GH SPC Model Solutions
Spring 2020

1. Learning Objectives:

1. The candidate will understand how to evaluate healthcare intervention programs.

Learning Outcomes:

(1a) Describe, compare and evaluate programs.

Sources:

Managing and Evaluating Healthcare Intervention Programs Ch. 9

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Describe three models used in care management program planning

(ii) Identify drawbacks of each model.

Commentary on Question:

In general, candidates were able to successfully describe the three models in part (i). Candidates generally were able to identify some, but not all of the drawbacks in part (ii).

(i) Model 1: Run a predictive model and stratify based on predictive risk score

Model 2: Condition-specific model. Expands on Model 1 by restricting stratification to specific chronic conditions

Model 3: Rules-based approach. Program managers determine a set of rules (condition specific or financial thresholds used) –often based on prior experience – that are designed to target patients for management.

1. Continued

(ii) Model 1:

- Prevalence of high risk members who are minimally intervenable and represent a low opportunity
- Mix of patients with different conditions, issues, and needs creates operational issues if population is very diverse

Model 2:

- High prevalence of co-morbidities in the high-risk population means that any program targeted at a specific condition will ultimately need to address all conditions within the population.

Model 3:

- Regression to the mean is likely
- Relies on clinicians for identification of candidates, but literature suggests clinicians are not particularly good at identifying candidates.

(b) Describe steps for conducting a focused review of literature about successful care management programs.

Commentary on Question:
Candidates were generally able to list the three steps, but struggled to earn full credit by describing each step.

Step 1: Search for relevant publications

- Purpose is to cast a wide net to identify all potential research studies that have shown a simultaneous improvement in quality and reduction in cost. Two ways to do so:
  - Pearl necklace approach
  - More thorough approach is to build search strategy using Medical Search Headings (MeSH) indexing system within PubMed: type key concept into MeSH

Step 2: Assess the quality of evidence

- A peer reviewed paper is likely to be of higher quality than typical white paper or vendor-published studies that have not been subjected to independent review
- A randomized controlled trial can provide robust evidence of efficacy
- In general, recommendations should be based on studies ranked towards the top of the hierarchy of evidence (i.e. meta-analyses, systematic reviews, and randomized controlled trials)

1. Continued

Step 3: Determine generalizability

- Determine if the programs identified in the literature search are likely to be effective in the population of interest
- In general, should favor studies conducted in the United States within the past 5 years on similar patient populations

2. Learning Objectives:

1. The candidate will understand how to evaluate healthcare intervention programs.

Learning Outcomes:

(1a) Describe, compare and evaluate programs.

(1d) Calculate chronic and non-chronic trends in a manner that reflects patient risk.

Sources:

Managing and Evaluating Healthcare Intervention Programs, Duncan, Ian G., 2nd Edition, 2014, Ch. 13: Understanding Patient Risk and Its Impact on Chronic and Non-Chronic Member Trends

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the per member per month (PMPM) effect of the DM program. Show your work.

Commentary on Question:

Most candidates did very well on this part of the question.

Year	Units per 1000	Unit Cost	Cost PMPM*
Baseline Year	100	$7,000	$58.33
Trend	1.03	1.08	
Projected Intervention Year	103	$7,560	$64.89
Actual Intervention Year	97	$7,560	$61.11
Reduction	6	$7,560	$3.78

*Cost PMPM = Units per 1000 * Unit Cost / 12,000 Member Months

The PMPM effect of the DM program is $3.78.

(b) Calculate the PMPY cost trend. Show your work.

Commentary on Question:

Most candidates did very well on this part of the question.

	Baseline Year		Intervention Year	
Risk Cohort	Prevalence	Cost PMPY	Prevalence	Cost PMPY
Low Risk	80%	$600	81.4%	$600
High Risk	20%	$6,000	18.6%	$6,000
Total		$1,680		$1,604

2. Continued

Intervention Year Low Risk Prevalence = 85% * 80% + 67% * 20% = 81.4%
Intervention Year High Risk Prevalence = 33% * 20% + 15% * 80% = 18.6%

PMPY cost trend = $1,604 / $1,680 – 1 = -4.5%

(c) Calculate the risk score trend. Show your work.

Commentary on Question:
Candidates generally struggled on this question. Those who received credit understood the difference between the two different cost trends that were given and how the information related to the risk score trend.

Baseline cost PMPM = $100
Baseline risk score = 1.01
Risk-adjusted baseline cost PMPM = $100 / 1.01 = $99.01

Intervention cost PMPM = $100 * (1 + 6%) = $106
Risk-adjusted intervention cost PMPM = $99.01 * (1 + 4%) = $102.97
Intervention risk score = $106 / $102.97 = 1.029

Risk score trend = 1.029 / 1.01 – 1 = 1.9%

(d) Critique the following statements. Justify your responses.

(i) Reduction in units per 1,000 helps convince DM program purchasers of the efficiency of the program, and satisfies the needs of most clients who need savings.

(ii) Equivalence requires stability in the underlying number of members between periods, and is a basic necessity for evaluating a disease management program.

(iii) If there is a change not due to the DM intervention in the chronic population, one can use risk adjustment to separate the effect of the intervention from other chronic population changes.

(iv) The trend used to adjust from the baseline year to the intervention year for a chronic population should be net of the effect of any population changes.

Commentary on Question:
Candidates struggled to critique and justify their responses, in particular to statements (iii) and (iv). Those who did not receive full credit often failed to address the specific topic or justify their response.

2. Continued

(i) False – Reduction in units per 1,000 helps convince disease management program purchasers of the efficiency of the program, BUT it does not satisfy the needs of most clients who need savings.

(ii) False – Equivalence is a basic necessity for evaluating a disease management program, BUT it does not require stability in the underlying number of member between periods.

(iii) False – If there is a change not due to the DM intervention in the chronic population, it may be DIFFICULT, if not impossible, to use risk adjustment to separate the effect of the intervention from other chronic population changes.

(iv) True – The trend used to adjust from the baseline year to the intervention year for a chronic population should INDEED be net of the effect of any population changes.

3. Learning Objectives:

2. The candidate will understand how to evaluate health insurance organization risk and mitigation strategies.

Learning Outcomes:

(2a) Evaluate an enterprise risk management (ERM) system.

(2b) Complete a capital needs assessment.

Sources:

Financial Enterprise Risk Management, 2nd Edition, Sweeting, 2011, Ch. 7: Definitions of Risk and Ch. 18: Economic Capital

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Describe four non-life insurance risks.

(ii) Explain how incidence and intensity affect non-life insurance premium and reserve calculations differently than life insurance.

Commentary on Question:

Candidates generally did well on this portion of the question.

1. Underwriting – Risk that the average level of claims in the portfolio as measured by incidence and intensity is different from that assumed
2. Volatility – Risk that remains even if risk is correctly underwritten and reflects uncertainty in the incidence and intensity of claims resulting from the fact that only a finite number of policies exist
3. Catastrophe – When a high-intensity low-probability event occurs, however they can occur as a combination of a smaller event combined with a high concentration of claim frequency, perhaps with an unusually high claim amount
4. Trend – Risk of unexpected changes from current levels in the incidence and intensity of claims.

3. Continued

(ii)

Two aspects need to be considered: incidence of claims and their intensity

- Incidence is not dissimilar to mortality risk, except it can be assessed over a shorter time horizon, is often at a higher rate, and can be much less stable from year to year
- Intensity of each claim is not necessarily the same from one claim to another. The maximum claim could be either known or unknown. Because the risks differ significantly from class to class, a variety of approaches are needed to model them correctly

(b) Describe factors affecting the Margin for Additional Risk in an Internal Capital Model.

Commentary on Question:
Candidates generally struggled with this portion of the question. Many candidates did not fully describe the factors affecting the Margin for Additional Risk in an Internal Capital Model.

- The uncertainty implicit in the product
- Extent to which the product acts as a diversifier to other businesses, products with offsetting risks can require less economic capital, and can reduce the economic capital needed by other parts of the business
- The volume of the product sold – as more of a product is sold, the extent to which it can act as a diversifier reduces
- The experience that emerges from a product

(c) Describe stages in designing an Economic Capital Model.

Commentary on Question:
To earn full credit on this question, candidates needed to describe, and not just list, each stage of the Economic Capital Model.

- Agree what the model will be used for:
  - How much capital to hold to protect against adverse events
  - Price new products
  - Decide how to allocate capital across business lines
  - Due diligence for corporate transactions
  - Provide financial state on an organization to a regulator
- Agreement on the risks that will be modeled

3. Continued

- Approaches to determine economic capital
  - Factor tables, which require a certain amount of economic capital to be held in respect of each unit of a particular activity. It is a simplistic approach commonly used by regulators
  - The deterministic approach is essentially a stress test that considers the amount that a firm would lose under different scenarios, with the amount of economic capital required being related to the losses under the various scenarios
  - The stochastic approach involves the use of a model. Three versions are:
    - Genuinely stochastic approach involves the construction of a full economic model capable of producing large numbers of simulated results.
    - Parametric – results are calculated based on an assumed statistical distribution
    - Empirical – results are based on past data on a firm's own losses or rating agency data
- Whether the model will be run for the entire enterprise or whether individual models will be run for each business and then combined
- The nature of the output required, in particular the output needed in the calculation of the risk metric and thus to determine the capital requirement

(d)

(i) Critique the recommendation. Justify your response.

(ii) Compare and contrast alternative approaches that could be taken to allocate the new capital requirement to each line of business.

(iii) Recommend an approach for allocating the new capital requirement. Justify your response.

Commentary on Question:
Candidates generally did well on parts (i) and (iii) of this question. Most candidates earned some credit for part (ii) of the question by describing the alternative approaches, but needed to compare and contrast each approach to earn full credit.

(i) This approach is not the best approach. This approach gives the full benefit of diversification to the new business line because the new business created the benefit. This benefit to the new business line is an accident of timing – had the new business line been in place with the existing line being the new one, the diversification would rest elsewhere. This approach is arbitrary.

3. Continued

(ii) Alternative approaches include

- Retain the difference centrally.
  - Not efficient use of capital and could make other lines uncompetitive.
- Start with the stand-alone capital requirement and allocate the benefit of diversification to each business line somehow.
  - Reduction in capital could be divided in proportion to the undiversified reserves held
  - Simple approach but could be conceived as unfair – a business line contributing the most to the diversification might be due the biggest benefit
- The Euler capital allocation principle which considers the marginal contribution of each additional unit of business to the overall capital required by the firm
  - Fairest allocation of capital between lines
  - However it is the most complicated

(iii) Two recommendations are acceptable:
Euler capital allocation because it gives the fairest allocation of capital between lines
or
Stand-alone capital requirement, while could be not as "fair" it is not as complicated as the Euler capital allocation model

4. Learning Objectives:

2. The candidate will understand how to evaluate health insurance organization risk and mitigation strategies.

Learning Outcomes:

(2b) Complete a capital needs assessment.

Sources:

GHS-128-19: RBC Calculation Examples
Group Insurance, Skwire, 7th edition, 2016, Chapter 39

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe the components of the ACL RBC formula.

Commentary on Question:

Almost all candidates earned partial credit for listing the formula and its components, but candidates needed to describe and not just list the components of the ACL RBC formula to get full credit.

ACL RBC = .5 x (H0+ square root (H1^2+H2^2+H3^2+H4^2))
H0 = Asset Risk for Affiliates – Risk that stock of affiliated company loses value
H1 = Asset Risk for Other Asset – Risk that stock of other assets lose value or default
H2 = Underwriting Risk – Risk of higher claims or inadequate premium
H3 = Credit Risk – Risk that amounts owed are not recovered
H4 = Business Risk – Administrative expense risk, excessive growth risk and general business risks not included elsewhere

(b)

(i) Describe the "back of the envelope" method to estimate the ACL RBC.

(ii) Calculate the ACL RBC for XYZ Health Insurance Company using the "back of the envelope" method. Show your work.

Commentary on Question:

For part (i), most candidates earned partial credit. Candidates who were able to provide more detail about the purpose and reasoning behind the "back of the envelope" method earned full credit. For part (ii), while many candidates correctly calculated the value of H2, some did not correctly apply the factor of 1/2 to estimate the ACL RBC.

4. Continued

(i) The "back of the envelope" method is an estimation technique using mathematical limits for material changes in risk. These limits simplify our understanding and set our expectations regarding changes in insurance risk and impact on RBC ratio. To simplify estimations for short term health RBC, assume H0, H1, H3, H4 are relatively minor. ACL RBC = .5 x H2.

(ii) ACL RBC = .5 x H2 = .5 x ($100m x 85% x 9% + $60m x 80% x 7% + $40m x 75% x 8%) = $6.705m

Senior management is proposing to double the Comprehensive premiums.

(c)

(i) Calculate the new ACL RBC Ratio for XYZ Health Insurance Company assuming the Comprehensive premium doubles with no other changes. Show your work.

(ii) Explain the ramifications of the new ACL RBC Ratio for XYZ Health Insurance Company.

(iii) Recommend changes to senior management to adjust the ACL RBC Ratio. Justify your response.

Commentary on Question:
Most candidates performed well on part (i). Candidates earned credit regardless of whether they calculated the new ACL RBC ratio via calculating the TAC and applying it to the new ACL RBC or by taking the prior ACL RBC and proportionally adjusting it based on the ratio between the current and new H2 values.

For part (ii), candidates typically provided some detail but needed to fully explain the ramifications of going under the RBC ratio of 200% to earn full credit.

For part (iii), a variety of different responses were accepted for partial credit as long as the recommended action raised the ACL RBC ratio. However, candidates needed to justify the reason why the actions are needed, i.e. to raise the ACL RBC ratio above 200%.

(i) Current ACL RBC Ratio = 300% = TAC/ACL RBC

TAC = Current ACL RBC Ratio x ACL RBC

TAC = 3.00 x $6.705m = $20.115m

4. Continued

New ACL RBC = .5 x (2 x $100m x 85% x 9% + $60m x 80% x 7% + $40m x 75% x 8%) = $10.53m

New ACL RBC Ratio = $20.115m / $10.53m = 191%

(ii) There is a concern about a 191% (less than 200%) ACL RBC Ratio. This is a company action level event (between 150%-200% ACL RBC Ratio). The company must submit a correction action plan to the state insurance commissioner.

(iii) The company should contribute more capital or reduce the doubling of Commercial premium. This is needed in order to keep the ACL RBC Ratio above 200%.

5. Learning Objectives:

3. The candidate will understand how to apply risk adjustment in actuarial work.

Learning Outcomes:

(3a) Describe and compare risk adjustments based on commonly used clinical data and grouping methods.

(3b) Apply risk adjustment to underwriting, pricing, claims and are management situations.

(3c) Apply applicable Actuarial Standards of Practice.

Sources:

Chapter 14 Healthcare Risk Adjustment and Predictive Modeling, Duncan (2nd edition)

ASOP 12, Risk Classification

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Compare and contrast Medicare Advantage and Traditional Medicare from the perspective of the member in these areas:

- Plan provisions
- Provider selection
- Medical Cost Management

Commentary on Question:

Many candidates were able to compare and contrast Medicare Advantage and Traditional Medicare in the areas of provider selection and medical cost management, but struggled in the area of plan provisions.

- Medicare Advantage cost sharing is typically less economically burdensome to the member than traditional Medicare cost-sharing
- Traditional Medicare benefits have an actuarial value of 84%, whereas Medicare Advantage must have an actuarial value of 84%, but in most cases is be greater.
- Medicare Advantage plans may offer benefits that are not covered by traditional Medicare, e. g. dental, vision benefits ("non-Medicare covered")
- Medicare Advantage is managed care and members must accept a more limited set of providers than those who participate in traditional Medicare.
- Medicare Advantage is a managed care plan, applying medical management techniques that traditional Medicare does not.

5. Continued

(b)

(i) State the goal of Medicare risk adjustment.

(ii) Describe the impact of Medicare risk adjustment on Medicare Advantage Organizations (MAOs).

Commentary on Question:
Most candidates performed well on part (i). Many candidates struggled on part (ii) in providing a full description of the impact.

(i) The goal of Medicare risk adjustment is to compensate MAOs appropriately for their members, taking into account costs that arise from each member's health status.

(ii)

- MAOs are responsible for capturing complete and accurate diagnoses for their members' health conditions.
- MAOs must validate their risk adjustment data for audits conducted by CMS. These are referred to as Risk Adjustment Data Validation (RADV) audits.
- Medicare risk model changes can have a greater impact on a MAO than it does on a national basis. MAOs need to conduct their own analysis to compare the new model risk score with that of the old model and estimate the difference.
- Medicare risk adjustment is a complicated process involving no small amount of operational complexity for MAOs.
- MAOs do not compete on selecting members who are better risks.
- To be successful, MAOs focus on 1) better outcomes, 2) improved population health, and 3) controlling per capita cost.

(c) Describe considerations, according to ASOP 12, for establishing risk classes for a financial or personal security system.

Commentary on Question:
Most candidates were able to list the considerations from ASOP 12, however, many candidates did not describe the considerations. Candidates who were able to provide descriptions for each consideration, rather than only list the considerations, received full credit.

5. Continued

- **Intended Use**: The actuary should select a risk classification system that is appropriate for the intended use. Different sets of risk classes may be appropriate for different purposes.
- **Adverse Selection:** If the variation in expected outcomes within a risk class is too great, adverse selection is likely to occur. To the extent practical, the actuary should establish risk classes such that each has sufficient homogeneity in outcomes.
- **Credibility:** Risk classes should be large enough to allow credible predictable outcomes.
- **Practicality:** The actuary should consider the cost, time, and effort needed to assign risks when determining how many risk categories are appropriate.
- **Applicable law:** Know and comply with any applicable law(s)
- **Industry practices:** Know industry practices for that type of financial or personal security system.
- **Business practice limitations:** Consider limitations created by business practices of the financial or personal security system as known to the actuary.
- **Reasonableness of Results:** When establishing risk classes, the actuary should consider the reasonableness of the results that proceed from the intended use of the risk classes (for example, the consistency of the patterns of rates, values, or factors among risk classes).

(d)

(i) Calculate the 2019 average Part C population risk score. Show your work.

(ii) Calculate the 2021 average Part C population risk score. Show your work.

Commentary on Question:
Many candidates performed will on both parts of the question. There were many instances of simple arithmetic errors resulting in incorrect answers. Some candidates did not recognize that the Fee for Service Normalization factor was a projection factor and applied it for the base period risk score. In part (ii), some candidates applied only one year's worth of trend and population adjustments.

5. Continued

Part (i)

Member A risk score

0.5 Age/gender factor
0.1 Diabetes without complications
0.4 Multiple sclerosis
1.0 Total (summation of components)

Member B risk score

0.6 Age/gender factor
0.0 Diabetes without complications (HCC 19 is overridden by HCC17)
0.3 Diabetes with acute complications
0.4 Multiple sclerosis
1.3 Total (summation of components)

Member C risk score: (1 point a/g, 1 point summation - max 2 points)

0.5 Age/gender factor
0.0 No diagnoses for new entrants
0.5 Total (summation of components)

Average Part C Population Risk Score

MM Weighted average: (1*12+1.3*12+0.5*6)/(12+12+6) = **1.02**
(Credit was also given for other averaging techniques)

Part (ii)

- Formula:
  Base year risk score x (annualized risk score trend) ^2 x (annualized population change factor) ^2 * (adjustment for CMS Fee for Service Normalization factor) * (CMS MA Coding Adjustment) =

- 1.020 * 1.014^2 * 1.005^2* (1/1.01) * 0.98 = **1.0278**

6. Learning Objectives:

3. The candidate will understand how to apply risk adjustment in actuarial work.

Learning Outcomes:

(3b) Apply risk adjustment to underwriting, pricing, claims and are management situations.

(3c) Apply applicable Actuarial Standards of Practice.

Sources:

GHS-120-17: HHS-Operated Risk Adjustment Methodology Meeting Discussion Paper, Ch. 4

ASOP 45: The Use of Health Status Based Risk Adjustment Methodologies

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe benefits and concerns of including prescription drugs in a diagnosis-based risk adjustment model.

Commentary on Question:

Most candidates performed well on this part of the question. Candidates who only listed some of the benefits and concerns without describing them received only partial credit.

Benefits:

1) Imputing missing diagnosis. Coding failure or stigma could cause diangostic reporting omissions, partial year enrollment limits visits.
2) Severity indicator for diagnosis. First, second, or third lines of treatment can indicate severity.
3) More timely standardized data. Drug data is often quicker, more complete, and easeier to access.
4) Mitigates disincentive to prescribe costly drugs. Risk adjustment compensates plans for expensive drugs.

Concerns:

1) Gaming, Perverse incentives, Discretionary prescribing. When an unnecessary, inexpensive drug is used to increase risk score. Drugs treatments favored over non-drug treatment.
2) Sensitivity of risk adjustment to variations in prescription drug utilization. Health plans with lower drug use would appear to have healthier members.
3) Added administrative burden, complexity, and cost. Any increase in data requirement increases the load.

6. Continued

4) Availability of outpatient drug data only. Hospitalized patients may appear to be less severely ill.
5) Multiple indications for most drugs. Many 'off label' prescriptions are difficult to trace to an HCC.

(b) List and describe criteria used to evaluate a diagnosis-based risk adjustment model which includes prescription drugs.

Commentary on Question:
Many candidates struggled with this part of the question. Some candidates were able to list criteria, but many candidates struggled to clearly describe the criteria.

1) Clinical / face validity: relationship between risk markers and expenditures
2) Empirical/predictive accuracy: drugs added must increase predictive power
3) Incentives for utilization: add drugs so inappropriate incentives are minimized
4) Sensitivity to variations in utilization: not reward high prescribing patterns
5) Incentives for diagnosis reporting: diagnosis is still needed in medical claims

(c) Describe considerations, according to ASOP 45, when selecting and implementing a risk adjustment model.

Commentary on Question:
Most candidates performed well on this part of the question. Candidates who only listed considerations without describing them received only partial credit.

- Intended Use – Whether the model was designed to estimate what the actuary is trying to estimate.
- Impact on Program – Whether the system may cuase changes in behavior because of underlying incentives.
- Model Version – How your version may differ from other versions.
- Population and program – Is your situation similar to the population & program used to develop the factors?
- Timing – Timing of data collection, measurement and estimation between model development and application.
- Transparency – Appropriate for intended use, whether weights are publically available.
- Predictive ability – Characteristics and performance commonly used and published.
- Reliance on experts – Are individuals the actuary is relying on knowledgable enough to apply the model, interpret, and understand the results?
- Practical considerations – Cost, familiarity, and other limitations should be understood and acknowledged.