

University of Michigan Health Risk Assessment (HRA) and Trend Management System™ (TMS)

CIGNA has entered into a long-term agreement with the University of Michigan, which gives it access to intellectual property developed by Professor D.W. Edington, Ph.D., and the researchers within the University of Michigan Health Management Research Center (UM-HMRC). The agreement includes an exclusive license within the United States for the use of sophisticated analytics that help consumers and CIGNA identify and address health risks and help employers develop worksite health and wellness programs. CIGNA is the only national carrier with **exclusive** rights to the University of Michigan Health Management Research Center's proprietary **Trend Management System™**.



The content of the University of Michigan Health Risk Assessment (HRA) questionnaire and the algorithms that comprise the University of Michigan Trend Management System (TMS), the analytic engine that supports the HRA, have been developed over the past 25 years by Dr. Dee Edington and his colleagues at the University of Michigan Health Management Research Center. Both the HRA questionnaire and its TMS analytic engine are based on extensive research (more than 140 published papers in peer-reviewed medical journals) on the relationship of individual health risks to future health care, disability, and lost productivity costs.

The purpose of this white paper is to describe the key components of the Michigan Trend Management System, the outputs that are produced by TMS, and how these outputs are used by CIGNA to drive engagement and intervention with CIGNA members who are identified as being at risk by the University of Michigan HRA. Early engagement and effective intervention, as guided by the Michigan HRA and TMS, result in a reduction of risk in the target employee population, and consequently, improved downstream clinical outcomes and reduced medical, disability, and lost productivity costs.



Fundamentals

The University of Michigan HRA questionnaire is designed to identify the current health status and preventive practices that most impact future health status and health care costs. Captured risk-related information is relevant for predicting which individuals are most likely to experience high health care, disability, and lost productivity costs over the following 1-3 years. Published research findings document the predictive accuracy of the University of Michigan HRA and Trend Management System with respect to future health care, disability, and lost productivity costs.

Specific HRA data elements comprise the inputs for the Trend Management System, a predictive analytic engine based on the results of a large number of multiple regression, factor analysis, and data mining methods that define the relationship between specific risk factors and combinations of risk factors with future costs and assigns each individual to a recommended intervention strategy. The research leading to the design of the TMS algorithms involved the analysis of over two million individuals' HRA and medical claims as part of ongoing research at the University of Michigan Health Management Research Center.

The University of Michigan Trend Management System utilizes critical risk factors for each individual completing the HRA questionnaire along with health risk calculations, mortality risk calculations, individual profiling data, and composite pattern variables from past health care claims when available, as inputs to assign each individual to a stratified level of engagement and intervention. The steps that the TMS follows in order to assign individuals to the appropriate engagement and intervention strategy are the primary focus of this white paper.



Trend Management System Basic Steps:

The TMS analytic engine follows six basic steps, each of which will be described in more detail.

1. Identify high risk factors for each individual completing an HRA and calculate an overall Wellness Score.
2. Identify any Dangerous Risk Combinations for each individual.
3. Prioritize risks for each individual.
4. Assign each individual to one of 240 Trend (TMS) Subgroups.
5. Assign each individual to an Intervention Level.
6. Assign each individual to a unique Risk Cluster.



Step 1:

Identify high risk factors for each individual completing an HRA and calculate an overall Wellness Score.

The Michigan HRA utilizes as its basic building blocks 16 health risks:

Health Risks	High Risk Criteria
Alcohol	> 14 drinks/week
Blood Pressure	Systolic > 139 and/or Diastolic > 89 mm Hg
Body Weight	BMI \geq 27.5
Cholesterol	Total cholesterol > 239 mg/dl
Existing Medical Problem	Heart Disease, Cancer, Diabetes, Stroke, Chronic Bronchitis/Emphysema
HDL Cholesterol	< 35 mg/dl
Absent Days (from regular activity) due to illness	> 5 days during the past year
Life Satisfaction	Partly satisfied or not satisfied
Job Satisfaction	Disagree or disagree strongly
Perception of Health	Fair or poor
Physical Activity	< once a week
Safety Belt Usage	Using safety belt < 100% of time
Smoking	Current smoker
Stress	High (stress scale score > 18)
Health Age Index	Appraised Health Age – Achievable Age > 4
Drug Use (for relaxation)	Almost every day or sometimes

Step 1: *(Continued)*

It is important to note that what defines high risk for each health risk factor was determined by statistical analysis, i.e., by what risk factors demonstrated a statistically significant correlation between the presence of individual risk factors and combinations of risk factors with future costs. Consequently, these definitions may differ from what various clinical guidelines define as high risk.

An overall categorization of individual risk (high, medium, low) is assigned to each individual based on that individual's total number of risk factors as follows:

Overall Risk Levels:

Low Risk = 0 to 2 risk factors present

Medium Risk = 3 to 4 risk factors present

High Risk = 5 or more risk factors present

The TMS makes use of a number of scores calculated by the University of Michigan HRA – stress score, appraised health age, achievable age, mortality risks – to calculate an overall Wellness Score that appears on the Member Profile Report. It represents an overall measure of health status, healthy behaviors, and utilization of preventive services and has a range of 50 – 100.



The Wellness Score has three components:

I. Age/Gender Mortality Risk Component (38 – 44% weight)

reflecting the individual's probability of dying from all causes relative to the individual's probability of dying from all causes if all modifiable risks are eliminated.

II. Health Behaviors and Health Status Component (50% weight)

- Smoking
- Exercise
- Alcohol Use
- Safety Belt Use
- Overweight
- Blood Pressure
- Total Cholesterol
- HDL Cholesterol
- Absent Days
- Health Status

III. Preventive Services Component (6 – 12% weight)

- Blood Pressure Screening
- Cholesterol Screening
- Tetanus Immunization
- Prostate Exam
- Colon Cancer Screening
- Influenza Immunization
- Pap Test
- Mammogram

Step 2:

Identify any Dangerous Risk Combinations (DRCs) for each individual.

Dangerous Risk Combinations are composite risk factors composed of combinations of individual risk factors that correlate with particularly high future health care costs based on multiple regression models and factor analysis.

There are 34 Dangerous Risk Combinations, each falling into one of eight classes:

- Absence
- Disease
- Psychological
- Physical
- Addictive
- Age
- Mortality
- Utilization

Individual Dangerous Risk Combinations are defined for each class based on the presence of individual high risk factors reported for each individual. Following are examples of two Dangerous Risk Combinations based on absence (from one's regular daily activity) and other specific psychological risk factors and risk age.

Absence-Related Dangerous Risk Combination Examples**

Example # 1: Absence DRC

Absence risk factor in conjunction with one or more specific chronic disease conditions

Example # 2: Absence DRC

Absence risk factor in conjunction with specific psychological risk factors and risk age

** Absence from daily work activity for six or more days in the past year.

Step 3:

Prioritize risks for each individual.

TMS generates a prioritized list of each individual's high risk factors by applying a weight based on the degree to which Dangerous Risk Combinations are present. This calculation produces an adjusted weight for each of the 16 risk factors.

The top three risks on the basis of risk factor adjusted weights are displayed on the first page of the Member Profile Report. The remaining risks and topics are addressed throughout the remaining pages of the Member Profile Report.

All risks and their respective priorities are available to the CIGNA clinician outreaching to a specific member for the purpose of engaging that member in lifestyle behavior change. In addition, aggregate reporting of prioritized risks at a customer level allows CIGNA to develop a population-based intervention strategy that reflects the particular customer's employee risk profile.

Step 4:

Assign each individual to one of 240 Trend Subgroups.

TMS defines 240 Trend Subgroups in terms of all possible combinations of the following variables:

- HRA Completion
- Age
- Gender
- Medical Conditions
- Healthcare Utilization
- Risk
- Dangerous Risk Combinations

The 240 Trend Subgroups were defined based on the results of extensive multiple regression models and decision trees involving HRA data and claims data for over two million individuals in the University of Michigan Health Management Research Center research database. Individuals belonging to a specific TMS Subgroup are similar in terms of their need and expected response to engagement/intervention targeted at improving health and DRC status.

Step 5:

Assign each individual to an Intervention Level.

Intervention Levels represent the recommended intensity of intervention and the associated level of resource investment to assist an individual with personal risk reduction and maintenance of health status. Seven levels of intervention were defined by the initial University of Michigan research that led to the development of Intervention Levels. For practical application, the University of Michigan has collapsed these seven Intervention Levels into three levels (High, Medium, Low).

Each Intervention Level comprises a group of TMS Subgroups. An individual is assigned to a High, Medium, or Low Intervention Level on the basis of his/her TMS Subgroup assignment (from Step 4).

The relative level of resources recommended for each Intervention Level is based on research into the level of resources required to help a member with that assigned Intervention Level realize potentially attainable savings based on his/her individual risk profile, assuming at least a 3.0 ROI. See *Predictive Ability of TMS With Respect to Recommended Intervention Level* on page 9 of this white paper.

The value of the University of Michigan Trend Management System can be summarized in the following diagram, which outlines how key outputs of the TMS are used to determine both the priority and mode of member engagement and intervention in a manner that is supported by research:

For an Individual Member Completing an HRA:

Ranked Risks + Intervention Level + Readiness to Change

are used to produce

CIGNA Adjusted Intervention Level

that determines

Priority and Mode of Member Intervention

Priority: the order in which individuals at risk are contacted for outreach
Mode: telephone outreach or letter outreach

Step 6:

Assign each individual to a unique Risk Cluster.

Risk Clusters are of four mutually exclusive types and provide context around an underlying set of risk drivers for each member completing the University of Michigan HRA:

- Low Risk / Medical Condition
- Biometric
- Psychological
- Risk-Taking

Individuals in each Risk Cluster type have more similar lifestyle behaviors based on their pattern of high risk factors compared to those individuals in other Risk Cluster types.

Risk Clusters were developed as a result of research that used factor analysis and other advanced statistical techniques to determine which risk factors frequently “travel together.” They are useful in helping the CIGNA clinician select the coaching approach best suited to assist a member with lifestyle change.



Risk Cluster Example

Member # 1 is overweight and falls into the **psychological cluster**. This member's weight may be heavily influenced by depression and/or stress; consequently, working on stress management first may be a more effective way of intervening with this member in order to achieve weight loss.

Member # 2 is overweight and falls into the **biometric cluster**. It may be more effective to work with this member on their weight in a more direct manner focused on healthy eating and physical activity.

Extensive research conducted by the University of Michigan Health Management Research Center with Risk Clusters allows identification of the dominating factors and typical prevalence in an employee population of each cluster type:

Cluster Type	Dominating Factors	Typical Prevalence
Low Risk / Medical Condition	Low/no risks other than medical conditions	10%
Biometric	Systolic and Diastolic Blood Pressure, Total Cholesterol, Body Mass Index, High Density Lipoproteins (HDL).	30%
Psychological	Stress, job satisfaction, perceived health, physical activity	40%
Risk-Taking	Smoking, health-age, alcohol, safety belt use	20%



Health Advocacy Engagement: Putting It All Together

The End-Result: By employing the University of Michigan HRA and Trend Management System (TMS), CIGNA is able to forecast costs and health status, assign member-specific health improvement strategies and recommend the optimal priority and mode of outreach to engage members in the most efficient interventions based on cost and expected benefit. Member-specific health improvement strategies are driven not only by the member's prioritized risks, dangerous risk combinations, risk cluster, and intervention level, but also by the member's readiness to change.

Specific interventions triggered by the University of Michigan HRA and its TMS analytic engine are as follows:

- 1. Member Profile Report:** Member responses to the University of Michigan HRA trigger the creation of a member profile report that identifies the member's most significant health risks and directs the member to additional sources of information regarding how to mitigate the member's health risks.
- 2. Online Coaching Modules:** Member responses to the University of Michigan HRA trigger online invitations to one or more (sequentially rather than concurrently) online coaching programs that are delivered over 6–8 weeks via the Internet:
 - Physical Activity
 - Nutrition
 - Stress
 - Sleep

Members can also access directly all of the online coaching modules via the myCIGNA.com member portal.

3. CIGNA Well Aware for Better Health®/ Smart Steps® Disease Management Programs:

Member responses to the University of Michigan HRA trigger referrals to the following disease management programs whenever the member is eligible and is not already enrolled:

- Weight Complications
- Asthma
- COPD
- Diabetes
- Acid-Related Stomach Disorders
- Osteoporosis

4. Condition Management:

Member responses to the University of Michigan HRA trigger referrals to the following condition management programs whenever the member is eligible and is not already engaged in this program:

- CIGNA Healthy Pregnancies, Healthy Babies®
- CIGNA Comprehensive OncologySM

5. Health Advisor Preference Sensitive

Care: Member responses to the University of Michigan HRA trigger referrals to the back pain preference sensitive care program whenever the member is eligible and is not already engaged in this program.

6. Health Advisor: Member responses to the University of Michigan HRA trigger referrals to Health Advisor for possible engagement/coaching on the following conditions whenever the member is eligible:

- Physical Activity
- Lose Weight (Healthy Eating if no LMP)
- Hypertension / Prehypertension
- Cholesterol
- HDL-Cholesterol
- Nutrition / Healthy Eating

7. Lifestyle Management Programs:

Member responses to the University of Michigan HRA trigger referrals to lifestyle management programs for smoking, weight loss, and stress management whenever the member is eligible and is not already engaged in one of these programs.

8. Employee Assistance Program: Member responses to the University of Michigan HRA trigger referrals to the CIGNA EAP for assistance with management of the following conditions whenever the member's employer has purchased CIGNA EAP services:

- Stress (if not eligible for Stress LMP)
- Drug Use
- Alcohol
- Life Satisfaction
- Job Satisfaction
- Absence

Predictive Ability of TMS With Respect to Recommended Intervention Level

Research conducted by the University of Michigan Health Management Research Center involving the relationship of TMS-generated Intervention Levels to future health care costs demonstrated that 83% of individuals completing the University of Michigan HRA for whom a high intervention level was recommended by the TMS were determined to be high cost during year one (i.e., during the year after the HRA was completed).

During year two (i.e., during the second year following completion of the HRA) 79% of the individuals for whom a high Intervention Level was recommended by the TMS were determined to be high cost.

These findings support the high predictive ability of the TMS with respect to determining the most appropriate Intervention Level for each individual based on that individual's characterization of risk using the University of Michigan HRA.

Enhanced Value that the TMS Provides Relative to Current HRA Analytic Capability

The University of Michigan HRA and Trend Management System provide CIGNA with capabilities for analyzing individual member risk data and applying the results of that analysis that have not previously existed. The ability of the Trend Management System to prioritize individual risks using the unique concept of Dangerous Risk Combinations, to categorize individuals with respect to their underlying risk drivers using unique Risk Clusters, and to assign individuals to a stratified Intervention Level, make it unique among health risk appraisals.

Currently, there are no industry-recognized measures to evaluate the performance of HRAs. However, the weight of published research underlying the University of Michigan HRA and TMS supports the claim that it represents best-in-class capabilities.

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