GH 301 Model Solutions
November 2025

1. Learning Objectives:

5. The candidate will understand how to explain the social determinants of health (SDOH) and their impact on health care costs and policy.

Learning Outcomes:

(5d) Evaluate applications of SDOH derived statistics in actuarial models.

Sources:

UMass Risk Adjustment Project for MassHealth Payment and Care Delivery Reform: Describing the 2017 Payment Method

Commentary on Question:

Commentary listed underneath question component.

Solution:

You are given the following risk score formula based on the Social Determinants of Health (SDoH) Model for MassHealth for predicting the total cost of care for a Medicaid population:

Predicted Cost = max[$15, min(f(x), $125,000)]

(a)

(i) Describe the components of the risk score formula.

(ii) Describe the total cost of care calculation in the Medicaid risk adjustment model prior to adding any SDOH variables.

(iii) Describe the SDOH factors that were added to the model, including their impact to the predicted cost.

Commentary on Question:

Most candidates were able to answer subpart (i) and (ii), but with respect to (iii) very few candidates included the impact to the predicted cost.

(i)

1. $15 minimum accounts for the cost of care management services, so the minimum predicted cost at the Medicaid member level
2. f(x) is the sum of the amounts associated with the risk characteristics of the member

1. Continued

3. The $125,000 is the trigger for top coding the claims to minimize the variance caused by high-cost claimants, so the maximum predicted cost for a Medicaid member.

(ii)
Prior to adding SDOH variables, the Medicaid risk adjustment model focused on a member's age/sex category and DxCG Relative Risk Score (RRS).

(iii)
Department of Mental Health (DMH) clients, Department of Developmental Services (DDS) clients and any other person entitled to Medicare due to Disability.

Unstable housing. Having 3 or more addresses and/or an ICD-code for homelessness.

Mental illness (SMI) and/or substance use (SUD).

Neighborhood stress score, NSS7, reflecting indicators of financial stress based on zip code.

(b)

(i) Calculate the predicted claim cost for an individual with the following characteristics. Show your work.

- 20-year-old male
- RRS of 3
- Substance abuse disorder (SUD)
- Serious mental illness
- Living in a neighborhood with a NSS7 four standard deviations above the mean

(ii) State whether the calculation is impacted by the minimum or maximum restraints.

Commentary on Question:
Most candidates were able to correctly answer both (i) and (ii)

(i)
See Excel File

(ii)
The result of $15,070 is clearly between the minimum of $15 and maximum of $125,000, so therefore not impacted by the restraints.

2. Learning Objectives:

1. The candidate will understand how to evaluate the effectiveness of provider reimbursement methods from both a cost and quality viewpoint.

Learning Outcomes:

(1a) Describe contracts between payers and providers.

(1b) Calculate provider payments under various reimbursement methods.

Sources:

GH301-105-25: Chapter 45 of Group Insurance, Skwire, Daniel, 8th Ed

Commentary on Question:

Candidates generally did well on this question. Candidates should pay close attention to the verb presented in each question. Describing items is not adequate when being asked to recommend an action and to justify such actions. In addition, providing descriptions when asked to list does not help achieve credit and instead leads to unnecessary time spent answering an item

Solution:

(a) List considerations for managing a provider network.

Commentary on Question:

Most candidates did well on this question. While candidate responses sometimes deviated from that in the source material, credit was awarded for relevant items. Some candidates also offered detailed descriptions to items, but additional credit was not awarded as a simple list was all that was required.

- Articulation of the goals of the network
- Compliance with applicable regulations
- Ensure quality standards are met
- Manage Costs
- Manage Risk
- Evaluate the network on an ongoing basis

(b) Describe four examples of providers with whom administrators may not choose to contract when developing a network.

Commentary on Question:

The majority of candidates were not familiar with the items discussed in the source material. However, relevant examples received credit as long as the description was appropriate.

2. Continued

- Hospital-based providers like anesthesiologist, radiologists, pathologists and laboratory technicians. They have little or no incentive to contract with an administrator, since the patient does not have a choice about which provider to use. These providers often send a separate bill for their services.

- Providers such as speech and occupational therapists – Their utilization is low that it may not be practical to contract with them.

- A patient may have a condition that is so rare or complex that only a limited number of providers are capable of treating the patient. Prior authorization is usually required if the provider is out-of-network, but cost sharing will normally be based on in-network benefit design parameters even though the provider is not participating.

- Services rendered in an emergency situation. Although emergency situations include life-threatening events, like a car accident, most state laws define "emergency" in terms of what a "reasonable" or "prudent layperson" may consider an emergency.

(c) Recommend actions the health plan can take to meet its goals regarding the management of provider networks. Justify your response.

Commentary on Question:
Candidates sometimes failed to recommend justified actions specific to goals of the network in the question. Otherwise, the majority of candidates offered sound recommendations such as implementing disease/case management programs.

- Reduce the size of the broad network
    - Smaller networks are associated with reduced costs but be careful to ensure you're not removing doctors that are highly utilized by members or members you're trying to attract
    - Likely safe given the demographics of the population as well as the goal of growing local membership.
    - Should reduce cost without negatively impacting reputation

- Implement an alternative payment method such as "FFS with a link to quality and value reimbursement"
    - Modernize FFS payment system to improve quality, safety, and efficiency
    - Higher quality care can improve consumer experience
    - May reduce costs but should at least keep costs consistent with prior experience

2. Continued

- Implement Disease Management programs for diseases that have a strong prevalence in the population
    - Improves quality and efficiency (potentially safety)
    - If implemented correctly can reduce claims trend

(d) Calculate the amount both the plan administrator and member would pay in both the in-network and out of network scenario. Show your work.

Commentary on Question:
This was a very simple calculation that most candidates got correct. Some candidates referenced an inability to balance bill. If stated alongside not balance billing the member, full credit was awarded. This underscores the importance of showing your work in a calculation.

See Excel File for answer

3. Learning Objectives:

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

Learning Outcomes:

(3a) Apply risk adjustment to underwriting, pricing, claims, and care management situations (applications include Medicare, Medicaid, and ACA products).

Sources:

Healthcare Risk Adjustment and Predictive Modeling, Duncan, Ian G., 2nd Edition, 2018, Ch. 14: Risk Adjustment in Medicare (excluding Appendix 14.1 & 14.2)

ASOP 23: Data Quality (excluding Appendices)

ASOP 41: Actuarial Communications (excluding Appendices)

ASOP 45: The Use of Health Status Based Risk Adjustment Methodologies (excluding Appendices)

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe why ASOPs 23, 41, and 45 are applicable to the MA bid process.

Commentary on Question:

Candidates generally performed well on part (a). Candidates who didn't earn full credit usually lost points for listing considerations from the ASOPs without connecting them to the MA bid process.

ASOP 23 (Data Quality) is applicable because the MA bid relies heavily on experience data to generate bid projections. It also relies on data supplied by others.

ASOP 41 (Actuarial Communications) is applicable because the MA bid and its assumptions and supporting materials are actuarial communications to CMS. There are likely also other actuarial communications that are issued as a part of the bid process, e.g. to internal stakeholders, bid reviewers, etc.

ASOP 45 (Use of Health Status Based Risk Adjustment Methodologies) is applicable because the MA bid projections leverage the CMS-HCC risk adjustment model (which is health-status based) to project differences in risk scores between population cohorts. While the CMS-HCC model itself is prescribed, this ASOP outlines key considerations while using the model.

3. Continued

(b)

(i) Describe the purpose of each bid projection factor.

(ii) Describe risks and implications to ABC of overestimating and underestimating each of the factors.

Commentary on Question:
Performance was mixed on part (b)(i). Many well-prepared candidates earned full credit. Common mistakes included mixing up the factors, not recognizing the FFS dynamics that drive the first two factors, and characterizing the third factor as a population change adjustment.

Candidates generally performed poorly on part (b)(ii), with many not recognizing that the first two factors are prescribed and therefore there is no risk that ABC misestimates them. Many candidates swapped the impacts of overestimating and underestimating the risk score coding trend factor. Responses that simply pointed to the directional impact on revenue but failed to elaborate further did not earn credit.

Part (b)(i)
Normalization factor: this factor accounts for the underlying fee-for-service (FFS) trend in risk scores. Applying it brings the average risk score back to 1.0.

MA coding adjustment factor: this factor accounts for the difference in the diagnostic coding patterns between Medicare Advantage (MA) and FFS. MA plans generally have higher coding completeness than FFS due to the associated revenue incentives.

Risk score coding trend factor: this factor is selected by the MA organization to reflect the impact of internal programs, procedures, and processes that are expected to cause the risk score to change between the base year and the contract year. Generally, the goal of the MAO is more complete capture of diagnosis codes.

Part (b)(ii)
The normalization factor and MA coding adjustment factor are both prescribed to CMS and therefore there is no risk to ABC of misestimating these factors.

ABC does set the risk score coding trend factor and therefore misestimation risk exists. If ABC underestimates the factor, this may result in an uncompetitive product that few MA beneficiaries would purchase. If ABC overestimates the factor, this could result in plan benefits being richer than they should be given the need to “spend down” rebates. This could lead to financial losses that may be slow to recover from.

3. Continued

(c) Calculate the blended risk score for each enrolled individual. Show your work.

Commentary on Question:
Performance on part (c) was mixed. The most common mistake was missing the interaction terms, which earned partial credit.

See Excel File for Answer.

(d) Recommend revisions to any inaccuracies in your colleague's e-mail. Justify your response.

Commentary on Question:
Candidates performed relatively well on part (d). The identification and justification of four inaccuracies was required for full credit. Credit was given for reasonable and accurate responses beyond those listed below (e.g. that the CMS-HCC model is deliberately skewed toward chronic, not acute, conditions). Credit was not given for items that weren't true inaccuracies (e.g. suggestions to elaborate on certain points) or cosmetic changes to the email.

Inaccuracy 1: *"These projections are essential as they directly inform the payments ABC receives from CMS."*
This is not true, as the payments ABC receives from CMS are based on actual risk scores, not projected risk scores.

Inaccuracy 2: *"There are separate models for Part C and Part D that predict the allowed cost of providing benefits…"*
While the Part C model predicts allowed costs, the Part D model predicts the cost net of member cost sharing.

Inaccuracy 3: *"…based on age/gender factors and concurrent diagnosis codes."*
The CMS-HCC model is prospective (predicts next year's costs based on HCCs from the current year), not concurrent.

Inaccuracy 4: *"These members have risk scores less than or equal to existing members because their risk scores are only based on age/gender factors, while existing members also layer on any applicable HCC factors."*
New-to-Medicare members have separate age/gender factors that are higher than existing members by design to account for the fact that there is no additional HCC component to new member risk scores. Therefore, this statement is not necessarily true.

4. Learning Objectives:

4. The candidate will understand how to describe medical coding, sources of data, and data quality.

Learning Outcomes:

(4b) Identify and explain the use of coding sets used in health practice (CPT, ICD-10, DRG, Revenue Codes).

(4c) Describe how coding sets change over time and evaluate the potential impact on actuarial analysis.

(4g) Evaluate types of study methods and identify the method used for a given study.

Sources:

eLearning Module FSA: Terminology and Analytical Use of Data for Healthcare Actuaries

Commentary on Question:

Candidates generally performed well on questions involving data categories and EHR-related challenges, with higher scores awarded for specific examples and sufficient depth. Scores were reduced for responses that were overly high level or limited in scope. Performance was weakest on the identification of study methods, where misclassification was common.

Solution:

(a) Describe examples for each of the following categories of medical and drug codes:

- Diagnosis
- Procedure
- Prescription drug
- Hospital billing

Commentary on Question:

Most candidates did well on this question. Credit was awarded for correctly describing each category and mentioning examples such as ICD for Diagnosis, CPT for Procedure, NDC for Prescription Drug, and Revenue Code for Hospital Billing. Partial credit was deducted for candidates who did not provide sufficient description to demonstrate their understanding.

4. Continued

- Diagnosis
  - ICD 9 and ICD 10 codes, commonly used for a whole range of diagnoses, such as diabetes with complications. There are additional digits that describe specificity.
  - Diagnostic related groups (DRG) – Summarize admits into general categories based on diagnoses codes on the claim
  - Major diagnostic categories (MDC) – Another high level grouping of diagnosis codes.
- Procedure
  - ICD 9 / ICD10 surgical procedure codes – detailed surgical codes.
  - Current procedural terminology (CPT) – 5 digit numerical codes commonly used by physicians to detail services performed, one per service line. May include modifiers to indicate professional or technical components, assistant surgeons, etc. Example is 99211 office e/m
  - Healthcare Common Procedure Coding System (HCPCS) – 5 digit codes, beginning with a letter. Covers services not described under CPT codes, such as supplied. A* codes are transportation, D**** codes are dental, etc.
- Prescription drug
  - National Drug Code (NDC) – most common code, includes digits to label each drug. The code progresses in specificity.
  - Therapeutic Class Codes – categorization of drugs based on their therapeutic class
  - Generic Product Identifier (GPI) – another more detailed classification of drugs, works like NDC where more digits progress in specificity of the categorization.
- Hospital billing
  - Uses diagnosis, DRG, and procedure codes described above. DRG is used to categorize drugs and often used for payment. Diagnoses and procedure codes are also usually used for payment.
  - Revenue Codes group a set of services together under one Revenue Code and are also often used for payment. These include lab services, drugs administered, etc… for an inpatient or outpatient stay, all bundled under one Revenue Code. These are 4 digit codes.

(b)

(i) Describe challenges actuaries face with Electronic Health Records (EHRs).

4. Continued

Commentary on Question:
Majority of candidates demonstrated a reasonable understanding of EHR-related challenges and earned credit by correctly identifying issues such as lack of standardization, unstructured data, or vendor differences, even when their wording differed from the model solution. However, a high score was only given to candidates who explicitly discussed data access/extraction issues, variability and standardization challenges, and the difficulty of linking raw EHR data to claims.

- Not all EHR data is created equal as there are multiple vendors for it. As such systems can be different and different approaches may be required to access data.
- Difficulty in accessing and extracting vendor data. Many different vendors can house data and EHR system is not universal for each provider meaning different providers can have information in different systems. Common extraction methods are HL7 messages, custom APIs, and flat-file data extracts.
- Databases are often unmanaged or without an in-house expert to interpret the database, which can make querying difficult due to understanding how tables are related or which fields are appropriate to pull and when.
- Data variations and lack of standardization. There is fair amount of variability among physicians in their coding terminology, even among those in the same clinic, which can make it difficult to capture all encounters related to a condition. Additionally, EHR allows for physicians and members to customize the workflow which is beneficial for them but complicates standardization of data.
- There is a need for a master patient index in order to map EHR data to claims data since health plan member IDs are not the same as the EHR's member IDs.
- Data is raw, unprocessed, and of unknown quality before extraction, meaning the data may not be in the correct format or quality enough to use in analysis and making preliminary analysis.
- Medical coding information can sometimes be stored in comments rather than a list of codes, which makes it extremely difficult to identify and extract encounters with these codes.

(ii) List examples of data available in an EHR dataset.

4. Continued

Commentary on Question:
Candidates generally performed well on this question. Many candidates deductions for responses that remained at a high level such as only mentioning structured and unstructured data without providing specific examples, or that included only a small number of examples or repeated examples within the same category.

- Demographic information (age, gender, DOB, etc.)
- Past medical history
- Current diagnoses
- Medications
- Allergies
- Episode of care progress notes
- Lab test results
- Radiology imaging

(c)

(i) Identify the type of study method used in each of the following scenarios:

A. A study of brain cancer epidemiology in all employees at several manufacturing plants located across the country over five decades.
B. A study of all identified brain cancer patients in an area via interviews, medical records, and genetic studies to obtain knowledge on risk factors for brain cancer outside of the workplace.
C. A study of the outcomes of a group of patients receiving a new experimental drug treatment and another group of patients receiving standard treatment.
D. A study observing the prevalence and daily life impact of brain cancer symptoms by surveying a subset of identified patients.

Commentary on Question:
The majority of candidates did not perform well on this question. Many incorrectly identified the study method, particularly for B, the case-control study method, and D, the cross-sectional study method. Credit was awarded as long as the correct study method was identified for each scenario, even if no descriptions were provided.

A: Longitudinal/cohort study where different populations are compared at different geographic locations over decades.

B: Case-control study where patients with a disease (case) are compared to other members from the same population but without the disease (control).

4. Continued

C: Clinical trial study; this is an experimental study that aims at proving the efficacy of a treatment in treating certain disease or illness.

D: Cross sectional study that aims at identifying the prevalence of a disease in a population at a certain time of period. It is a perfect way to get a snapshot of the population.

(ii) Compare and contrast the study methods in part (i).

Commentary on Question:
Many candidates demonstrated a reasonable understanding of several study designs and earned credit for factually correct elements even when their wording differed from the model solution. A high score was awarded to candidates who correctly addressed all four required methods and identified multiple accurate advantages or limitations. However, some candidates did not score well because they failed to cover all four methods or anchored their responses to incorrect study types carried over from part (i), which limited the number of valid elements. Extensive narrative detail did not result in additional credit beyond the required correct elements.

- All these study methods can be used to understand the exposure to certain risks on disease. They all involve identifying members and involve some sort of patient participation to some degree.
- A cross-sectional study is the cheapest and fastest, but also the least robust. They are used for quick snapshots.
- Case-control studies are more common than clinical trials and cohort/longitudinal studies and are both faster and cheaper. They can be used to identify patterns but struggle to support true association and causation.
- Longitudinal/cohort studies are better at determining associations between factors than case-control studies but are more expensive and take longer.
- Finally, clinical trials are the most accurate but are the most expensive and resource intensive. Additionally, they have ethical concerns, since you can't expose people intentionally to risk factors.

5. Learning Objectives:

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

Learning Outcomes:

(2b) Estimate savings, utilization rate changes, and return on investment.

Sources:

Managing and Evaluating Healthcare Intervention Programs, Duncan, Ian G., 2nd Edition, 2014, Ch. 8 Understanding the Economics of Care Management Programs

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Calculate the pre-tax hurdle rate and risk margin adjusted hurdle rate. Show your work.

Commentary on Question:

Some candidates did well calculating the pre-tax hurdle rate. If a candidate did not calculate the pre-tax hurdle rate correctly, that candidate could still earn credit for knowing to add 5% to that figure to calculate the risk-margin adjusted hurdle rate.

See Excel File

(ii) Describe reasons for applying a risk margin.

Commentary on Question:

Most candidates only received partial credits for this subpart. The common shortfall was to give less than two reasons for adding risk margin.

Reasons for adding risk margin include the likelihood of the proposed project being able to achieve the expected return due to the high variation around the expected return. Given the large number of variables that enter into a program and the calculation of savings, each of which has a distribution of likely outcomes, a discount or risk margin is warranted.

Another reason would be diminishing returns (to additional interventions and penetration into the population). Penetration at only the highest risk-level in a population returns high savings relative to program cost.
* As penetration increases, additional interventions could be performed that increases savings, but at a decreasing rate.
* As long as penetration can be increased at a marginal return greater that the hurdle rate, savings opportunities (produce a return greater than the intervention program cost) exist

5. Continued

(a) Calculate the gross return on investment (ROI) and total net savings PMPM for each program. Show your work.

Commentary on Question:
Most candidates performed well on this part. While candidates who provided both the PMPM and the Per Chronic Member Per Month (PCMPM) calculation were able to earn full credit, those who just calculated the PCMPM calculation without the PMPM calculation did not earn full credit.

See Excel File

(b) Recommend which program is a better investment. Justify your response.

Commentary on Question:
Candidates could have earned full credit for either recommending program 1 or 2, provided there was sufficient reasoning.

If Program 2 is recommended: While the ROI is lower than program 1 program will generate higher net savings across the program. The net savings on a PMPM basis are higher under program 1 than program 2 because it targets more members.

(d)

(i) Calculate the gross ROI for each penetration level. Show your work.

Commentary on Question:
Candidates could have earned full credit if they interpreted the Event Rate and Cost/Event on a cumulative or incremental basis for each penetration level. Many candidates interpreted them as a cumulative event rate instead of the below using an incremental basis; those candidates were still able to earn full credit.

See Excel File

(ii) Explain the ROI's pattern over the three penetration levels.

Commentary on Question:
Candidates who explained the ROI calculation in terms of fixed and variable costs, along with diminishing returns on savings performed well on this part. Candidates could earn full credit as long as it matched the ROI pattern they calculation in part (d)(i).

5. Continued

At a penetration level of 2%, the ROI is impacted by high start up costs; even though the savings per chronic member is high, the net savings per member is low resulting in a suboptimal ROI. At a penetration level of 7%, additional chronic members are brought in, yielding additional savings that are optimal for the three penetration levels presented. At the 12% penetration level, additional chronic members show a decreasing amount of net savings per member.

6. Learning Objectives:

1. The candidate will understand how to evaluate the effectiveness of provider reimbursement methods from both a cost and quality viewpoint.

6. The candidate will understand how to apply the framework of predictive analytics to healthcare data and business applications.

Learning Outcomes:

(1a) Describe contracts between payers and providers.

(6b) Differentiate between types of risk score models

(6d) Identify challenges specific to the use of healthcare claims in model development

Sources:

eLearning Module: FSA: Predictive Modeling for Healthcare Actuaries

GH301-105-25: Chapter 45 of Group Insurance, Skwire, Daniel, 8th Edition, 2021

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Critique the use of the HHS-HCC risk score model instead of the ACO's prospective risk scores for estimating the future claims cost.

Commentary on Question:

[*Most candidates struggled with this question as they are unable to connect the question with the source material intended. Very few candidates were able to distinguish the difference between concurrent and prospective risk score models and provide sufficient reasoning on why the concurrent risk score model is not appropriate for an ACO.*]

HHS-HCC is a concurrent risk score model. Concurrent models may be used for evaluating ACO performance outside of Medicare. As a result, it would not align with ACO's covered population.

The model's dependent variable is paid claims, rather than allowed claims as with the Medicare model, so the model attempts to explain variability in plan liability as a function of disease conditions. Additional considerations may be needed for an ACO, such as provider accountability via non-FFS payment arrangements.

6. Continued

The HHS-HCC model also is a hierarchical model, with only the most severe version of a condition contributing to a member's score. The model would need to therefore be supplemented with additional information (ex: procedures, under-represented populations, etc.) in order to capture risk scores representative to the ACO.

The underlying data of the HHS-HCC risk score model may not account for any ACO specific initiatives.

(b)

(i) Describe challenges with using healthcare claims data for predictive analytics.

(ii) Propose an approach to mitigate each challenge.

Commentary on Question:

(i)[*Most candidates did well on this question as they were able to list and describe the challenges. Candidates needed to provide several responses to get full credit. Those who scored poorly either didn't provide enough responses, or didn't answer the question as intended.*]

(ii) [*Most candidates did well on this question as they were able to propose an approach to mitigate each challenge. Candidates who scored well in part (i) typically scored well for this part as well. Candidates needed to provide several viable mitigations for full credit.]*

(i)

- Missing Values: Some members may have missing data, whether it be one or two values or a larger number. There may be whole fields with missing values.
- Incorrect Values: Some values may simply not make sense. Examples of incorrect values include birth dates before the year 1900, misspelled drug names, abnormal blood count numbers, etc.
- Outliers: Extreme results, which may affect the statistical significance within regression analyses due to their impact on standard deviations.
- Collapsing Claims to Patient / Member Level: Claims data includes one record for each service, not one record for each member; some members will not incur any claims during a given period, and therefore will not show up in the claims data at all.

6. Continued

- Claims Lag and Timeliness: The delay between the date on which a service occurs and the date on which a claim for this service is paid.
- Run-Out Diagnoses: Situations in which the presence of an ICD-10 diagnosis code does not confirm the presence of a condition.
- High Cardinality: Codes are typically grouped together into "Condition Categories", common for the grouping algorithms to result in hundreds of Condition Categories.
- Age Non-Linearity and Interaction with Gender: Relationships between these features and many healthcare outcomes are non-linear and include critical interactions.
- Death in Historical Data: For groups with high mortality rates, such as a Medicare population, end-of-life costs can account for a material portion of total healthcare expenditures for the group. This can create a potential pitfall when developing predictive models.
- Skew: This occurs when there is asymmetry in the data, causing issues when predicting at the tails

(ii)

- Missing Values: You could omit the data record with missing values. An alternative approach is to impute the most likely value for records with missing values or to add a flag in the records to indicate a missing value status. When most of the records in a data field are missing, omitting that data field altogether may be the best approach.
- Incorrect Values: You can treat incorrect values as missing values (applying the same techniques as above). You could create a new data field with corrected values.
- Outliers: Drop the record; assign a cap / floor on numerical variables; transform the numerical data variables to categorical value variables.
- Collapsing Claims to Patient / Member Level: Summarize the relevant fields from the claims data to a single row for each member to be included in the predictive model. Zero claim members should be flagged as having no claims. If the predictive model is intended to make a prediction for members enrolled at a certain point in time, it is often appropriate to use the eligibility or enrollment data to identify the members to be included in the training dataset for the predictive model.
- Claims Lag and Timeliness: Limiting the training data to claims paid through a specific date (such as one month after the latest service date included in the training data).

6. Continued

- Run-Out Diagnoses: Exclude diagnoses from certain laboratory and radiology services; exclude certain lists of procedure codes from the risk adjustment algorithm.
- High Cardinality: Grouping values to reduce the cardinality; Y-aware feature engineering; hashing trick; factorization machine.
- Age Non-Linearity and Interaction with Gender: Age and gender should be transformed for use in a linear model. A common approach is to create buckets for age ranges and split the buckets by gender.
- Death in Historical Data: Include members who were alive at the start of the response period, but who were not necessarily alive at the end of the response period.
- Skew: transform the data using logistic transformation or other probability distributions to emulate more normalized data in the model

(c)

(i) Describe external disruptors the ACO should monitor.

(ii) Propose how the ACO might address each external disruptor.

Commentary on Question:

(i)[*Most candidates did well on this question as they were able to list and describe the external disruptors below.*]

(ii) [*Most candidates scored sufficient points on this question. Some candidates struggled to address how to deal with each external disruptor and ended up repeating their answer in part c(i).*]

(i)

- Legislative Changes: Legislation at the federal, state, and/or local level that impact healthcare. Changes could have a direct or indirect impact on various healthcare services.
- Pandemic: A disease that spreads worldwide.
- Economic Conditions: Economic conditions, such as the unemployment rate. The current state of the economy.
- The Competition: Organizations that provide similar services as the ACO.

6. Continued

(ii)

- Legislative Changes: The provisions for legislative changes are often phased over time, so it's important to develop a framework that adapt to the anticipated changes over time and understand the impact it has on contracts, negotiations, and reimbursements etc.
- Pandemic: Make quick decisions on both services directly attributable to the pandemic (such as testing and treatment), and services indirectly affected (such as the rapid increase in telehealth services). Develop strategy or alternative methods to deliver care (i.e. increase in telehealth services, drug deliveries).
- Economic Conditions: Develop strategy to negotiate with commercial networks and to generate revenue when unemployment rates increases. Review the federal budget regularly to understand the impact it has on provider / commercial networks negotiations.

- The Competition: Be aware of what the competition is doing in terms of reimbursement levels and other factors. Compare reimbursement levels using coordination of benefits (COB) claims from competitors. Rely on published data from consultants. Negotiate a "most favored nations" contract with another administrator.