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Dementia Care Mapping and Patient-Centred Care in Australian Residential Homes: An Economic Evaluation of the CARE Study

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CHERE WORKING PAPER 2008/4

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First Version: July 2008
Current Version: June 2008

Abstract

Background: As the population ages, the incidence of dementia and its burden on society will increase. The economic costs of dementia are high, particularly for persons in the mid and late stages of the disease, when formal care arrangements such as nursing home placement are required. The need for care is often precipitated by the development of behavioural and psychological symptoms of dementia (BPSD) which also severely affect the quality of life of affected persons and their carers The Caring for Aged-Care REsident Study (CARES), the first randomised controlled trial to evaluate Dementia Care Mapping (DCM) and Person Centred Care (PCC), demonstrated that either of the two interventions improved outcomes compared to Usual Care (UC) on the primary outcome measure, the Cohen-Mansfield Agitation Inventory (CMAI). This study reports the results of an economic evaluation which was undertaken in conjunction with the trial. This information will provide additional information to assist policy makers in making choices between competing options.

Methods: Fifteen nursing homes were randomised to one of three conditions: DCM, PCC or Usual Care (UC). The sample consisted of 360 residents with dementia. Data were collected at baseline, three months, and eight months by assessors blind to group assignment. In addition to the CMAI, data were collected about the use and costs of health care resources and pharmacological interventions. Total costs associated with each of the interventions were estimated, which were contrasted with the outcomes using standard health economics methodology.

Results: Over one year, the cost per residential setting of implementing DCM and PCC relative to UC was $10,034 and $2,250 respectively. The additional cost per resident-level unit improvement in CMAI post-intervention (at follow-up) relative to UC was $48.95 ($46.89) for DCM and $8.01 ($6.43) for PCC. Compared to DCM, PCC produced a greater reduction in anxiety and agitation at a lower cost. Therefore, DCM was dominated by PCC and removed from the economic evaluation. Sensitivity analysis suggests this result is robust to changing model parameters.

Conclusions: PCC provides a greater decrease in agitation and related behavioural and psychological symptoms of dementia, compared with DCM, at a lower cost and is the preferred option for cost-effectiveness. While there is no existing standard for a reasonable cost for a point improvement in CMAI, the cost per unit under PCC seems acceptable.

Trial registration: The clinical trial used in the evaluation is registered as Australian New Zealand Clinical Trials Registry (ANZCTR) ACTRN12608000084381

Background

By 2030 the number of Australians aged 65 years or more is expected to increase to over six million, of which 944,000 are expected to be aged over 85.[1] This represents a 108% and a 154% increase respectively from 2008 figures.[1] The Australian Institute of Health and Welfare estimates that the number of people with dementia will increase from 175,000 in 2003 to 465,000 in 2031.[2] With the increasing prevalence of dementia, health care costs associated with the condition are predicted to increase by 225% between 2003 and 2030/1.[2]

The presence of behavioural and psychological symptoms of dementia (BPSD) including agitation, aggression, resistance to care, hallucinations and delusions, are often the main reason (or a significant contributory factor) for the admission of persons with dementia to residential care [3]. Both pharmacological and behavioural management techniques are used to assist in managing and minimising BPSD [4] although behavioural techniques are more labour intensive. One of the issues faced by the health care system is how to maintain acceptable standards of care and quality of life for persons with dementia in the context of finite resources [5]

There is a significant association between dementia severity and the annual costs of the disease, with costs increasing as the disease progresses. Direct costs include prescribed medications [2, 3] specialist medical consultations and non-medical services, such as respite and residential care. Indirect costs associated with increasing severity include changes in care worker productivity, increased absences from work and decreased caring ability as well as intangible costs, such as distress and lowered quality of life in persons with dementia and their caregivers.

Individually tailored behavioural interventions have been identified as the most promising way of supporting a persons' quality of life [6]. However, as the residential care sector is staffed mainly by people without specialist dementia care training, their ability to incorporate behavioural techniques into day-to-day care is limited Two accessible approaches to care are Dementia Care Mapping (DCM) and Person Centred Care (PCC). However, as both require significant levels of staff training and follow-up it is important to assess the extent to which the additional costs associated

with such programs can be justified in terms of improved behavioural outcomes for patients. This paper reports the results of an economic evaluation of the Caring for Aged-Care REsident Study (CARES), a cluster-randomised trial, which investigated the relative effectiveness of DCM, PCC and Usual Care (UC).

Person-Centred Care, both as a philosophy and a method of care, is based on the social-psychological theory of personhood in dementia.[7] This approach recognises the persistence of "personhood" despite other losses occurring in dementia, hence achieving well-being is a central focus of care. Kitwood proposed that the care environment must not only be informed by a person's clinical history but also the person's social and functional history, and be designed to cultivate the retention of capacities by enhancing remaining strengths rather than managing deficits. PCC methodology prescribes individualised care planning informed by the person's history, needs and preferences, material and management environments that reflect the principles described above, and care staff who are sensitised to the person's unique personality and preferences, able to interpret responses and behaviours and adjust care practices accordingly. PCC has been implemented most successfully in residential aged care for persons with dementia. In particular, it has been shown to reduce the use of physical and chemical restraints to manage behavioural disturbance.[8]

Dementia Care Mapping (DCM), which was developed by the Dementia Research Group at Bradford University (UK), also aims to assist staff in identifying and addressing factors which impact on the well-being of the person with dementia based on the philosophy of PCC [7].When DCM is used as a vehicle for closely analysing and correcting contextual factors which stimulate ill-being for the person with dementia, it has been shown to assist staff significantly to reduce the triggers for behavioural disturbance. It is also an effective education vehicle for introducing person-centred care in any formal care setting.[9] DCM entails specially-trained staff making continuous and systematic observations of residents going about their daily life for 6-8 hours, to identify factors associated with their expressions of both well-being and ill-being. These observations are carefully documented and scored and are fed back to care staff, with the aim of assisting them to devise person-centred care

plans and strategies that aim to improve well-being and reduce ill-being in the person with dementia. These strategies are then implemented and monitored regularly. The process has merit and is gaining worldwide popularity. However, the cost of implementing DCM may be prohibitive for aged care providers who wish to employ the process to improve care quality, as it is labour intensive, training is costly and full supervision is required from an accredited DCM trainer.[9, 10]

The CARES trial, the first to subject PCC and DCM to a randomised controlled trial, concluded that both PCC and DCM reduced agitation and improved quality of life relative to UC. However, it is unclear whether this result is adequate to justify economically generalised adoption of either technique. Economic evaluation is a potentially useful tool in this debate as it seeks to quantify both the benefits and costs of the approaches under consideration with the aim of identifying which intervention represents the better use of scarce societal resources. Generally, this means estimating an Incremental Cost-Effectiveness Ratio (ICER). If a new intervention is being compared with an existing intervention, the ICER estimated in the following way:

$$ICER = \frac{Cost_{New} - Cost_{Comparator}}{Effectiveness_{New} - Effectiveness_{Comparator}}$$

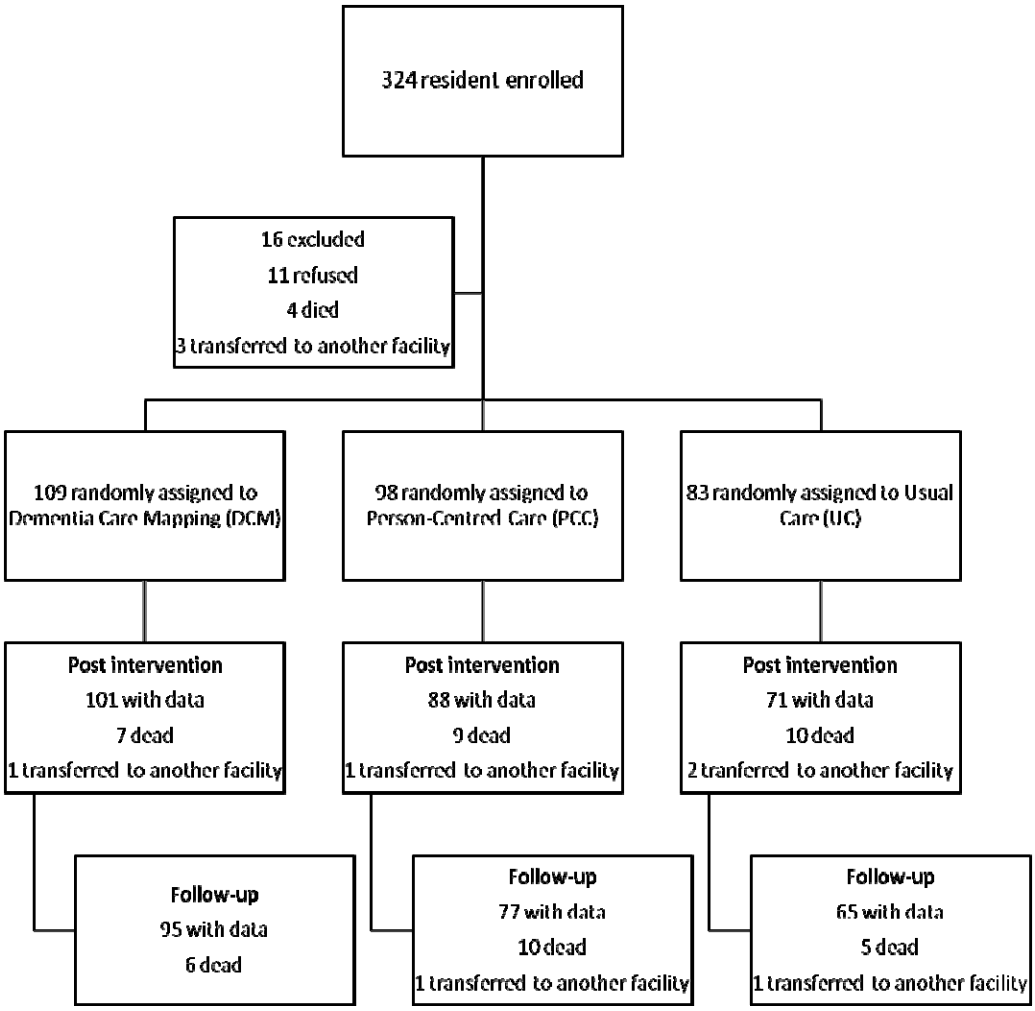
The ICER can be interpreted as the cost of a one-point improvement in whichever outcome measure is considered to best represent the effect of the intervention. In the case of DCM, PCC and Usual Care (UC), the ICERs of DCM and PCC can be contrasted with that of UC; it is then possible to compare DCM and PCC if the results are likely to further inform the decision-making process. For example, it would be appropriate to make such a comparison if both approaches are equally effective but one costs less in total. In this situation, cost-effectiveness analysis would identify the extra resources available for use in other areas of the healthcare sector. The aims of the economic evaluation reported here were to estimate both the costs and effectiveness of DCM and PCC relative to UC within the CARES trial; to contrast the aggregate costs and outcomes across the three interventions and attempt to reach conclusions about the optimal approach; and to present the limitations and uncertainties surrounding these conclusions.

Methods

CARES was a cluster-randomised trial based in Sydney, Australia. Trial participants (n=360) were recruited from 15 residential dementia care sites across the metropolitan area, selected for comparative management structure, standards and size. All selected residents: were aged at least 60 years; were classified under the Australian Resident Classification Scale (RCS) at category 1-3 (RCS determines level of care required for individual residents, ranging between 1-8, 1 being most dependent); and provided consent to participate in the trial directly or by proxy from their guardian or person responsible. Exclusion criteria were serious co-morbidities likely to complicate or mask dementia and/or receipt of palliative care.

The breakdown of units by intervention allocation, resident and staff numbers is shown in Figure 1.

Figure 1: Consort Diagram for Cluster Randomised Trial



DCM training was provided by two Bradford University-accredited trainers to two nurses/care staff for each of the five DCM sites. The authors (LC and Y-HJ) who were trained and experienced in the DCM techniques (also called mappers) conducted DCM mapping alongside the DCM trained nurses/care staff at each site for six continuous hours on two consecutive days and recorded observations from which a Well/Ill-being (WIB) score was calculated for each participating resident at each of the five sites. Using factors that were observed to stimulate well being and/or ill-being in the residents, care plans based on person-centred principles were developed by the mappers to provide feedback on the findings to site staff. The DCM trained staff at each site were then supported by LC and Y-HJ to continue encouraging site staff to maintain the recommended resident care plan strategies over the following four

months of the study and beyond. The time spent by trained staff on DCM-related activities was estimated.

The PCC training manual [11] was employed to provide PCC education for PCC site staff by one author (JS-P). This consisted of a two-day training session for two staff from each of the five PCC sites. In addition, PCC resource materials and two supervision field visits were provided at each site (over a two week period). Ongoing support by telephone and email was supplied and documented by JS-P. Once on-site training and supervision were completed, the trained staff in each site took on responsibility for the continued implementation of PCC.

Resident-level pharmaceutical use was collected at baseline, immediately following the intervention (at three months) and four months following the end of the intervention. Information was collected about the use of antidepressant, anti-psychotic, anxiolytic and other psychotropic medications as these are commonly prescribed to reduce the incidence and severity of BPSDs. The data collection detailed the product used, dosage and regularity of use. Pharmaceutical Benefit Schedule (PBS) codes were assigned to each instance of usage and multiplied by the regularity to provide a cost per patient per day. Since brand names were not recorded, it was assumed that all usage was of generic products when available. This assumption is unlikely to affect the relative results of the three intervention arms as there is no reason to believe that prescribing behaviour in this particular dimension is affected by training. Differences in the average expenditure per resident both over time and between intervention arms were estimated.

The primary study outcome, agitation (and related behavioural and psychological symptoms of dementia), was assessed using the Cohen-Mansfield Agitation Inventory (CMAI) (Cohen-Mansfield & Werner 1998) which has been used widely in dementia care. [12, 13] The CMAI is a 29-item tool, which assesses the level of agitation and related BPSDs, such as anxiety and anger responses, over the preceding seven days. Each item is scored between 1 (never) and 7 (several times per hour), making the range of scores vary from 29 to 203.

To adjust for baseline differences, characteristics of site and residents that differed between the intervention groups at baseline were included in models as covariates. The best method for presenting ICERs in this context is uncertain. Since the CMAI is effectively a count variable, it was decided to present the cost per behaviour avoided (i.e. a cost per 1-point reduction in one individual).

Since the analysis required a number of assumptions, in particular regarding the amount of intervention-specific time spent by each member of staff, a univariate sensitivity analysis was undertaken. This analysis investigated the effect of changing the model parameters on the baseline conclusions. Thus, the estimated time spent on DCM was increased and decreased by 8 hours per month to reflect uncertainty about the actual time spent on activities related to mapping and devising the care plan. In addition, the effects of increasing or decreasing the pharmacological costs by 20% in each of the intervention arms sequentially were analysed.

The perspective employed was that of the health service. Thus, no costs accruing beyond the residential home were considered. Discounting was not undertaken since all outcomes and costs occurred in the first year. Whilst it may be of considerable interest to ascertain whether benefits endured beyond the study period, no evidence was available which allowed this to be estimated in this study.

Results and Discussion

The clinical outcomes will be reported fully elsewhere [14] . Briefly, levels of agitation and aggression as measured by the CMAI decreased in residents enrolled in both the PCC and DCM intervention arms compared to those in Usual Care (UC), more so for PCC than for DCM. Greater variability in the PCC scores after evaluation meant that it was not statistically significantly better than UC while DCM was. These results are outlined in
Table **1**. Even when corrected for the differing baseline characteristics, the significant interaction term remained (p=0.001). (see Figure 2).

Table 1: Resident mean (SE) scores for agitation, neuropsychological status[1] and quality of life[2], by intervention group at each time point, adjusted for covariates that differed at baseline[3].

	Pre	Post	Follow-up	p values[4]
Agitation (CMAI)				
DCM	46.1 (6.5)	45.1 (6.6)	43.7 (6.5)	P(Group) = 0.33
PCC	47.5 (9.1)	41.7 (9.2)	37.2 (9.1)	P(Time) = 0.47
UC	50.3 (6.8)	58.7 (6.9)	57.7 (6.8)	P(G x T) = 0.005
Neuropsychological status (NPI)				
DCM	12.7 (5.1)	16.8 (5.1)	13.5 (5.1)	P(Group) = 0.68
PCC	21.3 (6.8)	14.5 (6.9)	12.6 (6.9)	P(Time) = 0.05
UC	16.9 (5.3)	20.2 (5.4)	15.3 (5.3)	P(G x T) = 0.30
Quality of life (QUALID)				
DCM	23.5 (1.6)	23.4 (1.6)	24.5 (1.6)	P(Group) = 0.78
PCC	22.7 (2.2)	21.5 (2.2)	20.8 (2.2)	P(Time) = 0.80
UC	23.2 (1.7)	23.7 (1.7)	24.4 (1.7)	P(G x T) = 0.33

1. NPI scores: means and SE from analysis of untransformed data; p values from analysis of square-root transformed data, significant covariates were GDS (p=0.01) and RCS (p=0.02).
2. QUALID ; significant covariates were GDS (p=0.006) and RCS (p=0.0003).
3. Six covariates differed at baseline: TESS-NH safety score, QUIS positive social score, RCS total score, GDS score, country of birth and number of co-morbid diseases.
4. p values from hierarchical linear models with all three time points included as outcomes: p(Group) is for main effect of intervention, p(Time) is for main effect of time (over three time points) and p(GxT) is for the interaction between group and time.

Figure 2: Adjusted Cohen Mansfield Agitation Inventory score by treatment group and time (higher scores indicate greater agitation)

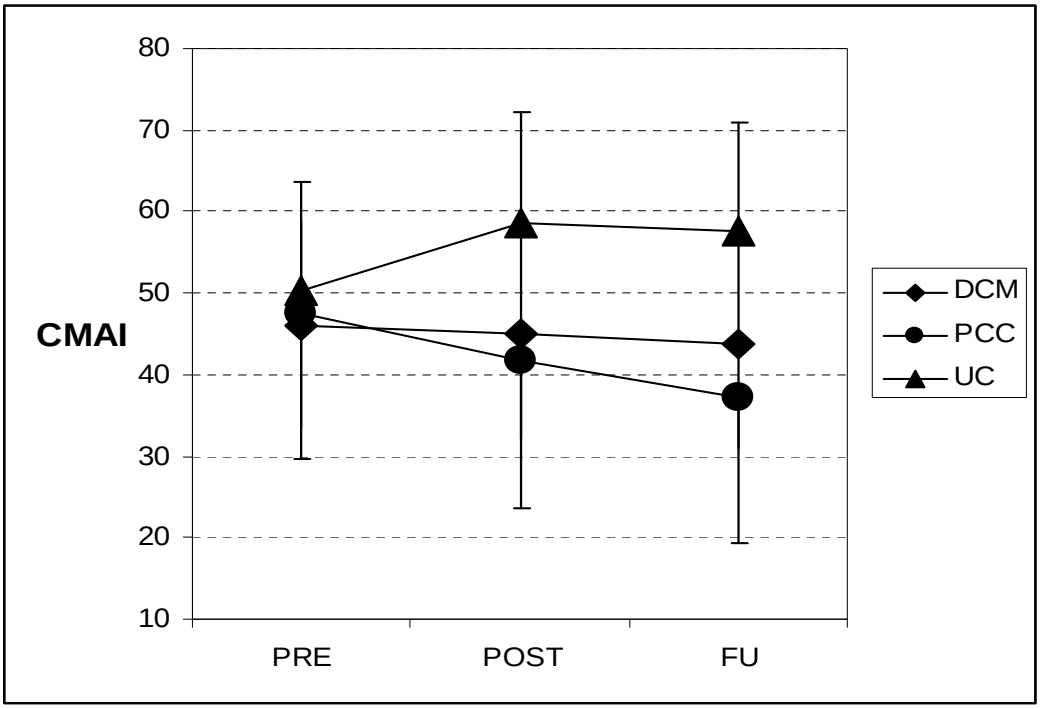


Table 2: Annual Pharmaceutical Costs Per Resident

Mean, standard deviation		DCM	PCC	UC	Total
Period	Pre-Intervention	598.44 (906.30)	647.35 (790.39)	473.25 (905.64)	579.51 (868.34)
	Post-Intervention	617.72 (955.06)	597.89 (852.35)	363.00 (852.75)	541.45 (897.13)
	Follow-up	542.21 (883.32)	560.49 (823.68)	398.19 (871.16)	508.10 (860.10)
	Total	587.31 (913.29)	605.37 (818.91)	414.96 (875.68)	545.55 (874.88)

Pair-wise t-tests were run on this information, investigating whether the pharmaceutical costs per person at a time point were statistically significantly different from the observed mean. In the nine pair-wise comparisons, none were statistically significant at the 5% level. Therefore, as the mean difference between

groups was small compared with other costs in the analysis, and the association between costs, intervention group and time period were unclear, the differences were not included in the base case economic evaluation findings.

The costs of training staff and ongoing activity under DCM and PCC are shown in Table 3. Since the pharmaceutical cost data were not significantly different between intervention groups, they are not listed as a cost difference (this issue will be investigated in the sensitivity analysis). Costs associated with critical incidents, or general doctor time were not included as there was uncertainty regarding the comparability of data collection methods in these areas.

Table 3: The Cost Per Site of PCC and DCM relative to UC

Cost	Unit cost (per hour unless stated, $Aus)	Units required per site	Total
PCC Trainer	60(Bradford University, UK)	9 (i.e. 45 / 5 sites)	540
Post-training support	60(Bradford University, UK)	6 (i.e. 30 / 5 sites)	360
PCC Staff Replacement	27 (Commonwealth Government Aged Care Nurses' Award)	2 x 25 hours	1,350
		PCC Total	2,250
DCM Trainer	950 per staff member(Bradford University, UK)	2	1,900
Post-training support	100(Bradford University, UK)	16 (i.e. 80 / 5 sites)	1,600
PCC Staff Replacement	27(Commonwealth Government Aged Care Nurses' Award)	2 x 25 hours	1,350
Mapping time over year	27(Commonwealth Government Aged Care Nurses' Award)	8 hours x 2 residents per month	5,184
		DCM Total	10,034

Using the average number of residents per site and the results of the CMAI, the total number of behaviours averted per site under each of the intervention arms was estimated. This information was then used to estimate the incremental costs and incremental outcomes (Table 4).

Table 4: Incremental Costs and Benefits

	CMAI change over intervention (at follow-up)	Average number of residents per site	Total CMAI point reduction for site (at follow-up) vs. UC	Incremental cost of intervention (vs. UC)	Cost per behaviour averted vs. UC (follow-up)	Cost per behaviour averted vs. PCC (follow-up)
UC	+8.4(+7.4)	16.4	N/A	N/A	N/A	N/A
PCC	-5.8(-10.3)	19.8	281(350)	2,250	$8.01 ($6.43)	N/A
DCM	-1.0(-2.4)	21.8	205(214)	10,034	$48.95 ($46.89)	-$102.42 (-$57.24)

N/A = not applicable

The results indicate that the DCM intervention is subject to what is referred to in the economic evaluation literature as "dominance". That is, relative to PCC, it averts fewer negative behaviours and is more costly. This remains the case whether the post-intervention or follow-up CMAI scores are used. A less effective and more costly intervention is not recommended on efficiency grounds. Therefore, DCM is excluded from the incremental component of the economic evaluation. The cost per negative behaviour averted in the PCC group relative to UC was $8.01 (post-intervention) and $6.43 (at follow-up).

This result remained robust under sensitivity analysis. Under all ranges of model values, DCM remained subject to dominance. The cost per behaviour averted for the PCC group relative to UC ranged from $6.23 to $9.79 post-intervention, and from $5.00 to $7.86 at follow-up, suggesting that different organisational contexts will produce different results. However, the differences in the ICER do not suggest DCM to be the cost-effective option under any of the circumstances considered here.

Table 5: Sensitivity analysis

Parameter	Base case value	Low value	High value	Dominance of DCM?	PCC cost per unit improvement*
Staff time	$27 p/h	$17 p/h	$37 p/h	Yes	PI: $6.23 – $9.79 FU: $5.00 - $7.86
Cost of post-DCM support	$1,600	$0	$3,200	Yes	N/A
Cost of post-PCC support	$360	$0	$720	Yes	PI: $6.73 - $9.29 FU: $5.40 - $7.46
DCM mapping time per month	16 staff hours	8 staff hours	24 staff hours	Yes	N/A

* PI = Post-intervention; FU = Follow-up

This evaluation is, to our knowledge, the first to investigate the relative costs of PCC and DCM in a dementia care setting. In similar population groups, existing work has been done in community settings for occupational therapy[15] and respite for carers.[16] However, neither these interventions nor this population group have received significant attention in the cost-effectiveness literature. Our results suggest that PCC, if properly implemented, can match (and potentially exceed) the positive outcomes achieved through the use of DCM and do so at a lower cost. This is an important result as it provides decision makers with information which they can use to allocate resources to other areas of dementia care and the healthcare sector as a whole, while maximising the quality of life (and minimising the rate and level of BPSD) experienced by residents of dementia care settings. Such considerations will become increasingly important with the future increase in dementia prevalence.[2] There are, however, a number of caveats which should be considered alongside this result.

Other cost issues might be significant in assessing the cost-effectiveness of PCC and DCM. For example, it has been found that caring for people with dementia-related behavioural problems may impact on the morale and turnover of staff.[8] If this is true, the potentially substantial costs associated with staff turnover (both in terms of ‘flag-drop’ costs of recruitment and in the cost of DCM/PCC training) should be

considered in the evaluation of these interventions. We do not know what the long-term implications are for staff working under some level of continuous distress caused by coping with the effects of BPSD on care-recipients/residents as well as themselves. BPSD is also likely to result in an intangible effect on the quality of life of members of the affected person's family who observe on a regular basis the distress of their loved one with unremitting BPSD [17]. Finally, as with all trials, replication in other settings would assist in determining how robust these results are.

We conclude that PCC appears to be a cost-effective method of reducing agitation and other behavioural disturbances in nursing home residents with dementia. Results such as those reported here, which establish the most cost-effective interventions from those available are useful for practitioners and service managers, enabling them to choose the best models of care for persons with dementia in different care settings.. In order to improve both resident and care staff quality of life, future research needs to take into account the cost of care associated with staff burden, as carer stress is linked to the well-being of the person with dementia [4, 17, 18].

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