[redacted]

NIHR WHELD

Improving well-being and health for people with dementia

[redacted] [redacted]

WHELD WP3 Statistical Analysis Plan

An Optimized Person Centred Intervention to Improve Mental Health and Reduce Antipsychotics amongst People with Dementia in Care Homes

Version 1 12/9/12

CO- SPONSORS: Oxford Health NHS Foundation Trust & King's College, London

FUNDERS: NIHR Programme Grants for Applied Research

STUDY COORDINATION CENTRE: Oxford Health NHS Foundation Trust

COREC reference: 11/SC/0066

DATA MANAGEMENT CENTRE**:** NWORTH - Bangor's Clinical Trials Unit

Statistical Analysis Plan Authorship		
Rhiannon Whitaker	Methodological PI/Statistician	
Yongzhong Sun	Trial Analyst	
Clive Ballard	Chief Investigator	

CONTENTS

1 STUDY DESIGN 3

2 DATA MANAGEMENT AND ANALYSIS 3

2.1 Quantitative data management 3

2.2 Missing data and imputation strategies 3

3 STATISTICAL ANALYSIS 4

3.1 Descriptive analysis 4

3.2 Modeling strategy 4

3.3 Intra-class correlations. 6

4 TIMELINE 6

APPENDIX 1: EDITED EXTRACTS FROM THE PROTOCOL, OVERVIEW 7

A1.1 Glossary of abbreviations 7

A1.2 Trial administration 8

A1.2.1 Trial Management Group (TMG) 8

A1.2.2 Data Management Centre 8

A1.3 Abstract 8

A1.4 Keywords 8

A1.5 Study Summary 9

APPENDIX 3: EDITED EXTRACTS FROM THE PROTOCOL:WP3 10

A2.1 Study Objectives 10

A2.1.1 Hypotheses 10

A2.1.2 Secondary objectives and qualitative evaluation 10

A 2.2 Study design 11

A2.2.1 Overall design 11

A 2.2.2 Number of participants and power of the study 12

A2.2.3 Randomisation 12

A2.2.4 Design and Consort diagram 13

A.2.2.5 Flow Chart (full milestones shown in WHELD Programme Gantt chart) 14

A2.3 Participant Entry 15

A 2.3.1 Home selection: inclusion, exclusion and withdrawal criteria 15

A2.3.2 Participant selection: inclusion, exclusion and withdrawal criteria 15

A 2.3.3 Staff selection: inclusion, exclusion and withdrawal criteria 15

APPENDIX 4: REFERENCES 16

APPENDIX 5: OUTCOME MEASURES 18

1 STUDY DESIGN

The study design is a cluster randomised, 2x2x2 factorial design with 2 replications, pilot study in 16 care homes. It is estimated that each cluster will include a minimum of 12 participants (depending upon size of the care home, the number of people with dementia and the number consenting).

Each cluster will receive a randomly allocated intervention for a minimum of 9 months.

2 DATA MANAGEMENT AND ANALYSIS

It is planned that anonymous data and all appropriate documentation will be kept securely for a period of 7 years following the completion of the trial, subject to discussion with relevant Ethics Committees.

Quantitative data management

Administrative databases will be held at the study centre. All participants and care homes will be identified by a unique study number; this number will be used to tag all research data sent outside the study centre, for example to NWORTH. Quantitative research data will be entered via a web interface to the MACRO™ research databases held at NWORTH. Primary data management will be conducted by the research team in the study centre, and the secondary cleaning and preparation of the data for analysis will be conducted by NWORTH.

2.2 Missing data and imputation strategies

There will be four types of missing data for a participant in the dataset:

- Baseline demographic details
- Missing items within a questionnaire
- Missing outcome measures at follow up
- Complete missing data at follow up (usually arising from participant death).

Key demographic variables will be obtained directly from care homes where possible. Where demographics are described, missing data will be noted. In order to maintain power, if a key covariate is missing, modal group substitution will be used to facilitate the analysis.

For items missing within a questionnaire:

- First the published rules for dealing with missing items for the relevant measure will be used where appropriate.
- Further missing items will be replaced with the mean score (mean value substitution MVS) of the remaining items in the questionnaire as long as the number of missing items does not exceed 10% of the total number of items in the questionnaire.
- If there are more than 10% missing items in the questionnaire the outcome measure will not be calculated at that time point.

Complete case data will be defined as the data for participants whose relevant outcome measures at both baseline and follow up (at 9 months) are available after implementing the "10% rule".

Full data set: Once the missing item rules have been applied we will make a full assessment of the remaining missing data and any consequential systematic biases which may occur by only analysing complete case data. Then we will design and test potential imputation strategies we may employ in WP5. These imputation strategies will be simple, clear and meaningful, to provide useful interpretations. We will run a series of sensitivity analyses (using the analysis plan described below) to test the imputation strategies both for defining the bounds of the analysis (extreme case scenarios) and for the a priori design of the imputation strategy for WP5. Particular attention will be made to establishing a best practice solution for dealing with the missing endpoints due to death.

3 STATISTICAL ANALYSIS

Outcome measures for pilot evaluation will be assessed at baseline and 9 months and are listed in Appendix 1. Each measure will be calculated as given in the relevant reference papers for that measure where appropriate although some flexibility needs to be maintained.

3.1 Descriptive analysis

The trial participant and care home flow will be reported to CONSORT standards. Descriptive statistics for three different interventions AR (antipsychotic review), SI (social intervention and pleasant activities) and Ex (exercise) in characteristics at both the individual patient and care home levels will be tabulated. Graphical techniques will be used where necessary. Any patterns of missing data will be described. The CONSORT diagram information will be assessed to identify potential differences in dropout rates and other data quality issues in order to inform the design of WP5

3.2 Modeling strategy

The covariates with major baseline differences will be detected and they are potential confounders and will be adjusted for in the corresponding ANCOVAs in the following steps.

The study hypotheses will be tested with standard multiple linear regression models for continuous outcome measures and with standard logistic regression models for binary outcome measures, followed by specifying robust standard errors to assess the likely effect of the clustering on standard errors to allow for the clustering within care homes. To address the problem of possible discrepancy resulting from the above two procedures, suitable summary measures for each cluster may be calculated and these summary measures then will be analysed using standard linear regressions, to provide further assurance regarding the appropriate conclusions.

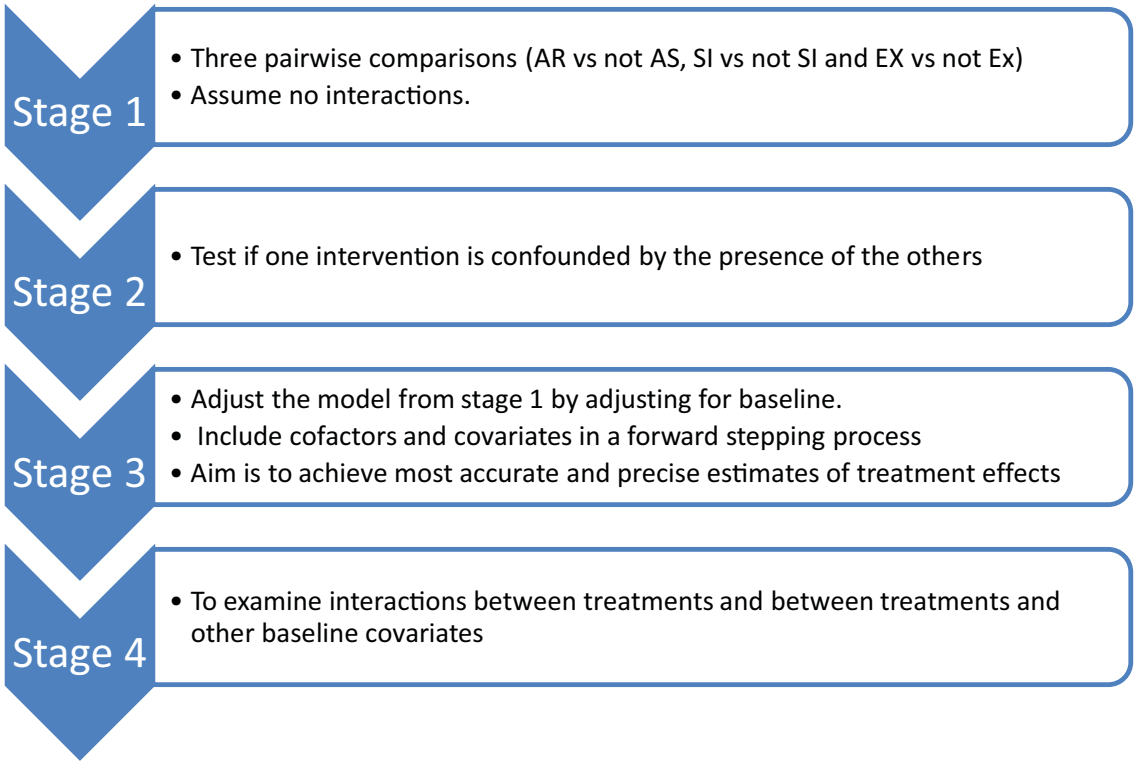
This is a pilot study therefore, for simplicity, we will analyse data only for those individuals with complete data because we only have two measurement occasions. We will then perform a series of sensitivity analyses based on some well-considered imputation strategies to assess the robustness of our main analysis results based on the complete data.

The strategy for linear and logistic regression modelling work is based on the individual post-treatment measurements at 9 months (as outcome measures) and is illustrated in figure 1.

Stage 1. We consider the three different interventions AR, SI and Ex separately in three regression models; this gives us the maximum power to obtain an initial idea about the crude treatment effect: how a particular intervention is effective in achieving a desired treatment result for a specific outcome measure by comparing the group of all individuals on the treatment with that not on the treatment. In this way, the full potential of a factorial design may be utilised. In particular, this modelling assumes no interactions between treatments.

Stage 2: We investigate whether the treatment effect of one intervention is accounted for by the other two interventions. The presence or absence of the three interventions will be simultaneously entered into the model to see which effects remain significant. If an intervention is found to be non-significant in relation to a specific outcome, the binary exposure may be excluded from the model. This may imply that this intervention has little or no effect on the outcome when taking the other interventions into account.

Figure 1: Modelling strategy for WP3.



Stage 3: We will include baseline outcome as a covariate at this stage to provide the best precision of treatment comparisons between each of the three interventions and person centred care (PCC) at the end of treatment. Then the possible confounders detected from the descriptive analysis will be adjusted for in a forward stepwise process. The aim is to achieve the most accurate and precise estimates of the treatment effect.

Stage 4: Two-way interaction effects between treatments and between treatments and other baseline covariates may be examined at this stage, focusing on those that are of most interest to us. In particular, for interactions between two interventions, we will adopt a p-value of 10% as the threshold for significance to reflect the exploratory nature of this investigation and to ensure that we identify any promising effects. These interaction terms will be added into the model one by one, to ensure the maximum power to detect them. They have been left to the last step, after allowing for all other possible linear adjustments to explain the model. The results based on this model may be used to describe the additional benefits conferred by the 3 key interventions compared with PCC.

If any interaction effects between treatments were found, we will need to discuss the implications of this very carefully with the team in order to select the best possible combination of interventions to take forward to WP5. In this case, the statistical power of the analysis to this point will be inevitably reduced.

For each intervention, we will tabulate the results based on two models: one with only main effects as developed by step 3 and the other including interaction terms as obtained from step 4. The effect estimates, standard errors and P-values from these models will be reported. The estimates for standard errors and P-values will be used to contrast with the corresponding estimates obtained by specifying robust standard errors to assess the likely clustering effect within care homes.

3.3 Intra-class correlations.

To inform sample size calculation at WP5, a random effect model will be used to analyse the primary outcome measure CMAI, to provide appropriate estimates for intra-class correlations due to care homes. Intra-class correlations for the other outcome measures will be calculated and tabulated in the same manner.

TIMELINE

Baseline data complete	Complete
Consort	Complete
Data extract syntax written and tested	Complete
Baseline demographics described	Complete
Measure calculation syntax written and tested	August 15th
DMEC meeting	September 21st
Follow up entry data complete and handed over	Est. Jan 2013
Initial results reported	+ 4 weeks
WP5 protocol development	+8 weeks
Further analysis	April-June 2013

APPENDIX 1: EDITED EXTRACTS FROM THE PROTOCOL, OVERVIEW

A1.1 Glossary of abbreviations

AR	Antipsychotic Review
CANE	Camberwell Assessment of Need for the Elderly
CDR	Clinical Dementia Rating Scale
CMAI	Cohen-Mansfield Agitation Inventory
COREC	Centre of Research Ethical Campaign
CONSORT	Consolidated Standards of Reporting Trials
CQC	Care Quality Commission
DEMQOL	Measure of Health related quality of life for people with dementia
DMEC/TSC	Data Monitoring and Ethics/Trial Steering Committee
Ex	Exercise
FAST	Functional Assessment Staging
FITS	
FG	Focus groups
PCC	Person Centred Care
PI	Principle Investigator
ICCs	Intra class correlations
NEST	
NICE	National Institute for Clinical Excellence
NIHR	National Institute of Health Research
NPI-NH	Neuropsychiatric Inventory – Nursing Home version
NWORTH	North Wales Organisation for Randomised Trials in Health
QoL	Quality of Life
QoL-AD	Quality of Life in Alzheimer's Disease
RAID	Rating Anxiety in Dementia
RCT	Randomised Controlled Trial
SDs	Standard Deviations
SI	Social Interaction
TMG	Trial Management Group

WHELD	An optimized intervention “welding together” the most effective elements of the best currently available intervention programmes and a standardised manual and training programme
WP	Work Package

A1.2 Trial administration

A1.2.1 Trial Management Group (TMG)

Chief Investigator (Clinical): Prof Clive Ballard

Co-investigators:

Ms Jane Fossey	
Prof Martin Orrell	Prof Dag Aarsland
Prof Esme Moniz-Cook	Ms Joanna Murray
Prof Robert Woods	Prof Martin Knapp
Mr Eddie McLaughlin	Dr Susanne Sorensen
Mrs Rhiannon Whitaker	Mrs Barbara Woodward-Carlton

Trial Manager/Coordinator: Dr Jane Stafford

Trial Statistician and NWORTH Clinical Trials Unit (CTU) Investigator (Methodological): Rhiannon Whitaker

A1.2.2 Data Management Centre

NWORTH - Bangor's CTU
Address: [redacted]
Tel: [redacted] Email: [redacted]
Website: http://www.bangor.ac.uk/imscar/nworth

A1.3 Abstract

700,000 people in the UK have dementia, 250,000 of whom live in care homes. These individuals have complex mental health problems, disabilities and social needs, compounded by widespread prescription of harmful sedative drugs. Dementia is a national priority with a vast impact on Health and Social Care Services. The optimized programme (WHELD) will combine the most effective elements of existing approaches to develop a comprehensive but practical intervention. This will be achieved by training care staff to provide care that is focused on an understanding of the individual and their needs; and by using additional components such as exercise, activities and social interaction to improve mental health, reduce the use of sedative drugs and also improve quality of life (QoL).

Work Package 3 (WP3) is the pilot study and qualitative evaluation to help develop the larger randomised controlled clinical trial (Work Package 5, WP5) which will establish the value of WHELD.

The overarching goal of the programme is to provide an effective, simple and practical intervention, which improves mental health of, and reduces sedative drug use in, people with dementia in care homes; which can be rolled out nationally to all UK care homes as an NHS intervention.

A1.4 Keywords

Dementia	Care Homes	Quality of life
Antipsychotic medication	Behavioural symptoms	Cost effectiveness
Implementation	Person centred care	Exercise
Social interaction		

A1.5 Study Summary

TITLE Work Package 3 WHELD programme

DESIGN Pilot factorial trial and qualitative and process evaluation utilising focus groups.

AIMS To help develop the intervention for testing in Work Package 5.

OUTCOME MEASURES

Quantitative:

Agitation, other behavioural and neuropsychiatric symptoms

Antipsychotic and other psychotropic drugs use

Mood and depression, quality of life, dementia severity

Unmet needs

Falls

Quality of interactions between staff and residents using the observational tool

Amount of staff time needed and cost of each intervention

Qualitative:

Use of case examples to understand the skills development and development of person centred attitudes amongst care home staff

The process of implementation within the environment in which the interventions take place. Staff beliefs, attitudes and behaviour in their work with people with dementia are key components of this context. Staff perspectives on the implementation of the interventions.

POPULATION Residents of 16 care homes

ELIGIBILITY Care homes identified from those rated 'adequate' or better in the CQC register, in the Oxfordshire, Buckinghamshire and London localities.

8 homes selected from a convenience sample and another 8 randomly selected.

Exclusion criteria:

Less than 60% of the residents have dementia.

Receiving special support from local authority

All individuals residing in participating care homes who scores '1' or greater on the CDR and score '4' or greater on the FAST.

Exclusion criteria:

Data will not be collected from individuals for whom consent has not been obtained

DURATION Up to 20 months

APPENDIX 2: EDITED EXTRACTS FROM THE PROTOCOL:WP3

A2.1 Study Objectives

Quantitative Evaluation will be undertaken using a factorial design. Evaluations will be undertaken to understand the breadth of additional benefits conferred by 3 key interventions compared with Person Centred Care alone.

(A)	Person Centred Care	(PCC)
(B)	Antipsychotic Review (discontinuation and safety)	(AS)
(C)	Social intervention and Pleasant Activities	(SI)
(D)	Exercise	(EX)

A2.1.1 Hypotheses

We hypothesise that each intervention will significantly improve several key outcomes, but none of the interventions will improve all outcomes on their own. This pilot study is not powered to answer these questions definitively. The role of these hypotheses is to guide the analysis and to generate firm hypotheses for testing in the main trial (WP5).

Specifically we hypothesise that, compared to Person Centred Care alone:

(1) The combination of Person Centred Care and Antipsychotic Review will result in the reduction of antipsychotic prescribing

(2) The combination of Person Centred Care and Social intervention and Pleasant Activities will result in additional improvements in agitation/aggression, especially in individuals already experiencing these symptoms at the baseline evaluation

(3) The combination of Person Centred Care and Exercise will improve overall mood and will reduce the number of falls

A2.1.2 Secondary objectives and qualitative evaluation

A key secondary objective will be to determine the specific impact of each therapy on a range of outcomes including mental health, psychotropic drug use, physical health and quality of life; as well as the impact on potentially important mediating factors such as activities, social interaction, staff attitudes and the quality of the interaction of care staff with people with dementia to inform subsequent work.

The purpose of the qualitative research is to increase our understanding of the process of implementation within the care environment. Staff beliefs, attitudes and behaviour in their work with people with dementia are key components. Recognition and acknowledgement of staff perspectives is also essential to negotiating the implementation of the interventions.

A 2.2 Study design

A2.2.1 Overall design

The study design is a cluster randomised, 2x2x2 factorial design with 2 replications, pilot study in 16 care homes. It is estimated that each cluster will include a minimum of 12 participants (depending upon size of the care home, the number of people with dementia and the number consenting).

Each cluster will receive a randomly allocated intervention for a minimum of 9 months.

Evaluations will be undertaken to understand the breadth of benefits conferred by 3 key interventions to be assessed when used **in addition** to the Person Centred Care training package, whose efficacy has already been established.

(A) Person Centred Care (PCC): PCC training will be delivered using the operationalized FITS manual [2], with demonstrated efficacy in a robust randomised controlled trial (RCT) [3] and incorporating relevant updated materials since original publication. This will be further augmented by additional elements of leadership training on the basis of input from an expert therapy development group.

(B) Antipsychotic Review: This will involve specific review of antipsychotic drugs by participants' own General Practitioners or specialists, based upon the principles outlined in the NICE dementia guidelines [1] and facilitated by an antipsychotic care pathway developed by the Alzheimer's Society in partnership with the Department of Health. General Practitioners will be offered an initial seminar outlining the best practice guidelines and they will be prompted when 12 week antipsychotic reviews are due (as advised by the NICE/SCIE guidelines). Care home staff will also be offered a seminar about the safe prescribing, monitoring and review of antipsychotics. In addition, for all participants continuing to receive antipsychotics after the initial review or where antipsychotics are started or re-started, a detailed medical antipsychotic care plan will be advised, using the principles outlined in the antipsychotic care pathway. This will include planned dates for further antipsychotic review.

(C) Social Interaction and Pleasant Activities: An intervention manual will be developed based upon 3 evidence based approaches and specific communication skills training to enhance staff–resident interactions. The approaches will include: (1) The Positive Events Schedule, developed and demonstrated to be effective in the treatment of agitation and depression in people with dementia in non-care home settings [44]; (2) The Social Interaction intervention demonstrated to be effective for the treatment of agitation in people with dementia in care homes by Cohen-Mansfield and colleagues [6]; (3) The NEST programme developed by Beuttner and colleagues [7]. Minor adaptations will be undertaken, in collaboration with the authors who developed the manuals, to ensure that they are suitable and practical for administration in a UK care home setting.

(D) Exercise: The main focus will be to promote exercise through encouraging enjoyable positive activities that involve exercise. Teri and colleagues have developed an effective approach, based upon their Positive Event Schedule approach, but focussing specifically on exercise based activities [5]. The NEST manual [7] and the ROM Dance programme [8], which has been shown to be effective in an RCT for older people in care settings with Arthritis [9], will be used as specific resources to offer people enjoyable individual and group exercise activities to augment activities identified specifically as hobbies or enjoyable activities by individual participants.

Treatment	Care home															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
B	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+
C	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+	+
D	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+

In the above design, care homes 1 and 9 will receive PCC only, while care home 4 will receive Social Interaction and Exercise in addition to PCC and care home 13 will just receive Antipsychotic Review in addition to PCC.

Each intervention will be delivered by 2 trained therapists, who will receive an intensive 10 day training package, each of whom will coordinate the delivery of the intervention into 8 care homes. Part of the intervention will be to train 2 lead care staff members (WHELD champions) in each care home to implement the intervention.

A 2.2.2 Number of participants and power of the study

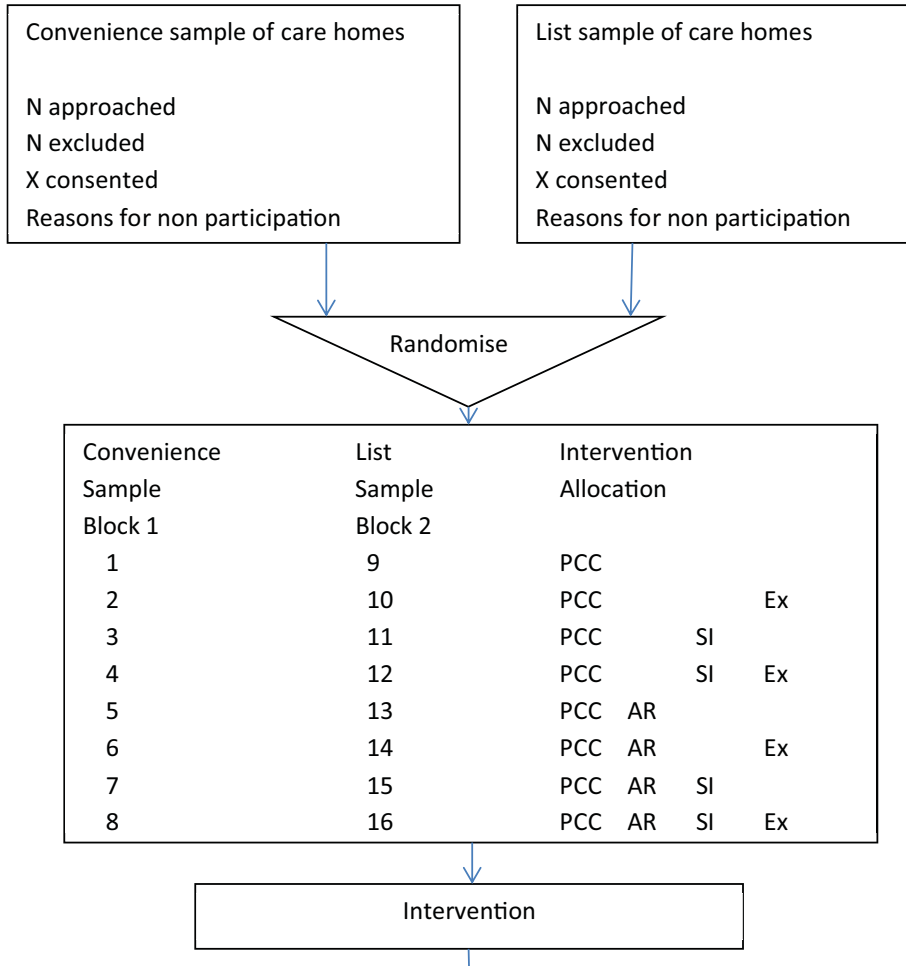
16 suitable care homes will be identified, recruited, randomised and the intervention delivered to all participating residents. The minimum target participant recruitment is 12 individuals with dementia per care home, therefore the target minimum sample size is 192, with a suggested upper recruitment limits of approximately 256 (i.e. 16 individuals with dementia per care home).

Baseline and follow up data will be collected on all consented residents who meet the inclusion criteria at each participating care home. This is a pilot study, whose main purpose is to collect data to enable the design and sample size calculation for the follow on RCT. As such the size of effect for the outcome measures, their standard deviations (SDs) and intra class correlations (ICCs) are unknown.

A2.2.3 Randomisation

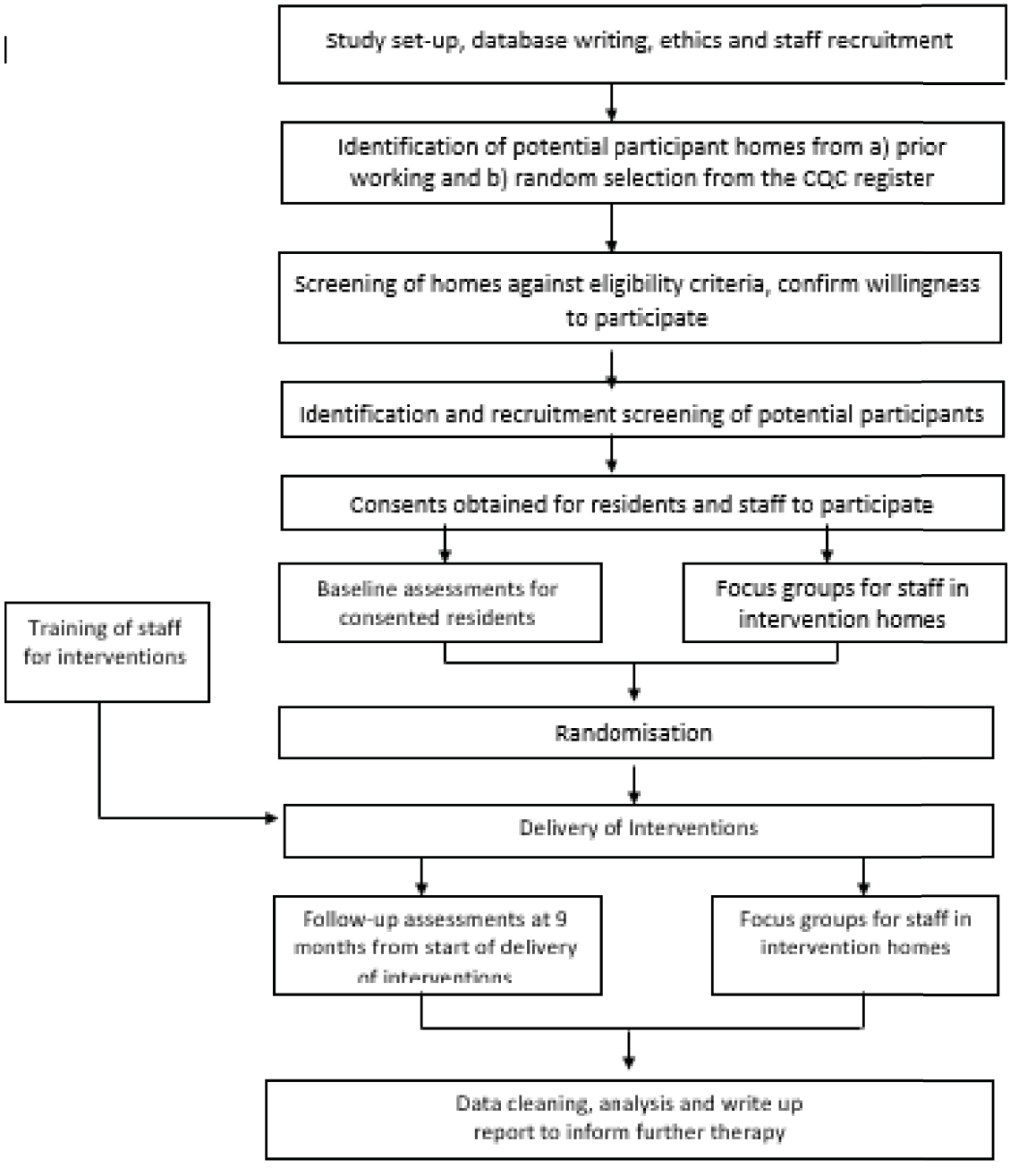
A restricted randomisation method will allocate the 8 interventions to the 8 care homes in the two samples. The randomisation will be completed as a complete list randomisation meaning that all care homes will have been recruited before the randomisation is performed. The restriction ensures an equal distribution of the number of interventions to each geographic location. The system has been coded and validated in R (statistical package).

A2.2.4 Design and Consort diagram



	Number of individual participants				
Care Homes	In home	Eligible	Consented	Completed Intervention	Followed up
1&9					
2&10					
3&11					
4&12					
5&13					
6&14					
7&15					
8&16					

A.2.2.5 Flow Chart (full milestones shown in WHELD Programme Gantt chart)



A2.3 Participant Entry

A 2.3.1 Home selection: inclusion, exclusion and withdrawal criteria

8 care homes will represent a convenience sample (block 1) of local care homes, already known to the research team, which meet the inclusion and exclusion criteria and have previously expressed a willingness to participate in research. The other 8 care homes will be identified from all care homes in the research area rated as 'adequate' or better on the CQC register (block 2). The list of eligible care homes will be randomised and the homes approached in the order of appearance on the randomised list. If a care home declines to participate the next care home on the list will be approached.

Inclusion:

- Care homes scoring 'adequate' or better on CQC register

Exclusion:

- Care home in which 60% or less of the residents have dementia
- Care homes receiving special support from local authority

Withdrawal Criteria:

- Care homes are free to withdraw from the study at any time.

A2.3.2 Participant selection: inclusion, exclusion and withdrawal criteria

All residents who would be potentially eligible for evaluation will be identified by the care home staff.

Inclusion for evaluation:

- All individuals residing in participating care homes who meet diagnostic criteria for dementia, score '1' or greater on the CDR [11] and score '4' or greater on the FAST [10].

Exclusion from evaluation:

- Any resident for whom consent is not obtained

Withdrawal Criteria:

- Individual participants would be able to withdraw from the study evaluation at any time.

A 2.3.3 Staff selection: inclusion, exclusion and withdrawal criteria

All staff working in participating care homes would be potentially eligible to participate in the focus groups as part of the qualitative evaluation. Consent for their participation will be sought separately. They will be excluded if consent is not obtained and are able to withdraw from the study at any time.

APPENDIX 3: REFERENCES

1. National Institute for Health and Clinical Excellence/Social Care Institute for Excellence (2007) *Dementia: the NICE SCIE guideline on supporting people with dementia and their carers in health and social care,* National Collaborating Centre for Mental Health.

2. Fossey, J. & James, I. (2008) *Evidence-based approaches for improving dementia care in care homes.* Alzheimer's Society: London.

3. Fossey, J., Ballard, C., Juszczak, E., James, I., Alder, N., Jacoby, R. & Howard, R. (2006) Effect of enhanced psychosocial care on antipsychotic use in nursing home residents with severe dementia: cluster randomised trial. *BMJ,* 332(7544): 756-61.

4. Teri, L., Logsdon, R. G., Uomoto, J. & McCurry, S. M. (1997) Behavioral treatment of depression in dementia patients: a controlled clinical trial. *Journals of Gerontology Series B-Psychological Sciences & Social Sciences,* 52(4): 159-66.

5. Teri, L., Gibbons, L. E., McCurry, S. M., Logsdon, R. G., Buchner, D. M., Barlow, W. E., Kukull, W. A., LaCroix, A. Z., McCormick, W. & Larson, E. B. (2003) Exercise plus behavioral management in patients with Alzheimer disease: a randomized controlled trial. *JAMA*, 290(15): 2015-22.

6. Cohen-Mansfield, J., Libin, A. & Marx, M. S. (2007) Nonpharmacological treatment of agitation: a controlled trial of systematic individualized intervention. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences*, 62(8): 908-16

7. Buettner, L. & Fitzsimmons, S. (2009) *N.E.S.T Approach: Dementia practice guidelines for disturbing behaviours*. Venture Publishing, Inc.

8. Harlowe, D. & Yu, T. (1984) *The ROM DANCE Program*. Tai Chi Health.

9. Van Deusen, J. & Harlowe, D. (1987) The efficacy of the ROM Dance Program for Adults with Rheumatoid Arthritis. *American Journal of Occupational Therapy*, 41(2): 90-95.

10. Riesberg, B. (1988) Functional Assessment Staging (FAST). *Psychopharmacology Bulletin,* 24: 653-659.

11. Hughes, C. P ., Berg, L., Danziger, W. L., Coben, L. A. & Martin, R. L. (1982) A new clinical scale for the staging of dementia. *British Journal of Psychiatry*, 140: 566-572.

12. Cohen-Mansfield, J., Marx, M.S., & Rosenthal, A.S. (1989) A description of agitation in a nursing home. *J Gerontol Med Sci*, 4: 77-84.

13. Wood, S., Cummings, J. L., Hsu, M-A., Barclay, T., Wheatley, M. V., Yarema, K. T. & Schnelle, J. F. (2000) The use of the Neuropsychiatric Inventory in nursing home residents, characterization and measurement. *Am J Geriatr Psychiatry,* 8: 75-83.

14. Alexopoulos, G. S., Abrams, R. C., Young, R. C. & Shamoian, C.A. (1988) Cornell Scale for Depression in Dementia. *Biol Psychiatry*, 23: 271-84.

15. Shankar, K. K., Walker, M., Frost, D. & Orrell, M. W. (1999) The Development of A Reliable and Valid scale for rating anxiety in dementia (RAID). *Aging and Mental Health,* 3: 39-49.

16. Reynolds, T., Thornicroft, G., Abas, M., Woods, B., Hoe, J., Leese, M. & Orrell, M. (2000) Camberwell assessment of need for the Elderly (CANE): development, Validity and Reliability. *British Journal of Psychiatry,* 176: 444-452.

17. Smith, S. C., Lamping, D. L., Banerjee, S., Harwood, R. H., Foley, B., Smith, P., Cook, J. C., Murray, J., Prince, M., Levin, E., Mann, A. & Knapp, M. (2007) Development of a new measure of health-related quality of life for people with dementia: DEMQOL. *Psychol. Med.,* 37: 737-46.

18. Logsdon, R. G., Gibbons, L. E., McCurry, S. M. & Teri, L. (1999) Quality of life in Alzheimer's Disease: patient and caregiver reports. *Journal of Mental Health and Aging*, 5(1): 21-32.

19. Dean, R., Proudfoot, R., Lindesay, J. (1993) The Quality of Interaction Schedule (QUIS): development, reliability and use in the evaluation of two domus units. *Int J Ger Psy*, 8: 819-826.

20. From Jiska Cohen-Mansfield (1991) Instruction manual for the Cohen-Mansfield agitation inventory (CMAI). *The Research Institute of the Hebrew Home of Greater Washington*

21. Woods SW, Chlorpromazine equivalent doses for the newer atypical antipsychotics. J Clin Psychiatry 2003; 64: 663-67 (28 in the Australian paper)

22. Cummings J.L. (2009) Neuropsychiatric Inventory - Nursing Home Version (NPI-NH): Comprehensive Assessment of Psychopathology in Patients with Dementia Residing in Nursing Homes. NPITest

23. Cummings JL. The Neuropsychiatric Inventory: Assessing psychopathology in dementia patients. *Neurology* 1997; 48 (Supple 6): S10-S16.

24. Alexopoulos, George S. (2002) The Cornell Scale for Depression in Dementia: Administration & scoring guidelines. Cornell Institute of Geriatric Psychiatry, Weill Medical College of Cornell University.

APPENDIX 4: OUTCOME MEASURES

(CMAI and antipsychotic use are two primary outcome measures)

Outcome measure	Subscale	Abbreviation	Scoring	Thresholds	References
Cohen-Mansfield Agitation Inventory (CMAI)		CMAI	Sum of all 29 items (scored 1/2/3/4/5/6/7)	There are no reported thresholds	Cohen-Mansfield 1989 [12], 1991 [20]
	Physical aggressive (items 1-11)	CMAI_pa	Sum of all 11 items (scored 1/2/3/4/5/6/7)		
	Physical non-aggressive (items 12-21)	CMAI_pna	Sum of all 10 items (scored 1/2/3/4/5/6/7)		
	Verbal aggressive (items 22-24)	CMAI_va	Sum of all 3 items (scored 1/2/3/4/5/6/7)		
	Verbal non-aggressive (items 25-29)	CMAI_vna	Sum of all 5 items (scored 1/2/3/4/5/6/7)		
Antipsychotic use			Antipsychotic doses were converted into chlorpromazine equivalents and then added together		Woods 2003 [21]
	Proportion of residents receiving drugs		A binary variable: 1 for on antipsychotic treatment and 0 for not on the treatment		
Use of other psychotropic drugs			Psychotropic doses were converted into chlorpromazine equivalents and then added together		Woods 2003 [21]
	Proportion of residents receiving drugs		A binary variable: 1 for on psychotropic treatment and 0 for not on the treatment		

Neuropsychiatric Inventory – nursing home version (NPI-NH)		NPI-NH	Neuropsychiatric Inventory has 12 domains in total. For each behavioural domain, frequency is rated 1 to 4 and severity is rated 1 to 3. The score for each domain is: domain score = frequency × severity. A total NPI-NH score can be calculated by adding all of the first ten domain scores together. All twelve domain total scores can be summed in special circumstances where the neurovegetative symptoms are of particular importance. Occasional Disruptiveness is rated 1 – 5. The disruptiveness score is not included in the total NPI-NH score but should be calculated separately by summing the disruptiveness scores of the behavioural domains.		Woods 2000 [13]; Cummings 2009 [22], 1997 [23]
Cornell Depression Scale		CSDD	There are 19 items in total. Each item is rated for severity on a scale of 0-2 (0=absent, 1=mild or intermittent, 2=severe). The item scores are added.	>10, probable major depression >18, definite major depression <6, absence of significant depressive symptoms	Alexopoulos 1988 [14], 2002 [24]
Rating Anxiety in Dementia (RAID)		RAID	Total score is the sum of items 1 to 18, each scored 0/1/2/3	≥11 suggests significant clinical anxiety	Shankar 1999 [15]
Camberwell Assessment of Need in the Elderly (CANE)		CANE	It is to be noted that scoring is a secondary aspect of the CANE as its primary purpose is to identify and assess individual unmet needs. (not used for this purpose in this research). The total CANE score is based on the rating of section 1 of each of the 24 problem areas (scored 0/1/2)		Reynolds 2000 [16]

	Count total number of met needs		The variables may take values between 0 and 24		
	Count total number of unmet needs		The variable may take values between 0 and 24		
	Count total number of needs identified		The variable may take values between 0 and 24		
Assessment of QoL for people with dementia (DEMQOL)		DemQoL	Sum of 28 items (scored 1/2/3/4). Positive items are scored reversely. Higher scores mean a better quality of life.		Smith 2007 [17]
	Overall quality of life		A four-point scale based on the patient's overall rating on his/her quality of life (the 29th item in the questionnaire)		
Assessment of QoL for people with dementia (DEMQOL proxy)			Sum of 31 items (scored 1/2/3/4). Positive items are scored reversely. Higher scores mean a better quality of life.		Smith 2007 [17]
	Overall quality of life	DemQol-proxy	A four-point scale based on the care giver's overall rating on patient's quality of life (the 32nd item in the questionnaire)		
QoL in Alzheimer's Disease (QoL-AD)		QoL-AD	Sum of 13 items (scored 1/2/3/4). Higher scores mean a better quality of life.	Patient and caregiver reports can be evaluated separately and/or combined into a single score	Logsdon 1999 [18]
QoL in Alzheimer's Disease (QoL-AD proxy)		QoL-AD-proxy	Sum of 13 items (scored 1/2/3/4). Higher scores mean a better quality of life.		Logsdon 1999 [18]

Quality of Interaction Schedule (QUIS, observational tool)		QUIS	It can be used as both a qualitative and quantitative tool to provide a measure of the quality of interaction between staff, patients and visitors. (used as a quantitative tool for WHELD). Simple percentages of the quality of interactions are perfectly acceptable for straightforward evidence of the quality of verbal and non verbal communication e.g. 20% of observation were positively social (n=20), 70% were basic care interactions (n=70), 5% were neutral interaction (n=5) and 5% were negative interaction (n=5). The scoring rule may depend on how the data were collected.		Dean 1993 [19]
Incident reporting form	Number of fractures within last 12 months		A binary variable: 1 for residents with one or more fractures and 0 for none		
	Proportion of residents with one or more falls		A binary variable: 1 for residents with one or more falls and 0 for none		