

Title: Impact of Multimedia Interventions for Musculoskeletal Health Amidst COVID-19 Pandemic

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Abstract: Lower extremity joint pain is a leading cause of disability and immobility in the United States. Movement is Life seeks to educate and empower patients to break the cycle that immobility starts in efforts to improve musculoskeletal and overall emotional and physical wellbeing. Studies in the past have described the correlation that exists between using Movement is Life education materials as well as a home exercise program to improve lower extremity pain and overall health short term but did not account for confounding factors during the COVID-19 pandemic. The effect of the COVID-19 pandemic on health goes beyond patients that have contracted the illness by promoting a sedentary lifestyle in the general public. This study aims to expand on previous research by comparing the short-term effects of this combined approach in lieu of the COVID-19 pandemic to results from previous years. Eligible patients were surveyed in a clinical setting in South Texas before educational and exercise intervention and then re-surveyed 2 weeks and 4 weeks following initial intervention with additional questions regarding health during the COVID-19 pandemic. Results were compared to results from similar studies from previous years. Paired and unpaired 2-tailed T-Tests were used to analyze the mean response differences when applicable. Overall mean improvements were observed when comparing follow up 2 and 4 weeks after intervention to baseline survey responses in previous studies, but no such clear or significant improvements were seen in our current cohort. Based on these data, we can conclude that although a combined approach of multimedia education and home exercise program can be a useful treatment alternative for patients with lower extremity joint pain, positive results are strongly influenced by the available opportunities patients have to physical activity. The COVID-19 pandemic has had a negative effect on patients' physical and emotional health especially in areas with high prevalence of health care disparities and physicians should be aware of this reality when initiating such treatments.

Introduction: Lower extremity joint pain and osteoarthritis are two of the leading causes of disability in the United States¹⁻². It has been well documented that immobility and sedentary lifestyle are risk factors for arthritic joint pain, and that exercise can improve and even reverse symptomatic joint pain⁴⁻⁵. Movement is Life is a national program aimed at raising awareness of how exercise and proper nutrition can help improve not only musculoskeletal pain and mobility but also emotional and general wellbeing. Movement is life seeks to empower patients by educating them on the consequences of a sedentary life and hopes to break the cycle of immobility, obesity, and joint pain by giving patients information on how to improve their lifestyle and health³. Studies in the past have described the positive relationship between "social prescribing" of exercise and lifestyle change on health outcomes⁶. Furthermore, studies have also demonstrated how multimedia education from Movement is Life combined with a home exercise program can improve short-term lower extremity joint pain levels as well as overall emotional

and physical wellbeing¹²⁻¹⁴. However, in the context of the global COVID-19 pandemic, engaging in physical activity and maintaining a healthy lifestyle has proven to be difficult and has likely affected patients' health in multiple ways⁷. The purpose of this study is to expand on previous research by comparing previous cohort's results to a new cohort while taking into consideration the effect that the COVID-19 pandemic has had on musculoskeletal and overall health.

Methods: Following methods from previous studies, 17 patients with lower extremity joint pain of the hip, knee, or ankle were surveyed in a clinical setting in South Texas¹⁴. Exclusion criteria included a history of prior lower-extremity surgery (within 1 year) except for diagnostic knee arthroscopy. Consenting participants were provided with a short survey asking general demographic information followed by a series of questions asking participants to rate pain level and its effect on their daily living, eating habits, emotional well-being, and physical activity level on a scale from 1-10 (1= poor, 10= very good/excellent). Participants were provided with multimedia educational materials including the Movement is Life brochure, links to the Movement is Life website, and a "Start Moving Start Living" video³. Multimedia educational materials were provided in both Spanish and English. Participants also received information and exercises specific to their diagnosis from the Sports Medicine Patient Advisor to be done at least once weekly¹¹. They then had follow-up phone calls every 2 weeks for 4 weeks after their initial visit, which consisted of a similar questionnaire to their baseline survey to compare with initial values. 3 questions were added to the 2-week follow up survey to address the effect that the COVID-19 pandemic had on patients' physical and emotional wellbeing as well as their employment status. Responses to these surveys were compared to corresponding responses from previous studies in 2019 before the COVID-19 pandemic. Data were analyzed using paired and unpaired sample 2-tailed T-tests where applicable.

Results: Mean baseline survey responses showed no statistically significant differences between the 2019 and 2020 cohorts (with exception of "Health improvement motivation": 2019 mean= 7.105, 2020 mean= 8.88, $p= 0.026$). When comparing 2 week responses to baseline the 2019 cohort showed improvement across all health outcomes with statistically significant improvement in pain level, overall activity level, and total weekly physical activity minutes: pain level (mean at baseline= 4.316, mean at 2 weeks= 5.474, $p= 0.022$), overall activity level (mean at baseline= 4.105, mean at 2 weeks= 5.00, $p=0.022$), physical activity minutes (mean at baseline= 162.778, mean at 2 weeks= 329.739, $p= 0.031$). Comparing 2 week results to baseline, the 2020 cohort showed mixed improvement and deterioration in health outcomes however none were statistically significant. When comparing responses from baseline to 4 weeks in the 2019 cohort, there were statistically significant improvements across all health outcomes. The 2020 cohort showed mean improvements across all health outcomes with exception of difficulty with work/school, emotional wellbeing, motivation and physical activity minutes. None of these results were statistically significant. When the 2020 cohort was asked how the COVID-19 had affected their physical and emotional health, group means were 3.786 and 4.071 respectively. Additionally, of the 14 patients that responded at 2 weeks, 10 patients reported the COVID-19 pandemic had negatively affected their employment status, with 7 patients now being unemployed (Table 2). Of the original 17 patients surveyed in the 2020 cohort, 5 were lost to follow up. Overall, patients were very satisfied with the educational materials they were provided with (mean at 4

weeks= 9.333). Mean health outcome results are graphed in Figure 1 below. Mean health outcomes and T-test results are shown in Table 1.

Figure 1

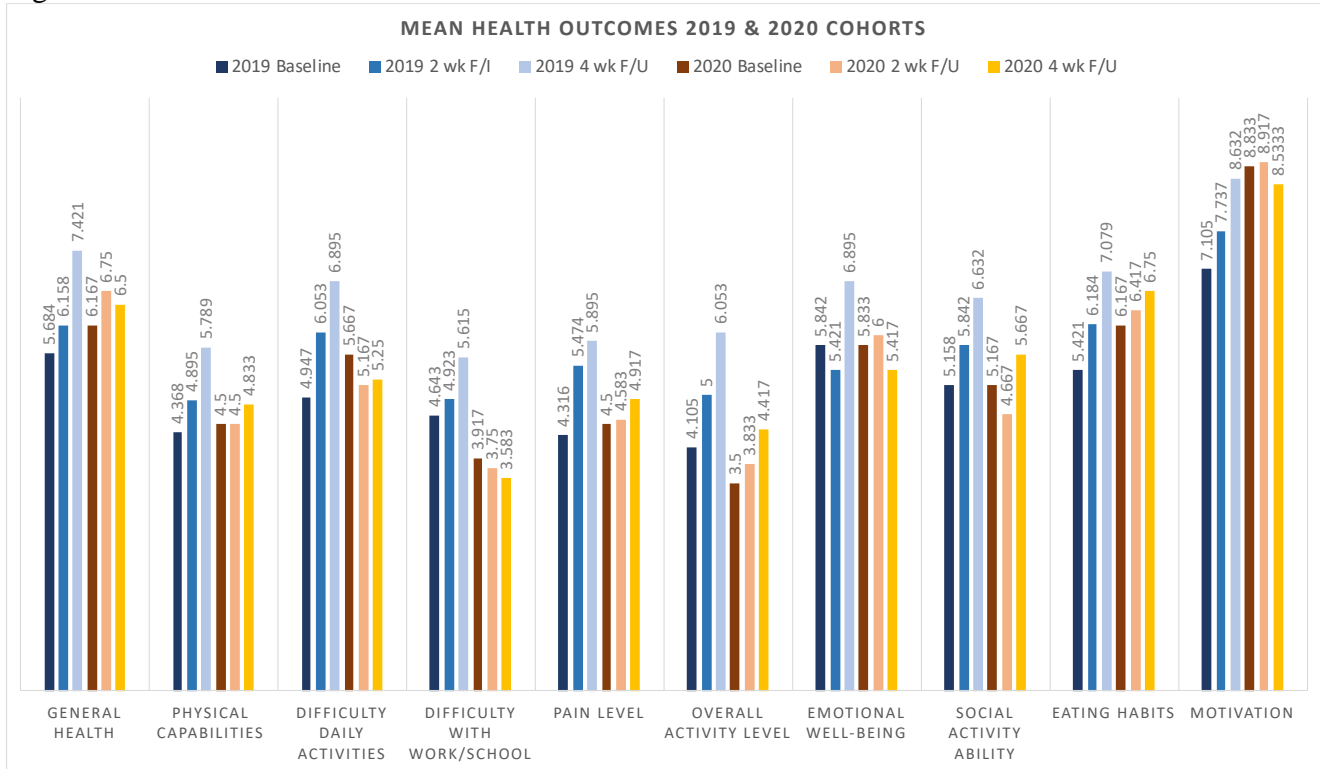


Table 1

| Question | Baseline 2019, 2020 | 2 Week 2019, 2020 | 4 Week 2019, 2020 | T-test Results | | | |
|----------------------------------|------------------------|----------------------|----------------------|----------------------------------|------------------------|----------------------------------|------------------------|
| | | | | T _a , df _a | p-value _a * | T _b , df _b | p-value _b * |
| | | | | 2019; 2020 | 2019; 2020 | 2019; 2020 | 2019; 2020 |
| General Health | 5.684 | 6.158, | 7.421, | 0.772,18 | 0.225 | 3.430,18 | 0.002 |
| | 6.167 | 6.750 | 6.500 | 1.103,11 | 0.294 | 0.456,11 | 0.658 |
| Physical Capabilities | 4.368, | 4.895, | 5.789, | 0.925,18 | 0.184 | 1.924,18 | 0.035 |
| | 4.500 | 4.500 | 4.833 | 0, 11 | 1 | 0.402,11 | 0.695 |
| Difficulty with Daily Activities | 4.947 | 6.053, | 6.895, | 1.160,18 | 0.131 | 2.263,18 | 0.018 |
| | 5.667 | 5.167 | 5.250 | 1.198,11 | 0.256 | 0.539,11 | 0.601 |
| Difficulty with Work/School | 4.643 | 4.923 | 5.615 | 0.823,18 | 0.213 | 1.387,18 | 0.095 |
| | 3.917 | 3.750 | 3.583 | 0.181,11 | 0.860 | 0.343,11 | 0.738 |
| Pain Level | 4.316, | 5.474 | 5.895, | 2.055,18 | 0.022 | 2.161,18 | 0.022 |
| | 4.500 | 4.583 | 4.917 | 0.109,11 | 0.915 | 0.861,11 | 0.408 |
| Overall Activity Level | 4.105 | 5.000, | 6.053, | 2.177,18 | 0.022 | 2.606,18 | 0.009 |
| | 3.5 | 3.833 | 4.417 | 0.616,11 | 0.550 | 1.733,11 | 0.111 |

| | | | | | | | |
|---|---------|---------|---------|----------|--------------|----------|--------------|
| Emotional Wellbeing | 5.842 | 5.421 | 6.895, | 0.914,18 | 0.187 | 1.900,18 | 0.037 |
| | 5.833 | 6.000 | 5.417 | 0.378,11 | 0.713 | 0.684,11 | 0.508 |
| Social Activity Ability | 5.158 | 5.842 | 6.632, | 1.396,18 | 0.090 | 2.460,18 | 0.012 |
| | 5.167 | 4.667 | 5.667 | 0.484,11 | 0.638 | 0.616,11 | 0.551 |
| Eating Habits | 5.421 | 6.184 | 7.079 | 1.363,18 | 0.095 | 2.546,18 | 0.010 |
| | 6.167 | 6.417 | 6.750 | 0.713,11 | 0.491 | 1.074,11 | 0.306 |
| Motivation | 7.105 | 7.737 | 8.632 | 1.145,18 | 0.134 | 2.925,18 | 0.005 |
| | 8.833 | 8.917 | 8.583 | 0.364,11 | 0.722 | 1.00,11 | 0.339 |
| Physical Activity Minutes | 162.778 | 329.739 | 798.158 | 1.993,10 | 0.031 | 2.640,10 | 0.008 |
| | 548.333 | 187.583 | 348.333 | 1.405,11 | 0.188 | 0.855,11 | 0.411 |
| *denotes 95% CI, _a denotes baseline to 2 week calculations, _b denotes baseline to 4 week calculations; Red= statistically Significant | | | | | | | |

Table 2

| Effect of COVID-19 Pandemic (2 weeks) | |
|---------------------------------------|---|
| Physical Health | 3.786 (N=14) |
| Emotional Health | 4.071 (N=14) |
| Employment | N=4 no effect N=3 reduced hours/work from home N=7 unemployed |

Discussion/Conclusion: Studies in the past have already shown that a combined education and home exercise program yield positive short-term health outcomes in patients with lower extremity joint pain¹⁴. When using this same combined intervention in times of a pandemic however, we do not see such positive results. While there were progressive improvements to 2 and 4-weeks post-intervention in the 2019 cohort (with statistically significant improvements across all health outcomes at 4 weeks), no clear or significant improvements were seen in the 2020 cohort. Several factors may affect and limit these results. Firstly, due to timeline constraints and a small initial sample size of the 2020 cohort, the power of the statistical tests was undeniably affected. We will continue to recruit patients for the 2020 cohort to improve power. Secondly, the effect that the COVID-19 pandemic has on health cannot be overstated⁷. Due to the closing of gyms, parks, and stay at home orders to try to control the spread of the virus, it has become increasingly difficult to maintain a healthy and active lifestyle. This is apparent by the fact that when the 2020 cohort was asked to rate how the pandemic had affected their physical health, the mean result was 3.768 out of 10. This score reflects that life during the COVID-19 pandemic has had a measurable negative effect on the health of patients regardless of if they have been infected or not. Additionally, the sample chosen during this study is one that was chosen out of convenience in a clinical setting in South Texas. This region of the state, which is primarily Hispanic in makeup, is one of the lowest ranking in terms of socioeconomic status in the state and country⁹. It is easy to infer then, that the detrimental health effects of the COVID-19 pandemic are felt more strongly here than in other regions as it is well known that coming from socioeconomically disadvantaged areas is associated with a sedentary lifestyle and worse health outcomes¹⁰. Future studies should aim to compare the detrimental health effects of life

during the COVID-19 pandemic across different ethnic and socioeconomic groups. We can conclude then, that although multimedia education and a combined home exercise program can be fruitful, positive results are strongly influenced by the available opportunities patients have to physical activity. Before initiating these combined treatment modalities for patients with musculoskeletal health issues, physicians should dive deeper and be aware of the feasibility of implementation in their patients' lives. Future studies ought to explore ways to make the implementation of these treatment modalities more efficient in the face of current challenges posed by the pandemic.

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