

ROI ANALYSES FOR MUSCULOSKELETAL CARE MANAGEMENT PROGRAMS



Jackie Walker, ASA, MAAA
Jackie.Walker@wakely.com

Robert Lang, FSA, MAAA
Robert.Lang@wakely.com

Sean Kinsman, PT, DPT, OCS
SKinsman@recoveryone.com

Jason Wendt, MBA, PMP
JWendt@recoveryone.com

Background

A care management program coordinates the delivery of healthcare, aims to improve patient outcomes, and focuses on optimizing the utilization of care. Although these programs can be effective, they can also involve significant investments of time, money, and resources. For this reason, it is important to regularly monitor and evaluate the effectiveness of these programs as well as the return on investment (ROI). There are many methods available to evaluate a care management program and determine an appropriate ROI. This paper focuses on analyses most appropriate for evaluating programs associated with musculoskeletal conditions.

Musculoskeletal (MSK) conditions are defined as diverse conditions affecting bones, joints, muscles, and connective tissues, resulting in pain and potential loss of function. Many of those impacted by these conditions revert to physical therapy (PT) to rehabilitate those body parts. This can come at a high cost to the member and the insurer, which is why care management programs for these conditions deliver value. Evaluating care management programs for these conditions has its own unique set of challenges. There is a wide range of severity for MSK conditions. Some conditions may or may not heal on their own with time, and improvements may be difficult to monitor depending on the patient's healthcare utilization. For these reasons, MSK care management programs are challenging to evaluate.

In response, Wakely and RecoveryOne have partnered to provide an overview of care management program analyses available and address how these methodologies and principles can be applied specifically to a MSK care management program. Wakely provides actuarial services to all sorts of entities across the healthcare industry. Of particular relevance is Wakely's expertise in evaluating care management programs. RecoveryOne is an MSK provider that offers a digital tool conveniently delivered via smartphone, tablet, or computer that will provide PT services to members directly. Through its digital platform, RecoveryOne allows patients to access their personalized exercise program and track their progress from anywhere, without the need for in-person visits. The program also includes regular check-ins with a licensed physical therapist to monitor progress and make adjustments to the program as needed. This paper will address ideas not only applicable to the RecoveryOne platform, but topics surrounding ROI quantification that would be applicable to all types of care management programs.

We will provide a general overview of three care management programs analyses, considerations when formulating these analyses, and how results can be translated into an evaluation of ROI and the effectiveness of the program.

Care Management Analyses Overview

A care management analysis can help determine if the care management program is achieving its goals. It can provide insights into the program's impact on patient outcomes, healthcare costs, and other important metrics. The methodology for these analyses is not a one-size fits all approach. There are multiple measurement methods that can be used to identify the impact of a care management program and which one is selected depends on a variety of factors including availability of data, type of intervention, type of population, etc. We will provide a brief overview of the methods and discuss pros and cons associated with each.

Pre/Post Program Analysis

A pre-post program analysis is a type of evaluation that compares data collected before a care management program is implemented to data collected after the program has been in place for some time. As with all the analyses discussed here, the purpose of the analysis is to determine if the program has had a significant impact on the outcomes being measured. Generally, this analysis is conducted by 1) collecting pre-program data, 2) implementing the program, 3) collecting post-program data, and 4) comparing the before and after results to determine if the variance is statistically significant.

The advantages of this analysis include:

1. Easy to implement.
2. Provides a baseline for comparison on patient outcomes, which can be helpful in identifying areas for improvement.
3. Pre-post program analyses can identify areas for improvement in care management programs.

Some challenges of this analysis include:

1. Data quality limitations
2. Pre-post program analyses do not include a control group, which makes it challenging to determine if changes in patient outcomes are the result of the program or other factors.
3. If the program is relatively short-lived, the analysis may not provide an accurate representation of the program's long-term impact.
4. Other factors may impact patient outcomes that are not accounted for in the analysis, such as changes in healthcare policy, changes in staffing levels, or changes in patient demographics.
5. Selection bias may cause the two groups to include meaningfully different populations.

Another significant challenge of this type of analysis is regression to the mean. This is a statistical phenomenon that occurs when a variable that is measured twice over time shows a tendency to move towards its average (or mean) value. In other words, if a variable has an extreme value in one measurement, it is likely to be closer to the mean in the subsequent measurement whether or not the program was actually effective.

Regression/Trend Line Analysis

Regression/trend line analysis is a statistical technique used to analyze the relationship between two variables. The goal is to identify whether a significant relationship exists between the two variables and, if so, to quantify the strength and direction of the relationship.

In this type of analysis, one variable is considered the dependent variable, most likely costs, while the others are considered independent variables, such as demographic/condition variables. A regression line is then drawn through the data points, which represents the best-fit line for the data. The regression line represents the average relationship between the variables, and it can be used to make predictions about the dependent variable based on the value of the independent variables.

Pros of regression/trend line analysis include:

1. Regression/trend line analysis can help identify significant relationships between patient variables and treatment outcomes.
2. Trend line analysis can help predict patient outcomes over time.
3. Regression/trend line analysis provides quantitative data that can support evidence-based decision-making in MSK care management.

Cons of regression/trend line analysis include:

1. Regression/trend line analysis only provides information about the variables that are included in the analysis.
2. Regression/trend line analysis is only as good as the data that it is based on. If there are confounding variables that are not accounted for in the analysis, the results may be misleading.
3. Care must be taken not to over-rely on statistical significance to make decisions in MSK care management.

This analysis is potentially more involved than the pre/post analysis described above since it requires much more detailed claims and computational resources in formulating anticipated claims costs. Regression/trend line analysis could be more in-depth but the depth is dependent on the volume and sufficiency of data available. Additionally, it focuses only on quantitative outcomes. Quality of life outcomes may not be sufficiently considered. This kind of study could also be more resource-intensive and time consuming to conduct.

Participating/Nonparticipating Analysis

Participating/non-participating analyses are a type of analysis used to compare the outcomes of patients who participate in care management programs versus those who do not. In this type of analysis, patients who opt to participate in the care management program are designated as the participating group, while those who do not participate are designated as the non-participating group. The outcomes of the two groups are then compared to assess the impact of the care management program.

This type of analysis requires a methodology for matching participating members to the non-participating cohort. One such method is propensity score matching. This method summarizes multiple characteristics into a single value, which allows matching on the score rather than across certain characteristics. This could only be based on observable variables and would have to determine which propensity scores are close enough to allow for a match. The second matching methodology is a matched cohort analysis. Under this method cohorts with similar risk characteristics, such as age, gender, or disease severity, would be chosen from both the participating and nonparticipating groups. Rather than being limited on matching members one to one, a cohort is chosen from each group to be used for comparison. This allows for more inference of conclusions since it reduces the potential for selection bias than if an individual matching methodology were used.

Some pros to conducting this type of analysis include:

1. Participating/non-participating analyses are based on real-world data, which means that the results are likely to be more applicable to clinical practice.
2. This type of analysis allows for a direct comparison of the outcomes of patients who participate in care management programs with those who do not.
3. Analysis of participating/non-participating data can help identify factors associated with participation in MSK care management programs, such as patient demographics, clinical characteristics, or socioeconomic factors.

Some cons of conducting a participating/non-participating analysis include:

1. Potential for selection bias
2. Lack of control over confounding variables
3. The results of participating/non-participating analyses may not be generalizable to all MSK care management programs or patient populations.
4. This analysis is limited in that it requires an alternative dataset of individuals with similar underlying conditions but without the same care management protocols.

With this type of analysis, there aren't the same credibility issues as the pre/post analysis, since it utilizes a large control group for comparison. As a benefit over the prior two analyses discussed, both quantitative and qualitative measures can be evaluated from the two populations. Although there is potential for results swayed by other conditions within the control group, these can be accounted for using careful selection and segmentation of the populations if data are large enough.

Methodology Selection and Study Considerations

There is no single "best" type of analysis for evaluating the effectiveness of MSK care management programs. Each type of analysis has its own strengths and weaknesses, and the most appropriate analysis will depend on the specific research question being asked, the available data, and the limitations of the data. For example, a pre-post program analysis may be useful for evaluating changes in MSK outcomes over time, while a regression/trend line analysis may be more appropriate for identifying associations between different variables. A participating/non-participating analysis may be useful for

comparing the outcomes of patients who participate in care management programs with those who do not, but it may also be subject to selection bias.

As noted above, availability of data and the specific questions being asked will help inform the ultimate decision on methodology. As the specific research questions are being considered, it's important to recognize that they don't necessarily need to be quantitative or cost-focused in nature as may be typical in a ROI analysis. Due to the uniqueness of the MSK-related conditions, there are components beyond cost that should be considered to understand impact on outcomes. Below is a tabular view of ROI categories and data that may be important in an MSK-related study. At a high level these include components that reduce costs and other benefits that can't be measured with a financial impact. The tables also list sub-components and potential sources of measurement.

High-Level ROI Component	ROI Component	Source of Measurement
Reductions in Cost	Utilization/Admits	Measure # of visits/surgeries
	Cost of Admits	Average unit cost
	Delayed Surgical Care	Measure proximity to surgery
	Decreased PT Visits	Calculate anticipated visits
Other Benefits	Decreased Pain Levels	Survey results
	Increased Range of Motion	
	Other Outcome Measures	

The above components are non-exhaustive and which ones are modeled will be dependent on data availability and goals of the study.

The methodology used is dependent on the research question being asked and the populations being studied. For individuals with historical claims representative of an MSK condition we believe that the most appropriate methodology selection for an MSK care management analysis is the Participating & Nonparticipating matched cohort analysis. The primary reasons for this selection are due to the following:

1. Access to Data: MSK-related issues are common and well-documented in claims records such that it should not be challenging to find a comparable control population not engaged in the given program.
2. Timing: The participating/nonparticipating analysis doesn't require as extensive of a data collection period as some of the other analyses may require.
3. Regression to the mean is a significant hurdle to overcome when applying results for more longitudinal studies as in the pre-post analysis where a control group isn't present.
4. Regression analyses tend to have higher overall complexity which is not appropriate in situations with limited data and resources.
5. Selection biases can be easily overcome if sufficient data are available in both the participating and non-participating populations to develop the necessary population cohorts.

We recognize though that the participating/nonparticipating analysis matched cohort analysis is not powerful enough to answer all questions. It can answer the typical ROI analysis questions pertaining to cost impacts for individuals having MSK-related events. However, we do not believe it can be effectively used to evaluate the MSK-related savings for members who engage with an MSK program and otherwise do not have MSK-related costs in the base period or in the measurement period. For this, a linear regression analysis may be more appropriate, as described later in this section.

The remainder of this section discusses considerations for both the analysis of members with MSK-related history and those without. While the focus of the discussion is around the Participating/Nonparticipating analysis and the regression analysis, many of the principles and considerations can be applied to other analyses.

Analysis of Participants with MSK-related History

Defining a Participant and Defining the Control

A clear definition of how to determine a program participant and the matched cohort is a critical step in evaluating a program's effectiveness. For defining participants, it's important to note that MSK-related interventions are unique from other programs such that a participant cannot simply be defined as anyone who starts the program. The program takes time to complete and individuals frequently start the program but may drop out before completion. Since some members may immediately start and stop the program, we suggest only counting a member as a participant if they've made it through a material portion of the intervention.

The participant population must be matched with a comparable control population. There are a multitude of ways to perform this matching. The most obvious criteria is that the control population needs to have an MSK-related event (i.e. it wouldn't make sense to compare MSK participants to a non-MSK population. Other criteria for selecting the control group could include age, gender, social determinants of health, type of MSK event, severity, etc. These criteria can be used as a way to ensure the distribution is comparable to the participating population or can be used as a way to stratify the population into various comparison groups. The ultimate criteria selected will depend on the availability, comprehensiveness, and volume of participants and data elements. These same criteria could also be considered in a regression analysis.

One additional challenge in defining a control group is centered around selecting members with an MSK-related event. In particular, a participant need not ever have had any prior MSK-related diagnoses or services before engaging in the intervention. Therefore, we cannot solely rely on the baseline data to determine whether to include a member in the control but simultaneously the control population should be limited to members who have MSK-related conditions. To overcome this challenge, there should be care taken to select a control population that has a comparable proportion of members as the participating population with an MSK-related diagnosis or event in the baseline period and 100% with an MSK-related diagnosis or event in the early months of the measurement period.

Baseline Data Collection & Measurement Period Data Collection

One important decision that must be made is how to define the baseline period, during which you can match enrollment, and the measurement period, during which you measure the outcomes for both populations. The baseline period impacts segmentation, but the measurement period is most important in determining the results of the analysis. A primary consideration here is to ensure there is sufficient history to appropriately match the population as well as sufficient runout post-intervention for the program to reach full effectiveness.

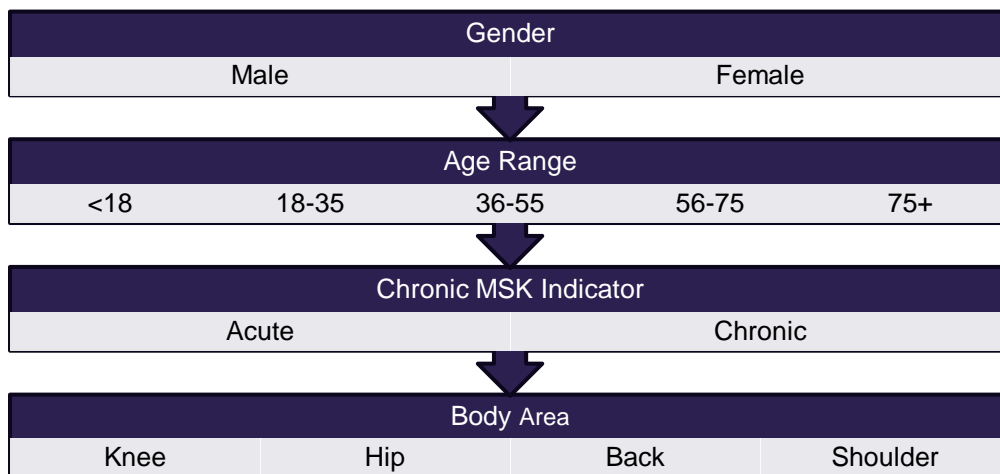
The length of time it takes for MSK-related issues to resolve after diagnosis and intervention depends on several factors, including the type and severity of the condition, the effectiveness of the treatment, and the individual patient's response to treatment. In some cases, MSK-related issues may resolve quickly, within a matter of days or weeks. For example, minor muscle strains or sprains may only require rest and basic pain management techniques, and the patient may experience relief within a few days. In other cases, MSK-related issues may take much longer to resolve, possibly months or even years.

The timeframe for the baseline and measurement periods will depend on the MSK-related outcomes being measured. The acute cases will not require as long a timeframe for the base collection, but chronic MSK cases may need at least a year of data collected. For thoroughness, we recommend at least a full year in all cases for the baseline collection. For the measurement period, since it takes time for outcomes to be impacted, we believe a full-year of data after beginning the intervention is necessary. Furthermore, the measurement data can be analyzed in stages (e.g. 3 months, 6 months, 9 months, 12 months) post intervention to evaluate the time it takes for the improvement in outcomes to be realized. This can be done for both the control and the participating populations. We note that a minimum of a year is not a rule and will depend on the specific questions being analyzed. For example, measuring impacts such as delayed and avoided surgical care likely need a longer timeframe to analyze.

Stratification/Segmentation of Populations: Study Group vs. Control Group

For an MSK care management analysis, it's important to recognize that there are various degrees of MSK conditions and populations. Therefore, the proposed matched cohort analysis should consider stratifying the compared populations into various segments or subgroups. This methodology matches a subset of the participating population to a subset of the nonparticipating population and compares outcomes across both for comparison. This helps ensure validity in the results by confirming that the differential in outcomes between the control and participating populations isn't caused by differences in types of MSK-related conditions or demographics. The control population should be "equivalent" to the participating population. Although each member is unique and equivalence cannot be guaranteed, segmentation would help to create similar cohorts to be used for comparison.

The chart below indicates examples of various levels of stratification to be performed. In a real-world setting, this analysis could be challenging to perform because of the numerous combinations and decreasing credibility of the segments with each one added. Each of these stratifications may not be necessary but which ones are will be dependent on the type of intervention, the purpose of the study, the demographics of the participating population, etc.



Four other potential splits that are not listed here include geography, social determinants of health, more specified MSK diagnoses, and comorbidities.

To reduce potential bias in the segmented populations, the researchers should also consider removing outlier cases from the populations. Outliers can include members with other unique circumstances that contribute to a cost profile that would skew results. For example, members in Hospice, ESRD members, members diagnosed with cancer, maternity patients, and members diagnosed with a chronic condition that could largely sway cost of care/number of office visits should be considered for removal from the study.

Analysis of Participants without MSK-related History

Many MSK members may not previously have had an MSK-related claims event in the base period or the measurement period. As alluded to in the preceding sections, we indicated that savings cannot be measured for these members using the matched cohort cost analysis above. Although the actual cost difference is the best method for evaluating direct ROI impact, predictive modeling can be used to calculate potential savings for members without incurred MSK costs. Using demographic and risk/condition information available, it is possible to predict the likelihood for intense care/surgery.

Predictive analytics is a branch of data analytics that uses statistical algorithms, machine learning, and other data analysis techniques to identify patterns and trends in historical data and make predictions about future events or behaviors. The goal of predictive analytics is to extract insights from past data and use them to forecast what is likely to happen in the future.

More specifically, a generalized linear model (GLM) is a statistical framework that allows us to model the relationship between a response variable and one or more predictor variables in a way that accommodates non-normal distributions of the response variable and non-constant variance. In a GLM, we assume that the response variable follows a probability distribution from the exponential family (e.g., normal, binomial, Poisson, gamma) and that the conditional mean of the response variable is a function

of the predictor variables, usually modeled using a linear combination of the predictors. However, the response variable need not be normally distributed or have constant variance, as in linear regression.

Under the proposed MSK study, anticipated surgery costs would be the response variable and the one or more predictor variables would be the member's demographic and risk condition information. The model would first need to be tested against the control population to determine which predictors have significant predictive capabilities. Since not all variables will likely be significant, it is best to start with more predictor variables and eliminate as needed. In addition to the parameters suggested in the participating/non-participating analysis, we suggest collecting the following information to serve as predictive variables for expected costs:

1. Geographic location: Healthcare costs can vary depending on the region in which the patient lives. At a minimum this should consider urban versus rural environments
2. Insurance coverage: The type and amount of insurance coverage a patient has can affect the cost of medical services.
3. Provider network: The provider network a patient uses, and whether they are in-network or out-of-network, can also impact costs.
4. Socioeconomic status: Patients with lower socioeconomic status may have higher healthcare costs due to limited access to preventative care and higher rates of chronic conditions.
5. Previous medical history: Previous medical history can impact healthcare costs, with patients with a history of high healthcare utilization likely to have higher costs in the future.

Once the predictive variables have been chosen, the model will need to be tested. To test the accuracy of a generalized linear model, you need to evaluate the model's performance on a test dataset that the model has not seen during training. After selecting the best predictive model, it can be used to make predictions for both the control and study group. The members from both groups would be run through the GLM to determine expected surgery costs during the measurement period, which would be compared against actual surgery costs. With these analyses of quantitative measures, the member may not have any spend or utilization in the baseline or measurement period, but their collected predictive information could still be used to quantify program impact.

Return on Investment Measures & Analyses

Return on Investment (ROI) is the financial metric used to evaluate the profitability of an investment or project. It is calculated by dividing the net profit of the investment by the initial cost of the investment, expressed as a percentage. For the purposes of an MSK impact analysis, we would consider the following formula to quantify ROI to health plans:

ROI = (Savings in medical costs due to Care Management program – Costs of Care Management program) / Costs of Care Management Program

The savings component would be determined from measuring the change in outcomes from the base period to the measurement period for the control population and the participating population. The differential in change of outcomes between the two populations can be considered as the savings. Below we go into more detail on how those outcomes can be measured.

ROI Analysis of Claim Costs

Calculating savings from claim costs is typically the most straight forward of the ROI components to collect and compare. The research question is simply “how does cost vary between the members enrolled in the managed care program and the control population during the measurement period?” With the matched cohort analysis, these cost comparisons are performed within each of the various segments. As such, the study may find that there is a meaningful impact for males, aged 36-55 with back pain but there isn’t such an impact on females under 18 with lower back pain. The conductors of the study should be prepared to evaluate the outcomes for each of the segmented cohorts as well as in aggregate across all segments.

Identification of what costs to include are important and the implications of each should be known. The two primary options are 1.) MSK-related costs only and 2.) Total cost of care. There are challenges with each that the researchers should be prepared to address such as coding practices across providers or variability in total claims costs due to other conditions. These claim costs should be collected and compared across the mentioned cohorts to evaluate where there are meaningful differences and decreased costs or savings in the study group due to the MSK care management program. It is not necessary to focus entirely on the cost side. Costs are generally reduced by means of lower unit costs or lower utilization patterns. Therefore, if costs are indeed lower in the participating population, it’s reasonable and appropriate to further explore what in particular is contributing to lower costs. This can be evaluated by studying the utilization and cost patterns among service categories (e.g. ER vs Surgery vs Physical Therapy).

These claims comparisons described in this section reflect a tangible methodology that can be used to measure actual cost savings for members with a history of MSK-related claims, and those without during the baseline period. The matching methodology considers these groups separately from each other, and differences in costs between the control and study groups may still be considered during the measurement period. However, in the case that members do not have MSK-related claims during either the baseline or measurement period, alternative methods for measuring savings can be considered.

Other Considerations

In addition to the quantifiable impacts to ROI above as a result of cost reductions, there are other measurable not explicitly financial impacts as well. This essentially means that there are aspects of the program that may generate ROI that can’t be directly attributed to a financial result. Examples include member satisfaction, member retention, quality of life improvements, improvements in pain levels, etc. There is no doubt that improvements in these categories are positive for the member, but these benefits simply cannot be assigned a dollar value.

Surgical avoidance and delay provide real savings, but they may not always be easy to quantify given the limited time frames measured. Research has shown that non-surgical interventions like Physical Therapy, can significantly reduce or delay surgeries in future years (see: Demir-Deviren, Sibel et al, 2019 and Noorduyn, et al, 2022, and Delitto et al, 2015.) Further, non-surgical patients in both studies showed improvements relative to surgical patients in clinical measures like pain, function, and opioid utilization over a multi-year time horizon.

To compare quality of life information, a range of survey results must be available for both the program participants and the control group. During the measurement period, pain levels, range of motion, and other measured goals or outcomes achieved can be compared among the two groups. We would suggest consistent surveys and data collection among both groups, and the consideration of how those results may change throughout the measurement period. We recognize that in a real-world setting, this information may not be available. However, satisfaction and pain reduction are considerations to build out a more complete ROI analysis. If possible, we recommend the relevant parties to the analysis decide, before conducting the analysis, how these results could translate into a relevant financial figure for the ROI study or a value-based payment arrangement.

For an ROI analysis, the above components measure the return of the MSK care management program. Although, the qualitative measures may not be used, the cost savings measures would be used to compare against the original investment or cost of administering the program. This ratio would represent the quantitative valuation of the program's ROI, but member's well-being as measured through qualitative measures should also be considered.

Conclusion

In conclusion, the exploration of various MSK care management analyses presented in this paper sheds light on the critical importance of these evaluation methods in enhancing healthcare outcomes, cost-efficiency, and patient satisfaction. A well-rounded care management review strategy that integrates retrospective, prospective, and concurrent analyses, along with advanced data analytics, is essential for optimizing healthcare delivery and achieving positive patient outcomes while containing costs. As the healthcare landscape continues to evolve, it is imperative for healthcare organizations to embrace these methodologies, continually refine their care management strategies, and prioritize patient-centered care.

The authors may be reached at the following emails for any questions or to discuss any of the concepts presented here:

Jackie Walker – Jackie.Walker@Wakely.com

Robert Lang – Robert.Lang@Wakely.com

Sean Kinsman – SKinsman@recovereveryone.com

Jason Wendt – JWendt@recovereveryone.com

Wakely's STORY

Five decades. Wakely began in 1969 and eventually evolved into several successful divisions. In 1999, the actuarial arm became the current-day Wakely Consulting Group, LLC, which specializes in providing actuarial expertise in the healthcare industry. Today, there are few healthcare topics our actuaries cannot tackle.

Wakely is now a subsidiary of Health Management Associates. HMA is an independent, national research and consulting firm specializing in publicly funded healthcare and human services policy, programs, financing, and evaluation. We serve government, public and private providers, health systems, health plans, community-based organizations, institutional investors, foundations, and associations. Every client matters. Every client gets our best. With more than 20 offices and over 400 multidisciplinary consultants coast to coast, our expertise, our services, and our team are always within client reach.

Broad healthcare knowledge. Wakely is experienced in all facets of the healthcare industry, from carriers to providers to governmental agencies. Our employees excel at providing solutions to parties across the spectrum.

Your advocate. Our actuarial experts and policy analysts continually monitor and analyze potential changes to inform our clients' strategies – and propel their success.

Our Vision: To partner with clients to drive business growth, accelerate success, and propel the health care industry forward.

Our Mission: We empower our unique team to serve as trusted advisors with a foundation of robust data, advanced analytics, and a comprehensive understanding of the health care industry.

Learn more about Wakely Consulting Group at www.wakely.com

RecoveryOne's Story

Revolutionizing MSK Care. Founded by a preeminent orthopedist in 2014, RecoveryOne delivers musculoskeletal (MSK) care through a technology-enabled user experience. RecoveryOne's virtual programs make it easier for individuals with MSK conditions to access high-quality care anytime, anywhere.

Human-First, Technology-Amplified Programs. Licensed physical therapists and certified health coaches monitor member progress, providing ongoing condition management and behavior change support via convenient, easy-to-use technology.

Clinical Excellence. RecoveryOne delivers positive outcomes through a rigorous clinical process supported by evidence-based methodologies. With over 200 clinically-validated programs and the ability to customize each to the needs of the individual, we support the recovery of every member uniquely.

Our Vision. A future where each individual embraces a personalized journey of physical, emotional, and mental recovery from musculoskeletal conditions. In this future, every individual has the resources, motivation, and confidence to get back out there.

Our Mission. To empower full MSK recovery and better health for individuals and populations, at a lower cost.

Learn more at Recoveryone.com