

# GH SPC Model Solutions

## Spring 2021

### 1. Learning Objectives:

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

### Learning Outcomes:

- (1a) Describe, compare and evaluate programs.

### Sources:

Valuation of Care Management Vendors, Health Watch, May 2020  
Chapter 3, Duncan

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

You have been asked to describe key attributes in valuing care management vendors.

- A. Describe how care management vendors can impact medical costs.
- B. Describe how to measure the effect of a medical savings initiative.
- C. Describe the methods of various complexity to measure medical savings.

### Commentary on Question:

*Most candidates realized that Valuation of Care Management Vendors, Health Watch, May 2020, was the source reading material for this question. Some candidates referenced Chapter 3, Care Management Programs and Interventions, Duncan in answering Part A.*

*Many candidates were able to list and describe the 6 methods in answering Part C.*

# 1. Continued

## **Solution:**

(a)

### **Utilization management**

- The vendor manages a specific set of medical procedures, often delineated by listed procedure codes
- Management may impact utilization based on medical necessity, appropriateness of the procedure for a specific diagnosis, medically redundant combinations of procedures or other scenarios
- Changes in average utilization are measured in units per thousand members, but in the case of inpatient admissions, can also be measured in average length of stay; in the latter case, bundling claims, where a decrease in length of stay may not provide any dollars savings, should also be considered

### **Site of care**

- A vendor may shift specified types of care to less expensive venues
- For example, if a certain procedure could be performed just as well at home or in the physician's office as in a hospital setting, management of that procedure could shift utilization from the most expensive place (the hospital) to one of the less expensive places

### **Diagnosis or patient type**

- Some vendor arrangements identify and manage patients receiving a certain type of care as determined by diagnosis, such as end-stage renal disease, pain management, medical/behavioral health comorbidity and so on
- Savings are often measured based on all covered care provided to persons under management rather than for a limited set of specific procedures or diagnoses
- The goal of these services is often to reduce unnecessary inpatient admissions or emergency department visits

### **Severity/downcoding**

- Some types of medical treatment are coded by severity levels, with higher payment made for greater severity
- A vendor might identify and verse inappropriate upcoding or "code creep," leading to a utilization shift from severe/expensive procedures to those that are less so

### **Descriptions of the following from Duncan Chapter 3 - Care Management Programs and Interventions were also acceptable responses**

- pre-authorization
- concurrent review
- case management
- demand management

- disease management
- specialty case management
- population health management
- patient center medical home
- accountable care organizations (ACOs)
- non-traditional provider intervention and care settings
- gaps in care and quality improvement programs
- telehealth, telemedicine, and automated monitoring systems
- bundled payment initiatives

(b)

- Take one group of people affected by the initiative and another group of people not affected by the initiative
- Measure the difference in total claim expenditures
- All else being equal, the difference between the two groups is your savings
- Methods used often depend on what data are available
- Measure the difference in the effect being targeted, that is, reduced admissions and the savings is the number of admissions avoided

(c)

#### **Pre-/Post-analysis**

- A comparison of experience under the vendor arrangement (experience period) to a period of time before implementation (base period). In its most direct form, simple averages are calculated for each period, with an adjustment for trend between the periods.
- The primary shortcoming of this method of analysis is that adjustments for trend and other differences between the base period and the experience period introduce cumulative uncertainty over time, resulting in decreased confidence in measurements with each passing time period

#### **Participating/Nonparticipating analysis**

- Some initiatives do not affect all plausibly defined members. For example, some enrollment or opt-in process may be required, which not all members or groups will pursue. Other initiatives may be limited by region or some other category that does not affect members' risk or cost expectation
- In this case one can define the control and test populations according to who is and who is not affected by the initiative
- Again, in its most direct form, simple averages are used, and since both populations are measured in the same time period, trend is not an issue

#### **Regression/trend line analysis**

- A more complex form of pre-/post-analysis in which a control population can be used to generate a formula, as with a regression formula
- Projected values are then compared to actual values and the difference between the two represents the savings

#### **Matched cohort analysis**

- A more complex form of participating/nonparticipating analysis in which a number of variables that are expected to affect claims totals is generated and then used to match members of the test population to risk-equivalent members of the control population
- The difference in costs between each matched pair represents the savings

#### **Propensity score matching**

- A more advanced method of matching test and control members that estimates the predicted probability that each member receives a treatment based on observed characteristics
- Bias from confounding variables is reduced and dropped observations are minimized
- However, a large sample size is required, and the selection of variables can affect the outcome

#### **Coarsened exact matching**

- In this matching method, defining variables are coarsened into ranges or bins; this allows a greater degree of exact matches between test and control populations
- The selection of variables is once again critical to the outcome of the exercise

## 2. 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:

GHS-121-18: Enterprise Risk Management, Ratings Direct

ASOP 46: Risk Evaluation in Enterprise Risk Management

ASOP 47: Risk Treatment in Enterprise Risk Management.

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

- (a)
  - (i) Define the following Health Insurance Risks:
    - Underwriting Risk
    - Pricing Risk
    - Claims Management Risk
    - Provider Renewal Risk
  - (ii) Evaluate how the concerns of the CRO relate to these risks.

### Commentary on Question:

*In general, candidates did well on both parts of this question.*

#### Underwriting Risk:

- Definition: Underwriting risk arises when the health insurance coverage offered has a different risk profile and therefore different loss distribution than is expected and assumed in pricing. Another factor that further complicates the underwriting risks is that not all health coverage is underwritten.
- Issues: Product was priced as guaranteed issue assuming a different cohort. The risk profile was changed to sedentary people aged 50-65 years from healthy active people aged 30-40 years.

## 2. Continued

### Pricing Risk:

- Definition: Pricing risk refers to the risk that the health insurance premium is not sufficient and can't be adjusted quickly to cover the cost of providing the health insurance coverage. This risk is particularly prominent when medical costs continue to rise at an accelerated pace.
- Issue: Product is priced for three years in a period of rapidly increasing medical costs

### Claims Management Risk:

- Definition: Claim management risk includes all exposures that arise from an insurer's practices around claim processing, reserving, and payment. Claim management risk may manifest itself as failures to identify claims filings abuse, miss-assessment of treatment necessity, and claim-cost development.
- Issue: New claims team would not be as familiar with company practices, etc as a more seasoned company claims team.

### Provider Renewal Risk

- Definition: Provider renewal risk arises when the health insurer experiences a drastic rise or sudden changes in health service cost of providers, but isn't able to promptly adjust provider contracts in response to the rise or the change. Particularly susceptible to provider renewal risks are insurers with heavy provider concentration, more provider renewals around a particular date (for many, January 1), or limited negotiation power with providers.
- Issues: Provider contracts were written for five years. Provider contracts are non-negotiable and renewed on a common date

- (b) Describe key elements essential to Operational Risk Controls.

### **Commentary on Question:**

*Many candidates struggled to describe the key elements essential to Operational Risk Controls.*

- Procedures in place to systematically identify operational risks and to monitor, assess, and mitigate those identified risks.
- A sound business continuity plan (BCP) that has undergone multiple drills.
- A business continuity plan comprises processes and procedures the insurer would follow to limit the adverse impact of an event.
- Risk controls around operational risks that are of particular importance to the individual insurer.

## 2. Continued

- (c) Verify the accuracy of the Risk Evaluation, according to ASOP 46. Justify your response.

**Commentary on Question:**

*Candidates were not penalized for noting item #1 as correct since the only inaccuracy was the misspelling of the word “fungibility”. Candidates did not earn points for merely stating incorrect or correct. Candidates needed to provide an explanation for each incorrect response for items 2, 3, 5 and 6 in order to earn full points.*

1. Should read: Limitations to the “fungibility” of capital across the organization.
2. Incorrect – Should read: The organization’s strategic goals, including goals for the level and volatility of profits, both short term and long term.
3. Incorrect – Should read: The degree to which the organization’s different risks interact with one another; actual and perceived diversification benefits; and dependencies or correlations of the different risks.
4. Correct
5. Incorrect – Should read: The potential differences between the current and long-term risk environments.
6. Incorrect – Should read: The extent to which the organization’s exposure to risks may differ from the exposures of its competitors.

- (d) According to ASOP 46,

- (i) Describe considerations when performing stress tests and scenario tests.
- (ii) Describe considerations to include when communicating your findings on stress tests and scenario tests.

**Commentary on Question:**

*Candidates generally performed well on this part of the question.*

- (i)
  - The extent to which various stress tests reflect similar or different degrees of adversity. Using different degrees of adversity may affect the comparability of stress tests.
  - Any items in the organization’s business plan that describe how the organization will function during an extreme event(s) as well as any historical organizational examples.

## 2. Continued

- That an extreme event scenario may be a single event or a series of events that, taken together, have catastrophic results.
  - How actions and reactions of various stakeholders and markets during extreme events may differ from those during “normal” times.
  - Whether the assumed interdependencies are appropriate under the stress or scenario testing assumptions due to the possibility of unanticipated consequences when risks interact in ways not seen historically.
  - How to define situations that result in a non-quantifiable risk and how to show plausible financial effects on the organization.
  - That some stress and scenario tests will be hypothetical situations for which the actuary will not need to validate the degree to which the scenario is realistic.
- (ii) The actuary should document and communicate the results of the stress and scenario tests and their intended use. The actuary should also disclose any known limitations of the stress and scenario tests including an assessment of the potential impact of these limitations on results. The actuary should also disclose the time frame and the basis of measuring loss.



### 3. 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.

#### Sources:

Creating Stability in Unstable Times – A Look at Risk Adjustment and Market Stabilization – The Actuary, December 2017, Web Exclusive

*Healthcare Risk Adjustment and Predictive Modeling*, Ch. 6: Development and Construction of DRGs, DCGs, and ETGs

#### Commentary on Question:

*Commentary listed underneath question component.*

#### Solution:

- (a) Describe the elements of the Affordable Care Act (ACA) designed to ensure a balanced risk pool.

#### Commentary on Question:

*Candidates were asked to describe the elements of ACA programs to ensure a balanced risk pool. Most candidates did well in this section describing 4 or more items to receive full points. Candidates who listed without describing received partial points.*

1. Individual Mandate – is a tax penalty on individuals who are deemed able to afford coverage but choose not to purchase it.
2. Subsidies – Tax credits are calculated relative to the second lowest cost silver plan in an enrollee’s area and reduce premiums to a fraction of the cost they would be otherwise.
3. Temporary Risk Stabilization Programs
  - a. Risk Corridor –a transitional program intended to protect issuers from large losses in the first three years of the ACA.
  - b. Transitional Reinsurance Program – intended to reduce premiums as well as reduce the risk to issuers by covering a portion of large claims.
4. Risk Adjustment – intended to equalize the profitability of members such that issuers were not benefited or hurt from enrolling a certain type of member.
5. Outreach and advertising – are key factors in maintaining and increasing enrollment to those who are eligible but have not enrolled.
6. Medicaid expansion – meant that individuals with incomes between 100 percent and 138 percent FPL would be part of the Medicaid program rather than the individual market.

### 3. Continued

7. Special enrollment periods – are exceptions where enrollment is allowed outside of the open enrollment period.
8. The ability to develop adequate rates – requires a stable regulatory environment and knowledge of the risk pool. Changes to the covered population—such as churn in the market, significant changes in total enrollment levels, and the entrance of transitional enrollees in some states—continued to make rating a challenge.

(b)

- (i) Calculate the retrospective and prospective relative risk scores for Member A and Member B. Show your work.
- (ii) Explain the reasoning for the difference between the retrospective and prospective relative risk scores.

**Commentary on Question:**

*Most candidates were able to calculate prospective scores correctly but failed to recognize that retrospective scores do not include an AgeSex factor. Many candidates also misinterpreted the risk score formulas and used sum products. Candidates who wrote out the formula correctly but whose calculations were incorrect received partial points.*

Formula for Prospective Risk Score:

$$\text{Risk } P_i = \text{AgeSex}_i + \sum_s \beta_s, \text{ where } \beta_s \text{ are prospective weights for ERG}$$

Formula Retrospective Risk Score:

$$\text{Risk } R_i = \sum_s \gamma_s, \text{ where } \gamma_s \text{ are retrospective weights for ERG}$$

**For member Jack:**

Retrospective Score:

$$\text{Risk } R_{\text{Jack}} = 0.9874 + 0.8200 + 0.1409 = 1.9483$$

Prospective Score:

$$\text{Risk } P_{\text{Jack}} = 0.7331 + 1.281 + 0.7913 + 0.1023 = 2.9077$$

### 3. Continued

**For member Jill:**

Retrospective Score:

$$\text{Risk } R_{Jill} = 2.2870 + 2.3972 = 4.6842$$

Prospective Score:

$$\text{Risk } P_{Jill} = 0.7032 + 2.0065 + 0.6474 = 3.357$$

In the retrospective risk score model, because all diagnosis-based conditions are known at the time that the score is calculated, the score may be derived only from diagnosis-based risk. When a prospective risk score is calculated, all diagnoses are not yet known and the *AgeSex* factor serves to capture the “unknown” portion of the diagnosis-based risk.

#### 4. Learning Objectives:

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

#### Learning Outcomes:

- (1a) Describe, compare and evaluate programs.

#### Sources:

Duncan 2nd Edition Managing and Evaluating Healthcare Ch. 11

Effects of a Population Health Community-Based Palliative Care Program on Cost and Utilization Journal Entry

#### Commentary on Question:

*Commentary listed underneath question component.*

#### Solution:

- (a) Describe advantages and disadvantages of propensity score matching

#### Commentary on Question:

*Most candidates performed well on this part of the question.*

Pro 1: Allows matching on composite score instead of directly on individual characteristics

Pro 2: Allows individuals to be grouped, because members with similar propensity scores will have similar values of the characteristics

Con 1: Sometimes close matching is difficult, so the number of matched treatment members becomes small relative to the total treatment group

Con 2: Only controls for observable, and not unobservable variables

Con 3: Score should not be used as the standalone criterion (matched individuals should still be “close” on other variables)

Con 4: There will always exist a trade-off between number of matches and “closeness” of the score

- (b) Compare and contrast propensity score and risk adjustment

#### Commentary on Question:

*Most candidates performed well on this part of the question.*

1. Risk adjustment and propensity score both calculate a composite score based on several characteristics.

2. Propensity score is usually based on a wider range of independent variables than risk score.

3. Risk score will almost always take into account more detailed diagnosis variables than the propensity score.

## 4. Continued

4. Risk adjustment uses the entire population, while propensity score matching can result in many members of the population being discarded when there is incomplete overlap between populations.
  5. Risk adjustment is a well-known technique among actuaries and increasingly among insurers and government officials, while propensity score is less well-known.
- (c) Critique the study design and conclusions of the journal entry “Effects of a Population Health Community-Based Palliative Care Program on Cost and Utilization”.

### **Commentary on Question:**

*Most candidates struggled on this part of the question. Many candidates described the study design and conclusions stated in the reading, but did not critique them. Candidates who provided a critique received full points.*

1. Data was tracked for non-enrolled members for full nine month study period, but only for time of enrollment for enrolled members. Members enrolled for fewer than two months were removed. Study doesn't mention if, at all, seasonality may have impacted results.
2. Authors rightfully note that the study is retrospective and subject to bias. They don't, however, explicitly state that propensity score matching can only control for bias in observable characteristics. Bias may still be present for unobservable member characteristics, e.g. attitudes towards palliative care.
3. Authors do a reasonable job of outlining limitations to the study but could be clearer. For example, they state that data could not be collected on members who enrolled in hospice care outside of Mount Carmel's hospice program. Are they inferring that results cannot be extrapolated to members in other hospice programs? Extrapolating results to different member populations should be noted as a limitation in the study.
4. Matching was not completed on pre-period PPPM claims. It is unknown whether the difference in PPPM claims demonstrated between the intervention and control group is due to the program or due to lower baseline claims for the intervention group.
5. Intervention population was small. Differences between size of intervention and control populations could present potential bias.
6. The control group consisted of patients who did not enroll because they were unreachable, opted out, expired before they could be enrolled, or were already referred to hospice. This could lend to sampling bias, meaning that people who enrolled may have been more likely to modify behavior anyway, regardless of program intervention.

## 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.

(3c) Apply applicable Actuarial Standards of Practice.

### Sources:

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

GHS-120-17: HHS-Operated Risk Adjustment Methodology Meeting Discussion Paper

Healthcare Risk Adjustment and Predictive Modeling, Duncan (2nd edition): Chapter 5]

### Commentary on Question:

*Commentary listed underneath question component.*

### Solution:

(a) According to ASOP 45,

- (i) Describe how the input data used in the application of risk adjustment needs to be reasonably consistent.
- (ii) Explain what the actuary should do if reasonable consistency cannot be achieved or if information concerning the quality and type of input data is not sufficient.
- (iii) Explain what the actuary should consider when evaluating consistency of input data.

### Commentary on Question:

*Most candidates performed well on parts i) and ii). Very few candidates received full points for part iii).*

- (i) The input data need to be reasonably consistent
  - With the type of data used to develop the model
  - Across Organizations
  - Populations
  - Time periods

## 5. Continued

- (ii) If reasonably consistent data cannot be achieved or input data is not sufficient, the actuary should:
  - Document why the combination of that data and the selected model was used.
  - Apply and document any adjustments made to the data, the model, or the methodology to address limitations in the data.
  - If sufficient information concerning the quality and type of input data used to develop or apply the model is not available, the actuary should consider whether use of the model is appropriate.
- (iii) When evaluating the consistency of input data, the actuary should consider the following:
  - Differences in provider contracts and how these differences can cause significant difference in risk adjustment results. For example, differences in results due to data quality rather than morbidity.
  - Determine how the model handles diagnostic services and whether data for those services should be included in the data input into the model.
  - The impact of differences in the accuracy and completeness of diagnosis and services coding across organizations (1 point) and time periods (1 point).
  - The actuary should consider whether adjustments to the risk adjustment process are appropriate.
- (b)
  - (i) Discuss concerns regarding partial year enrollees and feedback from the industry on how to improve the methodology.
  - (ii) Discuss advantages and disadvantages of the following options to address partial year enrollment in calculating risk adjustment payment transfers as part of the HHS risk adjustment model:
    - I. Adding a duration factor to the HHS risk adjustment model.
    - II. Employing wholly separate models that account for duration of enrollment and metal level.

### **Commentary on Question:**

*Most candidates received partial or full points on this part of the question. Candidates who were able to provide more detail and fully answer the question received full points.*

## 5. Continued

- (i) Concerns regarding partial year enrollees consist of the following:
- The current methodology undercompensates new or fast-growing plans.
  - The current methodology uses outdated data.
  - Some issuers experienced higher than expected claims costs for partial year enrollees
    - This led to partial year enrollees experiencing higher medical loss ratio than full year enrollees
  - Partial year enrollees with chronic conditions may not have accumulated diagnoses in their partial year of enrollment
  - Partial year enrollees with acute conditions may incur most of their annual medical expenses during a short period of time, making
  - Unverified special enrollment periods have produced selection issues for health plans (enrollees could enter, utilize services, and drop or change coverage after incurring expenses).

Feedback on improving the methodology consisted of the following:

- a. The model would be improved by using prescription drug data as a predictor.
- b. Adding a duration adjustment for partial year enrollees to improve the methodology (similar to the Massachusetts' alternate risk adjustment methodology)
- c. The impact of partial year enrollment could be measured by taking a population with multiple years of enrollment and comparing risk scores and health care costs when only a partial year is considered
- d. CMS was cautioned that any additions to the model should not influence clinical judgement or plan behaviors with respect to enrollees' coverage.

- (ii) Advantages of a duration factor:

- It's a simpler method to implement that doesn't require a significant change in the methodology

Disadvantages of a duration factor:

- The duration factor had a relatively small impact when added
- Therefore the duration factors did not appear to reflect noticeably higher costs with partial year enrollees
- The duration factors incorporate the risk of both partial year enrollees with no payment HCCs and partial year enrollees with payment HCCs, two populations with risk effects that tend to offset each other.



## 5. Continued

Advantages of a separate model:

- Separate models will predict accurately by enrollment subpopulations overall by age/sex categories and by HCC disease groups.
- Separate models indicate that expenditures for certain diagnoses are directly affected by enrollment length.

Disadvantages of a separate model:

- Separate models may present false precision for some conditions where there is a small sample size.
- Separate models add to the complexity of the HHS risk adjustment methodology
- Separate models would increase the number of models that would need to be calibrated each year.
- CMS found very different coefficients for expensive, acute conditions by duration as compared to chronic conditions.
- The data used for the study used mainly the experience of large employers so may not reflect the enrollees in the individual and small group market

(c)

- (i) Define identification algorithms used in grouper models.
- (ii) Discuss reasons that may make the use of commercially-available grouper models preferable for risk adjustment work.

### **Commentary on Question:**

*Candidates generally performed well on this part of the question. For part i), however, some candidates listed the individual grouper models rather than described what an identification algorithm is.*

- (i) Identification algorithms are rules that are applied to datasets to drive consistent identification of conditions and their severity within a member population.
- (ii) Reasons to use the commercially available model consist of:
  - i. There is a considerable amount of work involved in building algorithms from scratch, particularly when this has to be done for the entire spectrum of diseases.
  - ii. A model must be maintained to accommodate new codes. New medical codes are not published frequently, but new drug codes are released monthly, so a model that relies on drug codes will soon be out of date unless updated regularly.

## **5. Continued**

- iii. Providers and plans, whose financial stability relies on payments from a payer, often require that payments be made according to a model that is available for review and validation.
- iv. Regulatory uses—CMS decrees the use of specific grouper models for risk adjustment in Medicare Advantage and ACA plans.
- v. The predictive accuracy and usefulness of commercially available models has been studied extensively by the Society of Actuaries, which has published four comparative studies in the last 20 years.

## 6. 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.

### Sources:

GH-128-19, RBC Calculation Examples

Group Insurance, Skwire, 7th Edition, 2016, Ch. 39: Risk-Based Capital Formulas

### Commentary on Question:

*This problem is similar to Example H of the Group Health Specialty Study Note containing RBC calculation examples. Candidates that followed the spirit of methodology outlined in Example H and arrived at the correct answer were given full credit. Several candidates opted for the Simplified Methodology and were awarded partial credit for the less rigorous approach.*

### Solution:

- (a) Calculate the RBC ratio if the company changes its asset portfolio from 100% cash to
  - (i) 85% cash/15% equities
  - (ii) 85% cash/15% bonds

### Commentary on Question:

*The model solution approach will solve for H1 and substitute changes to H1. The same answer can be achieved if solving for H2 instead.*

(i)

Old  $H_1 = (1.00 * 0.003) * \text{Amount Invested} = 0.003 * \text{Amount invested}$

New  $H_1 = ((0.85 * 0.003) + (0.15 * 0.20)) * \text{Amount Invested} = 0.03255 * \text{Amount Invested}$

New  $H_1 / \text{Old } H_1 = 0.03255 / 0.003 = \mathbf{10.85}$

Old ACL RBC =  $0.5 * (3.2 * (H_2)^2 + (H_2)^2)^{1/2} = \mathbf{1.025} * H_2$

New ACL RBC =  $0.5 * (3.2 * (\mathbf{10.85} * H_2)^2 + (H_2)^2)^{1/2} = \mathbf{9.72} * H_2$

New RBC Ratio =  $325\% * (1.025 H_2 / 9.72 H_2) = \mathbf{34.3\%}$

### Simplified Method:

New RBC Ratio =  $325\% * 0.003 / 0.03255 = \mathbf{29.95\%}$

## 6. Continued

(ii)

85% Cash/15% Bonds

Old  $H_1 = (1.00 * 0.003) * \text{Amount Invested} = 0.003 * \text{Amount invested}$

New  $H_1 = ((0.85 * 0.003) + (0.15 * 0.01)) * \text{Amount Invested} = 0.00405 * \text{Amount Invested}$

New  $H_1 / \text{Old } H_1 = 0.00405 / 0.003 = \mathbf{1.35}$

Old ACL RBC =  $0.5 * (3.2 * (H_2)^2 + (H_2)^2)^{1/2} = \mathbf{1.025} * H_2$

New ACL RBC =  $0.5 * (3.2 * (\mathbf{1.35} * H_2)^2 + (H_2)^2)^{1/2} = \mathbf{1.307} * H_2$

New RBC Ratio =  $325\% * (1.025 H_2 / 1.307 H_2) = \mathbf{254.8\%}$

Simplified Method:

New RBC Ratio =  $325\% * 0.003 / 0.00405 = \mathbf{240.74\%}$

- (b) Assess whether either of the asset portfolio changes in part (a) require regulatory action and if so, propose an alternative asset allocation that requires no regulatory action. Assume no changes to the types of assets in each portfolio. Show your work.

### **Commentary on Question:**

*Candidates received full credit if they used an incorrect answer from Part A to answer Part B, but correctly answered Part B. No credit was given if a candidate did not justify their response in Part B.*

*No credit was given for suggesting a portfolio of 100% cash. Partial credit was given to candidates who used the simplified method to come up with a mix of 99.05% cash and 0.95% equities.*

The portfolio in part A(i) has an RBC ratio of 34.3%. This is below the 70% threshold that triggers the Mandatory Control Level, so Yes, regulatory action is required.

The portfolio in part A(ii) has an RBC ratio of 254.8%. This is above the 200% threshold that triggers regulatory action.

The exact ratio for part A(i) to get an RBC ratio of 200% is 98.82% cash, 1.18% equities. However, since the question merely asked for “an alternative asset allocation that requires no regulatory action,” any proposed mix of cash and equities that uses the correct formulas, identifies the threshold as being above 200%, and does generate an RBC ratio over 200% was given full credit.