

Research report

# 2024 Hinge Health Medicare Cost and Utilization Study



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# Executive summary

Hinge Health's chronic musculoskeletal (MSK) program is a digital care program designed by physical therapists and physicians to help members manage chronic MSK pain through computer vision and sensor-guided exercise therapy, education, and health coaching. Prevalence of MSK conditions is higher among older adults (aged 65 and over) and poses significant risk for increasing MSK-related healthcare spend. Although, a previous OptumInsight, Inc study has shown the Hinge Health program may lead to reduced MSK medical care use and medical claims spend among traditional Medicare beneficiaries<sup>1</sup>, possibly through higher engagement and achieving similar pain improvement as younger adults<sup>2</sup>, more studies are needed to examine the impact of the Hinge Health program on medical care use and spend, particularly on MSK care (e.g. surgery, injection, etc.) among older adults.

## A second study with OptumInsight, Inc

To achieve this goal, Hinge Health engaged OptumInsight, Inc for a second time to conduct a new claims study to estimate medical care use and medical claims spend on a larger and more recent group of Hinge Health members. Similar to the previous OptumInsight, Inc report, this study focused on Medicare Fee for Service (FFS) beneficiaries (aged 65 and over) and compared Hinge Health members to a matched, control group of nonparticipants. MSK-related healthcare spend was obtained from Medicare FFS enrollment and claims data under Parts A and B through the Centers for Medicare and Medicaid Services (CMS) Qualified Entity Program.

The analysis included 5,502 participants (1,222 Hinge Health members and 4,280 matched control participants). Hinge Health members spent \$274.11 less per member per month (PMPM) compared to matched non-Hinge controls on MSK services in the 12 months after program start date.

# \$274.11

Hinge Health members spend  
\$274.11 less per member per month

# 3.3 ROI

These savings translate to a gross  
return on investment of 3.3

These savings translate to a gross return on investment of 3.3 (i.e., \$3289 annualized savings divided by the \$995 Hinge Health program fee). The main drivers of cost savings were reduced hospital inpatient and outpatient facility spend and spend for professional services from specialists. Majority of the savings in this study came from reduction in use of services for members with diagnoses of osteoarthritis, spondylopathies/spondyloarthropathy, and joint pain.

In conclusion, the Hinge Health program resulted in reduced MSK-specific medical care use and medical claims spend within one year after the start of the program among Medicare FFS beneficiaries.



# Background

Chronic MSK pain significantly contributes to disability and spending in the United States, especially among older adults. MSK disorders were the leading cause of years lived with disabilities (YLD) among older adults aged 70 and over (7554 YLD per 100,000 adults) in the United States in 2019.<sup>3</sup> One common MSK disorder, osteoarthritis, shows increasing incidence and prevalence with age.<sup>4</sup> With aging populations, the standardized annualized rate of change for spending on osteoarthritis was 5.7% between 1996 and 2016, reaching \$80 billion in 2016, with most of the expenditures going to inpatient care for adults aged 65 years and over.<sup>5</sup>

## Digital health approaches

Clinical guidelines recommend that patients pursue conservative care before using high cost MSK surgeries because exercise and education are effective for managing MSK pain and associated comorbidities.<sup>6 7 8 9 10 11 12</sup> Digital health approaches are among the newest modalities for delivering these conservative therapies and can significantly improve knee and low back pain, and disability.<sup>13 14 15</sup>



Hinge Health is one such digital program that helps members manage chronic MSK pain through guided exercise therapy, education, and one-on-one health coaching for all members. Animations and videos demonstrate how to perform exercises (e.g., position, repetitions, duration). Computer vision technology powered by AI and motion sensors delivers more effective and engaging exercise therapy.

## The Hinge Health program provides educational resources about

- ① pain neuroscience
- ② movement
- ③ treatment options
- ④ coping
- ⑤ lifestyle changes
- ⑥ relaxation
- ⑦ social support
- ⑧ habit creation

Individual health coaches encourage members to complete at least three exercise therapy sessions per week and to adhere to the program. Coaches work with members to set goals, identify challenges to performing exercises, and implement strategies to overcome challenges.

In addition, physical therapists and orthopedic surgeons are available to consult, advise, and adapt or modify the program to maximize efficacy. Members may access all program components and providers through a dedicated app on a personal device.

## Higher engagement among older adults

Hinge Health has previously demonstrated high engagement and strong clinical outcomes among older adults. One study found that compared to younger adults, adults aged 65 and older had higher odds of completing Hinge Health's core 12-week program, completed 19 more exercise sessions, accessed 11 more articles, and sent 4 more messages to coaches. Younger and older adults had similar improvements in pain after the Hinge Health program.<sup>16</sup> In summary, older adults used Hinge Health more than younger adults, but had similar pain outcomes.

Although older adults in Hinge Health's chronic program had notable engagement and clinical outcomes, it had been unclear the extent to which the Hinge Health program decreased older adults' use of avoidable medical care services. To address this gap, this study's primary objective was to estimate medical care use and medical claims spend on MSK services for Hinge Health members versus a matched, control group of nonparticipants (herein, control group). To achieve this objective, this study examined post program change in MSK care use and spend by focusing on Medicare FFS beneficiaries. The study's secondary objective was to explore drivers of medical care savings produced by the Hinge Health chronic MSK program. Study results provided evidence about whether and how Hinge Health prevented use of high-cost, avoidable medical care.

# Methods

## Study design

This retrospective study calculated changes in medical care use and spend for traditional Medicare beneficiaries, after they started the Hinge Health program, compared to a matched control group. This study used Medicare FFS enrollment and claims data under Parts A and B obtained via the CMS Qualified Entity Program.

## Hinge Health and Control Group





Table 1 shows the inclusion and exclusion criteria for Hinge Health and the control group.

Table 1 – Inclusion and exclusion criteria

### Hinge Health group

-  Age 65 or older
-  Enrolled in Hinge Health for back, knee, shoulder, hip, or neck pain and completed one exercise session or accessed one educational article between February 2019 and January 2022
-  Continuously enrolled in Medicare Part A and Part B plans for at least 12 months before and 12 month after starting Hinge Health
-  Did not have more than \$150,000 in medical spend in the 12 months before starting Hinge Health

### Control group

-  Age 65 or older
-  Started physical therapy (herein, index event) for back, knee, shoulder, hip, or neck pain between February 2019 and January 2022
-  Continuously enrolled in Medicare Part A and Part B plans for at least 12 months before and 12 month after the index event
-  Did not have more than \$150,000 in medical spend in the 12 months before the index event

## Matching

Hinge Health members were matched to up to four control group members in two steps. First, Hinge Health members were matched exactly to control group members by a combination of characteristics including age category, gender, census division area, cancer diagnosis, any fall in the prior 12 months, Medicare secondary payer status, physical therapy (PT) use in the prior 12 months, and program start month and pathway (i.e. exact matching). Second, the exactly matched groups were further matched using a propensity score matching method based on risk score, dual status, baseline MSK service use (including imaging, injection, office visit, surgery), and total cost of care. We matched 1,222 Hinge Health members to 4,280 control members and included them in the analysis.

## Outcomes

The study included Per Member Per Month (PMPM) paid amounts for all medical care services with MSK-specific primary diagnosis codes in the 12 month post-period.

To examine drivers of savings, we examined paid amounts and service use for the following MSK-specific service categories: hospital inpatient and outpatient (facility) services, professional services by primary care providers and specialists; and subcategories: surgery, PT visit, office visit, injection, imaging, medication, ER visit, lab, and other MSK procedures using the Restructured BETOS Classification System. We explored specific diagnostic categories related to MSK conditions (see Appendix A). These categories were defined using ICD-10 diagnosis codes and grouped based on the Agency for Healthcare Research and Quality Clinical Classifications Software system.

## Analysis

The study calculated PMPM spend and annual service use for the Hinge Health and the control group in the 12-month post-period. The difference in spending or service use between the two groups is the control group result minus the Hinge Health group result. The relative change between the two groups is the control group result divided by the Hinge Health group result.

Using the Wilcoxon Test for significance (two-sided), we tested the MSK specific costs (paid PMPM) of the control and Hinge group for the 12 months post-program enrollment.

Additional details about the study method are shown in [Appendix A](#).

# Results

## Demographic Characteristics

Table 2 shows the demographic characteristics of Hinge Health members (N=1,222) and the control group (N=4,280) who started between February 2019 and January 2022. More than half of Hinge Health group (63.5%) were in the 65 to 74 years age group, 65.4% were female, and almost three out of every four members (69.5%) lived in the southwest central census region. Half of Hinge Health members had a back related MSK condition (48.4%), followed by knee and hip (21.1% and 12.0 %, respectively). One in five members had a PT visit (22.0%) prior to starting the Hinge Health program, and the average Hierarchical Condition Category (HCC) risk score was 0.828.

Table 2 – Baseline characteristics of the matched groups

	Hinge Health group (A)	Matched control group (B)
Number of unique members	1,222	4,280
<b>Exact matched characteristics</b>		
Age: 65-69	29.90%	28.20%
Age: 70-74	33.60%	35.00%
Age: 75-79	23.90%	24.90%
Age: 80-84	9.20%	8.60%
Age: 85-89	3.40%	3.30%
Female	65.40%	67.10%
Census Division: ES Central	2.00%	1.90%
Census Division: Middle Atlantic	1.00%	0.90%
Census Division: Mountain	4.30%	4.10%
Census Division: NE Central	3.50%	3.40%
Census Division: New England	-	-
Census Division: Pacific	8.50%	8.30%
Census Division: South Atlantic	7.80%	7.90%
Census Division: WN Central	3.40%	3.60%
Census Division: WS Central	69.50%	70.00%
Member had a cancer diagnosis in the study period	9.90%	7.60%
Member had a fall in the 12 months before	9.60%	8.30%
Medicare as secondary payer	5.50%	2.70%
Member used any PT in the 12 months before	22.00%	20.50%
MSK condition: Back	48.40%	49.40%
MSK condition: Hip	12.00%	11.60%
MSK condition: Knee	21.10%	21.20%
MSK condition: Neck	10.90%	10.10%
MSK condition: Shoulder	7.50%	7.70%
<b>Propensity score matched characteristics</b>		
Not dual eligible	99.90%	100.00%
Member used any imaging in the 12 months before	35.50%	37.00%
Member used any injection in the 12 months before	20.80%	20.80%
Member used any MSK office visit in the 12 months before	42.80%	43.70%
Member used any MSK surgery in the 12 months before	3.40%	2.70%
Risk Score	0.828	0.792
<b>Total Cost of Care (PMPM)</b>	<b>\$461.99</b>	<b>\$438.16</b>

## Spend and service use, by service category

The control group’s spend for chronic MSK-specific medical services in the post-period was \$274.11 PMPM greater than the Hinge Health group (i.e., 3.1 times higher, Table 3).

Table 3 also shows that, compared to the Hinge Health group, the control group had \$35.40 and \$192.36 PMPM higher spend for services in hospital inpatient and outpatient facilities, respectively, and \$40.23 PMPM higher spend for professional services from specialists. That is, the control group’s spend was 4.1 times higher for hospital-based services and 1.8 times higher for specialist professional services versus the Hinge Health group.

4.1x

higher spend on hospital-based services for the control group

1.8x

higher spend on specialist professional services for the control group

In the post-period, Hinge Health group’s total, hospital, professional specialist, and professional primary care PMPM were all significantly lower than the control group’s PMPM (p < 0.05).

Table 3 – MSK-Specific PMPM Medical Care Spend in the Post-Period for Hinge Health Versus Control Group

Service Category	Hinge Health group (A)	Matched control group (B)	Difference (B-A)	Relative Change (B/A)
Total chronic MSK	\$131.12	\$405.23	\$274.11	3.1
Hospital - Inpatient	\$30.67	\$66.07	\$35.40	2.2
Hospital - Outpatient	\$42.85	\$235.21	\$192.36	5.5
Professional - PCP	\$7.83	\$13.95	\$6.12	1.8
Professional - Specialist	\$49.77	\$90.00	\$40.23	1.8

Table 4 shows MSK spend for specific service types for the Hinge Health group compared to the control group in the post-period. MSK surgery and PT visits were the main drivers of savings. The control group had \$163.24 and \$47.08 higher PMPM spend on surgery and PT visits respectively, indicating that the control group spent approximately 4 times more (4.1 and 4.0) on these services.

Table 4 – MSK-Specific PMPM Medical Care Spend in the Post-Period for Hinge Health Versus Control Group

Service Category	Hinge Health group (A)	Matched control group (B)	Difference (B-A)	Relative Change (B/A)
Surgery (IP & OP)	\$52.75	\$215.99	\$163.24	4.1
PT visit	\$15.76	\$62.84	\$47.08	4.0
Office visit	\$12.31	\$21.58	\$9.27	1.8
Injection	\$15.98	\$20.86	\$4.88	1.3
Other MSK procedure	\$5.98	\$16.29	\$8.48	2.4
Imaging	\$6.27	\$12.59	\$6.32	2.0
Medication	\$5.34	\$10.52	\$5.18	2.0
ER visit	\$1.06	\$3.99	\$2.93	3.8
Lab	\$1.53	\$3.27	\$1.74	2.1
Other	\$14.14	\$39.13	\$24.99	2.8
<b>Total</b>	<b>\$131.12</b>	<b>\$405.23</b>	<b>\$274.11</b>	<b>3.1</b>

Per 1,000 FFS beneficiaries, the control group had 123 more hospital inpatient days, 10,755 more outpatient visits or procedures, 1,021 more primary care provider visits or procedures, and 2,464 more specialist visits or procedures compared to the Hinge Health group (Table 5). That is, the control group had 2.1 times more hospital inpatient days, 6.8 times more outpatient visits or procedures, 1.9 times more primary care provider visits or procedures, and 1.3 times more specialist visits or procedures versus the Hinge Health group.

Among the specific MSK services, the control group had 353 more surgeries (both inpatient and outpatient), 7,467 more PT visits compared to the Hinge Health group (Table 5). That is, the control group had 6.3 times more surgeries and 2.6 times more PT visits versus the Hinge Health group. This is consistent with Table 4 where surgeries and PT visits are the main drivers of MSK spend in the control group.

# 6.3x

Control group had 6.3 times more surgeries

# 2.6x

Control group had 2.6 times more PT visits

Table 5 – MSK-Specific Service Use (per 1000 Beneficiaries) in the Post-Period for Hinge Health Versus Control Group

Service Category (utilization per 1,000 member per year)	Hinge Health group (A)	Matched control group (B)	Difference (B-A)	Relative Change (B/A)
Inpatient stay days	108	231	123	2.1
Outpatient visits/ procedures	1843	12598	10755	6.8
PCP visits/ procedures	1200	2221	1021	1.9
Specialist visits/ procedures	9063	11527	2464	1.3
<b>Specific MSK service use</b>				
Surgery (IP & OP)	67	420	353	6.3
PT visit	4545	12012	7467	2.6
Office visit	2065	3343	1278	1.6
Injection	985	1276	292	1.3
Other MSK procedure	193	385	192	2.0
Imaging	1433	2661	1228	1.9
Medication	435	692	257	1.6
ER visit	49	129	80	2.6
Lab	714	1213	499	1.7

## Spend by diagnostic category

Table 6 shows spend for MSK diagnostic categories in the Hinge Health group versus the control group. The three diagnostic categories with the largest differences in spend were osteoarthritis, spondylopathies, and MSK pain (not low back pain). Specifically, compared to Hinge Health group, the control group had \$132.15 PMPM higher spend for osteoarthritis, \$74.29 PMPM higher spend for spondylopathies, and \$18.48 PMPM higher spend for MSK pain (not low back pain).

Table 6 – PMPM Medical Care Spend in the Post-Period for MSK-Specific Diagnostic Categories Among Hinge Health Versus Control Group

Top CCS Detailed Categories	Hinge Health group (A)	Matched control group (B)	Difference (B-A)	Relative Change (B/A)
<b>Total Chronic MSK Cost of Care</b>	<b>\$131.12</b>	<b>\$405.23</b>	<b>\$274.11</b>	<b>3.1</b>
Osteoarthritis	\$42.22	\$174.37	\$132.15	4.1
Spondylopathies/ spondyloarthropathy (including infective)	\$47.95	\$122.24	\$74.29	2.5
Musculoskeletal pain, not low back pain	\$13.81	\$32.28	\$18.48	2.3
Low back pain	\$4.26	\$19.96	\$15.69	4.7
Rheumatoid arthritis and related disease	\$4.21	\$9.32	\$5.12	2.2
Scoliosis and other postural dorsopathic deformities	\$0.17	\$4.92	\$4.75	29.1
Other specified connective tissue disease	\$2.36	\$6.05	\$3.69	2.6
Other specified joint disorders	\$1.12	\$4.69	\$3.57	4.2
Osteoporosis	\$3.50	\$6.48	\$2.98	1.9
Tendon and synovial disorders	\$4.38	\$7.31	\$2.93	1.7

# Discussion

This retrospective control-matched study showed that Hinge Health chronic program significantly reduced MSK-specific medical care use and spend. Based on findings, we estimated a gross return on investment of 3.3 (i.e., \$3,289 annualized savings divided by the \$995 Hinge Health program fee, Table 7).

Table 7 - Annualized Savings and Gross Return on Investment Estimates

\$274	\$3,289	\$995	3.3
PMPM Difference - Savings Estimate	Annualized Difference - Savings Estimate (a * 12)	Hinge Health Program Fees	Gross Return on Investment (b/c)

Savings were largely driven by avoided medical services in hospital facilities. Of the \$274.11 PMPM in savings for all MSK-services, 83% of the savings were from hospital inpatient and outpatient services (i.e., \$227.76) and 15% were from the spend for professional services from specialists (i.e., \$40.23). Furthermore, we observed that hospital (inpatient and outpatient) use per 1,000 FFS beneficiaries was 6.6 times higher for the control group versus the Hinge Health group.

In addition, savings were largely driven by certain diagnostic categories. Of the \$274.11 PMPM in savings, 48% were for osteoarthritis (i.e., \$132.15), 27% were for spondylopathies (i.e., \$74.29), and 7% were for MSK pain (not low back) (i.e., \$18.48). These findings are notable given the Centers for Disease Control and Prevention has projected that over one-quarter of the total adult population in the US will have MD-diagnosed arthritis by the year 2040.<sup>17</sup>

Compared to the previous OptumInsight, Inc study that focused on Medicare beneficiaries who had not used any prior MSK care, this study estimated a higher PMPM MSK cost saving as it also included members who had a prior MSK medical claim. It is plausible that some of these members who used traditional MSK care (e.g. PT, doctor office visit, etc.) prior to participating in the Hinge Health program might have planned to seek more invasive procedures such as joint replacement surgeries. Findings of this study highlighted the potential of digitally delivered conservative MSK care on meeting the MSK care need among members who are more advanced in their MSK journey.

Most Hinge Health members started the chronic program in 2020-2021 and were matched to control group members with PT visit in the same timeframe. Some study participants' 12-month baseline or post-period was during the COVID-19 pandemic, which disrupted elective, in-person medical care. Cost and service use results were likely lower than non-pandemic periods for both groups, but we assumed that the pandemic influenced the magnitude of change similarly for both Hinge Health and the control group.

The matching criteria were intended to identify a control group that was as similar as possible to the Hinge Health group on important member characteristics. After matching, both groups were similar. Matching is intended to improve the direct comparability of the Hinge Health group to the control group, resulting in more accurate estimates of the impact of the Hinge Health program on MSK-specific medical care use and spend.

When identifying matches for the Hinge Health population, we established that starting PT was equivalent to starting the Hinge Health program. We defined the start of PT for the control group (or the index event) as any PT visit with no prior visit in the 90 days leading up to that visit. We required that control matches started PT in the same month and for the same body region as Hinge Health members. We did not analyze the severity of the condition, but assumed that on average, the severity of Hinge Health members was equal to the severity of control members.

Study results may be most generalizable to a specific segment of the Medicare FFS population. Hinge Health members in this study included those with both Parts A and B, supplemental employer-based insurance (which covered Hinge Health fees). For example, findings may be slightly weighted by younger Medicare FFS beneficiaries. Almost 37% of Hinge Health members in this study versus 40% of the general Medicare FFS with both Parts A and B and employer-based health insurance were 75 years or older.<sup>18</sup>

## Conclusion

Among Medicare FFS beneficiaries, the Hinge Health chronic MSK program was shown to save \$3,289 annually, largely by reducing spend on hospital-based services and influencing osteoarthritis care.

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# Appendices

## Appendix A. Methods Details

### MSK Diagnosis codes included in the analysis to identify MSK-specific medical claims

G5700, G5701, G5702, M12011, M12012, M12019, M12051, M12052, M12059, M12061, M12062, M12069, M12111, M12112, M12119, M12151, M12152, M12159, M12161, M12162, M12169, M1218, M12211, M12212, M12219, M12251, M12252, M12259, M12261, M12262, M12269, M12311, M12312, M12319, M12351, M12352, M12359, M12361, M12362, M12369, M12411, M12412, M12419, M12451, M12452, M12459, M12461, M12462, M12469, M12511, M12512, M12519, M12551, M12552, M12559, M12561, M12562, M12569, M12811, M12812, M12819, M12851, M12852, M12859, M12861, M12862, M12869, M13111, M13112, M13119, M13151, M13152, M13159, M13161, M13162, M13169, M13811, M13812, M13819, M13851, M13852, M13859, M13861, M13862, M13869, M14611, M14612, M14619, M14651, M14652, M14659, M14661, M14662, M14669, M1468, M14811, M14812, M14819, M14851, M14852, M14859, M14861, M14862, M14869, M1488, M160, M1610, M1611, M1612, M162, M1630, M1631, M1632, M164, M1650, M1651, M1652, M166, M167, M169, M170, M1710, M1711, M1712, M172, M1730, M1731, M1732, M174, M175, 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## Service Category Definitions

- Inpatient – Medicare CLM\_TYPE\_CD = '60'
- Outpatient – Medicare CLM\_TYPE\_CD = '40'
- Professional – primary care provider – Medicare Part B CLM\_TYPE\_CD in ('81', '82) with provider specialty codes in ('01','08','11','16','50','89','97')
- Professional – specialist – Medicare Part B CLM\_TYPE\_CD in ('81', '82) with other provider specialty codes
- Other – Medicare Part B CLM\_TYPE\_CD in ('81', '82) with OptumInsight, Inc defined service categories including Ambulance, Home Health, DME, and Part B Rx claims.

## Specific MSK service subcategories definition

Surgery, PT visit, office visit, injection, imaging, medication, ER visit, lab, and other MSK procedures were defined using the Restructured BETOS Classification System published by Centers for Medicare and Medicaid services.

<https://data.cms.gov/provider-summary-by-type-of-service/provider-service-classifications/restructured-betos-classification-system>