

Group and single-subject evaluation of a programme to promote self-care in elderly nursing home residents

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Residents and staff of a nursing home in a metropolitan area were randomly assigned to three conditions to: (a) test whether staff's use of operant behavioural management strategies (Condition 1) would cause a greater increase in residents' self-care behaviour than staff's use of mutual goal setting (Condition 2) or routine nursing care (Condition 3), and (b) examine how useful group scores were, compared to individual scores, in determining change in individual residents' behaviour due to treatment. In-service training was provided to staff in Conditions 1 and 2 but not in Condition 3. Over a period of 22 weeks, nursing staff encouraged subjects to perform targeted self-care tasks independently. Data analysis indicated significantly greater change in self-care behaviours for subjects in Condition 1 than for subjects in Conditions 2 and 3. However, visual inspection of data for each case revealed that individual scores were more useful than averages and differences between groups for determining the effectiveness of the clinical interventions.

INTRODUCTION

Increasingly, practitioners must account for the care they provide clients. One way to achieve accountability is to monitor the client's functioning following an intervention (Barlow *et al.* 1984). This approach involves systematic

assessment to uncover relationships between interventions and outcomes. Statistics are commonly used to establish intervention effect in experimental studies based on data from large groups. The practitioner, however, is usually concerned with the individual, and statistical significance says nothing about the individual client undergoing treatment (Barlow & Hersen 1984, LeFort 1993). Thus, examination of group scores alone, without analysis of individual responses, will not necessarily determine the best individual treatment.

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Several authors (Chassan 1979, Blair 1986, 1985, Freer 1987, Reilly & Findley 1989, DaPrato 1992, Marvel & Amodei 1992, Ottenbacher 1992, Sterling & McNally 1992) have advocated using single-subject or small group research designs to test therapeutic interventions. Ottenbacher (1992) noted that the advantages of single subject designs include: (a) the ability to treat one client or a small group of clients at a time, (b) the ability to measure dependent variables directly relevant to each individual client's problem(s), (c) the ease of systematically measuring the dependent variable over time, and (d) the ease of assessing each client's performance over time.

In this study, both group and single-subject evaluation approaches were used to compare the effectiveness of three nursing interventions: (a) operant behaviour management (Condition 1), (b) mutual goal setting (Condition 2), and (c) usual nursing care (Condition 3) in fostering the morning self-care behaviours of shaving, bathing, dressing, combing hair, feeding self, and brushing teeth among elderly nursing home residents.

THE STUDY

The investigators used a repeated-measures design with one between-subjects and one within-subjects factor to test the hypothesis that subjects in Condition 1 would show a greater increase in self-care behaviours than subjects in Condition 2 and 3, as measured by mean goal attainment change scores. Additionally, an A/B/A single-subject design was used (in which A = 2-week baseline assessment, B = 6-week treatment period during which staff used strategies to promote self-care, and A = 16-week follow-up assessment), along with visual inspection of the data (Kazdin 1982, Barlow & Hersen 1984) to determine the effectiveness of the interventions in bringing about change in the behaviours of each subject in each group. Single-subject analysis was compared to the group application of statistics in assessing the efficacy of the interventions.

Setting and subjects

The study took place in a privately owned, intermediate-care nursing home in a metropolitan area of a Southern state in the USA. The home is licensed for 42 residents and had an occupancy rate of 100% at the beginning of the study. Twenty residents met the inclusion criteria: (a) reliant on nursing staff to perform morning activities of daily living (ADLs), (b) judged by the nursing and medical staff to be physically capable of carrying out their ADLs, (c) cognitively intact per DSM-III-R criteria (Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association 1987)) and Mini-Mental State Examination (MMSE) (Folstein *et al.* 1975) above 23, and able to participate in care planning and goal setting. The nature of the study was explained to all eli-

gible residents and 15 volunteered to participate and provided written consent. They entered the study over a consecutive 14-day period. Only day-shift staff participated in the study.

Residents and staff were randomly assigned to the three conditions. Throughout the study period, staff remained in their assigned groups and provided care to residents in the same group. On the two occasions when staff in Condition 3 substituted for colleagues in Condition 2 to accommodate meal breaks, the substitute staff followed the directions of the regular staff.

Staff for Conditions 1 and 2 included 2 RNs (registered nurses) and 3 LPNs (licensed practical nurses) and staff for Condition 3 included 3 RNs and 2 LPNs. All staff were females. RNs had worked in the facility for between 2 and 3 years; LPNs had worked in the facility for between 2 and 4 years. There was no staff attrition during the study period.

All subjects completed the study. The age of the four males and 11 females ranged from 64 to 96 years (78 ± 10 years). Their residency period ranged from 2 months to 2.5 years (18 ± 7.1 months). MMSE scores ranged from 24 to 27 (25 ± 1.13). Three were married, nine were widowed, and three were single. The groups did not differ significantly in age, residency period, or MMSE scores (see Table 1).

Procedure

The study included a 2-week staff training programme, a 2-week baseline phase, a 6-week post-baseline re-acquisition-of-skills phase during which staff helped subjects to overcome their targeted self-care deficits, and a 16-week follow-up phase during which staff helped subjects to maintain gains in targeted self-care behaviours.

Staff training

The first author (CEB) presented classes to staff over a 2-week period. They were trained together for 1 hour during the mid-morning period of weekday morning shifts. Volunteers and non-nursing staff assisted residents during the nursing staff's absence.

The training programme for staff in Condition 1 was based in part on a programme developed by Milne (1983). Topics included determinants of dependency in residents; behaviour management of dependent behaviours; principles of operant behaviour management; the behavioural strategies of prompting, shaping, and positive reinforcement; and resident involvement in treatment planning, and development and implementation of treatment plans, preparation of goal attainment follow-up guides, and assessment of goal attainment. The teaching format included lectures by CEB, interactive discussion of cases provided by the participants, modelling and demonstration of technical procedures, role-playing by staff, and proficiency exercises with immediate feedback and

Table 1 ANOVA for age, time in the institution, and MMSE scores for the three groups

Variables	Group 1		Group 2		Group 3		F	P
	M	SD	M	SD	M	SD		
Age	78	(12.36)	82	(8.69)	73	(8.80)	1.021	0.389
Time*	13.18	(7.49)	20.08	(5.57)	21.28	(6.90)	1.7938	0.208
MMSE	24.8	(0.84)	24.8	(1.30)	25.4	(1.34)	0.4286	0.661

*Time = months in the institution

directions. Staff in Condition 2 received the same training except for the content on behaviour management. The only topic addressed with staff in Condition 3 was assessment of goal attainment.

Baseline The baseline phase was implemented immediately after the staff training programme ended. No changes were made in institutional routine. Staff were assigned to residents in the normal fashion and provided care just as before the study. Staff systematically recorded in subjects' charts the frequency of performance of the targeted behaviours — shaving, bathing, dressing, combing hair, feeding self, and brushing teeth. Over the 14-day period, subjects performed none of the targeted behaviours. At the request of staff, each subject then identified three of the targeted behaviours on which he or she wished to focus attention. A follow-up guide was then prepared for each subject with the three behaviours as headings.

Re-acquisition-of-skills and follow-up phases The re-acquisition-of-skills and follow-up phases immediately followed the baseline phase. A new follow-up guide was prepared for each subject and his or her nursing care plan updated at the beginning of each 14-day period. Plans and guides were evaluated at the end of each period.

In Conditions 1 and 2, staff met with each subject at set times and mutually developed and evaluated the subject's nursing care plan. In Condition 3, staff developed and evaluated subjects' care plans without involving them. Staff in Condition 1 then systematically reminded subjects to do their ADLs and, when necessary, helped subjects. Also, staff helped subjects to obtain the materials necessary to carry out the tasks. When subjects partially or completely performed tasks, staff smiled at them, praised them, touched them affectionately, and when time allowed, conversed with them for short periods on topics of mutual interest. When subjects refused to do a task for no clear reason, the staff completed the task but withheld or limited verbal interaction and other social reinforcements associated with completing the task.

In Conditions 2 and 3, strategies were less clearly outlined in subjects' care plans and staff interpreted the directions as they saw fit. Generally, staff overly assisted the residents and infrequently encouraged or positively

reinforced subjects' attempts at, or successful performance of, self-care activities.

Instrument

The Goal Attainment Follow-Up Guide, the evaluation component of Goal Attainment Scaling (Kiresuk & Sherman 1968), was used to evaluate subjects' goal achievement (see Figure 1). As noted above, the three behaviours selected by residents were scored every 14 days and a new guide prepared by the researchers.

A targeted task was written at the head of each column on the guide (scale). Each scale had five expected attainment levels ranging from 'much less than expected' (-2) to 'much more than expected' (+2), with the 'expected' level set at 0. A weight was assigned to each scale to reflect its importance relative to others. Because residents and staff agreed that the scales were equally important, the investigators assigned a weight of two to each. At the end of 14 days, the subject's performance was evaluated and a check mark placed at the attainment level closest to the subject's behaviour level.

The weight and attainment level for each scale were then combined into the formula developed by Kiresuk & Sherman (1968) to compute a goal attainment score, a standardized score with a mean of 50 and a standard deviation of 10. By combining the outcome scores for all goals, this score provided an overall measure of a subject's progress or lack of progress towards the goals at the end of each 14-day period. The possible range of individual scores was 23.3 for subjects who scored at the (-2) or much less than expected level of achievement on all scales, to 77 for subjects who scored at the (+2) or much more than expected level of achievement on all scales. A score of 50 corresponded to the (0) or expected attainment level on all scales.

Inter rater reliability for goal attainment scaling has ranged from 0.65 to 0.99 on adult subjects of different ages and with varying mental health status (Kiresuk & Sherman 1977, Woodward *et al.* 1978, Kiresuk & Lund 1979, Smith & Cardillo 1979). Concurrent validity has ranged from 0.12 to 0.63 using other measures of treatment outcome (Mauger *et al.* 1974, Cytrynbaum & Jacob 1976, Woodward *et al.* 1978, Smith & Cardillo 1979). Inter rater reliability in the present study was 0.87.

Client name _____
 Follow-up guide no.: _____
 Goal setting date: _____
 Follow-up date: _____

Level of attainment	SCALE 1 Shaving	SCALE 2 Dressing	SCALE 3 Combing hair
	Weight = 2	Weight = 2	Weight = 2
Much less than expected (-2)	Shaved by staff	Dressed by staff	Hair combed by staff
Somewhat less than expected (-1)	Lathers face only	Only pulls on shirt	Combs hair only on back of head
Expected (0)	Shaves completely with directions from staff	Dresses completely with directions from staff	Combs hair thoroughly with directions from staff
Somewhat more than expected (+1)	Reminded to wash and dry face	Reminded only to put on socks	Needs directions to part hair in appropriate place
Much more than expected (+2)	Shaves independently	Dresses independently	Combs hair independently

Figure 1 Example of completed goal attainment follow-up guide.

Scores Twelve raw scores were calculated for each subject over the study period: one for the baseline phase, three for the re-acquisition-of-skills phase, and eight for the follow-up phase. The follow-up phase was divided into two halves and an evaluation was made independently for each. From the raw scores, four mean scores were calculated for each subject: one for baseline, one for the re-acquisition-of-skills phase, one for the first half of the follow-up phase, and one for the second. Mean scores for individuals ranged from 23.3 to 77.

A change score was calculated for each subject for each study phase by subtracting the subject's mean baseline score from the subject's mean score for that phase. A mean change score was then calculated for each of the three groups for the re-acquisition-of-skills phase, the first follow-up phase, and the second follow-up phase. Individual and group change scores were expected to range from 0 indicating no change to 54 indicating maximum change. Scores ranging from 0–12 indicated much less than the expected level of change in behavioural performance. Scores ranging from 13 to 26 indicated less than the expected level of change in behavioural performance. A score of 27 indicated the expected level of change in behavioural performance.

Scores ranging from 28 to 41 indicated more than the expected level of change in behavioural performance, and scores ranging from 42 to 54 indicated much more than the expected level of change in behavioural performance.

RESULTS

Mean individual raw scores

Table 2 shows individuals' mean raw scores for each phase of the study. All subjects scored 23.3 at baseline indicating complete dependence on staff to carry out targeted self-care tasks.

Individual and group change scores

Individual and group change scores could range from 0, indicating no change in subjects' dependence on staff, to 54 indicating maximum change to complete independence from staff. Table 3 shows the 15 individual and three mean change scores for each group.

Table 4 shows each group's mean change score and standard deviation for the re-acquisition-of-skills, follow-up 1,

Table 2 Individual mean raw scores for baseline, re-acquisition-of-skills and follow-up phases

Phase	Group	Subjects				
		1	2	3	4	5
Baseline	1	23.3	23.3	23.3	23.3	23.3
Re-acquisition-of-skills	1	55.2	33.7	36.7	44.8	61.9
Follow-up 1	1	65.0	52.1	33.2	53.3	75.6
Follow-up 2	1	57.2	30.0	33.3	38.4	75.0
Baseline	2	23.3	23.3	23.3	23.3	23.3
Re-acquisition-of-skills	2	23.3	29.2	34.4	45.1	27.3
Follow-up 1	2	26.6	45.0	42.2	48.5	30.0
Follow-up 2	2	28.0	36.1	40.5	44.1	28.0
Baseline	3	23.3	23.3	23.3	23.3	23.3
Re-acquisition-of-skills	3	27.1	23.3	26.3	23.3	24.9
Follow-up 1	3	23.9	23.3	25.6	23.9	24.5
Follow-up 2	3	23.9	23.3	25.0	23.9	23.9

and follow-up 2 phases. Residents in Condition 1 were expected to show greater increase in self-care behaviours than those in Conditions 2 and 3, as measured by mean goal attainment change scores.

As seen in Table 5, the analysis revealed a significant overall difference ($F(2,12)=8.22$, $P<0.006$). Tukey's post-hoc comparisons indicated that statistically significant differences existed between the scores for subjects in Conditions 1 and those in Conditions 2 and 3.

Group mean scores were also expected to be less useful than individual scores for determining change in subjects' behaviour due to the treatment. In Condition 1, individual change scores ranged from 6.7 to 52.3 while group change scores ranged from 23.08 to 32.54. In Condition 2, individual change scores ranged from 0 to 25.2 while group change scores ranged from 8.56 to 15.16. In Condition 3,

Table 3 Individual and group mean change scores for re-acquisition-of-skills, and follow-up phases

Phase	Group	Subjects					Group mean (SD)
		1	2	3	4	5	
Re-acquisition-of-skills	1	31.9	10.0	13.4	21.5	38.6	23.08 (12.09)
Follow-up 1	1	41.7	28.8	9.9	30.0	52.3	32.54 (15.86)
Follow-up 2	1	33.9	6.7	10.0	15.1	51.7	23.48 (18.96)
Re-acquisition-of-skills	2	0	5.9	11.1	21.8	4.0	8.56 (8.40)
Follow-up 1	2	3.3	21.7	18.9	25.2	6.7	15.16 (9.61)
Follow-up 2	2	4.7	12.8	17.2	20.8	4.7	12.04 (7.27)
Re-acquisition-of-skills	3	3.8	0	3.0	0	1.6	1.68 (1.72)
Follow-up 1	3	0.6	0	1.3	0.6	1.2	0.74 (0.53)
Follow-up 2	3	0.6	0	1.7	0.6	0.6	0.70 (0.62)

Table 4 Mean goal attainment change scores for the three groups at re-acquisition-of-skills, follow-up 1, and follow-up 2 phases

Nursing care condition	n	Re-acquisition-of-skills		Follow-up 1		Follow-up 2	
		mean	(SD)	mean	(SD)	mean	(SD)
1	5	23.08***	(12.09)	32.54*	(15.86)	23.48*	(18.96)
2	5	8.56	(8.40)	15.16	(9.61)	12.04	(7.27)
3	5	1.68	(1.72)	0.74	(0.53)	0.70	(0.62)

* Significantly different from group 3; $P<0.05$

** Significantly different from group 2; $P<0.05$

Table 5 Summary of analysis of variance

Source	Sum of squares (ss)	df	mean squared	F	P
Between ss					
within + residual group	3536.14	12	294.68		
	4843	2	2421.83	8.22	0.006
Within ss					
within + residual	373	24	15.56		
Evaluation time	214.48	2	107.24	6.89	0.004
Group by evaluation time	183.57	4	45.89	2.95	0.041

individual change scores ranged from 0 to 3.8 while group scores ranged from 0.7 to 1.68.

Table 6 shows the distribution of individual and group change scores for each group among the five ranges of change for the re-acquisition-of-skills, follow-up 1, and follow-up 2 phases. Except in Condition 3, group mean scores examined alone could be misleading since they did not reflect the variation in changes in individual subjects'

Table 6 Distribution of individual and group change scores for the three conditions for re-acquisition-of-skills, follow-up 1, and follow-up 2 phases

Phase	Range	Condition 1		Condition 2		Condition 3	
		Individual scores	Group score	Individual scores	Group score	Individual scores	Group score
Re-acquisition-of-skills	0-12	1		4	1	5	1
	13-26	2	1	1			
	27						
	28-41	2					
	42-54						
Follow-up 1	0-12	1		2		5	1
	13-26			3	1		
	27						
	28-41	2	1				
	42-54	2					
Follow-up 2	0-12	2		2	1	5	1
	13-26	1	1	3			
	27						
	28-41	1					
	42-54	1					
	Total	15	3	15	3	15	3

0-12 = much less than the expected level of change

13-26 = less than the expected level of change

27 = the expected level of change

28-41 = more than the expected level of change

42-54 = much more than the expected level of change

performance. In Condition 1, the group mean score reflected the true performance of only two of the five individuals in both the re-acquisition-of-skills and follow-up 1 phases, and of only one individual in the follow-up 2 phase. In Condition 2, the group mean score reflected the true performance of four of the five individuals in the re-acquisition-of-skills phase, of three individuals in the follow-up 1 phase, and of two individuals in the follow-up 2 phase.

Overall, of the 15 individual scores in Condition 1, four (27%) indicated much less than expected change, three (20%) less than expected change, five (33%) more than expected change, and three (20%) much more than expected change. In contrast, of the three group scores, two (67%) indicated less than expected change and one (33%) more than expected change.

Of the 15 individual scores in Condition 2, eight (53%) indicated much less than expected change and seven (47%) less than expected change. In contrast, two (67%) of the three group scores indicated much less than expected change and one (33%) indicated less than expected change.

DISCUSSION

This study was designed to determine whether operant behavioural strategies would promote greater change in

residents' dependent self-care behaviours than simply allowing residents to participate in care planning, or using the usual nursing care approach. As expected, the use of operant behavioural strategies by staff promoted greater change in residents' self-care behaviours than did the other two approaches. Visual inspection of data for each subject proved more accurate than averages and differences between groups in reflecting the efficacy of the interventions and consequent behavioural changes in individuals within each group.

The majority of change scores for subjects in Condition 1 (operant behavioural management) were at or above the more than expected behavioural change level. Several of these scores indicated very high levels of behavioural change. While subjects in Condition 2 (mutual goal setting) performed more self-care tasks than those in Condition 3 (usual care), none of the scores recorded for subjects in Condition 2 and 3 indicated levels of change in behaviour similar to Condition 1. In fact, all change scores recorded for subjects in Condition 2 and 3 indicated a less than expected level of behavioural change.

In all three conditions, group mean scores did not reveal all the variations in individual scores. Although mean group scores for subjects in Condition 1 indicated a moderate change in self-care behaviours for all subjects, scores of some individuals in this group actually indicated almost complete independence in self-care behaviours, while

those of others indicated consistently low performance of self-care behaviours. In Condition 2, although one subject remained completely dependent on staff throughout one of the change periods, the group's change score did not reflect this fact, since the group score indicated a small positive change in self-care behaviour for the group as a whole.

Problems

Two problems of group intervention studies are clear from the study reported here: (a) the problem of potentially misleading interpretations when examining only group averages without also examining the pattern of individual scores, and (b) the problem of determining for which subject or subjects the treatment has been particularly effective (Barlow & Hersen 1984). At no time in the study after baseline could an individual's progress be accurately evaluated by the group's mean change score. In contrast, single-subject data provided an accurate account of each subject's progress over time and an accurate evaluation of the effectiveness of the interventions.

CONCLUSIONS

The findings of this study clearly show that an intervention may be effective for some patients but have little or no effect on others. In such instances, single-subject evaluation approaches can help practitioners determine which clients' interventions are most effective and which clients are not helped. Moreover, use of single-subject evaluation approaches can help practitioners build a base of clinically relevant knowledge about which intervention is best suited to particular patients or group of patients.

The results of this study support Chassan's (1979) view that intense study of the single subject, which is based on frequent observations of the individual over time, can provide more operationally meaningful information which has more direct implications for practice than end-point observations extended over a relatively large number of clients.

Today, there is considerable interest in developing research-based nursing practice. While large group studies are desirable to establish generalizability of interventions from one set of subjects to similar others, alternatives to the traditional large-group design may allow nurses to better answer research questions unique to their particular practice setting.

Practising nurses should therefore be encouraged to test the effectiveness of their interventions on small manageable groups using single-subject analysis.

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