



An evaluation of the Arthritis and Osteoporosis Victoria Waves program 2014

Acknowledgements

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Executive summary

Worldwide, the prevalence and burden of musculoskeletal conditions is high. They are the leading cause of persistent pain, disability and reduced health-related quality of life (1). Exercise in warm water pools is commonly used by people with arthritis and musculoskeletal conditions. It is widely accepted amongst both consumers and health care professionals that exercise in warm water is an effective way to ease pain, improve the mobility of joints and improve function in people with musculoskeletal conditions. This is supported by past research (2).

This report presents the findings of a collaborative study between Arthritis and Osteoporosis Victoria and Monash University. It provides information on changes in pain, joint stiffness, physical function and health-related quality of life reported by people who have participated in Waves warm water exercise classes delivered by Arthritis and Osteoporosis Victoria. Information was gained by surveying people attending the classes before they commenced classes and 12 weeks later. A group of similar consumers who had not previously participated in Waves classes were also surveyed. This design enabled the impact of classes on pain, joint stiffness, physical function and health-related quality of life to be assessed. The aim of this study was, therefore, to explore if people participating in the Waves classes experience similar improvements to those reported in prior published studies. Information on the Waves participants' perceptions of the value, impact and accessibility of the classes was also collected. The findings of this study can be used to support ongoing development and delivery of peer-led exercise classes in warm water pools. The target audience for this document is Arthritis and Osteoporosis Victoria, class leaders, class participants, other providers of warm water exercise and health professionals recommending appropriate forms of exercise for people with musculoskeletal conditions.

Waves program

The Waves program provides peer-led exercise classes in warm water pools for people with arthritis and other musculoskeletal conditions. Classes promote general fitness through aerobic exercises, and physical function through strength and flexibility exercises. More recently, classes have also adopted balance exercises to mitigate the risk of falls—a frequent event in this population (3). Classes are delivered by trained volunteers at different aquatic centres across Victoria in indoor pools and include a maximum of 20 participants.

The Waves evaluation

This impact study was part of a three-stage project that also incorporated a systematic review of literature to determine the best-practice evidence for warm water exercise for people with musculoskeletal conditions (2) and delivery of this information to Waves leaders in interactive workshops. The key findings from the systematic review were:

- The research evidence suggests warm water exercise has beneficial effects on pain, physical function and health-related quality of life in adults with musculoskeletal conditions.
- The benefits achieved in the warm water exercise group appeared comparable to those achieved with land-based exercise.
- Gaps remain in our understanding of the characteristics (e.g. frequency, duration, intensity and exercises) of warm water exercise programs that provide the most benefit. However, based on the current evidence, successful programs appear to include two sessions of 60 minutes duration per week, run for at least 6 weeks, target strengthening of hip and knee extensors using resistance and weight-bearing exercises, and include moderate intensity aerobic exercise.

What did the impact study involve?

The impact study involved 82 people, with 43 people who participated in Wave classes — ‘Waves participants’, and a similar group of 39 consumers who were not participating in Waves classes or any other formal exercise programs— ‘control participants’. To measure the effects of participation in the Waves classes on pain, joint stiffness, physical function and health-related quality of life, each Waves participant was asked to complete two surveys at two different time points: initially prior to them starting the Waves program; and then again 12-weeks after this. The control participants also completed the two surveys at the same two time points. Changes in pain, joint stiffness, physical function and health-related quality of life over the 12-week period reported by the Waves participants were compared with those same outcomes reported in control participants.

What did we find?

Participation in Waves classes achieves minor improvements in symptoms and functional impairment

This study identified that participating in the Waves classes provides several benefits to people with arthritis or other musculoskeletal conditions. Waves participants reported improvements in pain, joint stiffness, physical function, mobility, daily activities and feelings of anxiety and depression, however these improvements did not reach statistical significance¹. It is likely that the small, yet diverse sample of people included reduced the ability to detect statistically significant changes in the other outcomes measured.

The Waves participants included in this study also reported statistically significant improvements in their overall health state scores as measured by the EQ-5D health-related quality of life assessment. The other domains of health-related quality of life assessed remained stable for both groups over the 12-week follow-up. However, scores were high in the first set of questionnaires suggesting there was minimal opportunity to further improve these domains.

Greater improvements may be achieved if Waves classes are more frequent, self-practice facilitated and class attendance improved

In comparison to prior studies which have reported statistically significant improvements in outcomes similar to that evaluated in this study, the Waves classes are less intensive. In the systematic review that was completed as stage 1 of this evaluation project, three studies of warm water exercise were found to have significant positive impacts on pain (2). In two of these three studies, the warm water exercise program was delivered twice per week (4, 5) and one study provided a class three times per week (6). In comparison, Waves participants typically attend one class per week. This lower dosage of exercise may be a factor contributing to smaller improvements than those reported by prior studies. Strategies to increase exercise dosage within existing resources include facilitating self-practice of warm water exercise outside of Waves classes by providing participants with an education and exercise pamphlet and leaders promoting the value of self-practice.

Over the 10-11 week period that Waves classes were offered (dependent on the length of the term), on average participants attended 7 of the possible 10-11 classes (minimum number attended = 2, maximum = 10). The modest levels of attendance at Waves classes may also have contributed to the smaller improvements in effects observed. Reasons for non-attendance were not recorded. However, it is likely that illness over the winter months, vacations and family commitments may have prevented Waves participants from attending classes. The number of participants included in this study was too small to

¹ Statistical significance refers to a mathematical technique used in research studies to determine whether the results of a study are likely to be true (i.e. the likelihood that a result is caused by something other than chance).

permit meaningful sub-group analysis across high and low attendees. This would be a valuable analysis to conduct in future studies given a large enough sample is obtained.

Waves participants perceive that the classes are enjoyable, acceptable and an effective strategy for managing their condition

There were high levels of satisfaction reported by Waves participants for the program:

- over 90% of participants reported that the Waves classes were enjoyable and would recommend the classes to others;
- more than 90% of participants plan to continue attending Waves classes; and
- more than 90% of the participants agreed that the class format is suitable for their condition.

Suggestions for improvement related to increased consistency of class content across leaders, better monitoring of post-class effects and communicating the purpose and safety of balance exercises

Maximising the delivery of a consistent set of exercises across classes has the potential to optimise outcomes as it facilitates participants mastering exercises so they are performed correctly. Waves leaders are currently encouraged to ensure a large proportion of the class contains exercises with which participants are familiar. Whilst inclusion of novel exercises is not discouraged—this has benefits such as keeping classes interesting and promoting the acquisition of new skills—there needs to be a focus on consistency rather than diversity. Encouraging leaders to ‘check-in’ with other leaders to compare class content and program staff auditing classes more frequently may facilitate greater consistency in exercises delivered across classes.

Leaders need to be reminded to continuously check-in with participants at the start of classes as this is an important strategy to monitor how individuals have responded to the specific exercises and intensity of the previous classes. This assists individuals to minimise negative effects such as excessive fatigue or muscle soreness and to exercise at a level that they perceive to be most beneficial for them.

Falls and fall injuries among adults aged 45 years or older with arthritis are more frequent than in people of a similar age without arthritis (3). Preventing falls is therefore a priority for this population and exercise is a well-established strategy to achieve this. To be effective at reducing falls risk, balance exercises should provide a moderate to high challenge to balance (7). The pool is an ideal environment to practise challenging balance exercises as there is a low risk of injury if the person loses their balance whilst performing the exercise. To increase participants’ understanding of the purpose of balance exercises, leaders could be encouraged to communicate to participants the need for balance exercises to be challenging to ensure they are most effective. Further, participants should be reassured that the most likely consequence of overbalancing is to get their hair wet rather than suffering any injury. As with all exercises included in the Waves program, participants may choose not to perform balance exercises if they are not comfortable in doing so.

In summary, the key messages that emerged from this impact study are:

- the Waves warm water exercise program provides minor improvements in symptoms and functional impairments in people with arthritis and other musculoskeletal conditions;
- there is an opportunity to achieve greater impacts by offering more frequent classes to increase class attendance and encouraging self-practice; and
- the majority of participants find the Waves warm water exercise program enjoyable, easily accessible and beneficial to their health.

Where to from here?

The information gained from this study can be used to inform the strategic planning and development of the Waves program. Key recommendations relating to program development include:

- exploring reasons for modest class attendance and strategies to improve this;
- following up participants up 1 year after they completed their baseline surveys to gain insights into long-term outcomes;
- if the satisfaction survey is used again, consider adding a question regarding maintenance of the participants' symptoms rather than focusing on improvement;
- implementing strategies to increase the frequency of performing warm water exercise outside of Waves classes such as: providing education and an exercise pamphlet, and leaders promoting the value of self-practice;
- Waves leaders should be reminded to communicate with participants at the start of each class to determine whether there were any adverse effects from the previous class;
- Waves leaders should provide confirmation to participants about the safety of the exercises being performed especially exercises that aim to challenge balance;
- Waves leaders should 'check-in' more frequently with other leaders to compare class content to facilitate greater consistency in exercises delivered across classes sessions; and
- program staff could facilitate consistency in exercises provided by leaders by auditing classes more frequently.

This study provides a comprehensive overview of the effectiveness of the Waves warm water exercise program provided by Arthritis and Osteoporosis Victoria. On the basis of the findings presented in this report, it appears that the Waves program can decrease the burden of arthritis and other musculoskeletal conditions by decreasing pain and joint stiffness, and improving physical function. Findings from this study can be used by Arthritis and Osteoporosis Victoria to promote the benefits of warm water exercise and the need for further evaluation.

Project scope and purpose

The Waves program provides peer-led exercises in warm water pools for people with arthritis and other musculoskeletal conditions. The program was established in 1977 and there are now more than 120 trained volunteer leaders providing 45 classes in more than 20 locations across Victoria to over 450 participants. The Waves classes aim to decrease the burden of chronic musculoskeletal conditions through physical activity and to support, promote and improve the well-being of participants.

An evaluation of the Waves program was completed in 2008-2009 which provided information on the demographic and diagnostic characteristics of program participants and qualitative data on the perceived benefits of the program and potential areas for development and improvement(8). The evaluation did not assess the impact of the Waves program on pain, function, joint stiffness and health-related quality of life.

This report describes the findings of an impact study which explored the effect of the Waves program on these outcomes. The impact study was part of a three-stage project that also incorporated a systematic review of the literature to determine the best-practice evidence for warm water exercise for people with musculoskeletal conditions and delivery of this information to Waves leaders in interactive workshops.

The Waves evaluation project

Stage 1	A systematic literature review that identifies current best-practice evidence for warm water exercise in a population with musculoskeletal conditions and maps the evidence to the current Waves exercise repertoire.
Stage 2	Preparation and delivery of three Waves program leader workshops to disseminate the findings of the stage 1 review to the leaders and to facilitate the development of new exercises to address evidence-practice gaps identified.
Stage 3	Undertaking of a cohort study to identify the impact of the Waves program on key self-reported measures of pain, physical function, joint stiffness and health-related quality of life.

The stage 3 impact study aimed to answer the questions: *Does participation in Waves classes decrease pain and joint stiffness and improve physical function and health-related quality of life?* In addition, key recommendations are made based on the findings of this project that can be used to inform planning and development of the Waves program. The findings can also be used to promote the benefits of warm water exercise and the need for further evaluation. The target audience for this document is Arthritis and Osteoporosis Victoria, class leaders, class participants, other providers of warm water exercise and health professionals recommending appropriate forms of exercise for people with musculoskeletal conditions.

Background

The burden of musculoskeletal conditions

Worldwide, the prevalence and burden of musculoskeletal conditions are extremely high and are one of the world's leading causes of persistent pain, physical disability and reduced health-related quality of life(1). Musculoskeletal conditions cause 21.3% of the total years lived with disability worldwide, second to mental and behavioural problems (23.2%), and are the fourth greatest burden on the health of the world's population, accounting for 6.7% of the total global disability-adjusted life years² (9). In 2002, Australia announced that arthritis and other musculoskeletal disorders were the country's 7th largest national health priority (10), with 31% of Australians suffering from one or more of these conditions (11).

Musculoskeletal conditions are also the most common causes for utilising healthcare resources (12). In 2008-09, \$5,690 million was spent on arthritis and other musculoskeletal conditions in Australia. Of this, \$1,637 million was spent on osteoarthritis; \$1,177 million on back problems; \$355 million on rheumatoid arthritis; and \$306 million on osteoporosis (13).

The benefits of aquatic exercise

Health care professionals and consumers advocate that aquatic exercise is an effective and comfortable form of exercise for people with musculoskeletal conditions. The unique characteristics of the aquatic environment can allow higher-intensity exercise to be undertaken, with lower cardiovascular stress and joint impact than is possible on land (14). The benefits of aquatic exercise arise from the physiological effects of immersion and the hydrodynamic principles of exercise in the aquatic environment (15). Buoyancy decreases compressive weight-bearing stresses on joints and allows functional exercise with lessened gravitational load, improving both strength and range of movement (16). Additionally, immersion in thermo-neutral water (32-36 degrees Celsius) decreases sympathetic nervous system activity, which in combination with the compressive effects of hydrostatic pressure, can reduce swelling, decrease pain sensation and stiffness of the musculoskeletal system, and can initiate muscle relaxation in people with musculoskeletal conditions (15, 17).

The evidence-base for aquatic exercise

There is a growing body of evidence indicating the beneficial effects of aquatic exercise for people with musculoskeletal conditions. Several systematic reviews published in the last decade have sought to establish the effectiveness of aquatic exercise in people with musculoskeletal conditions. A Cochrane review of six randomised controlled trials (RCTs) published in 2007 identified that aquatic exercise has beneficial short term effects for people with hip and/or knee osteoarthritis (18). Results from the meta-analysis showed a small-to-moderate effect on pain, function and health-related quality of life in the aquatic exercise group compared to the no exercise group (18). A more recent meta-analysis from 2011 comparing aquatic exercise to land-based exercise concluded that both aquatic and land-based exercise programs appear to result in comparable outcomes for function, mobility or pooled health outcomes(19). This review included 10 RCTs in adults with osteoarthritis or rheumatoid arthritis (19). Both these reviews highlighted the lack of high-quality studies in this area of research. Reviews completed on the effects of aquatic exercise for people with fibromyalgia (20, 21) and low-back pain (22) have also reported positive impacts with aquatic exercise.

² Disability-adjusted life years is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. It is calculated as the sum of the "Years of Life Lost" due to premature mortality in a population plus the "Years Lost due to Disability" for people living with the health condition or its consequences. One disability-adjusted life year can be thought of as one lost year of "healthy" life.

These reviews investigated the effectiveness of aquatic exercise on individual musculoskeletal conditions. The systematic review completed as part of **stage 1 of this evaluation** was the first systematic review conducted across different musculoskeletal conditions including: osteoarthritis; rheumatoid arthritis; low back pain; fibromyalgia; and osteoporosis (2). The meta-analysis included information on 26 RCTs and showed that aquatic exercise provides significant benefits to people with musculoskeletal conditions, reflected in reduced pain and improved physical function and health-related quality of life compared to a non-active control group (2). The review concluded that compared to land-based exercise, aquatic exercise achieved equivalent improvements in pain, physical function and health-related quality of life. The meta-analysis results also showed that benefits were mostly consistent across condition types. One of the motivations for this impact study was to enable comparison of effects experienced by Waves participants with those reported in prior studies of similar programs in similar populations.

Why did we complete this study?

The primary aim of this impact study is to assess the effect of the Waves program on key self-reported measures of pain, physical function, joint stiffness and health-related quality of life in people with arthritis or other musculoskeletal conditions. A secondary aim was to explore participant perceptions of the value, impact and accessibility of the Waves program. The following sections provide a brief overview of the methods, key findings, and suggested next steps following on from this evaluation.

What did we do?

Design

An observational cohort study was undertaken where outcomes were compared across people participating in Waves classes—the ‘Waves participants’, and a similar group of consumers who were not participating in Waves classes or any other formal exercise programs—the ‘control participants’. Ethical approval to conduct the study was obtained from Monash University Human Research Ethics Committee.

Participants

Between April 2013 and February 2014, 146 people were recruited to participate in this study via informed, written consent.

The following exclusion criteria are applied by Arthritis and Osteoporosis Victoria for participation in the Waves exercise classes:

1. have uncontrolled epilepsy;
2. have uncontrolled diabetes;
3. have an unstable heart condition(s) or severe cardiac failure;
4. have unstable blood pressure – severe postural hypertension or uncontrolled hypertension; or
5. have open wounds or ulcers.

In addition to these exclusion criteria, people were excluded from participating in this evaluation if they had:

1. participated in the Waves program in the last 6 months; or
2. insufficient English language skills (as the evaluation uses self-report questionnaires, which are only available in English, to measure impacts participants must be able to complete the questionnaires).

In addition to the exclusion criteria noted above, people were excluded from participating in the impact study as control participants if they were:

1. already participating in, or intending to participate in the Waves program in the next 3 months; or
2. participating in another form of formal exercise for more than 1 hour per week for 8 or more consecutive weeks in the last 3 months.

These criteria were designed to ensure accurate measures of change in these outcomes could be assessed from commencement in the program to 3 months follow-up.

Participant selection

Participants were recruited to participate in this study by Arthritis and Osteoporosis Victoria staff between 1 April 2013 and 28 February 2014. Participation was voluntary. A (\$20 gift voucher) was provided to control participants to promote participation and return of surveys.

People who contacted Arthritis and Osteoporosis Victoria to enrol in the Waves program and who were eligible to attend classes were invited to participate in the impact study. Those that provided consent to participate in the study (by returning the questionnaires), formed the Waves participants.

To recruit control participants, Arthritis and Osteoporosis Victoria advertised this study through their newsletters and membership database. Advertisements included an invitation for consumers to participate in the study and to contact Arthritis and Osteoporosis Victoria via telephone to obtain further information. Arthritis and Osteoporosis Victoria screened consumers who made contact according to the above criteria. Individuals who met the study eligibility criteria, and who weren't participating in the Waves program, were invited to participate in the study as ‘control participants’.

Waves exercise classes

The Waves exercise program aims to provide enjoyable, affordable, accessible and effective exercise for people with arthritis and other musculoskeletal conditions. Classes promote general fitness via aerobic exercises, and physical function via strength and flexibility exercises. More recently, classes have also adopted balance exercises to mitigate the risk of falls—a frequent event in this population (3).

Classes are delivered at different aquatic centres across metropolitan Melbourne in indoor pools with a water temperature between 32 to 36 degrees Celsius. Classes are led by a trained volunteer leader and include a maximum of 20 participants. The use of volunteers as class leaders is thought to be one of the program's strengths and follows Arthritis and Osteoporosis Victoria's commitment to the principles of supporting self-management, peer support, service efficiency and role modelling.

Waves classes run in line with Victorian school terms (i.e. approximately 8-11 weeks' duration) with more than one class per week being held at most venues. Classes last approximately 45 minutes and include:

- 5-10 minutes of warm-up (light aerobic exercises and range of motion);
- 15–25 minutes of strength (focus on large muscle groups such as the biceps, quadriceps and gluteals) and moderate aerobic exercise (for example jogging and jumping); and
- 10-15 minutes of cool-down period (range of motion and stretching exercises).

All participants follow the same general exercise program as demonstrated by the leader, but are encouraged to work at their own pace and within their own capacity limits. Each class varies in content according to the leader and participant preferences; however, it is recommended that each class include the above components.

An example Waves class plan is presented in Appendix 1.

Measuring impacts

Waves and control participants completed two self-reported outcome questionnaires on entering the study (baseline) and at 12 weeks post baseline. For Waves participants, baseline was defined as the time of enrolment to the Waves program. The questionnaires measured:

- pain;
- physical function;
- joint stiffness; and
- health-related quality of life.

Pain, physical function and joint stiffness

The Western Ontario and McMaster Universities (WOMAC) Osteoarthritis (OA) Index was used to measure pain, joint stiffness and physical function (Appendix 2). The WOMAC is a standardised self-report questionnaire that has established reliability and validity for measuring these outcomes in people with osteoarthritis of the knee and hip, low back pain, rheumatoid arthritis, juvenile rheumatoid arthritis, systemic erythematous and fibromyalgia (23). It includes the subscales for pain, joint stiffness and physical function. The pain subscale includes five items (summed score range 0-20), the stiffness subscale two items (summed score range 0-8), and the functional limitations subscale has 17 items (summed score range 0-68). A total score for the WOMAC OA Index, that combines the scores for the pain, joint stiffness and physical function subscales, was generated yielding a total score between 0-96. Lower scores on the WOMAC indicate less pain, joint stiffness, and functional limitations.

Health-related quality of life

Health-related quality of life was measured using the EuroQOL five dimensions questionnaire (EQ-5D) — one of the most commonly used generic questionnaires to measure health-related quality of life (Appendix

3). The EQ-5D has been found previously to be a valid and reliable measure of health-related quality of life (24). The EQ-5D comprises five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each dimension has three levels: no problems, some problems, extreme problems. The respondent is asked to indicate his/her health state by ticking (or placing a cross) in the box against the most appropriate statement in each of the five dimensions. Lower scores for each of the five dimensions indicate better health-related quality of life.

An EQ-5D index utility score representing overall health-related quality of life was generated from the five dimension scores. The utility score ranges from -1 to 1. The utility score represents overall health state and is scored between -1 and 1 where a score of 0 indicates a health state equivalent to death, less than 0 a health state worse than death and 1 perfect health. Overall, a higher utility score indicates better overall health-related quality of life.

The EQ-5D also includes a question where the respondent scores their overall self-rated health status on a graduated (0–100) scale, with higher scores for higher health-related quality of life.

Participant satisfaction

Participant satisfaction with the Waves program was measured by a customised satisfaction survey (Appendix 4) that was developed by the investigators. This survey included questions regarding the value, impact and accessibility of the Waves program. Only Waves participants were required to complete this survey.

Statistical analysis

All statistical analyses were performed using STATA (version 12.1) statistical software. Descriptive statistics were used to profile the study participants, Waves class attendance and satisfaction survey outcomes. Differences in demographic and diagnosis variables between groups were assessed using chi-squared tests. Within and between-group comparisons of WOMAC and EQ-5D questionnaires data were performed using t-tests as data were normally distributed and means and SD were reported. Linear models were applied to assess differences in WOMAC and EQ-5D questionnaire scores that incorporated adjustment for variables not balanced across groups and known to affect the outcomes being measured. This enabled more reliable estimates of effect to be obtained. Statistical significance was set to a p value <0.05.

Findings

Participants

Recruitment began on 1 April 2013 and was completed by 28 February 2014. During this time, 189 people were either approached due to their enrolment within the Waves program, or contacted Arthritis and Osteoporosis Victoria to take part in the study and were assessed for eligibility. From this sample, 146 people were considered eligible to participate in the study. Of these eligible people, 101 were Waves participants and 45 were control participants. Baseline questionnaires were returned from 67 Waves participants and 42 control participants. 24 Waves participants and 3 control participants failed to complete 12-week questionnaires and were considered lost to follow-up. Overall, a total of 82 participants completed the protocol, 43 in the Waves intervention group and 39 in the control group, and were included in the analysis. The study flow of participants is presented in Figure 1.

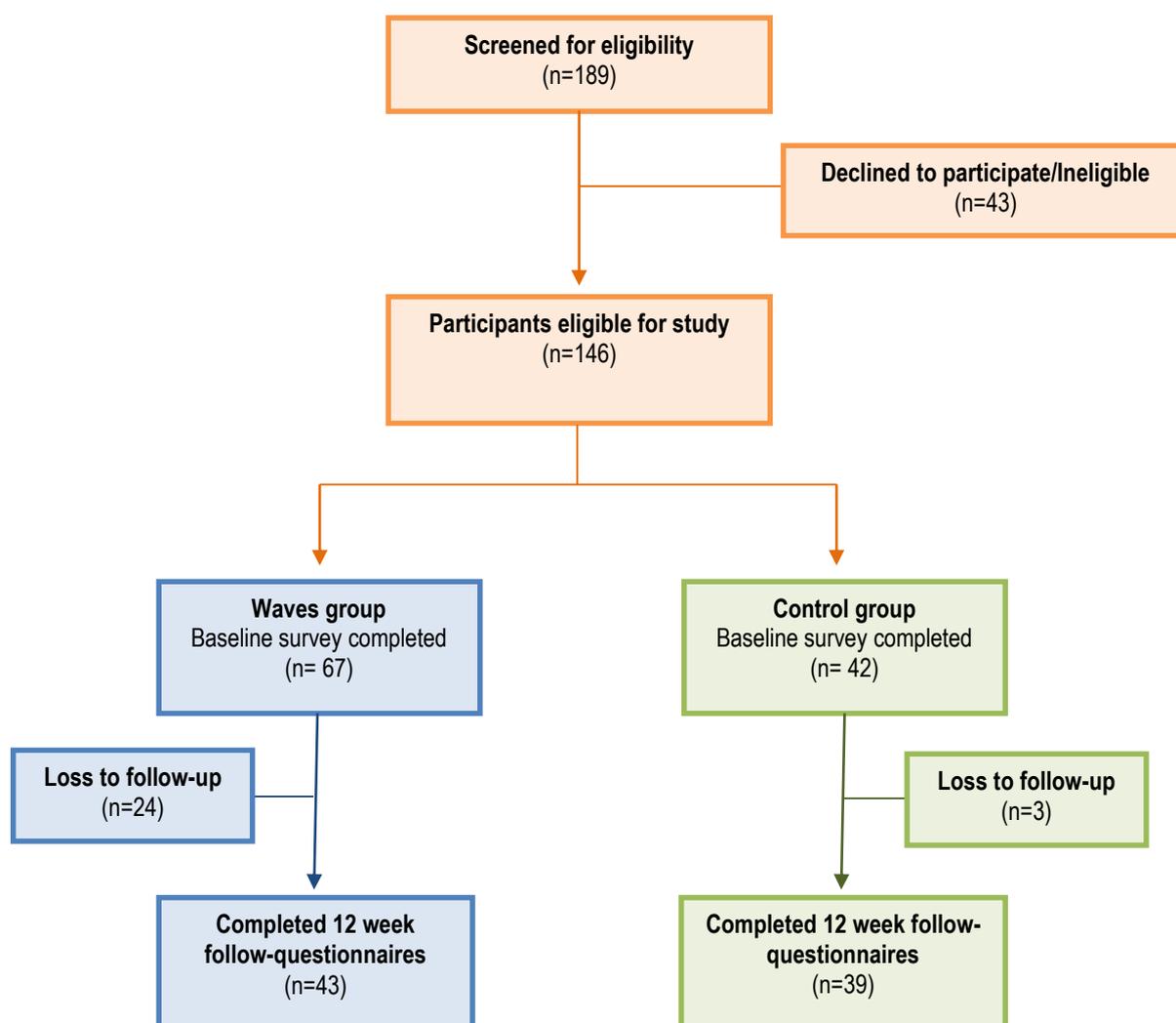


Figure 1: Flow of participants through the study

Of the 109 participants who completed the baseline questionnaires, 89 (81.5%) were women and the mean (SD) age of the sample was 65.18 (14.35) years. Over half the participants in the study reported that they had osteoarthritis (67%), 14 rheumatoid arthritis (13%), 10 fibromyalgia (9%), 2 low back pain (2%), 3 ankylosing spondylitis (3%), 7 osteoporosis (7%) and 20 another musculoskeletal condition (18%). Some of these conditions included gout and psoriatic arthritis. This age and diagnosis profile was similar to that

reported in prior studies that examined the effectiveness of warm water exercise in people with arthritis and musculoskeletal conditions (2). Apart from age (mean difference = 8.63 years; 95% CI: 3.23 to 14.02), there were no significant difference between the groups for any of the baseline characteristics. The characteristics of the study participants are summarised in Table 1.

Table 1: Characteristics of study participants measured at baseline assessment

	Waves participants (N=67)	Control participants (N=42)
Females, n (%)	57 (85%)	32 (76%)
Age, mean (SD)	68.53 (13.09)*	59.90 (14.81)
Musculoskeletal condition, n (%)^		
Osteoarthritis	52 (78%)	21 (50%)
Rheumatoid arthritis	8 (12%)	6 (14%)
Fibromyalgia	4 (6%)	6 (14%)
Low back pain	2 (3%)	0 (0%)
Osteoporosis	5 (12%)	2 (5%)
Ankylosing spondylitis	1 (2%)	2 (5%)
Other	9 (13%)	11 (26%)

^People could have multiple musculoskeletal conditions recorded

*Statistically significant difference from control group (p<0.05)

Waves participant geographic profile

Table 2 summarises the Waves class locations for participants included in this study. Participants attended classes at 18 different pools across Melbourne. The majority of participants attended classes at Sunshine Hospital (10 people, 15% of Waves participants included in the study). On average, Waves participants lived 5.7 kilometres from the pool they attended, however one lived 27 kilometres away and 12 more than 10 kilometres away.

Table 2: Locations of Waves classes attended

Pool attended	Waves participants (%)	
	N=67	
Able Australia	2	(3%)
Aqualink Box Hill	1	(1%)
Bayfit Leisure Centre	3	(4%)
Belmore School	1	(1%)
Casey RACE	3	(4%)
Caulfield Med Centre	3	(4%)
Croydon Aquatic Centre	3	(4%)
Dandenong Valley School	1	(1%)
Dandenong Oasis	3	(4%)
East Bentleigh	8	(12%)
Epworth, Camberwell	7	(10%)
Healthways	1	(1%)
Heidelberg Repat	3	(4%)
Knox Leisure Works	7	(10%)
Maribyrnong	1	(1%)
Monash Medical Centre	3	(4%)
Royal Melbourne Hospital Parkville	7	(10%)
Sunshine Hospital	10	(15%)

Figure 2 depicts the place of residence of Waves participants. Each marker represents a participant and markers are colour coded by the pool attended. The 'other' pool attended category represents pools where there were fewer than 5 participants included in this study.

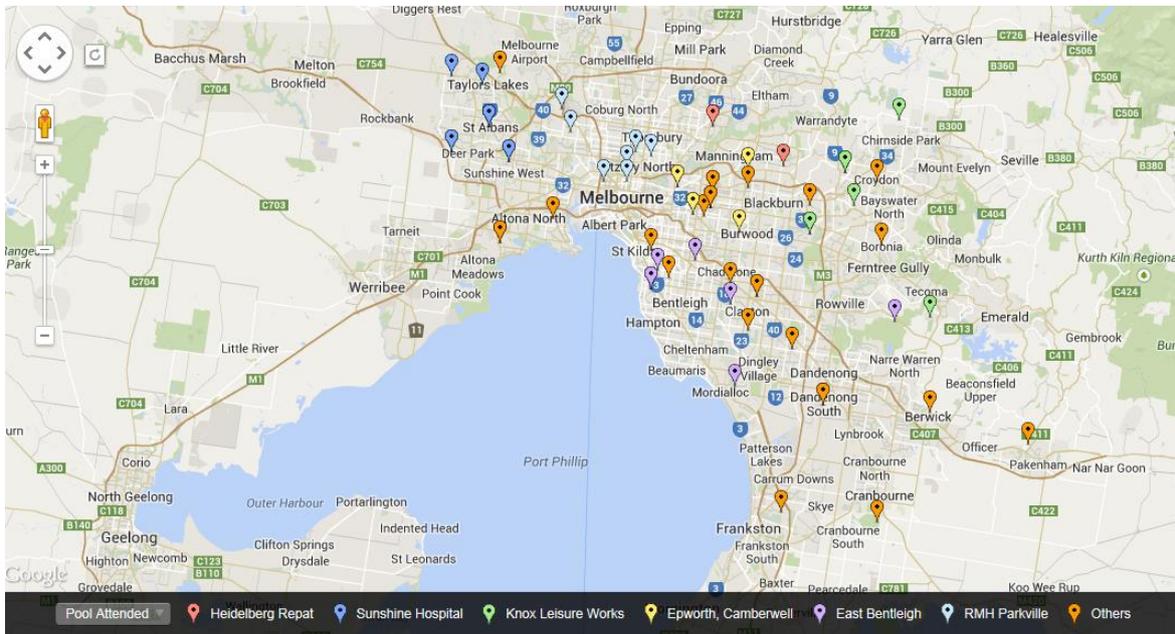


Figure 2: Where Waves participants live

Adherence

Measuring intervention adherence provides important information about program effectiveness. There was varying levels of attendance to the Waves classes across the Waves participants. Over the 10-11 week period that Waves classes were offered (dependent on the length of the term), on average participants attended 7 of the possible 10-11 classes (minimum number attended = 2, maximum = 10). No participants attended more than 10 Waves classes during the 12-week follow-up and only 28 participants (65%) attended 6 or more classes in the 12-week follow-up. Figure 3 summarises the number of classes attended by the Waves participants.

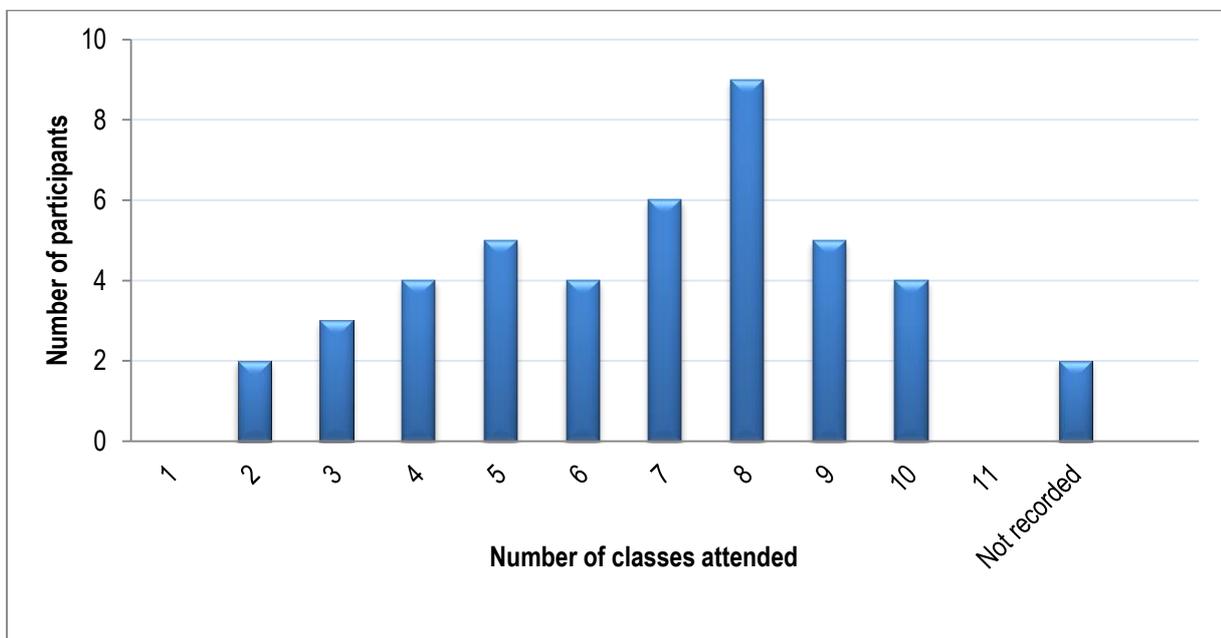


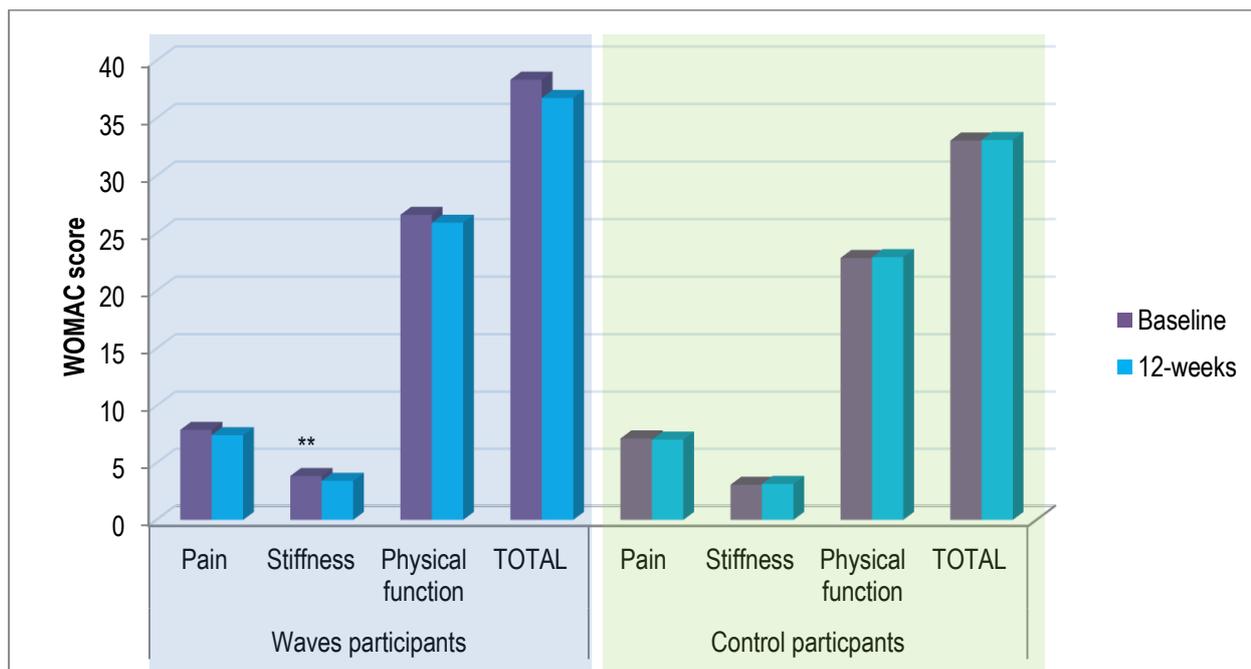
Figure 3: Waves class attendance for study participants

Impacts

Pain, physical function and joint stiffness

Table 3 and Figure 4 outline the baseline and 12-week WOMAC subscale and total scores for each group.

At baseline, there were no significant differences in the pain, physical function or total WOMAC scores between the two groups. The WOMAC stiffness subscale score was significantly higher (indicating higher levels of joint stiffness) in the Waves participants compared to the control participants at baseline (mean difference=0.76; 95% CI: 0.10 to 1.42; $p=0.024$). Whilst the scores depicted in Figure 4 for physical function and total WOMAC scores may appear to be different between the two groups, the large variability in participant scores in each group (as represented by the large standard deviation values in Table 3) meant that differences did not reach statistical significance.



Note:

A decline in scores = improvement

**Significant difference from control group at baseline ($p \leq 0.05$)

Figure 4: Mean WOMAC scores by group and time

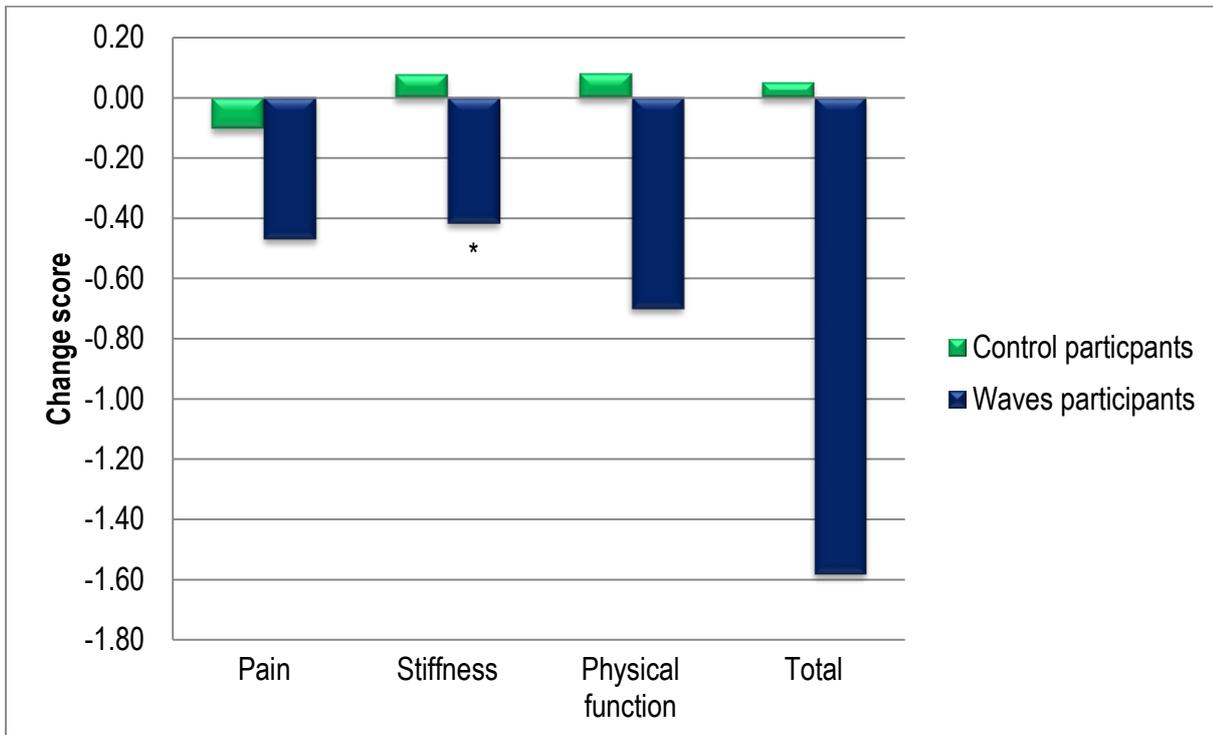
Figure 5 displays the change in WOMAC subscale and total scores from baseline to the 12-week follow-up by group. A decline in WOMAC subscale and total scores indicates an improvement.

In the Waves group, there were no statistically significant changes in scores over the 12-week follow-up in any of the three WOMAC subscale scores. However, there was a trend towards a statistically significant improvement in the stiffness subscale scores for the Waves participants (mean difference=0.42; 95% CI: -0.04 to 0.86; $p=0.0714$).

In the control group, there were no significant changes in any of the three WOMAC subscale scores over the 12-week follow-up.

There were no significant changes in the WOMAC total scores for either group over the 12-week follow-up.

There were no significant between-group differences in the 12-week change scores in any of the three WOMAC subscales or the total score. Between-group differences in change scores remained non-significant when the analysis adjusted for age and baseline scores.



A decline in scores (negative values for change) = improvement

*Trend for significant difference from baseline to follow-up within group ($p \leq 0.10$)

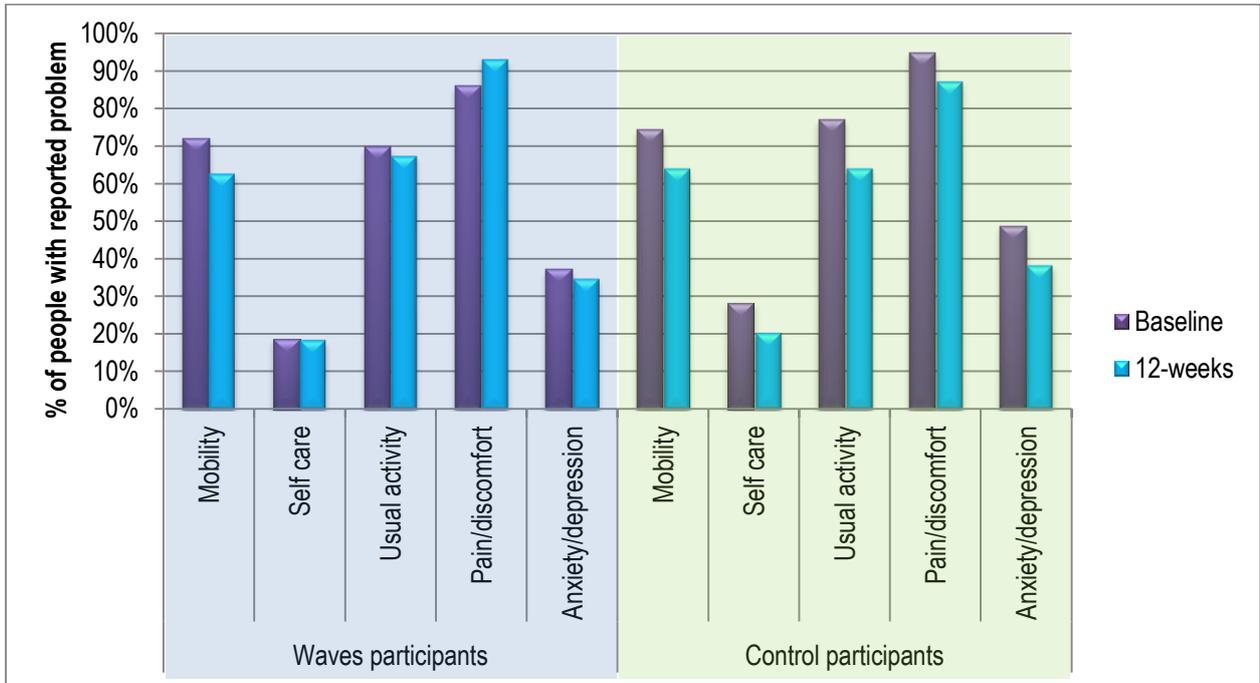
Figure 5: Mean change in WOMAC scores from baseline to 12-weeks by group

Health-related quality of life

Table 3 outlines the baseline, 12-week and change scores for the EQ-5D domains (% of people with reported problem), overall self-rated health and utility scores for each group.

There were no significant differences between the groups for the percentage of people reporting a problem for each of the EQ-5D domains, overall self-rated health and utility scores at baseline.

Figure 6 displays the percentage of people reporting problems in each of the EQ-5D domains on the baseline and 12-week surveys. A decline in percentage of people with reported problems for each domain indicates an improvement, whilst an increase in overall self-rated health and utility scores indicates an improvement. There were no statistically significant differences from baseline to 12-week follow-up in the percentage of people reporting the problem for any of the five EQ-5D domains for either group.



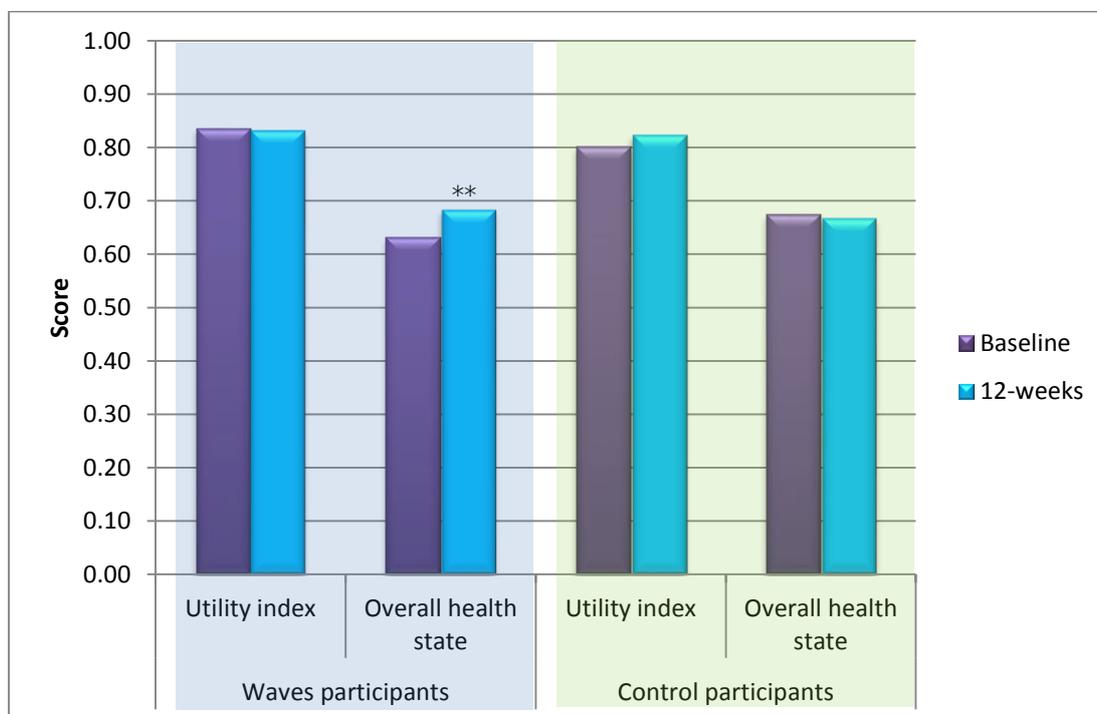
A decline in % = improvement

Figure 6: Percentage of participants with a reported problem in each domain by group and time

Figure 7 displays the change in the EQ-5D overall health state and utility scores. The overall health state question on the EQ-5D asks respondents to indicate on a scale from 0 to 100 (note this is represented as 1.00 on Figure 7) how good or bad their health is today, in their own opinion. A score of 100 represents a 'best imaginable health state' and 0 a 'worst imaginable health state'. For Waves participants, there was a statistically significant improvement in overall health state scores over the 12-week follow-up (mean change: = 5.40%, 95% CI 1.38% to 9.43%; p=0.010). There was a trend towards a statistically significant difference in the overall health state change scores between groups (mean difference=6.18; 95% CI: -1.01 to 13.35; p=0.091).

The utility score is an aggregated score generated from the responses to the five domain scores for mobility, self-care, usual activity, pain/discomfort and anxiety/depression. The utility score represents overall health state and is scored between -1 and 1 where a score of 0 indicates a health state equivalent to death, less than 0 a health state worse than death and 1 perfect health.

There were no statistically significant differences in the baseline EQ-5D utility score between the two groups. There were also no statistically significant differences in change in the EQ-5D utility score from baseline to 12-week follow-up in the EQ-5D utility score for either group or between groups.



An increase in scores = improvement

**Significant difference from baseline to follow-up within group (p≤0.10)

Figure 7: Mean EQ-5D overall health state and utility scores at baseline to 12-weeks by group

Table 3: Mean (SD) and mean change (95% CI) values for WOMAC and EQ-5D outcome measures at baseline and 12 weeks

	Waves participants (n=43)			Control participants(n=39)		
	Baseline Mean (SD)	12-weeks Mean (SD)	Change Mean (95% CI)	Baseline Mean (SD)	12-weeks Mean (SD)	Change Mean (95% CI)
WOMAC						
Pain (0-20)	7.88 (3.82)	7.42 (3.73)	-0.47 (-1.27 to 0.34)	7.13 (3.46)	7.03 (3.52)	-0.10 (-1.16 to 0.96)
Joint stiffness (0-8)	3.84 (1.53) ** ^{BL}	3.42 (1.69)* ^{Within}	-0.42 (-0.88 to 0.04)	3.08 (1.46)	3.15 (2.07)	0.08 (-0.43 to 0.58)
Physical function (0-68)	26.60 (14.57)	25.91 (13.07)	-0.70 (-3.92 to 2.53)	22.85 (11.17)	22.92 (11.66)	0.08 (-2.90 to 3.06)
TOTAL (0-96)	38.33 (19.12)	36.75 (17.94)	-1.58 (-5.75 to 2.59)	33.05 (14.91)	33.10 (16.21)	0.05 (-4.05 to 4.15)
EQ-5D						
Reported problem	Number (%)	Number (%)	% (95% CI)	Number (%)	Number (%)	% (95% CI)
Mobility	31 (72%)	27 (63%)	-9% (-29% to 10%)	29 (74%)	25 (64%)	-10% (-31% to 10%)
Self-care	8 (19%)	8 (19%)	0% (-16% to 30%)	11 (28%)	8 (21%)	-8% (-27% to 11%)
Usual activity	30 (70%)	29 (67%)	-2% (-22 to 17%)	30 (77%)	25 (64%)	-13% (-32% to 7%)
Pain/discomfort	37 (86%)	40 (93%)	7% (-6% to 20%)	37 (95%)	34 (87%)	-8% (-20% to 5%)
Anxiety/depression	16 (37%)	15 (35%)	-2% (-23 to 18%)	19 (49%)	15 (38%)	-10% (-32% to 12%)
	Mean (SD)	Mean (SD)	Mean (95% CI)	Mean (SD)	Mean (SD)	Mean (95% CI)
Overall self-rated health state (0-100)	63.07 (17.18)	68.31 (16.73)** ^{Within}	5.40 (1.38 to 9.43)* ^{Change}	67.49 (17.78)	66.72 (20.91)	-0.77 (-6.98 to 5.44)
Utility (0-1)	0.84 (0.10)	0.83 (0.11)	-0.01 (-0.03 to 0.02)	0.80 (0.09)	0.82 (0.12)	0.01 (-0.01 to 0.06)

All data were normally distributed

**^{BL} Statistically significant difference from control group at baseline

*^{Within} Trend for significant difference from baseline to follow-up within group (p≤0.10)

**^{Within} Significant difference from baseline to follow-up within group (p≤0.05)

*Change Trend for significant difference in change scores between groups ($p \leq 0.10$)

Participant satisfaction

The satisfaction survey results are presented in Figure 8. In the Waves group, all of the 43 participants that completed the 12-week follow-up completed the participant satisfaction survey. Survey responses showed that over 90% of participants found the Waves classes enjoyable, and would recommend the classes to others. More than 90% of participants plan to continue attending the Waves program, and more than 90% of the participants agreed that the class format is suitable for their condition. Most participants (80%) agreed that the Waves classes were beneficial for their condition(s).

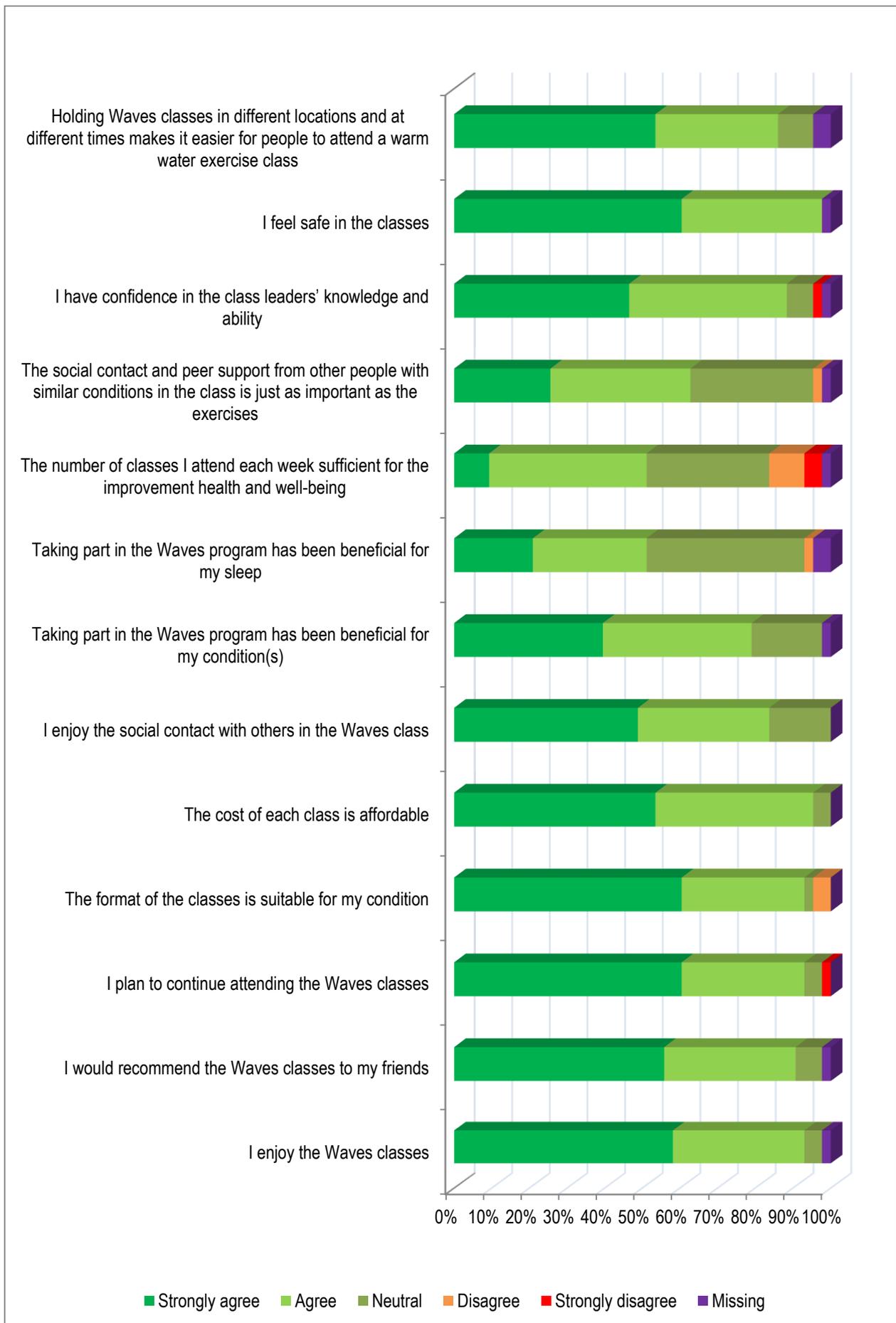


Figure 8: Satisfaction survey results

In addition to the questions displayed in Figure 8, the satisfaction survey included the question 'Do you have any additional comments about the value, impact or accessibility of the classes?'. Twenty-one of the 43 respondents answered this question. Key themes from responses were that participants found the classes enjoyable and effective.

I find it hard to motivate myself and make time to look after myself as much as I should. However, I find the Waves classes so beneficial I never miss them, even though I tram both ways and it takes a large proportion of the day to do so, I find Waves hugely beneficial.

So far I feel that I have put off any surgery to my hip, so I'm hoping that it lasts as long as I keep attending the classes.

The leaders are always very friendly and encouraging.

Suggestions for improvement related to facilitating self-practice of exercises, increased consistency of class content across leaders and modifying class content for individuals who experience post-class fatigue.

I would welcome some additional time at the end of formal instructions to practise exercises on my own – e.g. another 15 mins of water time rather than having to exit pool after 40 min due to next scheduled class commencing.

Class flow is disjointed between the 3 leaders.

My medics are wary because it's taking 24-48 hrs to recover.

One participant raised that they felt unsafe whilst performing balance exercises.

The balance exercise performed in my class is quite unsafe, standing on one foot, eyes closed, with hand above head.

Whilst most people enjoy the social chatter during classes, it can be distracting for some people.

I enjoy the social contact but I find too much chatter distracting.

A full summary of the participant comments to this question is provided in Appendix 5.

Key learnings and recommendations

Warm water exercise is growing in popularity in both people that live with arthritis or musculoskeletal conditions and the health professionals that provide care to them. The effectiveness of warm water exercise has been demonstrated by a number of research studies published in international healthcare journals (2).

The Waves program, established in the late 1970's, is a key service provided by Arthritis and Osteoporosis Victoria. With more than 120 leaders providing 45 classes in more than 20 locations across Victoria to over 450 participants, the Waves program is one of the largest formalised warm water exercise programs in Australia. Whilst this popularity in itself provides evidence of the positive impacts participants are likely to experience from the program, in an environment of evidence-based best-practice provision of empirical data to support the impacts is a priority. This impact study sought to address this need.

Participation in Waves classes achieves minor improvements in symptoms and functional impairment

In this study, people participating in Waves classes reported improvements in pain, joint stiffness, physical function, mobility, daily activities and feelings of anxiety and depression. The improvement in stiffness was the only one to reach statistical significance. It is likely that the small yet diverse sample of people included reduced the ability to detect statistically significant changes in the other outcomes measured. Other factors likely to have contributed to the lack of statistical significance are that the control participants appeared younger, to have lower levels of symptoms and functional impairment and that the Waves classes are of lower intensity than similar programs tested in prior studies and attendance at classes was modest. Whilst the analysis of differences between groups for change scores was adjusted for differences in baseline scores the differences did not reach statistical significance. Of note, the WOMAC scores for the Waves participants in this study appeared comparable to those of participants with OA included in previous successful trials of warm water exercise (4, 26, 27).

People attending Waves classes already have high levels of self-reported health-related quality of life

The Waves participants included in this study reported statistically significant improvements in their overall health state scores as measured by the EQ-5D health-related quality of life assessment over the 12-week follow-up. The self-care, usual activity, pain/discomfort, anxiety/depression and utility scores for the EQ-5D health-related quality of life assessment remained stable for both groups over the 12-week follow-up. Changes in these aspects of health-related quality of life may require a longer follow-up period to detect changes. Alternatively, the goal with health-related quality of life may be to maintain rather than improve in this population. Indeed the health-related quality of life reported by participants in this study was comparable to that reported for general population of the same age (Waves utility = 0.84 age matched norm utility=0.82) (28). This suggests health-related quality of life may have already been optimised in Waves participants and therefore there was no room for further improvements. Maintenance, rather than improvement in outcomes is important. In light of this, a question regarding maintenance of the participants' condition should be added to the satisfaction survey in longer-term follow-ups, rather than focusing solely on improvement.

Greater improvements may be achieved if Waves classes are more frequent, self-practice facilitated and class attendance improved

In comparison to prior studies which have reported statistically significant improvements in outcomes similar to that evaluated in this study, the Waves exercise classes were less intensive. In the systematic review that was completed as stage 1 of this evaluation project, three studies of warm water exercise were found to have significant positive impacts on pain (2). In two of these three studies, the warm water

exercise program was delivered twice per week (4, 5) and one study provided a class three times per week (6). In comparison, Waves participants typically attend one class per week. This lower dosage of classes may be a factor contributing to smaller improvements than those reported by prior studies.

An alternative to increasing the frequency of Waves classes as a strategy to provide a higher dose of exercise is the provision of materials to support self-practice of exercise. For example, participants could be provided with leaflets that include information on the benefits of self-practice and exercise examples to encourage participants to practise exercises outside of class times, and/or information about other times they could access the pool. Waves leaders could also be trained to encourage self-practice.

The modest levels of attendance at Waves classes may also have contributed to the smaller improvements in effects than reported by other published studies of warm water exercise in similar populations. Over the 10-11 week period that Waves classes were offered, on average participants attended 7 of the possible 10-11 classes (minimum number attended = 2, maximum = 10). No participants attended more than 10 Waves classes during the 12-week follow-up and only 28 participants (65%) attended 6 or more classes in the 12-week follow-up. Reasons for non-attendance were not explored and would be a useful activity for Arthritis and Osteoporosis Victoria to perform. Reasons for modest attendance may include illness over the winter months, vacations and family commitments. The number of participants included in this study was too small to permit meaningful sub-group analysis across high and low attendees. This would be a valuable analysis to conduct in future studies if a large enough sample was obtained.

Waves participants perceive that the classes are enjoyable, acceptable and an effective strategy for managing their condition

An important finding of this study was the high levels of satisfaction with the Waves classes. Overwhelming, study participants in the Waves group endorsed the Waves classes as being enjoyable, acceptable and effective for managing their condition.

There were a small number of comments provided by participants relating to areas where the program could be further developed. These include: facilitating self-practice of exercises, increased consistency of class content across leaders and modifying class content for individuals who experience post-class fatigue or other symptoms. It must be noted that these suggestions came from individual participants rather than being consensus recommendations across all participants surveyed. Despite this, the comments would appear to offer valuable areas to consider developing the program.

Checking-in with participants at the start of classes is important

When commencing a new exercise program it is important to monitor how individuals respond to the specific exercises and the intensity of the classes. There may be specific exercises which elicit an increase in symptoms, classes may result in fatigue or muscle soreness that disrupts participants' usual activities or conversely participants may feel the program was too easy and they would like more challenging exercises. Waves leaders should be reminded to communicate with participants at the start of each class to ensure there were no adverse effects from the previous class and that the intensity is at a level that they feel will be most beneficial for them (3).

Waves leaders should provide confirmation to participants about the purpose and safety of the balance exercises

The prevalence of recurrent falls and fall injuries among adults with arthritis is up to 2.4 and 2.5 times higher, respectively, than those without arthritis (3). Preventing falls is therefore a priority outcome for this population and exercise is a well-established strategy to achieve this.

To be effective at reducing falls risk, balance exercises should provide a moderate to high challenge to balance (7). The pool is an ideal environment to practise challenging balance exercises as there is a low risk of injury should a person over-balance whilst performing the exercise. To increase participants' understanding of the purpose of balance exercises, leaders should be encouraged to communicate to participants the need for balance exercises to be challenging to ensure they are most effective and reassure participants that the most likely consequences of over-balancing is to get their hair wet rather than suffering any injury. As with all exercises included in the Waves program, participants may choose not to perform balance exercises if they are not comfortable performing them.

Waves leaders should be encouraged to provide consistency in exercises across Waves classes

Providing a consistent set of core exercises across classes has the potential to optimise positive effects on health as it facilitates participants mastering exercises so they are performed correctly. Learning a new exercise takes time and often the first few times it is practiced may not produce benefits. Waves leaders are currently encouraged to ensure a large proportion of the class contains exercises with which participants are familiar. Whilst inclusion of novel exercises is not discouraged—this has benefits such as keeping classes interesting and promoting the acquisition of new skills—there needs to be a focus on consistency rather than diversity. Encouraging leaders to 'check-in' with other leaders to compare class content and program staff auditing classes more frequently may facilitate greater consistency in exercises delivered across classes.

Limitations

There are several limitations of this study that should be acknowledged.

Long-term outcomes were not assessed in this study so it cannot be determined if the positive effects reported by Waves participants can be maintained over time, or if greater improvements could be achieved with a longer follow-up period. Changing outcomes may take time and 12 weeks is a relatively short time period over which to measure changes in outcomes. A more realistic timeframe may be in the order of 6-12 months.

Whilst it is important to know the short term impacts of exercise interventions, studies of longer-term outcomes are required. A study by Cochrane *et al.* found pain and physical function improved after 1 year of aquatic exercise for people with osteoarthritis, though effects were lost at 18 months follow-up when aquatic exercise was ceased for 6-months (29). Similarly, a study by Thomas-Carus *et al.* reported significant improvements in health-related quality of life, pain and physical function following completion of a 12-week aquatic exercise program in people with fibromyalgia with effects being maintained only for pain after a consecutive 12-week period of physical inactivity (6). Therefore, persistence with aquatic exercise training may be essential for preserving changes in health-related quality of life and physical function, but effects of aquatic exercise on pain may be maintained for longer periods. Larger more robust trials are required to more accurately determine the long-term effects of aquatic exercise. The data collected in this pilot study may indeed serve to develop large-scale grant applications for this purpose.

The lack of random allocation of participants to the intervention and control groups is a limitation of this study. Therefore, selection bias, a type of bias caused by choosing non-random data for statistical analysis, could have occurred and influenced our study findings.

This study initially aimed to recruit 100 Waves participants and 100 control participants over the six-month recruitment period and to then match the Waves participants to the control participants based on age and condition. However, due to an insufficient number of recruits, this process was unable to be completed. This could account for the differences between baseline characteristics of the two groups

being compared and inability to detect effects that may have otherwise been observed with a larger sample.

Differences between groups observed in the outcomes measured in this study may have also been due to confounding factors not measured. Factors such as medication use and other co-interventions were not collected from participants, which may have confounded our results.

The small sample meant it was difficult to detect significant changes in outcomes. In addition, confidence intervals were wide, suggesting the sample was heterogeneous. The small sample size also didn't allow us to complete a sub-group analysis of intervention effectiveness according to specific musculoskeletal conditions.

Summing it up

In summary the key messages that emerged from this impact study are:

- the Waves warm water exercise program provides minor improvements in symptoms and functional impairments in people with arthritis and other musculoskeletal conditions;
- there is an opportunity to achieve greater impacts by offering more frequent classes, encouraging self-practice and increasing class attendance; and
- the majority of participants find the Waves warm water exercise program enjoyable, easily accessible and beneficial to their health.

The information gained from this study can be used to inform planning and development of the Waves program. Key recommendations relating to the program development include:

- exploring reasons for modest class attendance and strategies to improve this;
- following up participants 1 year after they completed their baseline surveys to gain insights into long-term outcomes;
- if the satisfaction survey is used again, consider adding a question regarding maintenance of the participants' symptoms rather than focusing on improvement;
- implementing strategies to increase the frequency of performing warm water exercise outside of Waves classes, such as providing an education and exercise pamphlet and leaders promoting the value of self-practice;
- reminding Waves leaders to communicate with participants at the start of each class to ensure there were no adverse effects from the previous class;
- the implementation of Waves leaders providing confirmation to participants about the safety of the exercises being performed especially exercises that aim to challenge balance;
- getting Waves leaders to 'check-in' with other leaders on a more regular basis to compare class content to facilitate greater consistency in exercises delivered across classes; and
- implementing that program staff could facilitate consistency in exercises provided by leaders by auditing classes more frequently.

This study provides a comprehensive overview of the effectiveness of the Waves warm water exercise program provided by Arthritis and Osteoporosis Victoria. On the basis of the findings presented in this report, it appears that the Waves program can decrease the burden of arthritis and other musculoskeletal conditions by decreasing pain and joint stiffness, and improving physical function. Findings from this study can be used by Arthritis and Osteoporosis Victoria to promote the benefits of warm water exercise and the need for further evaluation.

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Appendices

Appendix 1: Example Waves class

Appendix 2: WOMAC OA Index questionnaire

Appendix 3: EQ-5D questionnaire

Appendix 4: Satisfaction survey

Appendix 5: Satisfaction survey responses

Appendix 1: Example Waves class

TYPE	ACTIVITY/EXERCISE	TIME (mins) or REPS	MODIFICATIONS (Easier/Harder)	EQUIPMENT / NOTES
WARM UP				
Introduction	Hokey pokey	2 mins		
Light aerobic	Walking across the pool	2 mins	Increase speed, change stride length and starting to swing arms	
Light aerobic	Walking across the pool sideways	2 mins	Increasing speed and starting to swing arms	
CORE				
REPEAT THIS SERIES TWICE		15 - 25 mins		
Strength - lower body	Lunges	10+10		
Aerobic	Punching	2mins		
Strength - lower body	Single leg Cycling	10 + 10 reps	10 times forward, then 10 reverse	
Aerobic	Star jumps (opposite arms / legs)	2 mins		
Strength - upper body	Rail/Wall push ups	10 reps		
Aerobic	Swimming strokes	2 mins	On the spot or walking around the pool	
ROM (range of motion)	Playing the accordion	1 min	Moving hands up and down	
REPEAT CORE SECTION TWICE OR THREE TIMES DEPENDING ON TIME				
COOL DOWN				
ROM - 'doing the domestics!	Washing machine (trunk rotations)		Can swing arms around the body	
ROM - 'doing the domestics!	Playing the piano		Can walk or move side to side as you play	
ROM - 'doing the domestics!	Doing the domestics		Stir the pot, tumble dryer with hands,	
ROM - 'doing the domestics!	Doing the domestics		Reaching high to brush away spiders	
Arthritis ROM	Hands & feet			
Spine ROM	Neck		Side stretch & head rotation	
CONCLUSION NOTES (Health and safety):				
REASONS FOR EXERCISES AND SEQUENCES:				
The class core involves minimal equipment. Exercises alternate between strength exercise to Aerobic exercise. This is one of the different ways to structure a class core to maintain a moderate intensity and save time.				

Appendix 2: WOMAC OA Index

INSTRUCTIONS

In sections A, B and C questions will be asked in the following format and you should give your answers by putting an "X" in one of the boxes.

NOTE:

1. If you put your "X" in the left-hand box, i.e.

None	Mild	Moderate	Severe	Extreme
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

then you are indicating that you have no pain.

2. If you put your "X" in the right-hand box, i.e.

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Then you are indicating your pain is extreme.

3. Please note:

- that the further to the right you place your "X" the more pain you are experiencing.
- that the further to the left you place your "X" the less pain you are experiencing.
- Please do not place your "X" outside the box.

You will be asked to indicate on this type of scale the amount of pain, stiffness or disability you have experienced in the last 48 hours.

Remember, the further you place your "x" to the right, the more pain, stiffness or disability you are indicating that you experienced.

Section A

INSTRUCTIONS

The following questions concern the amount of pain you have experienced due to arthritis. For each situation please enter the amount of pain experienced in the last 48 hours.

Please mark your answers with an "X"

QUESTION: How much pain do you have?

- | | | | | | |
|------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Walking on a flat surface | None | Mild | Moderate | Severe | Extreme |
| | <input type="checkbox"/> |
| 2. Going up or down stairs | None | Mild | Moderate | Severe | Extreme |
| | <input type="checkbox"/> |
| 3. At night while in bed | None | Mild | Moderate | Severe | Extreme |
| | <input type="checkbox"/> |
| 4. Sitting or lying | None | Mild | Moderate | Severe | Extreme |
| | <input type="checkbox"/> |
| 5. Standing upright | None | Mild | Moderate | Severe | Extreme |
| | <input type="checkbox"/> |

SECTION B

INSTRUCTIONS TO PARTICIPANTS

The following questions concern the amount of joint stiffness (not pain) you have experienced in the last 48 hours. Stiffness is a sensation of restriction or slowness in the ease with which you move your joints.

Please mark your answers with an "X"

6. How severe is your stiffness after first waking in the morning?

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

7. How severe is your stiffness after sitting, lying, or resting later in the day?

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

SECTION C

INSTRUCTIONS TO PARTICIPANTS

The following questions concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following questions please indicate the degree of difficulty you have experienced in the last 48 hours due to arthritis.

Please mark your answers with an "X".

QUESTION: What degree of difficulty do you have?

8. Descending stairs

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

9. Ascending stairs

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

10. Rising from sitting

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

11. Standing

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

12. Bending to floor

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

13. Walking on flat

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

14. Getting in/out of car

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

15. Going shopping

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

16. Putting on socks/stockings

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

17. Rising from bed

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

18. Taking off socks/stockings

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

19. Lying in bed

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

20. Getting in/out of bath

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

21. Sitting

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

22. Getting on/off toilet

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

23. Heavy domestic duties

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

24. Light domestic duties

None	Mild	Moderate	Severe	Extreme
<input type="checkbox"/>				

THANK YOU FOR COMPLETING THE QUESTIONNAIRE

Appendix 3: EQ-5D questionnaire

Please read each statement and select the one that best describes your health today.

Mobility

PLEASE TICK ONE BOX

Thinking about your health today, which of the following statements best describes your mobility?

- I have no problem walking about
- I have some problems in walking about
- I am confined to bed.

Self-care

Thinking about your health today, which of the following statements best describes your self-care?

- I have no problems with self-care
- I have some problems washing and dressing myself
- I am unable to wash or dress myself.

Usual activity

Thinking about your health today, which of the following statements best describes your usual activities such as work, study, housework, family or leisure activities?

- I have no problems with performing my usual activities
- I have some problems performing my usual activities
- I am unable to perform my usual activities.

Pain/discomfort

Thinking about your health today, which of the following statements best describes any pain or discomfort you may be experiencing?

- I have no pain or discomfort
- I have moderate pain and discomfort
- I have extreme pain and discomfort.

Anxiety/depression

Thinking about your health today, which of the following statements best describes any anxiety and depression you may be experiencing?

- I am not anxious or depressed
- I am moderately anxious and depressed
- I am extremely anxious and depressed.

Now I would like you to think of a scale between 0 and 100, where 0 is the worst health you can imagine and 100 is the best you can imagine. (0-100)

What number between 0 and 100 best describes your health today? _____

THANK YOU FOR COMPLETING THE QUESTIONNAIRE

Appendix 4: Satisfaction survey

Please complete this survey about the Waves classes using the following scoring system

A	B	C	D	E
Strongly agree	Agree	Neutral	Disagree	Strongly disagree

I enjoy the Waves classes	A	B	C	D	E
I would recommend the Waves classes to my friends	A	B	C	D	E
I plan to continue attending the Waves classes	A	B	C	D	E
The format of the classes is suitable for my condition	A	B	C	D	E
The cost of each class is affordable	A	B	C	D	E
I enjoy the social contact with others in the Waves class	A	B	C	D	E
Taking part in the Waves program has been beneficial for my condition(s)	A	B	C	D	E
Taking part in the Waves program has been beneficial for my sleep	A	B	C	D	E
The number of classes I attend each week sufficient for the improvement health and well-being	A	B	C	D	E
The social contact and peer support from other people with similar conditions in the class is just as important as the exercises	A	B	C	D	E
I have confidence in the class leaders' knowledge and ability	A	B	C	D	E
I feel safe in the classes	A	B	C	D	E
Holding Waves classes in different locations and at different times makes it easier for people to attend a warm water exercise class	A	B	C	D	E

Do you have any additional comments about the value, impact or accessibility of the classes?

THANK YOU FOR COMPLETING THE QUESTIONNAIRE

Appendix 5: Satisfaction survey responses

Do you have any additional comments about the value, impact or accessibility of the classes?
Access to classes for the Frankston area is difficult. The night time class at CASEY RACE Cranbourne is the only close class and is hard on older people to attend!
As I have to walk to and from Monash Hospital, it would be more convenient if I could use the Clayton Aquatic Centre. From my home this takes just 5 minutes to commute by walk.
Excellent value. Class leader's knowledge about how to complete exercises safely is very questionable. Class flow is disjointed between the 3 leaders. They appear to be 'just getting it done', moving quickly between repetitions, and often finishing after 40 mins, leaving us to float on a noodle etc. The balance exercise performed in my class is quite unsafe, standing on one foot, eyes closed, with hand above head. Also the dumbbell under the foot and doing quad lifts is also dangerous for balance and control of dumbbell.
I am very happy and all are very supportive and friendly.
I can only cope with 30mins due to fatigue.
I enjoy the social contact but I find too much chatter distracting. It disturbs my concentration and personal enjoyment of the activity, but I do enjoy the friendliness and support of other group members.
I find it hard to motivate myself and make time to look after myself as much as I should. However, I find the Waves Classes so beneficial I never miss them, even though I tram both ways and it takes a large proportion of the day to do so. I find Waves hugely beneficial.
I find the group very friendly and helpful especially the leader. I can get to the classes although they are a long way from where I live but if I could not drive I could not attend.
I suffer at times after the program and must try to be less agile. Waves is good.
I would welcome some additional time at the end of formal instructions to practise exercises on my own - e.g. another 15 mins of water time rather than having to exit pool after 40 minutes.
I'm 44 and feel very young in the class. Most people are a lot older. It would help if you could change classes if can't attend one - subject to availability.
My medics are wary because it's taking 24-48 hours to recover. Post-polio syndrome is my first disability. Have had additional problem diagnosed since starting Waves. I believe Waves helps me cope with it all. Class leaders are great. The group I attend with are all different. It's very special. I believe my strength has improved too. I would have preferred morning class as it takes real effort to go out mid-afternoon.
No. Everything is good and enjoyable.
I do feel that the overall system could be greatly improved. My class falls on a Monday night. Due to school holidays (probably can't alter that) public holidays - again no classes and most importantly, the hydrotherapy pool not being 'up to scratch' therefore classes having to be cancelled, twice so far, I am not able to access the value of the exercises on my health.
I feel that I have put off any surgery to my hip, so I'm hoping that it lasts as long as I keep attending classes.
Thank you, during the time of the class my pain felt a little less. The hot water felt good, but the pain was still there.
The leaders are always very friendly and encouraging.
Unfortunately I was only able to attend 3 out of the 10 classes, as I developed shingles and did not want to come into contact with others.
Very convenient location for me. I would like to continue in 2014.

Arthritis

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