested adjusting poverty thresholds to incorporate a “‘benchmark insurance plan’ that offers a minimum level of coverage” (Banthin in Kahlinosky and Kohler, 2004).

While utilization beyond this basket would likely generate beneficial health effects, it is suggested that this approach highlight a minimum service set that all individuals should be able to access. In principle, this package should reflect some societal agreement on, and willingness to contribute towards, reasonable population-level access to a basic benefit or service set. An ideal package includes effective preventive services, enables reasonable management of ongoing health conditions, and ensures access to appropriate care for incident health events. The process of defining this minimum benefits set requires input from a broad spectrum of contributors. Such a process should include substantive contribution from knowledgeable experts, but must also incorporate adequate consideration of public preference. Standards to be set under ACA would be most appropriate to serve as this basket.

Barring release of the ACA benefits standards in the near future; it is recommended that index developers rely on similar state-level initiatives to guide/inform the process of developing this benefits set. For example, Massachusetts’s health reform legislation formally institutes population level

¹⁷ Wolfe’s (1998) proposed bundle includes “those services for which a well-informed person of moderate income would be willing to pay the full cost, in order to engage in the full range of daily activities permitted by the person’s underlying health status,” where the bundle “may vary according to certain characteristics: health status, age, whether or not the individual lives alone” (p. 29).

participation in coverage purchasing. In effect, this reform law sets a minimum level of insurance benefits that population members are obligated to purchase. Currently, this policy model most directly addresses the normative challenge of defining a population wide minimum benefit standard. As such, we recommend that developers learn from the Massachusetts process and product, in both its strengths and weakness, when addressing this challenging task.¹⁸

Finally, we note that operational application of the minimum benefits criterion while designing the index introduces two substantive data limitations: (1) Individuals with generous insurance benefits or limited economic constraints might report utilization that exceeds the standardized service basket; and (2) Individuals with no insurance benefits, limited benefits, or economic constraints might report underutilization of appropriate services. We emphasize that a well-designed index includes sufficient adjustment for both of these factors.

Quantitative Methods and Risk Measures. In the previous section, we suggested individual-level classification of health risk. Similarly, we recommended an individual unit of analysis for the purpose of modeling the relationship between expenditures and health risk. We address the process of aggregating from individual measures to the family unit following our review of alternative approaches to modeling expenditures.

Prior to development of an expenditure model, developers must identify an appropriate measure of risk. The depth of this challenge is easy to overlook; however, if we begin to examine its implications in the design of the index, it becomes an exceptionally challenging task. In the first place, we draw from Klugman to clarify the terminology ‘risk measure’:

A risk measure is a mapping from the random variable representing the loss associated with the risks to the real line (the set of all real numbers). A risk measure gives a single number that is intended to quantify the risk exposure (Klugman, Panjer and Willmot, 2008, p. 42).

¹⁸ See Appendix B for a listing of Massachusetts’ 2010 and 2011 Minimum Creditable Coverage Standards.

A primary challenge in developing an index is determining how to move from a range of plausible outcomes to a singular measure of economic impact. If we think back to the earlier discussion of health risk, losses, and loss distributions, it should become clear that this implies that developers must specify a single measure that captures the most important information from a family's distribution of potential losses. It may be the case that this measure focuses exclusively on the probability of tail losses, or otherwise that the measure is based on some 'meaningful' moment of the loss distribution.

While developers might define other measures, we identify two (very different) potential summary measures of expenditure risk: (1) The probability of family expenditures exceeding a given expenditure threshold (exceeding a prospective MIT); or (2) a measure of expected expenditures per family unit (expected MIT). In either case, developers must identify appropriate actuarial (e.g. fitting loss distributions to a set of mutually exclusive risk cells), or econometric (e.g. specifying a regression-based adjustment model) methods to model the relationship between risk characteristics and expenditures.

While both of these modeling approaches might be adapted to quantify these risk measures, developers may determine that a particular approach is best suited for the estimation of a particular risk measure. In the section that follows, we review a number of factors developers might consider in the selection of an econometric or actuarial approach to risk assessment.

Finally, we note that it is possible to think of expenditure risk as the actuarially fair cost (plus some adjustment for risk load) of purchasing a fixed or specified benefit plan, where this benefit plan is comprehensive in terms of coverage of needed medical care. We do not believe it conceptually appropriate to think of expenditure risk as the market cost of purchasing insurance. This is because in practice, we do not observe a market where everyone is insurable, insurance companies offer (only) this fixed benefit plan, and premiums are not subsidized or politically modified, but reflect the risk-rated premium cost of purchasing this coverage plan.

Probability of Expenditures Exceeding a Given Threshold as a Measure of Risk. One representation of medical care economic risk might entail estimating family-level probability of incurring unaffordable medical care expenses. Notably, all families will experience some risk of tail (e.g. catastrophic) events. What will vary across the population is whether a family has an out-of-pocket maximum as a component of any insurance holding, and additionally whether non-catastrophic medical expenditures are unaffordable. Thus, after accounting for the impact of insurance characteristics on economic risk, a measure reporting the risk of exceeding an ‘unaffordable’ threshold would capture (i) whether a family’s stop-loss provision (if present) effectively kicks-in before a family faces unaffordability, and (ii) how at-risk a family is of experiencing an unaffordable ‘loss’ if, for example, there is no stop-loss, or the stop-loss provision kicks-in after a family reaches unaffordability.

Risk assessment might rely on econometric methods or the fitting of loss distributions. In the case of an econometric methodology, the general approach might entail defining a family’s affordability threshold, determining the level of (unadjusted) expenditures that cause a family to meet this threshold upon insurance adjustment (premium costs and coverage benefit), and estimating the likelihood that a family’s annual expenditures exceeds this unadjusted expenditure value.

However, if we reflect upon our previous recommendations, we have advocated for individual-level risk classification and risk assessment. Thus, under this approach, developers would need to classify risk at the family-level, or develop a method of moving from an individual-level risk measure to a family-level model. Additionally, we emphasize that any method developed using this approach should include careful consideration of model specification given the heavy-tailed nature of expenditure data (for example, see Mullahy 2009).

Under the second methodological approach, loss distributions would be fit to each actuarial cell defined under the health risk classification scheme. Following this approach each individual could be assigned a probability distribution of annual expenditure loss based on cell membership. Finally, as

demonstrated by Handel (2010), after adjusting for coverage characteristics individual loss distributions could be aggregated to produce a family-level probability distribution of out-of-pocket expenses. A final estimate of family probability of exceeding an affordability threshold would combine information on premium costs, insurance coverage and individual loss distributions.

In comparing these methods, we note that a loss distribution approach may limit the level of refinement that can be introduced in the classification of health risk. In contrast, a regression-based approach might allow developers to introduce greater complexity (accuracy) in the system of risk classification. Particular strengths of a loss distribution approach include the relative ease with which we could move from an individual-level to family-level measure of health risk, and the relative clarity of the method and final measure.

Expected Expenditures as a Measure of Risk. Mullahy (2009) provides a substantive review of the econometric considerations implicit in the development of a well-formed adjustment model (e.g. the econometric approach). Adopting the notation of Mullahy (pages S105-S106), we summarize the most relevant points here. In this application of health econometrics, modeling is employed to produce estimates of the conditional mean, $E[y | \mathbf{x}] = g(b_0 + b_1x_1 + b_2x_2 + \dots + b_kx_k)$ where y is (annual) health expenditures and \mathbf{x} represents a vector of risk characteristics. In the most basic circumstance $E[y | \mathbf{x}]$ is modeled using a linear specification, and the process of combining model parameter estimates with risk factor information to produce individual-level estimates of expected expenditures is straightforward.

While this approach is observed most often in the adjustment literature, given the use of large samples in model development and a preference for ease of model interpretation in applied contexts, alternate econometric specifications might be warranted. Specifically, the heavy tailed nature of health expenditure data and the large number of zero observations are important considerations in model development. We do not review the topic of appropriate specification in great detail, but note that considered alternative specifications (again, summarizing Mullahy) include the exponential conditional

mean, e.g. $E[y|\mathbf{x}] = \exp(\mathbf{b}'\mathbf{x})$, or two-part model, e.g. $E[y|\mathbf{x}] = \text{Prob}(y>0|\mathbf{x}) \times E[y|y>0, \mathbf{x}]$ specifications.

The reader is directed to Mullahy (2009) for a review of supporting literature and the appropriate application of these models. Beyond econometric specification, Mullahy highlights a number of additional factors that we suggest MCER developers consider. These include appropriate transformation/retransformation methods (if necessary), approaches to testing model fit, the impact of heavy tailed data, and covariate specification (specifically, interaction/endogeneity considerations),¹⁹

As an alternative, developers may choose to directly model loss distributions at the cell-level. Under this approach sample members would be assigned to one actuarial cell from a set of mutually exclusive risk cells. An individual's measure of expected expenditures would be based on probability distributions fit to annual losses at the cell-level. There are limitations to each of these methods. A sizeable proportion of the variation in health expenditures will remain unexplained in an econometric model. Under the loss distribution approach, feasibility constraints and data limitations might leave developers with a less than ideal level of refinement in risk categorization. Specifically, the need to ensure sufficient observations per risk cell and to limit the workload necessary to implement the index, might limit the number of risk cells incorporated into this type of model.

Finally, we note that singular reporting of expected expenditures as a measure of risk does not effectively emphasize the range of potential outcomes that families face. The selected risk measure should recognize the distributional features of health expenditure outcomes; including the unlikely, but real occurrence of catastrophic (tail) events. Accordingly, we suggest that developers adopt a risk measure that reflects a family's probability of experiencing unaffordable outcomes. If developers select expected expenditures as a measure of risk, this measure should be accompanied by consideration of standard deviations or other distributional moments as relevant indicators of risk.

¹⁹ Again, we direct the reader to Mullahy (2009) for a review of this literature.

Examples: Operational Approaches to Health Classification and Risk Modeling. We briefly

identify alternative approaches developers may consider:

- Rely exclusively on available adjustment software to produce individual-level estimates of expected expenditures. Notably, MEPS panels 1-9 include relative risk scores developed using DCG models; relative risk scores can be used to compute these individual-level estimates.²⁰
- Develop a unique risk model using the MEPS data files; assign individuals a measure of expected expenditures based on the parameters from this model. Developers may wish to specify a risk model that requires a limited amount of individual information that might be collectable in other contexts; this approach might be designed specifically to meet this objective.
- Compute individual-level risk scores using an available software package. Following the approach of Handel (2010), create a set of mutually exclusive risk cells based on cut-points in the risk score distribution and fit loss distributions to expenditures observed in each cell.
- Use independent predictors or actuarial cells identified in an available software model to form a set of mutually exclusive risk cells; fit loss distributions to each of these cells.

²⁰The MEPS HC-092 documentation file from the Agency for Healthcare Research and Quality (2008) is a useful resource for understanding the development and applications of these scores. We outline some of the most relevant points here. A relative risk score is defined as “a summary of disease burden and expected annual health care resource use at the individual level”, which “can be converted into a dollar predication by multiplying by an appropriate sample mean” (p. C-2). Relative risk scores are based on large sample DCG regression models, which include demographics (age and sex), DxCG’s Hierarchical Condition Categories (HCCs) and appropriate interaction terms. HCCs represent a unique classification of ICD-9-CM diagnoses, were: “Each code is classified into one of 184 condition categories, and hierarchies are further imposed to make predictions more robust to variations in how disease codes are captured, to reward specific coding, and to increase model stability” (p. C-1-C-2).

- In the case that developers wish to develop a loss distribution approach that requires a small set of (easily collectable) information, identify a set of actuarial cells based on this information set. Fit loss distributions as in alternatives three and four.

Medical Resource Valuation and Defining Affordability

Thus far, we have dealt predominately with challenges introduced by the medical care needs component of the MCER index. Index developers are faced with similarly complex considerations when working with the resources component of the index. We begin with the treatment of insurance benefits in the index, and subsequently examine the role of family characteristics and monetary resources in index development.

Risk Protection. In part, the MCER index should measure whether a family's insurance holding offers sufficient protection against medical expenditure risk. To meet this objective, we suggest that the index methodology first produce a measure of family-level of risk protection, and then assess separately whether this level is sufficient given family characteristics. Families of different size or economic circumstance might require different levels of risk protection to meet this sufficiency requirement. Separation of these steps can improve the transparency of the underlying methodology, and might aid in the identification of feasible interventions and policy targets.

To assess a family's level of risk protection (e.g. post-coverage expenses), information on insurance characteristics could be applied to member loss distributions/expected expenditures prior to family-level aggregation. If a family does not hold any insurance, there is no change in the original measure of risk/loss distribution and this step is not relevant for them. At a minimum, this step should incorporate information on deductibles and stop-loss. In addition, it is preferable to incorporate information on coinsurance and copayments.

A simplified measure might apply information on a plan's actuarial value, family level deductible and stop-loss to compute post coverage expenses. Copayment and coinsurance information specific to

emergency department services, hospitalizations, primary care, prescription fills and other services might be too complex for this index and are included to a reasonable degree through the actuarial value. For example, the detailed level of information might require service specific modeling of expenditure risk. If this level of complexity is desirable, the cost model from Handel (2010) provides an operational example of an approach employing more extensive treatment of insurance characteristics.

The Definition of Affordability. The definition of acceptable level(s) of unprotected expenditure risk is not directly addressed in this technical document. This is a complex and value-laden task that is best left to a broader contributing body. Consideration of the affordability thresholds outlined in the ACA might inform this discussion. Relevant to this as well is the question of how to treat assets. By this we mean financial assets including vested pensions, IRAs etc. One approach, and the one we suggest tied to the issue of affordability is to take an annuitized value where a family receives the value of an annual flow of income from their financial assets based on the life expectancy of adults in the family using existing life tables. Alternative approaches might use some specific percent of assets. Evidence suggests that a majority of individuals with very high expenditures in any one year are likely to face high expenditures in subsequent years. Hence we do not recommend using (or counting) a majority of assets in any one year. This annuitized value would be added to income and compared to unprotected expenditure risk. We note, as well, that post-insurance risk can be represented as a measure of expected expenditures or a distribution of potential expenditures. Developers will need to decide which scenario most adequately reflects the purpose of this index. In the case of the former approach, it is necessary to consider whether any risk of very large expenditures is ‘affordable.’

PREVIOUS CONTRIBUTIONS TO THE MEASUREMENT OF MEDICAL RISK AND NEED

In the section that follows, we briefly summarize a selection of measurement strategies that relate to the development of a MCER index. While no single strategy reflects our ideal version of the

index, each of the highlighted measures introduces some component method that we incorporate into our suggested framework. For each strategy, we highlight the primary measurement steps, review shortcomings of the strategy with respect to MCER development, and underscore the particular method that we incorporate under the final framework.

Doyle, Beauregard and Lamas (1993)

Doyle, Beauregard and Lamas evaluate six different poverty measures based on the methods outlined by Moon (1993) and additional recommendations from the National Academy of Sciences Panel on Poverty and Family Assistance: Concepts Information Needs and Measurement Methods.²¹ Given our focus on designing a separate index of medical care economic risk, we focus exclusively on the Two-Tiered Health Benefits Paid option, which is outlined below:

- A family is classified as poor if income falls below 96.4% of their respective threshold (e.g. the threshold less average out-of-pocket expenditures in 1987) after factoring in taxes and MOOP.
- A family is classified as poor if the value of covered services received by the family falls below the level of coverage offered under a standardized benefit plan.

A primary critique of this measure is its reliance on observed utilization and expenditures. While this measure does capture the burden of medical care expenditures experienced by a family, it does not reflect need in the event that a family underutilizes services, nor does it reflect the economic risk resulting from events that might have occurred. A lasting contribution of this method is its effective adaption of the standardized benefits suggestion into an operational measurement strategy; our framework relies on the specification of a standardized benefits package to define appropriate medical coverage.

²¹ The specific measures evaluated include: (1) the official Poverty Measure, (2) Post-tax Measure, (3) Post-tax Post-OOP Measure, (4) Two-tiered Uninsurance Measure, (5) Single-tiered Health Benefits Paid Option, and (6) Two-Tiered Health Benefits Paid Option (see pages 10-11 for measure descriptions).

Short and Banthin (1995)

The original work of Short and Banthin is designed to estimate the amount of underinsurance among privately insured population members under age 65. Their initial work identifies three measures of underinsurance; a first measure examines the actuarial value of current insurance coverage relative to values assigned to the Health Security Act (HSA, proposed during the Clinton administration) and the Blue Cross and Blue Shield federal employee benefit offering (an alternative to the HSA proposed in 1994). Individuals are underinsured if their current coverage is not assessed as having equal or greater actuarial value, where actuarial value is a measure of “average claims paid per policy holder” (p. 1303). In addition, they examine whether individual plans include a standardized set of coverage characteristics based on the HSA and FEHB plan offerings, forming a second definition of underinsurance.

The third Short and Banthin measure examines the number of individuals who are underinsured in the specific circumstance that they experience a catastrophic event. Their measure, which draws extensively from the previous work of Farley (1985), includes the following components:

- Benefit standards are based on an individual’s risk level and family income
- Individuals are categorized as high- or low-risks based upon an estimate of their expected expenditures; those with expected expenditures in the upper 25th percentile are considered high-risks, the remaining individuals are considered low-risks.
- Expected expenditure are computed from a linear regression model with age, race/ethnicity, sex, income, perceived health status, disability days, and limitation of usual activity as independent predictors.
- For each individual, the authors measure the level of financial protection provided by an individual’s insurance coverage. The ‘simulated’ catastrophic event is defined as “the average for people in the 99th percentile of actual expenses in 1987” per one’s respective risk group.

- Finally, individuals who accrue expenditures above 10% of family income after accounting for coverage characteristics are considered underinsured.

The major contribution of the (third) Short and Banthin method is its focus on economic circumstance in the case of a catastrophic event. The objective of this approach is entirely different from a strategy designed to identify whether an expected expenditure outcome would cause economic hardship. As is highlighted in this third measure, we feel strongly that the MCER must recognize the potential for catastrophic outcomes. While this measure achieves this objective in part, it is not a robust measure of all types of catastrophic or simply economically challenging scenarios (see for example Banthin, 2011). A final strategy should introduce a greater degree of sensitivity in its identification of economic hardship. Finally, we note that a measure similar to the actuarial value measure from the first Short and Banthin method is adopted under our final framework.²² This construct allows us to apply a summary measure of an insurance plan's coverage benefit when adjusting a family's loss distribution for the effect of insurance coverage.

Doyle (1997)

Doyle recommends adoption of the Short and Banthin method, with the following modifications:

- Incorporate income definitions applied under the traditional or proposed poverty measure revision.
- The measure should be designed for application across the population, with the exception of individuals residing in institutions.²³
- Consider public insurance, public coverage combinations, and public-private coverage combinations.

²²Banthin and Bernard (2006) note that the benefits information utilized in the Short and Banthin method is not available beyond the 1996 MEPS panel. Thus, our suggested method calls for extended data collection.

²³ The original Short and Banthin method examines underinsurance among those who hold private insurance and are under the age of 65.

- Include an affordability standard “consistent with ability to pay” and consider the impact of other forms of care or coverage subsidies.

The framework outlined in this document is designed to adhere with the second and third recommendations outlined here. We are less specific on the definition of income and affordability. Additionally, we do not suggest a method to estimate family access to charity care, or similar forms of subsidized coverage.

Banthin and Bernard (2006)

Banthin and Bernard modify the Short and Banthin method to match with the reduced collection of coverage characteristics after the 1996 MEPS panel. The unit of analysis is the family-level, and estimates focus on identification of families with actual expenditures exceeding 10% and 20% of after-tax family income.²⁴ This measure falls short of the MCER objectives, since it does not reflect a family’s risk of experiencing high-value (catastrophic) expenditures. Additionally, Banthin and Bernard estimate the prevalence of financial burden by population subgroups, defined according to insurance type, poverty status, health status, health conditions and various demographic factors. We rely on many of these same characteristics to form actuarial cells or adjustment factors under the MCER framework.

Handel (2010) – Section 5.2: Cost Model

While Handel’s paper does not focus exclusively on the development of a medical risk index, Handel’s empirical framework includes the specification of an ex-ante cost model at the family level. The model “predicts health risk at the individual level and then aggregates these predictions to the family level” (p. 24). The model incorporates the following steps:

²⁴ Banthin and Bernard compute two measures of health expenditures: (1) premiums plus out-of-pocket expenditures, and (2) out-of-pocket expenditures only.

- Claims are organized into four separate categories: hospital and physician claims, pharmacy claims, mental health related claims and physician office claims.
- The Johns Hopkins ACG software is used with individual demographic and prior use (claims) diagnosis information to estimate total and pharmacy specific utilization in the next year.
- Per claim category, sample members are assigned to a risk cell. Each risk cell is comprised of a collection of similarly risky individuals as determined using the ACG software.
- Using the actual claims experience of risk cell members, they fit an expenditure distribution for each risk cell/claim type combination.
- Next, each individual is assigned a joint claims distribution based on the individual's specific risk profile (e.g. risk cell membership for each claim type) and the respective estimated distributions.
- Applying coverage characteristics, this joint claims distribution can be "mapped" to a distribution of out-of-pocket expenditures; individual distributions and coverage characteristics are combined to form family-level distributions of out-of-pocket expenditures.

While we develop a MCER framework that can be adapted under alternative measurement approaches, the recommended measure of family-level expenditure risk is a simplified version of the Handel model.

We suggest a number of simplifications such that the application of this cost model is feasible using MEPS data and stylized to fit the objectives of a MCER measure.

HOW DO WE MEASURE ADVERSE MEDICAL EVENT RISK AND SUBSEQUENT ECONOMIC HARDSHIP?

General Approach

We suggest the following multistage stage approach to the development of a MCER measure:

- Baseline measurement of medical expenditure risk at the individual-level.

- Adjustment of individual expenditure risk for the level of risk protection guaranteed by an individual's insurance benefit followed by aggregation of individual risk measures to form a family-level measure of medical care expenditure risk. And
- Measurement of family economic resources, preferably including annuitized value of financial assets (excluding insurance benefit), followed by examination of the relative acceptability/affordability of a family's premium costs and medical expenditure risk given this economic baseline.

It is suggested that developers consider the merits of reporting the first two measurement stages alongside the release of an indexed affordability assessment. It is recommended that developers of the measure balance complexity (e.g. refinement), feasibility, and interpretability/applicability in designing the final measure. The usefulness of an index will depend on both the transparency of its construction, and the extent to which selected methodologies reflect expert knowledge and public values.

Selecting a Data Source

A number of options are available to developers as they determine the best source of data for constructing the MCER index. Dataset options include:

- The Medical Expenditures Panel Survey (MEPS),
- The Survey of Income and Program Participation (SIPP),
- The Annual Social and Economic Supplement of the Current Population Survey (CPS), and
- The American Community Survey (ACS).

A separate paper commissioned for this workshop reviews the relative strengths and weaknesses of each data source. While we do not review these data sources, we do highlight a number of key points developers may wish to consider when selecting the data source. Relative availability of key variables should be a primary consideration in dataset selection. Three categories of variables are necessary to construct an adequate index: health characteristics and related medical risk variables, insurance coverage and coverage design characteristics, and family-level economic resource information.

Expenditure risk models should be developed using a dataset that collects detailed and reliable expenditure data, such as the MEPS data. MEPS' strength lies in its collection of health and medical expenditure data, while the collection of economic resource data is one of this dataset's relative weaknesses. Developers may wish to look to Banthin and Bernard (2006), who apply an after-tax income simulation model to MEPS data when analyzing medical expenditure burden. Other factors developers may wish to consider include lag time to data release, alignment (if desirable) with the dataset used for the poverty measure or the supplemental poverty measure, and the ability to produce stable population estimates of MCER distribution/outcome at the state-level.

Unfortunately, the MEPS data currently do not include sufficient information on insurance characteristics to construct the MCER index as it is conceptualized in this paper. We suggest that deductible, stop-loss and an estimated proportion of (post-deductible/pre-stop-loss) expenditures covered are necessary for the construction of an index. We are not convinced that a MCER index would be sufficiently meaningful without these measures, although perhaps there are reasonable arguments otherwise.

While collection of this information might be burdensome, we do not believe them unreasonable. Provisions under the ACA rely on the actuarial value of a coverage offer to determine (in part) whether an employer-sponsored plan meets minimum coverage requirements, and also whether an insurer's particular coverage offering meets the requirements of Exchange participation. While we do not know the details of how this actuarial value will be defined, we suggest that collection of coverage information for the MCER might be coordinated with the collection of the information required under the ACA.

Finally, we note that the design of the measure must also reflect its expected purpose. For example, we can envision a detailed measure that requires information from claims data and health surveys to compute a family's MCER measure. In an alternative scenario, the health component of the measure

might only require answers to one or two health-related questions per family member, and each individual's age and gender. If developers select the former case, the MCER index might be limited to the MEPS data in development and subsequent use. In the latter case, the introduction of the MCER index into other datasets is reasonable and the use of the index in other (non-dataset) contexts becomes feasible. For example, a MCER developed for use in the determination of public program eligibility might require this second approach due to its limited data burden.

Framework for MCER Development

Next, we outline a generalized framework for the development of the MCER index. Core considerations in index construction are identified for each stage of MCER development.

Stage One: Measuring Individual Medical Expenditure Risk

In the initial stage of development, it is necessary to specify a risk cell/factor based approach to individual risk assessment. Core considerations when selecting risk characteristics include:

- Developers must determine the appropriate balance between maximizing the predictive capacity of the risk model, versus reducing complexity and reporting burden in the selection of risk cells/factors.
- Risk cells/factors should incorporate characteristics that are already available, or otherwise reasonable to collect in the survey set selected for MCER development.
- Selection of the risk model should consider other relevant data limitations, e.g. well-formed expenditure models will require sufficient observations per risk cell.
- Risk cell/factor classifications should reflect characteristics highly explanatory of health expenditure outcomes. Selections might include demographic characteristics (age/gender), chronic conditions, disability, or other health or functional status measures. (See Appendix A for detailed examples).

Core considerations when developing expenditure risk models include:

- Expenditures should reflect only those expenditures covered under the specified 'minimum' benefits package.

- Expenditure models should adjust for underutilization of uninsured/underinsured relative to medical need.
- Developers should use the Medical Expenditure Panel Survey for expenditure model development, which could take various forms. Developers might select a cell-based loss model approach; alternatively, developers might adopt econometric methods to model risk factor expenditure effects.
- In the latter scenario, careful attention must be given to zero expenditures and tail expenditures when specifying functional form of an expenditure model.
- Developers must determine whether it is necessary to model expenditure risk separately across service types.

Finally, developers must identify an appropriate operational definition of medical expenditure risk,²⁵ some alternatives include:

- **Risk Measure I:** An individual's 'medical expenditure risk' is defined as the probability of exceeding a given expenditure threshold per his or her respective risk cell, or given his or her particular combination of risk characteristics. This is our recommended approach. We suggest that this measure is identified by fitting a parametric probability distribution to the annual claims experience (e.g. annual losses) of risk cell members.
- **Risk Measure II:** Expected expenditures (based either on estimated risk factor effects, or a risk-cell measure of expected expenditures) and one standard deviation above and below this value.

²⁵ While we separate the measurement of expenditure risk from considerations of premium costs, the definition of affordability should consider a family's premium costs and expenditure risk. Consistent with other recommendations, the premium cost should be limited to the cost of the recommended basket of coverage. The process of combining these two measures under the index is addressed in stage three of the framework.

Importantly, we recognize that this section incorporates a number of suggestions that require methodological solutions that remain unanswered here. Among the insured, expenditure models will most certainly reflect some degree of unnecessary utilization. This is partially resolved by suggesting that expenditure models exclude all expenditures from services that are not included under the standard benefits package. Nonetheless, even with these parameters, the models will still capture some overutilization of the benefits available in this standard package.

In contrast, the claims experience of the uninsured or underinsured will most certainly reflect underutilization of necessary services. A straightforward method that might resolve this limitation is to model losses/expected expenditures only on those with insurance that meets the standard benefit package. This approach might be insufficient if few in the sample have such coverage, or if certain groups of risks are less likely to have such coverage due to existing denial of coverage or limited capacity of certain groups (for example those with severe mental illness) to understand coverage. As well, this approach assumes that the uninsured/underinsured within a given risk cell have the same underlying health risk as the members of the same cell who hold sufficient insurance (e.g. the same expected expenditures or same probability of tail expenditures). If this is not the case, the model would misrepresent the true risk of the uninsured by adopting this assumption.

Stage Two: Aggregation to the Family-Level and Adjustment for Insurance

In the next section, the outlined methods assume the use of Risk Measure I in the development of the MCER index. Developers may wish to design the MCER index using alternative measurement and/or aggregation strategies. Given the use of Risk Measure I, the process of aggregating individual risk measures to the family-level, and assessing the effects of existing insurance coverage might include one of the following two scenarios.

Assuming Independence of Family Member Claims:

- As is done by Handel, for each individual, simulate draws from his or her assigned distribution of losses. Apply his or her unique insurance characteristics to form an insurance-adjusted distribution of out-of-pocket expenditures.
- Identify the family unit, and (assuming independence) aggregate individual distributions of out-of-pocket losses to the family-level. In the case where members of the family unit hold a group coverage offering with group level provisions (family OOP maximum), apply these provisions in the process of aggregating to the family level.

Assuming Correlation of Family Member Claims

- Identify the family unit and aggregate the parametric loss distributions of unit members to create a multivariate distribution of family-level losses. If possible, incorporate correlation of family member claims when forming this distribution (see below for further discussion).
- Simulate multivariate draws from the joint distribution of family losses, and apply individual and family-level coverage characteristics to generate out-of-pocket payments for each draw.
- Once this process is completed, focus only on the overall probability of family-level out-of-pocket expenses for Stage Three of the model (once estimated properly, the multivariate properties of this distribution do not affect our outcomes).

If the correlation coefficient is known in advance and does not vary with family unit characteristics, then forming the aggregate loss distribution may be rather straightforward. On the other hand, introducing family-level correlations into the model may prove to be a rather complex task: specifically, correlation of family member claims might depend on the characteristics of each family unit (e.g. member risk types, number of members).

Estimating these correlations with MEPS data (as Handel has done at the individual level across claim types) may be infeasible due to the number of possible member number/risk type combinations, and the small number of observations per family unit type. At best, this may require limiting the

number of risk types (and perhaps family sizes) represented in the model. With respect to the accuracy of the index, we are not sure that the gains from introducing correlation of family member claims in this manner would outweigh the losses from reducing the capacity of the model to distinguish between different types of family units and individual risks.

We expect correlation of family member claims for reasons such as shared physical and social environments, similar genetics, and perhaps similar behaviors. Assuming independence is certainly problematic for medical events that are random and occur across the family simultaneously (for example an accident affecting all members). We are less certain that this independence assumption is problematic in the case of expenditures that result from managing a chronic condition.

Family members may share a particular factor (genetic/environment) that results in the presence of a particular chronic condition among members, but presence of these conditions is reflected in risk cell assignment. Acute events related to a condition occur at the individual level, and not across a family. Admittedly, these cells will not reflect base severity or the likelihood and frequency of acute events, which might be similar within families.

Accidents and genetic diseases are likely the main causes of positive covariance. Noting that covariance resulting from these (and other) factors is likely already studied by insurers; we suggest further consultation with insurers on this issue and perhaps empirical testing to determine the best route forward.²⁶ The likelihood of these (and other) types of positive covariance might be adjusted in the risk index after these informed discussions.

Stage Three: Indexing Economic Resources to Family-Level Risk

²⁶ A straight forward empirical test for covariance is to compare the difference between expenditures summed across members of a (fully insured) family, and expenditures summed across a collection of individuals whose combined risk profile is equivalent to that of the comparator family.

Under the remaining component of index development, developers must identify a standard definition of unaffordable premium and out-of-pocket expenditures; which we refer to as an unaffordability threshold. Previously suggested by Doyle (1997), we advocate the development of an “inverted threshold” that reflects “the amount of out-of-pocket expenses you should be able to afford for medical care,” where the threshold “can be established for a group as a function of the poverty threshold itself or can be computed for an individual or family as a function of income or assets.”

Specifically, we suggest that the threshold identify the maximum percent of family income allocated towards medical care expenses that can be considered affordable.²⁷ In determining a family’s ability to pay for medical care services, the threshold should consider the amount of family resources required to cover base needs identified in the SPM or original poverty measure. As such, a well-formed index should include the development of multiple thresholds to reflect other relevant factors such as family size and family income.²⁸ As one example, this approach might be draw from the poverty categories and income percentages introduced under the ACA to distribute premium and out-of-pocket expenditure subsidies..²⁹

²⁷ Doyle (1997) recommends that income definitions utilized under a medical risk index reflect those adopted under one of the poverty measures. Alternatively, developers may wish to consider both income and assets when defining appropriate thresholds. Our suggestion regarding assets is to use an annuitized flow concept to the extent it is feasible to measure financial assets. Ultimately however, determining which approach is most appropriate is left to the Panel.

²⁸ We note that a large family with a lower level of income might be assigned a lower affordability threshold than a similarly low-income but smaller sized family. A larger family will ‘use up’ a larger proportion of income on other relevant needs (e.g. housing, food, etc.), leaving fewer resources to allocate towards medical care.

²⁹ We caution that if these categories were adopted directly, any level of medical care expenditures for families above 400% FPL (even catastrophic expenses) would be considered affordable. Further attention should be directed to this issue if, in fact, these guidelines are considered for purposes of the MCER index.

The procedure of applying affordability thresholds to family-level resource and risk information might entail the following steps:

- Assign the appropriate threshold to a family based on family resources and characteristics.
- Combine threshold and family-level income information to determine the amount of medical expenditures that meets this threshold.

The remaining steps depend on the selected measurement methodology. In the case of the loss distribution risk measure I (probability of exceeding the affordability threshold) approach, the next steps include:

- Subtract premium costs from the assigned threshold.³⁰
- If premium costs exceed this threshold, the family is not 'at risk' of accruing unaffordable expenses. Rather the family experiences unaffordable medical care costs (e.g. probability of exceeding affordability threshold=1).
- If premium costs do not exceed the threshold, the next step is to determine the amount of out-of-pocket expenditures that (with these premium costs) would place a family at their respective affordability threshold.

³⁰ An alternative approach is to subtract premiums and any other (insurance adjusted) family member expenditures that are 'known' ahead of time (e.g. the costs of appropriate preventive care and disease management). In this respect, we assume there is no component of risk in the realization of these expenses during the next year. Following this approach, these expenditures should be excluded when loss distributions are fit to the claims experience observed in each risk cell. While this approach correctly distinguishes between expenditures that are known with certainty and expenditure risk, we suggest that in practice it is difficult to assign a correct measure of known expenses prospectively. Nonetheless, in principle, we agree with commentary from the workshop that advocated this type of approach. If developers are able to incorporate this method into the model, it would improve the accuracy of the MCER measure.

- The final step is to determine the family's probability of exceeding this amount of out-of-pocket expenditures using the family-level adjusted loss distribution.

The method outlined above represents our recommended approach. We believe this method meets the objectives of MCER development while remaining feasible (assuming there is some capacity to invest in additional data collection). Using this approach, it is possible to report national-level (and perhaps state-level) estimates of the number of families at risk of exceeding an affordability threshold. As well, it is possible to estimate the number of families who exceed the threshold with premium purchases. This could also be calculated for subgroups by for example, race/ethnicity, age and region. Reporting might also include information on risk level, e.g. the number of families at low/medium/high risk of exceeding this threshold. It would also be possible to calculate the depth of expected unaffordable expenses similar to a poverty gap measure (e.g. if families are at risk of experiencing unaffordable expenses, how extreme are these prospects?). Finally, we note that a family could be assigned a threshold range if it is undesirable to define one specific level of 'unaffordable' expenditures.

In the case that risk measure II (expected costs) is selected, the next steps entail subtracting premium costs from the affordability threshold and comparing this value against the family's insurance-adjusted expected expenditures. In addition, we suggest repeating this exercise using something akin to standard deviation values (if applying the loss model approach). This measure can be interpreted as the level of expenditures a family might expect to incur in the next year, with the standard deviations reflecting the type of expenditure outcomes observed by families who incur a high (and low) level of expenditures relative to their expected outcome. The easiest way to do this is to square the difference of the predicted value minus the actual value; however, this has an ex post aspect to it that is not consistent with a prospective risk concept.

Finally, in the case that econometric methods are used to estimate probability of unaffordable expenses, developers will need to identify an appropriate method of moving from an individual-level risk

characterization to a family-level expenditure model. Alternatively, the initial set of risk characteristics might be defined only at the family-level. Developers would need to consider when and how to best introduce coverage adjustments to expenditures, and similarly how to treat mixed coverage families.

Treatment of the Uninsured Coverage Eligible

While the measurement of Medical Care Economic Risk should reflect current coverage status, we suggest that developers additionally consider computing this measure in the hypothetical case of full take-up among those who are public coverage eligible. This could also include private coverage if there were a data set that permitted one to know if the firm at which an individual worked offered ESI (and the coverage characteristics of this offer). This secondary measure represents an upper bound on the potential impact of improved communication and targeted policy measures to increase take-up under current offerings.

LIMITATIONS AND CONCLUDING POINTS

The choice of dataset for MCER reporting introduces some important tradeoffs for developer consideration. The ideal base dataset includes family-level economic variables, insurance characteristics and an appropriate level of health information. While MEPS contains the largest proportion of these data, the sampling design does not enable release of basic statistics at the state-level. Other surveys are designed to meet this reporting objective; however selection of an alternative dataset introduces greater need to add new questions during base data collection. At a minimum any alternative dataset should include insurance data and a subset of health characteristics sufficient to match these data at the cell or adjuster level to expenditure models developed in MEPS. Alterations to sample design and addition of new variables introduce added costs that developers should consider. It is suggested that developers not only consider the relative benefits of these choices in the context of MCER development, but also consider the relative benefit of survey question additions or sampling expansions in complementary areas of research.

While we identify a feasible approach to MCER development, a number of compromises are introduced throughout this framework. Development of an operationally feasible index may necessitate that developers introduce a relatively coarse system of risk classification. Similarly, the final index might reflect a simplified examination of the impact of insurance coverage characteristics on family expenditure risk. As a tradeoff, this approach might reduce data collection burden and limit the complexity of risk modeling and associated challenges. Finally, developers face tradeoffs in the selection of an appropriate method of representing risk. Reliance on estimates of expected expenditures in the underlying methodology does not capture the real occurrence of outlier events. In contrast, a measure that categorizes all families without a stop loss provision as experiencing medical care economic risk might place too much weight on these tail events. Developers must carefully consider the objectives of this index and its implications as they refine the definition and representation of medical care expenditure risk.

A number of additional relevant, yet challenging issues are left unresolved in this framework. Developers must reach consensus on standard definitions of minimum benefits package and affordability. Additionally, those involved in the development of risk models must identify an appropriate method of adjusting for underutilization of the uninsured or underinsured in the baseline data source. Finally, we note that the suggested framework does not distinguish between medical risk that is not modifiable, and medical risk that can be prevented or reduced through use of preventive services or good care management practices. Research in this direction might identify other important routes to reducing the medical care economic risk experienced by families.

While this framework outlines alternative methods of modeling expenditure risk, developers may identify superior modeling approaches as they move forward with index design. There is much work to be done to complete the process of moving from a framework to an operational MCER index; this framework identifies a conceptual base to build upon while completing this task.

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APPENDICES

Appendix A: Risk Classification Examples

TABLE A.1 Risk Cell Model I (Survey Collected Data, Claims Data Not Necessary)

Characteristic	Categories
Gender x Age (20-30 categories)	Female x Age Male x Age <i>CMS-HCC age categories are:</i> ³¹ 0-34, 45-44, 54-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95+ (Pope et al., 2004)
High cost morbidity (2 categories)	High # ADLS or extreme obesity Neither
Pregnancy (female, age appropriate only) (2 categories)	Yes No

Risk Cell Model II (Survey Collected Data; Claims Data Necessary)

Characteristic	Categories
Gender x Age (20-30 categories)	Female x Age Male x Age <i>CMS-HCC age categories are:</i> 0-34, 45-44, 54-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95+ (Pope et al., 2004)
Diagnosis-based risk level (3 categories)	Low, moderate or high risk score
High cost morbidity (2 categories)	High # ADLS or extreme obesity Neither

³¹ This model is developed for the Medicare population; additional categories for the 0-34 population (for example infant, child and young adult), and perhaps fewer categories in older age ranges are suggested.

Appendix B: Massachusetts' 2010/11 Minimum Creditable Coverage Standards [MCC]³²

Coverage for a broad range of medical services. Specifically,

- * Ambulatory patient services, including outpatient day surgery and related anesthesia
- * Diagnostic imaging and screening procedures, including x-rays
- * Emergency services
- * Hospitalization, including at a minimum, inpatient acute care services which are generally provided by an acute care hospital for covered benefits in accordance with the member's subscriber certificate or plan description
- * Maternity and newborn care
- * Medical/surgical care, including preventative and primary care
- * Mental health and substance abuse services
- * Prescription drugs
- * Radiation therapy and chemotherapy
- * Doctor visits for preventive care, without a deductible
- * A cap on annual deductibles of \$2,000 for an individual and \$4,000 for a family for services received in-network
- * For plans with up-front deductibles or co-insurance on core services, an annual maximum on out-of-pocket spending of no more than \$5,000 for an individual and \$10,000 for a family for services received in-network
- * No caps on total benefits for a particular illness or for a single year
- * No policy that covers only fixed dollar amount per day or stay in the hospital, with the patient responsible for all other charges
- * For policies that have a separate prescription drug deductible, it cannot exceed \$250 for an individual or \$500 for a family for services received in-network

In 2011, MCC will also include:

- * No fixed-dollar cap on prescription drug benefits
- * Core medical services and a broad range of medical services for any dependents, if dependents are covered

An exemption is available for people who have a firmly held religious belief that prevents them from enrolling in a health plan

³² Health Connector 2010 (See https://www.mahealthconnector.org/portal/site/connector/template.MAXIMIZE/menuitem.3ef8fb03b7fa1ae4a7ca7738e6468a0c/?javax.portlet.tpst=2fdfb140904d489c8781176033468a0c_ws_MX&javax.portlet.prp_2fdfb140904d489c8781176033468a0c_viewID=content&javax.portlet.prp_2fdfb140904d489c8781176033468a0c_docName=MCC%20Benefits.htm&javax.portlet.prp_2fdfb140904d489c8781176033468a0c_folderPath=/Health%20Care%20Reform/What%20Insurance%20Covers/MCC%20Background/&javax.portlet.begCacheTok=com.vignette.cachetoken&javax.portlet.endCacheTok=com.vignette.cachetoken (August 21, 2011))