Economic evaluation of the differential benefits of home visits with telephone calls and telephone calls only in transitional discharge support

FRANCES KAM YUET WONG1, CHING SO2, JUNE CHAU2, ANTONY KWAN PUI LAW1, STANLEY KU FU TAM3, SARAH MCGHEE2

1School of Nursing, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong, China
2Department of Community Medicine, School of Public Health, University of Hong Kong, Hong Kong, China
3Department of Medicine, Queen Elizabeth Hospital/Hong Kong Buddhist Hospital, Hong Kong, China

Address correspondence to: F. K. Y. Wong. Tel: (+852) 27666419; Fax: (+852) 23649663. Email: frances.wong@polyu.edu.hk

Abstract

Background: home visits and telephone calls are two often used approaches in transitional care, but their differential economic effects are unknown.

Objective: to examine the differential economic benefits of home visits with telephone calls and telephone calls only in transitional discharge support.

Design: cost-effectiveness analysis conducted alongside a randomised controlled trial (RCT).

Participants: patients discharged from medical units randomly assigned to control (control, N = 210), home visits with calls (home, N = 196) and calls only (call, N = 204).

Methods: cost-effectiveness analyses were conducted from the societal perspective comparing monetary benefits and quality-adjusted life years (QALYs) gained.

Results: the home arm was less costly but less effective at 28 days and was dominating (less costly and more effective) at 84 days. The call arm was dominating at both 28 and 84 days. The incremental QALY for the home arm was −0.0002/0.0008 (28/84 days), and the call arm was 0.0022/0.0104 (28/84 days). When the three groups were compared, the call arm had a higher probability being cost-effective at 84 days but not at 28 days (home: 53%, call: 35% (28 days) versus home: 22%, call: 73% (84 days)) measuring against the NICE threshold of £20,000.

Conclusion: the original RCT showed that the bundled intervention involving home visits and calls was more effective than calls only in the reduction of hospital readmissions. This study adds a cost perspective to inform policymakers that both home visits and calls only are cost-effective for transitional care support, but calls only have a higher chance of being cost-effective for a sustained period after intervention.

Keywords: transitional discharge support, home visits, telephone calls, hospital readmissions, cost-effectiveness analysis, older people

Background

Transitional care programmes are proved to be effective in bringing positive outcomes to support post-discharge patients including reduced readmission rates [1,2], enhanced quality of life [3], self-efficacy [1, 3] and satisfaction [2, 3]. Home visits and telephone calls are the two most common approaches used in transitional care programmes. Systematic reviews show that effects of calls alone are inconclusive [4] while programmes with home visits seem to be more promising in reducing admissions to long-term care [5] and health-care costs [6]. Stuck and Kane [7] criticised that home visits can be costly. Some studies included cost as an outcome without the execution of a full economic evaluation. These studies usually reported expenditures saved such as hospitalisations prevented...
were calculated by dividing differences in cost between the groups by differences in QALYs. Missing QOL observations were imputed using multiple imputation by chained equation methods [15, 16] using variables related to QOL including age, gender and ADL score. Results are presented as cost-effectiveness planes and acceptability curves. Net monetary benefits (NMB) for each of the 1,000 replicates were calculated using the formula: QALYs gained × value of a QALY − cost. The group with the highest NMB was considered most cost-effective. Costs are reported in HK$ (£1 = 12HK$, US $1 = 7.8HK$ approx).

Results

A total of 610 patients were involved (home = 196, call = 204, control = 210). The intervention groups had an apparently lower readmission rate than the control group but only the home arm achieved significance at 28 days (10.7 versus 11.8%, P = 0.047) (Table 1).

Intervention costs for home and call arms were $997 and $451, respectively, per subject. The average cost of readmission was lower in the intervention groups than in the control group (Supplementary data, Appendix S2 available in Age and Ageing online). Net incremental costs for the home and call arms compared with the control were −$1,398/−$2,374 (28/84 days) and −$1,966 (28/84 days), respectively. Net incremental QALYs for the home and call arms were −0.0002/+0.0008 (28/84 days) and +0.0022/+0.0104 (28/84 days), respectively. The call arm was more costly but also more effective than the home arm at both 28 and 84 days. The ICER of call versus home was $42,465/QALY gained at 84 days (Supplementary data, Appendix S2 available in Age and Ageing online).

The cost-effectiveness planes (Supplementary data, Appendix S3 available in Age and Ageing online) show that the home intervention has a high chance of being cost-saving regardless of the value of a QALY gain. For the call arm, there is a high chance that it is more effective and cheaper than the control. Figure 1 shows that both home and call groups are cost-effective compared with NICE threshold (£20,000 (HK $240,000)). When the three groups are compared simultaneously at 28 days (Figure 2), the home intervention has a greater probability of being cost-effective up to a value of $420,000 per QALY. For a value of a QALY greater than this, the call intervention is most likely to be cost-effective. At the NICE threshold, the home and call interventions have a, respectively, 53 and 35% chance of cost-effectiveness at 28 days and 22 and 74% at 84 days (Figure 2).

Discussion

This study has provided a cost perspective in considering the effectiveness of a transitional care intervention. The original RCT showed that the bundled intervention involving home visits and calls was more effective than calls alone in a 4-week transitional care programme. Details of the study are described elsewhere [3] and below is a brief outline. Medical patients with chronic conditions discharged from a regional acute hospital in Hong Kong were recruited between August 2010 and June 2012. Consenting subjects were randomly allocated to home, call and control groups. Both home and call groups received a 4-week programme led by nurse case managers (NCM) assisted by volunteer nursing students. The NCM used the Omaha System, a validated assessment-intervention-evaluation framework to assess and execute care in environmental, psychosocial, physiological and health-related domains [3]. The home group received home visits the 1st and 3rd weeks and calls the 2nd and 4th weeks while call group received calls only every week. Mutual health goals were set between the providers and patients in each interaction. The control group received two placebo social calls within the programme period of 4 weeks.

Cost and health outcomes

Costs and outcomes were compared between intervention and control groups. The costing used a societal perspective including costs of pre-intervention, delivery of intervention and hospital use (Supplementary data, Appendix S1 available in Age and Ageing online). For the estimation of quality-adjusted life years (QALYs), we used the Hong Kong Chinese 36-item Short-Form Health Survey (SF-36) which has been locally validated [13] and for which a local algorithm has been developed to derive utility values [14]. National Institute for Health and Care Excellence (NICE) has recommended the use of EQ-5D for eliciting QALYs, but there is no Hong Kong algorithm available for this purpose.

Statistical analysis

Costs and QALYs gained at 28 and 84 days were compared between groups. Incremental cost-effectiveness ratios (ICER)
Current research has provided evidence to suggest that transitional care is effective in supporting patients returning home. Nurse home visits and telephone calls are the two most common approaches in care delivery to achieve the goals of strengthening self-care ability and confidence through regular monitoring and education [3, 17, 18]. Comparing home visits with telephone calls, Sochalski et al. [19] reviewed 10 RCTs and concluded that in-person communication had a better readmission outcome compared with telephone communication. Home care provides face-to-face communication but can be costly [7]. Jolly [20] compared a home-based programme with a centre-based programme for cardiac patients and found that the home arm cost significantly more than the centre-based arm, though when the patients’ travel cost was included the significant difference disappeared. When in-hospital expenses were used for calculation, home visits resulted in less cost [3, 21].

Tele-support including telemonitoring and telephone support was found to reduce medical costs [22]. Wong et al. [11] have reported that a 4-week transitional care programme using a complex intervention of home visits and calls has an 89% chance of being cost-effective at the threshold of £20,000 (HK$240,000)/QALY. Miller [23] also tested a 4-week early discharge and rehabilitation service for older people discharged home from hospital. The chance of cost-effectiveness was ~65% at the £20,000 (HK$240,000)/QALY threshold.

Delisle [24] commented that currently available studies lack cost-effective analyses to provide evidence to guide transitional care programmes. This study has contributed to the knowledge gap by providing a cost-effectiveness analysis of home visits and telephone calls and describes the differential benefits. We have shown that telephone calls are more cost-effective particularly over a longer period. Given our results showing how effective the call intervention was in gaining QALYs, for values of a QALY around the NICE threshold the call intervention would be preferable. The home intervention is potentially more cost-saving and may be preferred if QALY gain is not a primary concern.

In general, the use of economic evaluation findings in decision-making is limited [25]. Peacock [26] pointed out that managers do not only consider cost in deciding on service priority but are more concerned whether the initiative is pragmatic and ethical. Telephone calls are probably more sustainable than home visits in these regards since they are easily organised and accessible involving low technology [4]. The time spent on calls in various studies ranged from 15 to 60 min [27] which concurs with our findings. The length of intervention is reasonable, and without the involvement of traveling time, which in turn saves cost.

Conclusions

The measurement of costs in health studies helps to provide important information not only on costs but cost-effectiveness of modes of care service delivery [28]. This study informs health-care managers that both home visits with telephone

### Table 1. Comparison of effectiveness by groups

| Health service utilisation | Control (N = 210) | Home visit arm (N = 196) | P value | Call arm (N = 204) | P value |
|----------------------------|-------------------|-------------------------|---------|-------------------|---------|
| Patient readmitted to emergency (n, %) |                    |                         |         |                   |         |
| 28 days | 44, 21.0% | 30, 15.3% | 0.141<sup>a</sup> | 32, 15.7% | 0.166<sup>a</sup> |
| 84 days | 71, 33.8% | 57, 29.1% | 0.306<sup>a</sup> | 60, 29.4% | 0.336<sup>a</sup> |
| Patient readmitted to hospital (n, %) |                    |                         |         |                   |         |
| 28 days | 37, 17.6% | 21, 10.7% | 0.047<sup>a</sup> | 24, 11.8% | 0.093<sup>a</sup> |
| 84 days | 54, 25.7% | 42, 21.4% | 0.310<sup>a</sup> | 42, 20.6% | 0.217<sup>a</sup> |
| Length of stay of readmissions (mean, 95% CI) | 6.4 (3.5, 9.4) | 4.7 (2.4, 7.0) | 0.601<sup>b</sup> | 8.0 (3.4, 12.7) | 0.470<sup>b</sup> |
| Quality of life |                |                         |         |                   |         |
| QOL score | Control (N = 113) | Home visit arm (N = 118) | P value | Call arm (N = 145) | P value |
| Baseline | 0.737 (0.712, 0.763) | 0.737 (0.714, 0.760) | 0.982<sup>c</sup> | 0.719 (0.695, 0.742) | 0.284<sup>c</sup> |
| 28 days | 0.734 (0.708, 0.760) | 0.729 (0.706, 0.752) | 0.575<sup>c</sup> | 0.773 (0.752, 0.794) | 0.003<sup>c</sup> |
| 84 days | 0.731 (0.703, 0.759) | 0.748 (0.725, 0.771) | 0.719<sup>c</sup> | 0.762 (0.739, 0.785) | 0.055<sup>c</sup> |
| Within-group comparison | 0.899<sup>d</sup> | 0.219<sup>d</sup> | <0.001<sup>d</sup> | 0.0012 (0.0053, 0.0136) | <0.001<sup>d</sup> |
| QALY gained from baseline |                    |                         |         |                   |         |
| 28 days | -0.0001 (-0.0010, 0.0008) | -0.0003 (-0.0012, 0.0005) | 0.911<sup>b</sup> | 0.0021 (0.0012, 0.0030) | <0.001<sup>b</sup> |
| 84 days | -0.0009 (-0.0052, 0.0036) | 0.0001 (-0.0038, 0.0036) | 0.792<sup>b</sup> | 0.0096 (0.0053, 0.0136) | <0.001<sup>b</sup> |

<sup>a</sup>Pearson’s χ² test.
<sup>b</sup>Mann–Whitney U-test.
<sup>c</sup>ANOVA test (28 and 84 days adjusted by baseline).
<sup>d</sup>Repeated measures ANOVA.

CI, confidence interval; ANCOVA, analysis of covariance; ANOVA, analysis of variance.
follow-up calls and telephone calls only are cost-effective in transitional care support. However telephone calls alone had a higher probability of being cost-effective due to their greater gain in QALYS. For reasonable values of a QALY, this extra gain in the outcome outweighed the savings in net costs of the home intervention.

**Key points**

- Both home visits with calls and calls alone are cost-effective for transitional care.
- Call interventions are effective in gaining QALY’s and have a higher chance of being cost-effective for a sustained period.
- Telephone calls require low technology and are easily accessible to patients requiring transitional discharge support.

**Conflicts of interest**

None declared.

**Supplementary data**

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

**References**

1. Wong FK, Ho MM, Yeung S. Effects of a health-social partnership transitional programme on hospital readmission: a randomized controlled trial. Soc Sci Med 2011; 73: 960–9.
Evaluation of benefits of home and call groups

2. Naylor MD, Broopen DA, Campbell RL et al. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. J Am Geriatr Soc 2004; 52: 675–84.

3. Wong FKY, Chow SKY, Chan TMF et al. Comparison of effects between home visits with telephone calls and telephone calls only for transitional discharge support: a randomised controlled trial. Age Ageing 2014; 43: 91–7.

4. Mistiaen P, Poot E. Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home. Cochrane Database Syst Rev 2006; DOI: 10.1002/14651858.CD004510.pub3.

5. Elkan R, Kendrick D, Dewey M et al. Effectiveness of home based support for older people: systematic review and meta-analysis. BMJ 2001; 323: 719–25.

6. Marek KD, Baker CD. Nurse home visit programs for the elderly. Annu Rev Nurs Res 2006; 24: 157–78.

7. Stuck A, Kane RL. Whom do preventive home visits help? J Am Geriatr Soc 2008; 56: 561–3.

8. Ledwidge M, Barry M, Cahill J et al. Is multidisciplinary care of heart failure cost-beneficial when combined with optimal medical care. Eur J Heart Fail 2003; 5: 381–9.

9. Wong FKY, Mok MP, Chan T et al. Nurse follow-up of patients with diabetes: randomized controlled trial. J Adv Nurs 2005; 50: 391–402.

10. Patel A, Knapp M, Perez I et al. Alternative strategies for stroke care. Cost-effectiveness and cost-utility analyses from a prospective randomized controlled trial. Stroke 2004; 35: 196–203.

11. Wong FKY, Chau J, So C et al. Cost-effectiveness of a health-social partnership transitional program for post-discharge medical patients. BMC Health Serv Res 2012; DOI: 10.1186/1472-6963-12-479.

12. Mason JM, Young RJ, New JP et al. Economic analysis of a telemedicine intervention to improve glycemic control in patients with diabetes mellitus. Dis Manage Health Outcomes 2006; 14: 377–85.

13. Lam CLK, Tse EY, Gandek B et al. The SF-36 summary scales were valid, reliable, and equivalent in a Chinese population. J Clin Epidemiol 2005; 58: 815–22.

14. McGhee SM, Brazier J, Lam CL et al. Quality-adjusted life years: population-specific measurement of the quality component. Hong Kong Med J 2011; 17: 17–21.

15. Royston P, White IR. Multiple imputation by chained equations (MICE): implementation in Stata. J Stat Softw 2011; 45: 1–20.

16. van Buuren S, Boshuizen HC, Knook DL. Multiple imputation of missing blood pressure covariates in survival analysis. Stat Med 1999; 18: 681–94.

17. Mattke S, Seid M, Ma S. Evidence for the effect of disease management: is $1 billion a year a good investment? Am J Manag Care 2007; 13: 670–6.

18. Scott IA. Preventing the rebound: improving care transition in hospital discharge process. Aust Health Rev 2010; 34: 445–51.

19. Sochalski J, Jaarsma T, Krumholz HM et al. What works in chronic care management: the case of heart failure. Health Aff (Millwood) 2009; 28: 179–89.

20. Jolly K, Lip GYH, Taylor RS et al. The Birmingham rehabilitation uptake maximization study (BRUM): a randomised controlled trial comparing home-based with centre-based cardiac rehabilitation. Heart 2009; 95: 36–42.

21. Adlbrechts C, Huelsmann M, Berger R et al. Cost analysis and cost-effectiveness of NT-proBNP-guided heart failure specialist care in addition to home-based nurse care. Eur J Clin Invest 2011; 41: 315–22.

22. Clark R, Inglis SC, McAlister FA et al. Telemonitoring or structured telephone support programmes for patients with chronic heart failure: systematic review and meta-analysis. BMJ 2007; 334: 942–5.

23. Miller P, Gladman RF, Cunliffe AL et al. Economic analysis of an early discharge rehabilitation service for older people. Age Ageing 2005; 34: 274–80.

24. Delisle DR. Care transitions programs: a review of hospital-based programs targeted to reduce readmissions. Prof Case Manag 2013; 18: 273–83.

25. Hoffman C, Graf von der Schulerung JM. The influence of economic evaluation studies on decision making: A European survey. The EUROMET group. Health Policy 2000; 52: 179–92.

26. Peacock S, Ruta D, Mitton C et al. Using economics to set pragmatic and ethical priorities. BMJ 2006; 332: 482–5.

27. Furuya RK, Mata LR, Veras VS et al. Original research: telephone follow-up for patients after myocardial revascularization: a systematic review. Am J Nurs 2013; 113: 28–31.

28. Ratcliffe J, Laver K, Couzner L et al. Not just about costs: the role of health economics in facilitating decision making in aged care. Age Ageing 2010; 39: 426–9.

Received 3 January 2014; accepted in revised form 1 July 2014