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# **The feasibility of increasing physical activity in care home residents: Active Residents in Care Homes (ARCH) programme.**

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## Abstract

**Objectives:** Maintaining physical activity for older residents in care homes maximises their physical and mental health and wellbeing, independence, dignity and quality of life.

Unfortunately, most residents do not participate in regular physical activity. *Active Residents in Care Homes, ARCH*, was designed to increase physical activity by facilitating whole-system change in a care home. We evaluated whether *ARCH* can be delivered, its effects on resident's physical activity, wellbeing and costs.

**Design:** Feasibility study.

**Setting:** Three residential care homes.

**Participants:** Care home residents and staff.

**Intervention:** Occupational and physiotherapists implemented *ARCH* over 4 months with an 8-month follow-up.

**Main outcome measures:** Assessment of Physical Activity, Pool Activity Level, EQ5D-5L, Dementia Care Mapping, cost of implementing *ARCH*, health and social care utilisation.

**Results:** After implementing *ARCH*, residents displayed more positive behaviours, better mood and engagement and higher physical activity levels, but these improvements were not sustained at 8-month follow-up. The cost (2016 prices) of implementing *ARCH* was £61,037, which equates to £1,650/resident. Healthcare utilisation was £295/resident (SD320) in the 4 months prior to *ARCH*, £308/resident (SD406) during the 4-month implementation and £676/resident (SD438) in the 8-month follow-up.

**Conclusions:** The *ARCH* programme can be delivered, it may have some short-term benefits and is affordable. Rather than have unrealistic increases in the health and longevity of older care home residents, *ARCH* may slow the decline in physical, mental and emotional well-being usually seen in older people in care homes, return some dignity and improve their quality of life in their last months or years.

**Clinical Trial Registration number:** ISRCTN24000891

## **Contribution of the Paper**

- most older care home residents spend long periods physically and mentally under-stimulated
- *Active Residents in Care Homes, ARCH*, is a programme designed to increase participation in physical activity
- this study shows *ARCH*
  - can be delivered
  - is relatively cheaply
  - may produce short-term improvements in physical, mental and emotional health and wellbeing
  - may slow decline usually seen in frail elderly people
- rather than unrealistic improvement in health or longevity, *ARCH* may slow deterioration and bring older people greater dignity and quality of life

**Key words:** older people; care homes; physical activity; health, well-being, quality of life.

## Background

In the UK more than 420,000 older people live in residential care homes (1). Providing them with meaningful physical, social, leisure, intellectual, emotional and spiritual activities tailored to each person's needs and preferences (2) is vital for their general health, wellbeing and quality of life (3). Importantly, increasing physical activity can improve mobility, strength, flexibility (4), sleep, concentration, memory (5), reduce risk of falls (6), maximise independence and reduce carer burden. 'Traditional' exercise interventions in care homes have little impact on residents' physical activity (7, 8). However, increasing physical activity requires a whole-system approach that provides residents with opportunities to engage in activity, develops care home staffs' ability and confidence to devise and encourage residents to be active, and overcomes organisational, working practices, risk averse mindsets and environmental that prevent residents participating in physical activity (9-12).

The need for a whole-system approach to increase physical activity informed the development of "Access to Wellbeing" a holistic, multidimensional programme that we implemented in an adult day centre (13). We adapted the Access to Wellbeing programme to increase physical activity in older residents in care homes (14), incorporating elements of the Model of Human Occupation (15), Person, Environment and Occupation model (16) and theories of personhood and person-centred care (17).

This study investigated the feasibility of delivering *ARCH* in residential care homes under real-world conditions, the willingness of care homes, their staff and residents to participate on the programme and the study, appropriateness of outcome measures, estimated the programmes' effects on residents' physical activity and behaviours, general health and wellbeing, and the costs of delivering the programme.

## Method

**Design.** Pragmatic feasibility study.

**Recruitment of care homes and residents.** Care home managers of nine care homes providing residential care, were identified by health and social care departments in three South London boroughs and sent a letter introducing the study. Those who expressed an interest in participating received detailed information and a meeting arranged with senior staff to discuss the study, commitments and timeframe. From each care home we aimed to recruit 10-15 residents, considered suitable for a feasibility study (18). From their knowledge of their residents the care home staff identified potential participants. To be included residents had to be over 65 years old, cared for out of bed, able to maintain a seated upright position, able to follow simple commands, no unstable physical or mental conditions, and they may have had mild (but not severe) cognitive impairment.

Recruitment and consenting residents was a multi-staged process (19). Research team met potential participants to explain the study, assess inclusion criteria, answer questions and assess their capacity to consent following Mental Capacity Act (MCA) 2005 guidance (20). Residents with capacity to consent were provided with detailed information in a suitable format (normal/large print or audio), allowed 48 hours to consider participation. Residents agreeing to participate were asked to provide written consent. For residents without capacity to consent, assent was obtained from a consultee following MCA 2005 guidance (20). As residents often had complex, changing needs, their capacity to consent, willingness and/or ability to participate in the study may fluctuate, so these were assessed on an occasion-by-occasion basis, using verbal questioning and observing body language, behaviours and verbal signs which might indicate disengagement and unwillingness (21). If at any point it was felt a resident did not have capacity to consent consultee assent was used (20).

**The programme.** The programme has been described in detail elsewhere (14) and Appendix 2. Briefly, a team of two or three occupational and physiotherapists were involved in implementing the *ARCH* programme. Knowing, understanding and addressing the residents' needs and preferences are at the very heart of the *ARCH* programme. These are gleaned during one-to-one interviews with the residents when their personal, family and social history, interests and preferences, particularly relation to physical activity, and from these a personalised care plan with physical activities that would engage each individual resident were developed for the staff to implement. The therapists conducted an in-depth Residential Environment Impact Survey (REIS) of each care homes' physical environment, working practices, attitudinal and organisational facilitators and barriers of physical activity (22). From this REIS a detailed report was prepared with a plan to encourage physical activity by, for example, suggesting changes to the physical environmental (room layout to encourage social interaction), working practices (identifying staff "champions" who worked with specific residents to increase their activity), challenging organisational and individual attitudes, fears and concerns that discouraged physical activity, and instigating staff training to increase their confidence and ability to promote activity. *ARCH* took approximately 4 months to implement in each care home, after which time the therapy team withdrew except for a rehabilitation assistant who attended the care home one day a week during the following 8 months to sustain adherence to the central principles of the programme.

**Outcomes.** Residents physical activity levels and behaviours were assessed using several outcomes before the programme was implemented (baseline), immediately after implementation (4 months) and at follow-up 8 months later.

The *Assessment of Physical Activity (APA)* in frail older people is an interview-based subjective assessment of the frequency, duration, intensity and type of physical activity over a 24-hour period (23). It focuses on the main physical activities walking, standing, time on feet indoors/outdoors, sitting/lying and was designed and validated for older people.

The *Pool Activity Level Checklist (PAL)* is a widely used, validated, measure of older people's engagement with activity (24). Researchers rate residents' ability to plan and perform during nine common daily activities – bathing/washing, dressing, eating, contact with others, group work skills, communication skills, practical activities, use of objects, reading/looking at a newspaper/magazine. Each activity is scored on a four point scale: 1 = 'Planned - needing little or no help with everyday activities'; 2 = 'Exploratory - able to carry out familiar activities in familiar surroundings'; 3 = 'Sensory - limited ability to perform an activity'; 4 = 'Reflex' - unable to perform basic everyday tasks without assistance'. For example, assessing residents' ability to dress themselves was scored as:

Plans what to wear; selects own clothing from cupboard; dresses in correct order	P = 1
Needs help to plan what to wear but recognises items and how to wear them: needs help with order	E = 2
Needs help to plan, and with order of, dressing, but can carry out small tasks if someone directs each step	S = 3
Totally dependent on someone to plan, sequence and complete dressing; may move limbs to assist	R = 4

Residents could score 9-36 points, lower scores indicate greater ability to plan and perform activities.

The *EQ-5D-5L* is a self-completed questionnaire measuring health-related quality of life.

*Dementia Care Mapping (DCM)* captures information about the quality of care and type of activity residents participate in (25-28). In communal areas of the care homes two trained DCM "mappers" (JW, RS) observed residents' and every five minutes for 6 hours, on 3 or 4 days at each assessment. They recorded residents' activity, interactions with staff and other residents, behaviour, mood and engagement, as one of 21 behaviours having high (n=17), neutral (n=2) or low (n=2) potential for positively affecting a resident's mood and engagement (Table 1). For example, behaviours with high potential for positively affecting mood and engagement include "interacting with others verbally or otherwise" and "leisure, fun and recreational activity", behaviours with low potential for positively affecting mood and engagement include "attempting to communicate without receiving response". The percentage of high, neutral or low behaviours recorded was calculated. Higher scores indicate greater physical activity and more positive behaviours.



Mood and engagement refer to residents' engagement with the activity they are performing (Table 1). During each 5-minute DCM timeframe the mapper assessed and recorded a residents' mood and engagement on a 6-point scale, +5 very engaged in the activity they were doing to -5 withdrawn, uninterested and disengaged with what they were doing (28).

For example, one resident was observed ("mapped") for a total of 3 hours. Initially they spent most of their time painting and drawing which they were clearly enjoying, so their behaviour was categorised as L(leisure activity) and their mood and engagement as +3(considerable positive mood, considerably engaged). During lunch they were categorised as F(eating) +1(neutral), eating but without visible enjoyment. Later they were observed reading a newspaper but did not appear to be as engaged as when they were drawing and so categorised as L(leisure activity) +1(neutral).

*Data Analysis.* Descriptive statistics were used to describe the data. The data were Normally distributed. Odds ratios (OR) were estimated to assess the probability of residents displaying positive or negative behaviours and physical activity levels after implementing *ARCH*. Data presented as mean, odds ratio or differences to baseline values with the 95% Confidence Intervals (CI). The DCM mappers' inter-rater reliability was estimated as Cohens Kappa 0.78 to 0.87, moderate to strong agreement (29).

*Economic Analysis.* To assess the programmes' costs a pragmatic approach was used to estimate the resources needed to deliver *ARCH*. The direct costs of *ARCH* comprised equipment and materials therapists' time in intervention-related activity such as staff training, therapists-staff contact time and time interacting directly with residents or their family. Residents' health and social services utilisation (GP and healthcare professionals consultations, hospital use (A&E, outpatient, stays), ambulance and paramedics were collected retrospectively for the four months prior to *ARCH* implementation, during the implementation and eight months post-implementation. The unit cost for each resource was obtained from the Personal and Social Services Research Unit 2016(30) and other relevant sources (Appendix 1). These unit costs were multiplied by the

frequency and duration of each item, and summed to provide a full cost per care-home. For each time period the unit costs were averaged to provide a mean cost per resident.

When assessing healthcare utilisation the most detailed, reliable information was available from Care Home 3, therefore primary economic analysis of healthcare utilisation is based on data from Care Home 3.

## Results

**Participants.** Three care homes were recruited, one from each of the boroughs approached, from whom 35 residents were recruited (12/19 from Care Home 1, 10/19 from Care Home 2, 13/37 from Care Home 3), residents mean age was 89 years (range 71-98), 29 were female, 30 white British, 3 white other and 2 black Caribbean. Participants had complex, multi-morbidity, most had mild dementia.

**Outcomes.** The *EQ-5D-5L* and *APA* were very difficult for residents to understand and for researchers to apply, so were discontinued in Care Home 1.

*Dementia Care Mapping.* The percentage of positive DCM behaviours rose from 66% at baseline to 75% after implementing *ARCH*, then decreased to 71% during the 8-month follow-up (Table 2). The probability of residents displaying positive DCM behaviours was higher after implementing *ARCH* (OR 1.219, CI 1.08 to 1.38), but not 8 months later (OR 0.93, CI 0.82 to 1.06). DCM mood and engagement levels increased from 1.28 at baseline to 1.46 after implementing *ARCH*, but 8 months later had declined to 1.43 (Table 2). The probability residents had better mood and engagement was higher (OR 1.27, CI 1.11 to 1.45) at 4-months compared to baseline, but not at 8-month follow-up (OR 0.75, 0.651 to 0.85).

*Pool Activity Level (PAL).* Compared to baseline of 3.56, participant's engagement with activity increased after implementing *ARCH* to 3.21 (change from baseline -0.4; -0.72 to -0.07), but returned to baseline values at 8-months at 3.63 (change -0.03; -0.35 to 0.29) (Table 2).

*Costs.* The total costs (2016) of materials, equipment, etc, needed to implement *ARCH* in Care Homes 1, 2 and 3 were £937, £619 and £750 respectively.

In Care Home 3, which had the most reliable care utilisation data the programme was delivered by two Band 7 occupational therapists and a Band 5 physiotherapist, whose time, activity and

costs are detailed in Table 3. The total direct cost of *ARCH* was £61,037. Although 11 residents were involved in the research in Care Home 3, as *ARCH* is a whole system intervention all 37 residents will have benefited from better staff training, working practices and an environment that encourages physical activity, therefore the cost was estimated to be £1,650/resident.

*Healthcare utilisation.* There was no indication that *ARCH* was associated with reduced health or social care utilisation. The mean healthcare utilisation of 11 residents in Care Home 3 was £436/resident (SD 378) in the 4 months prior to intervention, £323/resident (375) for the 4 months during the intervention and £2,468/resident (4011) during follow-up (Table 4). Higher costs during the follow-up were largely due to the large number of A&E visits and hospital attendances of two residents. Omitting these two residents from the analyses, healthcare utilisation costs were £295/resident (320) prior to the programme, £308/resident (406) after *ARCH*, and £676/resident (438) during follow-up.

## Discussion

*ARCH* is a person-centred, holistic, multidimensional programme, designed to increase physical activity of older care home residents by facilitating whole-system change. We have shown that *ARCH* can be implemented in care homes and, although objective measurement of physical activity is difficult, the programme may have short-term improvements in physical activity levels and behaviours and is relatively inexpensive, but these benefits aren't sustained and it didn't reduce health and social care utilisation.

The need for *ARCH* arose from the benefits physical activity has on care home residents' health and wellbeing (2-6), but the limited effectiveness of "traditional" exercise programmes (7, 8). *ARCH*'s short-term improvements are encouraging, as even small improvements in physical activities can improve peoples' quality of life. Unfortunately, these short-term benefits were not sustained. Sustaining its benefits might be achieved through ongoing input from therapists, but in the long term this is impracticable, expensive and at the mercy of extrinsic factors such as therapy staff availability. Originally, we planned that a rehabilitation assistant would visit and work with each care home one day a week during the 8-month consolidation period to maintain the central *ARCH* principles. Unfortunately, staffing problems meant this was not possible. This problem reflects real-life and pressures clinical departments are under, their need to prioritise acute hospital activity over care homes. We believe that future iterations of *ARCH* should enhance staff training and instil a greater sense of "ownership" of the programme to ensure care homes apply *ARCH*'s central ethos and principles. This would be a more effective, more efficient and more desirable way to sustain the programmes' benefits, as well as mitigating the one-off set-up and training costs.

Lack of sustained benefits was not unexpected. The trajectory of care home residents' physical activity and health is steady, sometimes rapid decline (31, 32). However, at the end of the 12 months intervention period our participants' activity levels and behaviours were around the

previous baseline values, but these were higher than expected given the decline that would be anticipated in a year. Rather than having unrealistic expectations of dramatically improving residents' health, longevity and reducing health and social care costs, the value of programmes such as *ARCH* may be in slowing decline by providing people the opportunity to do more, live better lives and maintain their dignity for the duration of their time in care.

*Strengths and limitations.* This was a pragmatic feasibility study to see if *ARCH* could be delivered under “real-world” conditions, assess the willingness of care homes, residents and staff to participate, establish appropriate outcomes and estimate the effects of the programme and its costs. We successfully implemented the programme in the three care homes, adapted it to fit the contextual needs of their residents and staff, almost 50% of residents agreed to take part, we identified (in)appropriate outcomes and found *ARCH* had short-term but not long-term benefits and its costs were not prohibitive. However, being a small, non-randomisation, uncontrolled study, our findings must be treated with caution. Although randomised controlled trials in care homes are possible, they are extremely difficult to conduct, and funding for research in this “unglamorous” area is also extremely limited. One of the biggest problems we encountered was objectively measuring residents' physical activity. Residents and researchers found commonly used measures (EQ-5D-5L, APA) difficult to perform, which raised concerns about their validity and reliability in this population (33), so we abandoned them to avoid overburdening the residents with unnecessary assessments. The short-term improvements in the PAL and DCM is encouraging, especially DCM which was developed using person-centred approaches to care and is increasingly used to assess the effects of care home interventions (25-28). However, the PAL and DCM are quasi-objective measures of activity and subject to possible bias. Similarly, measuring health and social care utilisation in care homes is challenging as residents' records are often inconsistent. Care Home 3 posed the fewest challenges collecting service use data and in whom we are most confidence in their reliability, but its findings are based on 11 people and so need to be considered with some caution. While we believe our study's findings are as robust as possible, from a

representative sample of care homes residents and staff and were conducted under “real-world” conditions, whether they can be replicated and generalised to other care homes needs to be corroborated.

In summary, *ARCH* is a person-centred, multidimensional programme designed to produce system-wide change to care home organisational, environmental and working practices in order to increase residents’ participation in physical activity, thereby increasing their health, wellbeing and quality of life. Despite the many difficulties typically encountered when working in care homes we demonstrated that *ARCH* can be delivered under “real-world” conditions, may have short-term benefits and is affordable. Rather than dramatically improving older care home residents’ health or quantity of life, the value of programmes like *ARCH* may be in slowing decline of residents’ physical activity and health, improving their quality of life and maintaining their dignity during their last months. This is very important for the large and increasing number of older people in residential care homes, their loved ones and the staff caring for them, and fits with the current concept of good care (34).

**Ethics Approval:** Ethics approval was obtained from the National Research Ethics Service (NRES) Committee London - South East in September 2014 (ref 14/LO/1329). For residents, a process consent model was adopted(35) and where participants lacked capacity they were only included if a relative was willing to act as a consultee and the assent was sought from the resident. The *ARCH* trial is registered as ISRCTN24000891(14).

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**Conflict of Interest:** None of the authors had any conflicts of interest.

**Table 1. Dementia Care Mapping Behaviour Category Codes (BCC), Mood and Engagement criteria, with scoring values.**

<u>Code</u>	<u>Memory Cue</u>	<u>General description of category</u>
A	<b>Articulation</b>	<b>Interacting with others verbally or otherwise</b>
B	Borderline	Being engaged but passively (watching)
C	<i>Cool</i>	<i>Being disengaged, withdrawn</i>
D	<b>Doing for self</b>	<b>Self care</b>
E	<b>Expressive</b>	<b>Expressive or creative activities</b>
F	<b>Food</b>	<b>Eating or drinking</b>
G	<b>Going back</b>	<b>Reminiscence and life review</b>
I	<b>Intellectual</b>	<b>Prioritising the use of intellectual abilities</b>
J	<b>Joints</b>	<b>Exercise or physical sport</b>
K	<b>Kum and go</b>	<b>Walking, standing or moving independently</b>
L	<b>Leisure</b>	<b>Leisure, fun and recreational activities</b>
N	Nod (land of)	Sleeping, dozing
O	<b>Objects</b>	<b>Displaying attachment to or relating to inanimate objects</b>
P	<b>Physical</b>	<b>Receiving practical, physical or personal care</b>
R	<b>Religion</b>	<b>Engaging in a religious activity</b>
S	<b>Sexual expression</b>	<b>Sexual expression</b>
T	<b>Stimulation</b>	<b>Direct engagement of the senses</b>
U	<i>Unresponded to</i>	<i>Attempting to communicate but getting no response</i>
V	<b>Vocational</b>	<b>Work or work-like activity</b>
X	Excretion	Episodes related to excretion
Y	<b>Yourself</b>	<b>Interaction in the absence of any observable others</b>

**High potential for positive mood and engagement (n = 17)**

Neutral potential for positive mood and engagement (n = 2)

*Low potential for positive mood and engagement (n = 2)*

	<b>MOOD</b>	<b>ME Value</b>	<b>ENGAGEMENT</b>
	Very happy, cheerful. Very high positive mood	+5	Very absorbed, deeply engrossed/engaged
	Content, happy, relaxed. Considerable positive mood	+3	Concentrating but distractible. Considerable engagement
Neutral.	Absence of overt signs of positive or negative mood	+1	Alert and focused on surroundings. Brief or intermittent engagement
	Small signs of negative mood	-1	Withdrawn and out of contact
	Considerable signs of negative mood	-3	
	Very distressed. Very great signs of negative mood	-5	



**Table 2. Outcomes before (baseline), immediately after and 8 months after the ARCH programme had been implemented.**

Outcome	Baseline Mean	Follow-up	
		4-month Mean	8-month Mean
Dementia Care Mapping*:			
<b>Positive behaviour (%)</b>	<b>66.6</b>	<b>75.1</b>	<b>71.9</b>
Neutral behaviour (%)	26.4	22.4	26.9
<i>Negative behaviour (%)</i>	<i>7.0</i>	<i>2.5</i>	<i>1.2</i>
Mood and Engagement	1.3	1.5	1.4
Pool Activity Level**	3.56	3.21	3.63

\*Higher values better

\*\* Lower values better

**Table 3. Therapist and staff time spent in Care Home 3 with associated costs**

Therapist	Activity	Time spent (hrs)	Sub totals (hrs)	Cost of Activity	
	Total days in care-home	62 (days)	465	-	
<b>Band 5 Physiotherapist</b>	Research Related	3		-	
	Office Admin	189		£6,056	Total cost of therapist time = £14,504
	Care Home Alone	49	454	£1,552	
	Care Home Interaction	216		£6,896	
	time with Manager	23		£910	Total cost of staff time = £7,280
	time with Care home staff	156	181	£6,230	
	time with Other Staff	4		£140	
time with Resident	593	596	-		
time with the Family	3		-		
<b>Band 7 Occupational Therapist</b>	Total days in care-home	39 (days)	293	-	
	Research Related	31		-	
	Office Admin	63		£3,250	Total cost of therapist time = £10,933
	Care Home Alone	64	210	£3,302	
	Care Home Interaction	84		£4,381	
	time with Manager	26		£1,040	Total cost of staff time = £10,910
	time with Care home staff	213	273	£8,500	
time with Other Staff	34		£1,370		
time with Resident	50	50	-		
time with the Family	0		-		
<b>Band 7 Occupational Therapist</b>	Total days in care-home	30 (days)	225	-	
	Research Related	1		-	
	Office Admin	50		£2,613	Total cost of therapist time = £11,359
	Care Home Alone	104	219	£5,392	
	Care Home Interaction	65		£3,354	
	time with Manager	12		£490	Total cost of staff time = £5,300
	time with Care home staff	96	132	£3,850	
time with Other Staff	24		£960		
time with Resident	76	81	-		
time with the Family	5		-		

**Total cost of ARCH implementation** (therapy, staff, equipment costs etc) **£61,307**

**Cost per resident** (n=37) **£1,650**

Cost per resident per month (over 12-month intervention) **£137**

**Table 4. Healthcare utilisation and cost per resident in Care Home 3.**

	Average number of contacts per resident			Average cost of contacts per resident			
	Prior to implementation (4 months)	During implementation (4 months)	Follow-up (8 months)	Prior to implementation (4 months)	During Implementation (4 months)	After intervention (8 months)	
Sample size N	11	11	11	11	11	11	
District nurse	1.64	0.55	0.91	£58.9	£19.6	£32.7	
Continence nurse	0.00	0.00	0.09	£0.0	£0.0	£3.3	
Specialist nurse other	0.18	0.36	0.00	£11.1	£22.2	£0.0	
Matron	0.00	0.00	0.00	£0.0	£0.0	£0.0	
Physiotherapist	0.45	0.00	0.09	£14.5	£0.0	£2.9	
Occupational therapist	0.00	0.00	0.09	£0.0	£0.0	£4.0	
SALT	0.09	0.00	0.00	£2.9	£0.0	£0.0	
Dietician	0.18	0.00	0.00	£5.8	£0.0	£0.0	
Audiology	0.00	0.09	0.00	£0.0	£2.9	£0.0	
Psychologist	0.00	0.00	0.00	£0.0	£0.0	£0.0	
Chiropodist	0.09	0.09	0.18	£2.9	£2.9	£5.8	
Optician	0.00	0.09	0.36	£0.0	£2.4	£9.7	
Dentist	0.36	0.36	0.45	£19.6	£19.6	£24.5	
GP in person consultation	3.55	2.27	3.18	£127.6	£81.8	£114.5	
GP phone consultation	0.18	0.27	0.27	£0.8	£1.3	£1.3	
changes in GP orders	1.55	1.64	1.73	£43.3	£45.8	£48.4	
Day hospital visits	0.00	0.00	0.18	£0.0	£0.0	£129.6	
Hospital Outpatient Appointment	0.00	0.00	0.18	£0.0	£0.0	£20.2	
A&E Visits	0.00	0.00	1.64	£0.0	£0.0	£1,616.7*	
A&E Ambulance Use	0.64	0.91	0.82	£62.4	£89.1	£80.2	
Ambulance call out with treatment by paramedics at care home	0.45	0.18	2.00	£84.1	£33.6	£370.0*	
				<b>Sub total =</b>	<b>£434 (376)</b>	<b>£321 (374)</b>	<b>£2464 (4013)*</b>

\* The relatively higher average cost per participant in the final follow up period is driven by two factors. 2 residents had a high number of A&E attendances and ambulance call outs which are costly.

No participants had any contact or consultations with other health and social care professionals not listed above such as diabetes nurse, Pharmacist, CPN, Social worker, Geriatrician, out of hours GP, etc.

No inference should be made on this change over time beyond descriptive purposes due to the relatively small sample size.

# Appendices.

## Appendix 1. Unit costs.

Item	Cost £ /per unit)	Source	Comment
Care home manager	40 /hour	11.7 Home care manager. PSSRU 2016	per hour
Care home staff (carer)	24 /hour	11.6 Home care worker. PSSRU 2016	equivalent to Band 3 1 hour
Care home staff (other)	24 /hour	11.6 Home care worker. PSSRU 2016	equivalent to Band 3 1 hour
District nurse	36 /hour	10.1 PSSRU Nursing costs. Agenda for change midpoint band 5	Band 5
Continence nurse	36 /hour	10.1 PSSRU Nursing costs. Agenda for change midpoint band 5	Band 5
Specialist nurse other	61 /hour	10.1 PSSRU Nursing costs. Agenda for change midpoint band 8a	band 8a
Physiotherapist	32 /hour	9. Scientific and professional staff. PSSRU 2016	Assume 1 hour visit. Band 5
Occupational therapist	44 /hour	11.5 Community occupational therapist (LA)	Assume 1 hour visit. Band 6
Rehabilitation assistant	43 /hour	12.11 Re-ablement service. PSSRU 2016. cost per hour of contact	Assume 1 hour visit
Speech and language therapist	32 /hour	9. Scientific and professional staff. PSSRU 2016	Band 5
Dietician	32 /hour	9. Scientific and professional staff. PSSRU 2016	Band 5
Audiology	32 /hour	9. Scientific and professional staff. PSSRU 2016	Band 5
Psychologist	52 /hour	9. Scientific and professional staff. PSSRU 2016	Band 7. 1 hour contact
Challenging behaviour team	79 /hour	11.2 Social worker, ADULT. PSSRU 2016. Assumed similar to social worker	Assume 1 hour visit.
Social worker	79 /hour	11.2 Social worker, ADULT. PSSRU 2016	Assume 1 hour visit.
Chiropodist	32 /hour	9. Scientific and professional staff. PSSRU 2016	Band 5
Optician	£26.66 /hour	PSSRU (2016) Assume pay similar to specialist professional community worker. Band 8a. Mean duration of contact applied 25.8 minutes. (£62/h)	Opticians specific: Industry standard is 20mins but usually more than that. A study identified mean duration 25.8mins (ranging from 15 to 40mins)
Dentist	53.9 / hour	10.7 Band 2 activity. Dentist - providing performer. PSSRU 2016	
Other healthcare	29 /hour	Used band 4 community Nurse as an average contact. 10.1 PSSRU 2016	Band 4 1 hour
GP in person consultation	36 /9.22 minute consult	10.3b. PSSRU 2016.	
GP phone consultation	4.6 /4 minute	10.4 telephone triage. PSSRU	
changes in GP orders	28 /prescription	10.3b PSSRU 2016	
Day hospital visits	713 /case	7.1 NHS reference costs for hospital services. PSSRU 2016	
Inpatient overnight	3653 /case	7.1 NHS reference costs for hospital services. PSSRU 2016	elective average cost, irrespective of duration
Hospital Outpatient Appointment	111 /attendance	NHS reference costs 2013/14. Weighted average of all consultant led and non-consultant led attendances	
A&E Visits	988 /visit	8.2 PSSRU 2016	Average cost for all users A&E and outpatient. 2009 uprated to 2016 for inflation
A&E Ambulance Use	98 /use	7.1 NHS reference costs for hospital services. PSSRU 2016	Overall average for all ambulance services (see and treat, refer, and convey).
Ambulance call out with treatment by paramedics at CH	185 /use	7.1 NHS reference costs for hospital services. PSSRU 2016	See and treat and refer only.

## Appendix 2. TiDier Checklist.

**BRIEF NAME.** *Provide the name or a phrase that describes the intervention.*

Improving the health of care home residents through increased physical activity: *Active Residents in Care Homes, ARCH.*

**WHY?** *Describe any rationale, theory, or goal of the elements essential to the intervention.*

There is extensive evidence showing the benefits physical activity has on health and wellbeing for older people in residential care homes. However, facilitating physical activity is a complex process and requires a flexible, holistic whole-systems approach that takes into account individual residents' needs, staff skills, organisational processes and the physical environment, and must be contextualised for each care home. *Active Residents in Care Homes, ARCH*, aims to increase care home residents' physical activity by creating a culture of within a care home where residents engagement in physical activity is integral. The programme is based on theories about changing culture, adult education principles and organisational models, the Model of Human Occupation, the Person, Environment and Occupation model and theories of personhood and person-centred care.

**WHAT?** *Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).*

The whole-systems approach used by *ARCH* has key elements (integration of therapy team into care home, resident personal profiling and assessment, training of care staff through theoretical and experiential learning, assessing and changing the physical, social, organisation and environment in order to facilitated increased levels of resident activity engagement, providing resources to increase resident engagement, training staff to provide increased opportunities for residents to engage in activities that are appropriate and meaningful.

### **Physical materials:**

Equipment – mobility aids; resources that enable participation in leisure activities such as recreation, cooking, gardening, reading, etc.

Care home - Activity boards; staff training equipment (files, notes, PowerPoint, projector); stationary supplies; furniture; storage facilities.

Care home environment - changes and re-design to care homes (restructuring, decoration, garden design) if appropriate and resources available; organise days out to stimulate residents' physical activity.

### **Informational materials:**

Resident profiling/assessment - Outcome measures and assessments (Pool Activity Level, falls assessments, EQ5D, Assessment Physical Activity, Dementia Care Mapping

Environmental assessment - Resident Environment Impact Survey (REIS); Stirling University resources for creating dementia-friendly environments; Model of Human Occupation; Person, Environment and Occupation model; theories of personhood and person-centred care in dementia; theories around changing culture adult education principles and organisational models; National Institute of Health and Care Excellence (NICE) guidelines of interventions and care in care homes.

Staff training - Training modules; handouts supplementing training module; homework tasks.

Therapists – training to use the “Wellbeing Wheel”; documents used to guide *ARCH* therapists in the initial ‘*getting-to-know-you*’ phase of the project; schedules; meeting agendas; documents to track levels of activity during specific times of the day; staff

interview templates; manager environmental assessment feedback; presentation templates for proposed changes; holistic resident assessments.  
Dementia Care Mapping training for at least two researchers and/or therapists.

**PROCEDURES:** *Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.*

The *ARCH* programme is organised into an **Implementation Phase (0–4 months)** where the therapists work with care staff to integrate the important central tenets of the programme into everyday working practices, and a **Consolidation Phase (5–12 months)** when therapists withdraw from the home leaving the rehabilitation assistant to support managers, staff and residents to take responsibility for the programme once the rehabilitation assistant leaves.

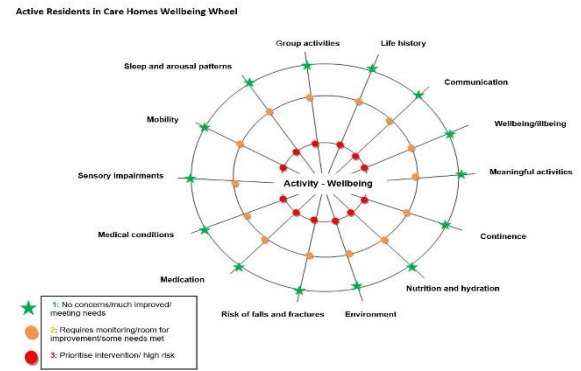
The **Implementation Phase** comprises three elements which are not linear but iterative and often overlap.

1. ***Assessment of the care home organisation and working practices*** involves the therapy team spending time getting to know residents, staff and managers by:
  - i. profiling each resident getting to know their personal, family and social history, interests and preferences particularly relation to physical activity
  - ii. conducting one-to-one staff interviews to build trusting relationships and understand viewpoints and barriers to activity;
  - iii. set up staff training schedule to fit in with the working practices and day-to-day running of the care home;
  - iv. spend time explaining to staff the aims and processes of the programme.

The assessment findings are used to develop an implementation plan outlining a series of practical actions to enhance residents' opportunities to engage in activity. This is discussed with managers and staff who work with the therapists to refine and agree a final implementation plan.

2. ***Environmental assessment*** uses the Residential Environment Impact Survey to consider what and how changes to the physical environment might facilitate physical activity, e.g. moving furniture, signage, etc. Resources are purchased to help encourage residents' activity and start to run individual and group activities.
3. ***Staff training and experiential learning*** encourages staff to think about residents' individual needs, teaches theories behind challenging behaviours and ways to change their working practices to encourage residents' engagement in physical activity. The training comprises:
  - i. Twelve 2-hour taught training modules are adapted for each care home. Each module is delivered twice each week to ensure maximum staff attendance around their shifts and include:
    - Introduction to *ARCH* and the wellbeing wheel;
    - Importance of knowing the person;
    - Communication;
    - Wellbeing, ill-being and behaviour;
    - Meaningful activity;
    - Facilitating group activities;
    - The environment;
    - Mobility, activity and positive risk taking;
    - Falls and medication;
    - Sleep and arousal.

ii. The modules are based on the ‘*Wellbeing Wheel*’ and modified to the context of each home. The ‘*Wellbeing Wheel*’ is a bespoke, easy to use, visual tool for staff used to aid clinical reasoning and problem-solving around the barriers and facilitators to participation in physical activity. It provides a framework for the assessment of individual residents’ needs related to activity and wellbeing, and the development of a personalised activity plan.



iii. *handouts* and homework tasks consolidate staff training.

iv. alongside the training modules staff undertake *experiential work-based learning with one-to-one coaching* by therapists to build their confidence and competence in facilitating residents’ physical activity. Each staff member is assigned a resident who they “*Champion*” by working closely with them to implement their learning and develop and implement their personalised plans for their resident, help them work towards it, ensuring the plan remains appropriate to their needs, abilities and interests. The therapy team help staff identify and work through problems and difficulties as they arise.

v. to ensure there is a *change in the culture* of the whole of the care home it is emphasised that staff must apply the principles of *ARCH* to every resident not just those they are championing.

During the ***Consolidation phase (5–12 months)*** the therapists withdraw from the care home leaving a rehabilitation assistant to support managers, staff, residents and families to carry on supporting residents with activities. Staff are encouraged to take responsibility for the programme to enable sustainability when the rehabilitation assistant withdraws from the care home after 8 months. Structures are put in place to ensure the principles of the programme are sustained, e.g. lead champions for ensuring the environmental changes remain, organisational structures such as meeting templates for staff to convene once a month to ensure aspects of what were started to continue handing over of resources such as the training module content should staff need to refresh themselves in the future or integrate new staff, templates for falls assessment, activity profiling, etc.

**WHO PROVIDED** For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.

A senior occupational therapist designed, lead and supervised the implementation of the *ARCH* programme, supported by other therapists and a rehabilitation assistant. Not all therapists were full time, but generally each day of the week was covered by at least one therapist at each care home.

**HOW** Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.

All interventions were delivered face-to-face, either individually (e.g. staff interviews, resident assessments, manager meetings, resident activities, etc.) or as a group (staff training, resident group activities, staff meetings etc).

**WHERE** Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.

Three residential care homes in three South London boroughs. Fully committed senior management was essential to the implementation and sustainability of the programme and

measures were taken along the way to ensure, as far as possible, that the manager understood and supported the aims and implementation of the project.

**WHEN and HOW MUCH** Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose. Implementation of *ARCH* took approximately 4 months, with lighter touch support over the following 8 months.

**TAILORING** If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.

There were no set schedule besides the broad phases of the project described above. The first ‘*getting to know you*’ phase conducted at each care home involved detailed assessment, analysis, scoping, understanding, observing the care home as a whole – staff, environment, culture, resident’s needs, wants, abilities, resources, barriers, etc. – through a process of interviews, observations, clinical assessments, participation in the life of the home, etc. From this the needs of each care home were identified by the therapy team and tailored to that care home.

**MODIFICATIONS** If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).

The programme was adapted and contextualised to each care home.

It was planned that rehabilitation assistants would help sustain the programme during the 8-month follow-up period after the therapy team withdrew from the care home. Unfortunately, staff pressures prevented this, so care home staff were encouraged to do more of the maintenance.

**HOW WELL. Planned:** If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.

The Senior Occupational Therapist who devised the programme oversaw the daily implementation of the programme and ensured fidelity to the programme.

**Actual:** If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.

Staff changes meant new members of staff had to be trained while the programme was being implemented.



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