Economic evaluation of promoting activity in early dementia

Victory Ezeofor, Ned Hartfiel, Pim Doungsong & Rhiannon Tudor Edwards

Centre for Health Economics and Medicines Evaluations
Bangor University

- There are conflicting evidences to the premise suggesting that regular exercise can slow the rate of dementia progression.
  - MODEM trial
    - **Study design:** cross-sectional baseline data from a cohort study
    - **Objectives:** to model how changes in the treatment and care of people with dementia and support for carers can result in better outcomes
    - **Populations**: people with mild to moderate dementia and their carers
    - **Conclusion**: cognitive impairment severity is not associated with the lower quality of life (QoL) for people with dementia.
  - DAPA trial
    - **Intervention:** the 12-month Dose structured exercise programme versus usual care
    - **Outcomes:** health-related quality of life outcomes (QALY)
    - **Objectives:** to compare the cost effectiveness of the exercise programme versus usual care
   - **Results:** This programme is *not* cost-effective

Health economic analysis (models) help to extrapolate beyond the 12-month clinical trial period. They are designed to capture and accumulate all outcomes and costs of the health Intervention over that period?

- PrAISED intervention was a home-based tailored exercise programme aimed to improve health outcomes of people with early dementia, their carers.
  - The cost effectiveness study was conducted alongside this project
- **Objectives:** This economic evaluation investigated the cost and effects of the PrAISED intervention for patients with Mild cognitive impairment (MCI) or dementia (Montreal Cognitive Assessment score of 13-25 out of 30).
- **Primary Outcomes:** Disability Assessment for Dementia (DAD) and health-related quality of life outcomes (QALY), cost per participant of the intervention

- NICE (2022) defined cost-effectiveness analysis as "Cost-effectiveness analysis is used to determine if differences in expected costs between technologies/interventions can be justified in terms of changes in expected health effects".
  - Health effects should be presented in terms of QALYs
- The benefit of cost-effectiveness analysis is maximising health gains from a limited NHS and PSS budget.

- How relevant is cost-effectiveness in cases of dementia?
- A wider perspective is needed including SROI
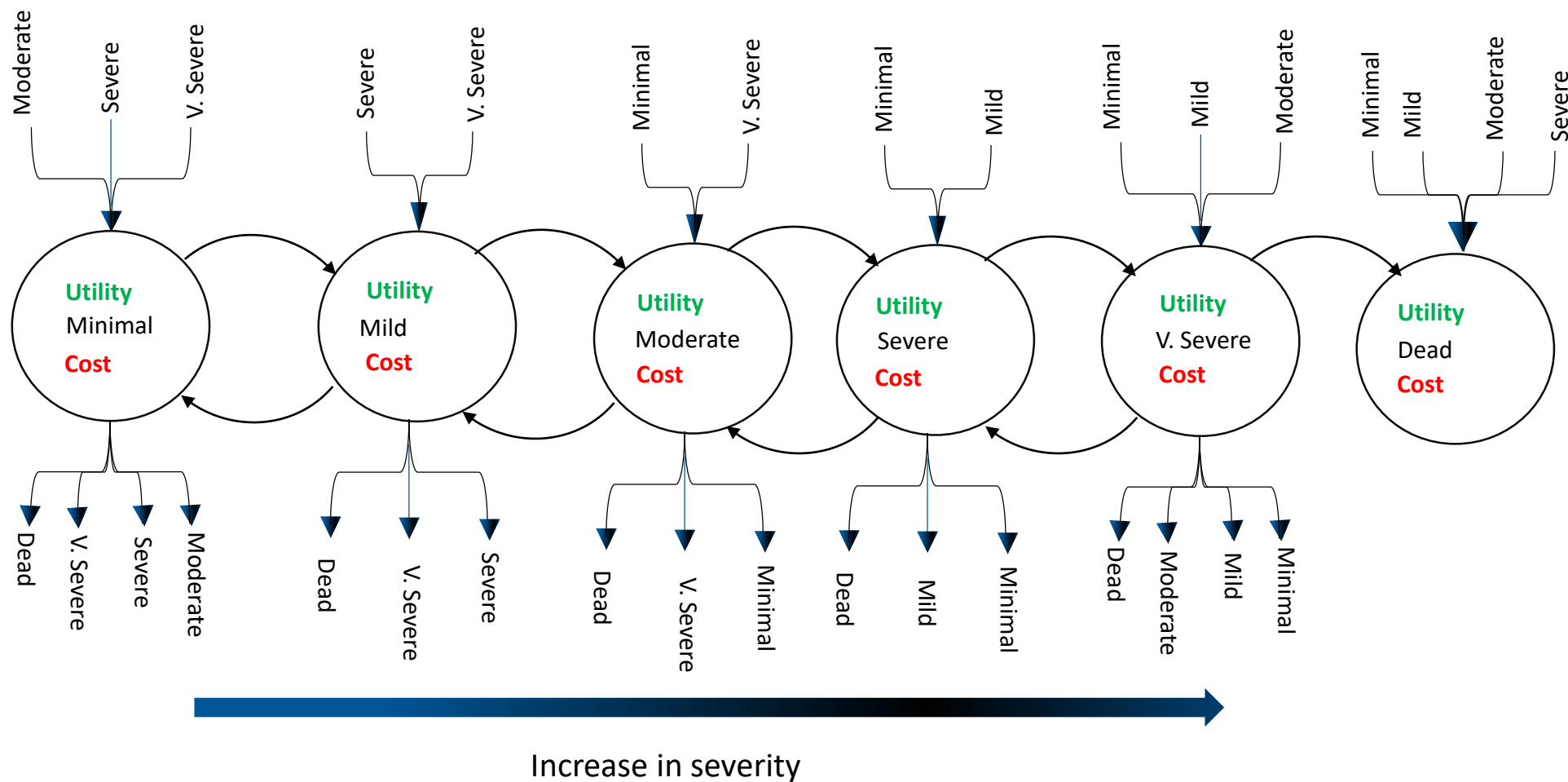
Fig: Simplified representation of the disease simulation structure for the Markov model. **V. Severe** = Very Severe

Costs

Cost (annual cost per patient) £	
Intervention Cost	**2212**
Cost per health state (CSRI form)	
Minimal Cost	730
Mild Cost	997
Moderate Cost	1837
Severe Cost	3035
V.Severe Cost	19938
Dead	0.00

Utility (EQ-5D)

Utilities	
Minimal	0.86
Mild	0.82
Moderate	0.74
Severe	0.62
V.Severe	0.50
Dead	0.00

Transition Probabilities (DAD Score)

PrAISED

	minimal	mild	moderate	severe	v.severe	dead
minimal	1-SUM(D1	0.226415	0.169811	0.037736	0.018868	H5+qx
mild	0.116667	1-SUM(C18	0.35	0.1	0.033333	H6+qx
moderate	0	0.04	1-SUM(D1	0.28	0.04	H7+qx
severe	0	0	0.15	1-SUM(E20	0.25	H8+qx
v.severe	0	0	0	0	1-H21	H9+qx
dead	0	0	0	0	0	1

Usual care

	minimal	mild	moderate	severe	v.severe	dead
minimal	1-SUM(M1	0.36	0.18	0.06	0	Q5+qx
mild	0.057143	1-SUM(N1	0.4	0.1	0	Q6+qx
moderate	0	0.166667	1-SUM(O1	0.333333	0.055556	Q7+qx
severe	0	0	0.086957	1-SUM(P20	0.391304	Q8+qx
v.severe	0	0	0	0	1-Q21	Q9+qx
dead	0	0	0	0	0	1

| Intervention | Costs | QALYs | Incremental | | ICER (£/QALY) |
			Costs	QALY	
PrAISED	£11,919	-0.07	£4,852	0.02	£226,254
Usual Care	£7,067	-0.09			

$$ICER = \frac{C_P - CC}{E_P - EC}$$

ICER is the incremental cost-effectiveness ratio (£/effect)
C_P: the cost of PrAISED intervention (£)
C_C: the cost of usual care intervention (£)
E_P: the effectiveness of PrAISED implementation
E_C: the effectiveness of usual care implementation

PrAISED intervention reduced QALY loss compared to usual care but was not enough to offset the additional cost of PrAISED.

Time Horizon (Years)	Intervention	Cost	QALYs	Incremental		ICER
				Cost	QALY	
2	PrAISED	£12,173	1.51	£4,950	-0.08	Dominated
	Usual Care	£7,224	1.58			
5	PrAISED	£38,246	2.74	£5,099	-0.15	Dominated
	Usual Care	£33,148	2.90			
7	PrAISED	£51,876	3.13	£5,610	-0.09	Dominated
	Usual care	£46,267	3.22			
Lifetime (15 years)	PrAISED	£65,391	3.45	£10,787	0.05	£224,681/QALYs
	Usual care	£54,604	3.40			

The ICER-values at different time horizons are still not cost-saving or cost-effective under the NICE threshold of £20,000 - £30,000 per QALY.
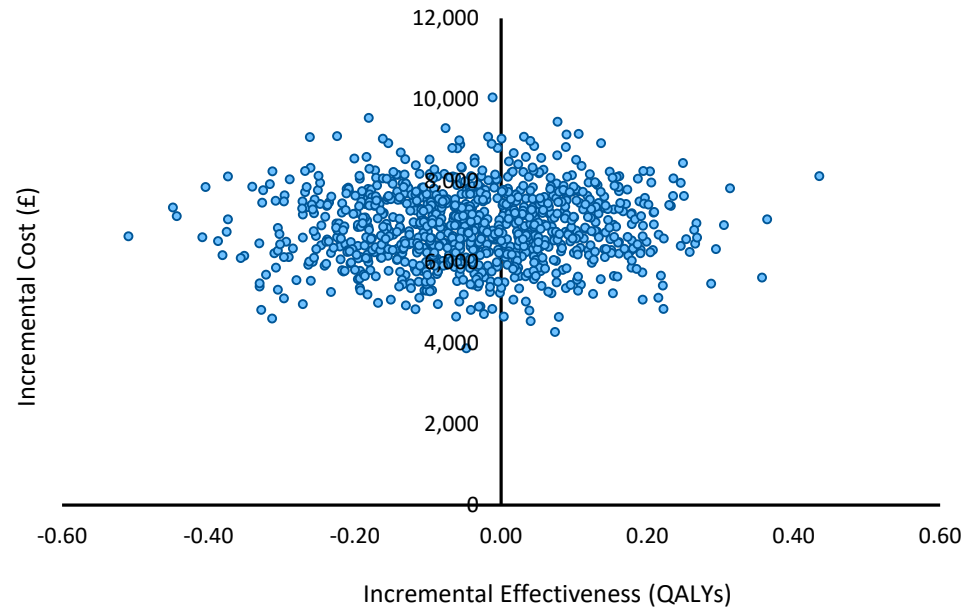
A) ICER Scatter plot: Incremental cost and incremental effect over a lifetime.
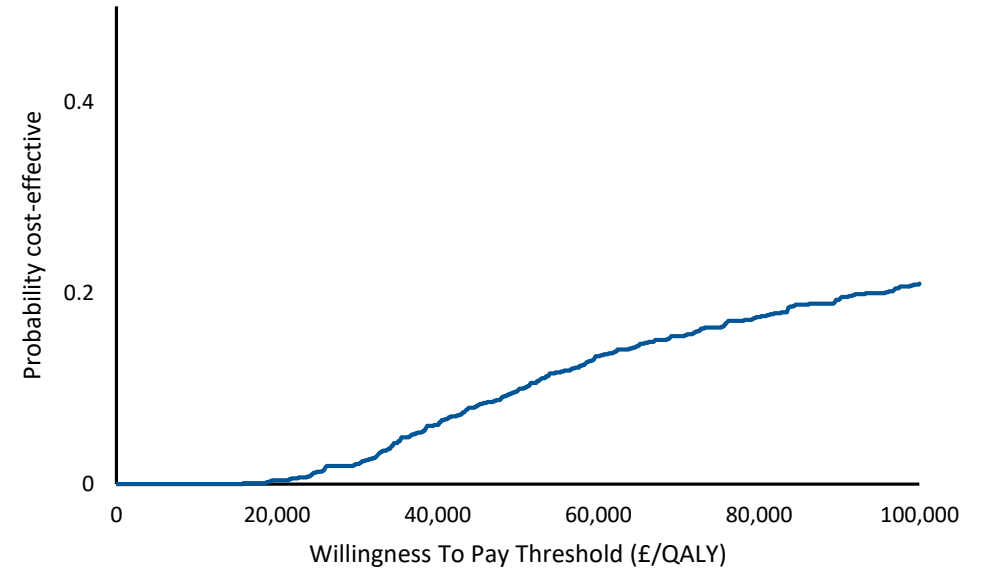
B) CEAC plot: Cost-effectiveness acceptability curve.

WTP Threshold	Probability of Cost-Effectiveness
£20,000/QALY	0.004
£30,000/QALY	0.021
£50,000/QALY	0.098

Figure: The Markov trace shows the rate at which patients move between health states.
Continuous lines – PrAISED Intervention, Dash lines – Usual care.

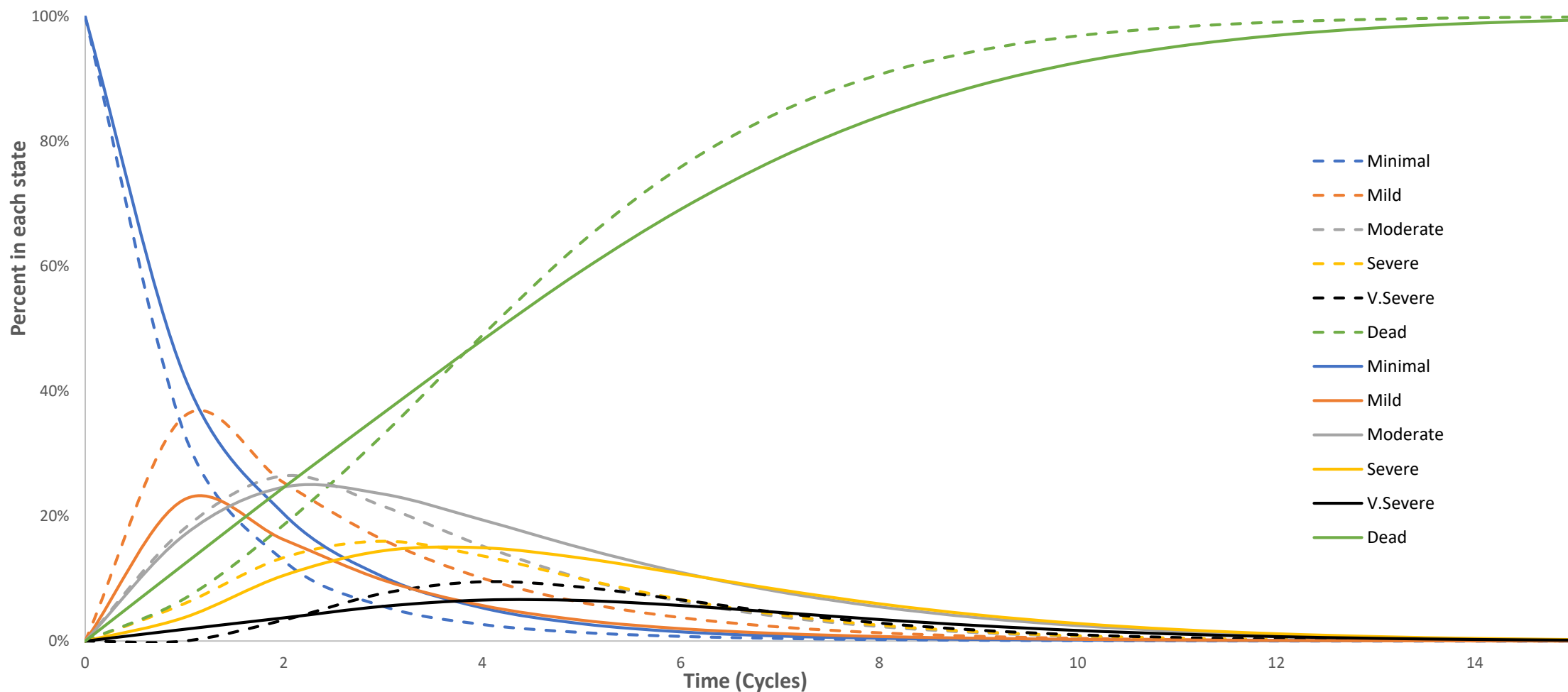| Lifetime (Base case)	Intervention	Costs (£)	QALYs	Incremental Costs	Incremental QALYs	ICER (£/QALY)	20,000	30,000	50,000
≥ 65 yrs	PrAISED	65,391	3.449	10,787	0.048	224,681	0.004	0.056	0.193
	Usual care	54,604	3.401						
65 - 74 yrs	PrAISED	83,271	4.029	14,922	0.153	97,589	0.002	0.053	0.254
	Usual care	68,349	3.877						
75 - 84 yrs	PrAISED	65,391	3.449	10,787	0.048	224,681	0.003	0.038	0.155
	Usual care	54,604	3.401						
≥ 84 yrs	PrAISED	43,153	2.629	6,874	-0.039	-177,192	0.003	0.031	0.104
	Usual care	36,278	2.667						
Discounting QALYs 0%		Costs (£)	QALYs	Costs	QALYs	(£/QALY)	20,000	30,000	50,000
≥ 65 yrs	PrAISED	65,391	3.789	10,787	0.104	103,323	0.010	0.080	0.258
	Usual care	54,604	3.684						
65 - 74 yrs	PrAISED	83,271	4.521	14,922	0.258	57,905	0.028	0.168	0.433
	Usual care	68,349	4.264						
75 - 84 yrs	PrAISED	65,391	3.789	10,787	0.104	103,323	0.007	0.074	0.276
	Usual care	54,604	3.684						
≥ 84 yrs	PrAISED	43,153	2.805	6,874	-0.021	-324,183	0.009	0.041	0.140
	Usual care	36,278	2.827						

Incremental (Costs, QALYs), **ICER (£/QALY)**, **Probability of Cost-Effectiveness at Willingness To Pay (£/QALY)** (20,000, 30,000, 50,000).

The younger patients have better ICER values from the PrAISED intervention.

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Discussion

The PrAISED intervention is shown to slow the progression rate of patient to more severe dementia health states but this is achieved at a high cost making it neither cost-saving nor cost-effective.

Conclusion

In the short term and long term the PrAISED intervention is not cost-effective.

What if we use an alternative methodology that takes into account the social value generated from PrAISED intervention?

**Social Return on Investment
comparing in-person and
blended PrAISED programmes**

Dr Ned Hartfiel
Bangor University

Research Fellow in Public Health
and Prevention Economics

- SROI developed from cost-benefit analysis

- Comparing costs and social value between in-person and blended PrAISED programmes

- Concept of value is broader than that which can be captured by market prices

- Monetary values are assigned from the Social Value Bank (SVB) to changes in outcomes

- SVB values based on 'wellbeing valuation' – recommended in the HM Treasury Green Book

1. Identify stakeholders (patient participants, carer participants, NHS)

2. Create a theory of change (inputs > outputs > outcomes)

3. Evidence outcomes (DAD, FES-I, EQ5D-5L, CSI, CSRI)

4. Value outcomes (Social Value Bank, wellbeing valuation, social value calculator)

5. Estimate costs (training costs and delivery costs for PrAISED programme)

6. Calculate SROI ratio (social value per person/cost per person)

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PrAISED
Promoting Activity, Independence and Stability in Early Dementia

Inputs

*Cost of training therapists

*Cost of delivering PrAISED

*Cost of transport

*Cost of materials and equipment

Outputs

*Exercise sessions delivered by therapists

*Community activities referred by therapists

Outcomes

*Improved activities of daily living

*Less fear of falling

*Improved health-related quality of life

*Less carer strain

*Less health service use

Impact

*Improved exercise habits resulting in better overall health

*Extended social connection due to community referral

*Saving to NHS due to reduced health care costs

- 64 patient participants completed in-person PrAISED before the start of COVID-19 in March 2020

- 301 patient participants completed a blended PrAISED programme (phone calls, video conferencing)

- Five relevant outcomes (proxy-reported) identified for SROI analysis:

  1. Disability assessment for dementia scale (DAD)

  2. Falls efficacy scale - International (FES-I)

  3. Health-related quality of life (EQ5D-5L)

  4. Carer strain index (CSI)

  5. NHS health service resource use (CSRI)

- All outcomes collected at baseline and 12-month follow-up

Group	Outcome	Quantity improved by 10% or more	Value from Social Value Bank	Total Social Value	Social value per participant
PrAISED	DAD	3/29 (10%)	£3,537 per year- frequent mild exercise	£10,611	£366
Usual care	DAD	3/31 (10%)	£3,537 per year- frequent mild exercise	£10,611	£342
PrAISED	FES-I	7/29 (24%)	£13,080 per year - high confidence	£91,560	£3,052
Usual care	FES-I	4/30 (13%)	£13,080 per year - high confidence	£52,320	£1,744
PrAISED	EQ5D-5L	6/30 (20%)	£20,141 per year – good overall health	£120,846	£4,028
Usual care	EQ5D-5L	4/30 (13%)	£20,141 per year – good overall health	£80,564	£2,685
PrAISED	CSI	9/31 (29%)	£6,784 per year - able to rely on family	£61,056	£2,035
Usual care	CSI	5/29 (17%)	£6,784 per year - able to rely on family	£33,920	£1,094

Group	Outcome	Quantity improved by 10% or more	Value from Social Value Bank	Total Social Value	Social Value per participant
PrAISED	DAD	3/73 (4%)	£3,537 per year- frequent mild exercise	£10,611	£145
Usual care	DAD	6/59 (10%)	£3,537 per year- frequent mild exercise	£21,222	£360
PrAISED	FES-I	10/69 (17%)	£13,080 per year - high confidence	£130,800	£1,896
Usual care	FES-I	15/58 (26%)	£13,080 per year - high confidence	£196,200	£3,383
PrAISED	EQ5D-5L	12/79 (15%)	£20,141 per year – good overall health	£241,692	£3,059
Usual care	EQ5D-5L	5/62 (8%)	£20,141 per year – good overall health	£100,705	£1,624
PrAISED	CSI	18/70 (26%)	£6784 per year - able to rely on family	£122,112	£1,744
Usual care	CSI	15/60 (25%)	£6784 per year - able to rely on family	£101,760	£1,696

SROI ratios for in-person and blended progammes

	In Person	Blended
Outcome 1 - increased activities of daily living	£24	-£215
Outcome 2 - improved confidence (less fear of falling)	£1,308	-£1,487
Outcome 3 - improved health related quality of life	£1,343	£1,435
Outcome 4 - less carer strain	£941	£48
NHS health service resource use	£11.70	-£24.96
Total social value for all stakeholders	**£3,628**	**-£244**
Total cost	**£2,212**	**£1,571**
SROI ratio	**£1.64: £1**	**-£0.16: £1**

- Positive SROI ratio (£1.64: £1) of in-person PrAISED programme was less than in the PrAISED feasibility study (£3.46 to £5.94 for every £1 invested)

- Tapering effect: 2x/week visits in first three months; 1x/month visit in last three months

- Less contact may have led to lower exercise adherence, less social connection, poorer outcomes

- Blended delivery: more difficult for multidisciplinary team to develop therapeutic relationships

- Blended delivery: restricted home visits and limited referral to community activities

- Blended programme without community referral generated a negative SROI ratio

- In-person programme with community referral generated a positive SROI ratio

Thank you.
Any questions ?

Dr. Ned Hartfiel
(ned.hartfiel@bangor.ac.uk)

Dr. Victory Ezeofor
(v.ezeofor@bangor.ac.uk)

Miss Pim (Kodchawan) Doungsong
(kdd21yjh@bangor.ac.uk)

Professor Rhiannon Tudor Edwards
(r.t.edwards@bangor.ac.uk)