

A comparison of two sources of primary and social care resource use data in a care home setting

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Introduction

Economic evaluations are only as reliable as the data and methods upon which they are based. For both costs and outcomes there are multiple methods available and choice of approach has been demonstrated to impact on the conclusions reached for some evaluations (Drummond et al., 2015). In undertaking a cost analysis there are three broad steps: identification, measurement and valuation. At the identification stage the important resources (large cost drivers) that are likely to differ between the treatment groups are identified, though methods for this are not always evident in published economic evaluations (Thorn et al., 2013, p.159). There are also various methods for collecting resource use information, dependent on the context of the research and health sector being studied. In the UK context, the most likely sources available could include medical records, care institution records, or direct reporting (e.g. questionnaires). It is often assumed that information derived from medical notes will be more accurate than self-report which can suffer from recall bias and missing data, however, evidence suggests this is not universally true for all types of health care resources (Noble et al., 2012; Byford et al., 2007).

Comparatively little research has been undertaken looking at methods of resource use measurement (Thorn et al., 2013) and as such, there remains a lack of consensus about which data source(s) should be used in economic analyses and in what circumstances a particular data source might be most appropriate. If source of data leads to different estimates of resource use and costs, then it is important to begin to understand the potential implications of choice of data source on the results and conclusions reached particularly where this may change resource allocation decisions.

The objective of this study was to assess which resource items might be important to collect and to see if there are any differences in primary care and social care resource use reporting comparing two sources (General Practice (GP) records versus care home records) of this data in the care home setting.

Methods

This study is based on data collected as part of the CAREMED trial which evaluated the effectiveness of multi-professional clinical medication reviews in care homes for older people (Desborough et al., 2011; Sach et al., 2014). The trial employed a cluster randomised control trial design, across care homes in Cambridgeshire and Norfolk (UK), during 2011-2013. Intervention homes (n=15) received a multi-professional medication review at two time points, whereas control homes (n=15) received usual care.

The sample size of this study was determined by the sample size of the overall trial (Desborough et al., 2011) and the practicality of collecting data from two sources for all residents. Data extraction for specified time points (covering a period of around seven months) was performed by a pharmacy technician. GP records were electronically searched to find visits which were then recorded manually, whilst in care homes there was no electronic recording of information such that each resident's paper records had to be obtained and information extracted manually. This involved searching two sections of the resident's care plan ('visits by health professionals' and 'daily reporting') and care home health professional's visits book as appropriate in each care home.

Resource use data extracted included every visit or contact recorded in the GP and care home residents' records, although in this analysis the focus is limited to primary and social care resources.

Statistical analysis

To identify which resource items were used most frequently and thus might be important to capture in future studies, the mean number of contacts per resident for each resource item and the mean number of total contacts per resident (sum of contacts of individual resource items divided by number of residents) were calculated, along with the mean difference (95% CI) between the two data sources. Likewise, the mean cost per resident with the mean difference (95% CI) in cost is presented in order to quantify the difference between data sources in terms of cost (see Supplementary table 1 for unit costs).

Level of agreement was assessed using data from residents with a positive number of contacts recorded for each resource item according to at least one data source. Residents with zero contacts on both data sources were excluded from the

analysis as inclusion would give misleading high levels of agreement. Resource use data are continuous, where the units are number of contacts to the resource item stated or in total (number of visits across all resource items summed), thus the following methods were chosen: per cent agreement (Banerjee et al., 1999), Lin's Concordance Correlation Coefficient (CCC) (Lin, 1989), and the 95 per cent limits of agreement (Bland & Altman, 1986). Per cent agreement reports the proportion of observations that are the same between the two data sources without adjusting for chance agreement. Lin's Concordance Correlation Coefficient (CCC) (Lin, 1989), is a scaled agreement index, which takes into account systematic bias; it provides a measure of agreement between two continuous variables obtained via two different methods, by producing a value ranging from 1 for perfect agreement to -1 for perfect disagreement where 10 or more data pairs are available. It is suitable for data from non-normal distributions making it appropriate for resource and cost data (Noble et al., 2012). The 95 per cent limits of agreement investigate the amount of random variation between the two data sources (Bland & Altman, 1986).

All analyses were undertaken in STATA 14 SE and where necessary 0.05 was taken as the level of significance.

Results

Data were available for 362 residents from the 15 intervention care homes for a period of around seven months. The mean age of residents was 87.91 years (sd: 6.62; min-max 56 to 104); 80.39 per cent were female; had been resident at the home for a mean of 2.5 years (sd 2.38; min-max 0.01 to 15.95) at time of entry to study, 45.86 per cent had dementia; were classified as residential (nursing) 83.98 per cent (16.02%); had a mean number of comorbid conditions of 5.07 (sd 2.64; min-max 1.00 to 14.00); and were on a mean number of medications of 8.72 (sd 4.28; min-max 0.00 to 20.00) at the first review meeting. The care homes were evenly split between Norfolk and Cambridge.

Table 1 shows the mean number of contacts according to GP and care home records and the mean difference with 95 per cent confidence interval. The mean total number of visits according to GP records was 12.47 compared to 16.06 according to care home records, a difference of -3.58 (95% CI -5.08 to -2.09). This shows that the two data sources give significantly different levels of overall resource use per resident. This was also the case for the individual resource items shown in bold, though the mean resource use for some individual items was low. The resource item with the biggest difference in recorded utilisation between the two data sources was found for district nurse visits -3.16 (95% CI -4.61 to -1.70).

Table 1: Mean number of contacts and mean cost (UK£2016/2017) of health and social care service use data collected from GP records compared to care home records for the complete sample (n=362)

Resource Item	Mean number of contacts (GP)	Mean number of contacts (Care Home)	Mean difference in contacts (95% CI)(GP minus Care Home)	Mean cost of contacts (GP)	Mean cost of contacts (Care Home)	Mean difference in costs (95% CI) (GP minus Care Home)
Total visits	12.472	16.055	-3.583 (-5.079 to -2.087)	625.14	765.32	-140.18 (-206.38 to -73.98)
Audiologist	0.005	0.019	-0.014 (-0.028 to 0.000)	0.27	0.96	-0.68 (-1.39 to 0.03)
Care of the elderly physician	0.003	0.003	0.000 (-0.008 to 0.008)	0.52	0.52	ND
Continuing health care review nurse	0.041	0.097	-0.055 (-0.090 to -0.20)	0.19	0.43	-0.25 (-0.40 to -0.09)
Chiropodist	0.022	1.663	-1.641 (-1.872 to -1.410)	0.97	72.96	-71.99 (-82.13 to -61.85)
Community geriatrician	0.000	0.003	-0.003 (-0.008 to 0.003)	0.00	0.52	-0.52 (-1.53 to 0.50)
Community matron	0.003	0.000	0.003 (-0.003 to 0.008)	0.07	0.00	0.07 (-0.06 to 0.19)
Dentist	0.000	0.099	-0.099 (-0.140 to -0.059)	0.00	2.15	-2.15 (-3.01 to -1.28)
Dietician	0.086	0.182	-0.097 (-0.146 to -0.048)	6.51	13.85	-7.35 (-11.08 to -3.61)
District nurse	3.119	6.272	-3.157 (-4.613 to -1.702)	130.16	261.93	-131.77 (-192.50 to -71.04)
Falls team	0.013	0.000	0.013 (-0.0005 to 0.027)	1.12	0.00	1.12 (-0.04 to 2.29)
General Practitioner (GP)	7.138	5.870	1.268 (0.920 to 1.615)	305.54	251.26	54.27 (39.41 to 69.14)
GP by telephone	0.003	0.000	0.003 (-0.003 to 0.008)	0.08	0.00	0.08 (-0.07 to 0.23)
Health care assistant	0.066	0.014	0.052 (0.010 to 0.095)	1.77	0.37	1.40 (0.28 to 2.53)
Mental health team	0.003	0.044	-0.041 (-0.080 to -0.003)	0.38	6.05	-5.68 (-10.96 to -0.39)
Music therapist	0.000	0.144	-0.144 (-0.269 to -0.018)	0.00	3.30	-3.30 (-6.19 to -0.42)
Nurse prescriber	0.003	0.000	0.003 (-0.003 to 0.008)	0.07	0.00	0.07 (-0.06 to 0.19)
Optician	0.017	0.152	-0.135 (-0.174 to -0.097)	0.52	4.78	-4.26 (-5.47 to -3.04)
Occupational Therapist	0.036	0.025	0.011 (-0.034 to 0.056)	2.65	1.84	0.82 (-2.50 to 4.13)

Resource Item	Mean number of contacts (GP)	Mean number of contacts (Care Home)	Mean difference in contacts (95% CI)(GP minus Care Home)	Mean cost of contacts (GP)	Mean cost of contacts (Care Home)	Mean difference in costs (95% CI) (GP minus Care Home)
Out of hours district nurse	0.003	0.019	-0.017 (0.032 to -0.001)	0.18	1.26	-1.08 (-2.08 to -0.08)
Out of hours GP	0.489	0.273	0.215 (0.145 to 0.286)	52.85	29.56	23.29 (15.64 to 30.94)
Paramedic	0.212	0.222	-0.019 (-0.081 to 0.042)	52.35	57.11	-4.76 (-19.96 to 10.44)
Phlebotomist	0.152	0.000	0.152 (0.101 to 0.203)	0.48	0.00	0.48 (0.32 to 0.64)
Physiotherapist	0.082	0.423	-0.340 (-0.497 to -0.182)	4.17	21.27	-17.09 (-25.01 to -9.17)
Podiatrist	0.155	0.169	-0.014 (-0.076 to 0.048)	6.79	7.39	-0.61 (-3.32 to 2.10)
Practice nurse	0.080	0.003	0.077 (0.043 to 0.112)	1.00	0.03	0.96 (.054 to 1.39)
Psychiatrist	0.028	0.014	0.014 (-0.007 to 0.035)	9.43	4.71	4.71 (-2.46 to 11.89)
Speech & Language therapist	0.064	0.036	0.028 (-0.003 to 0.058)	5.03	2.84	2.19 (-0.24 to 4.70)
Social worker	0.019	0.064	-0.044 (-0.082 to -0.007)	1.61	5.30	-3.69 (-6.81 to -0.57)
Specialist GP	0.003	0.000	0.003 (-0.003 to 0.008)	0.12	0.00	0.12 (-0.11 to 0.35)
Specialist nurse	0.624	0.232	0.392 (0.267 to 0.518)	40.16	14.93	25.23 (15.09 to 35.38)

Notes: Bold text represents a statistically significant mean difference in resource use. ND means no difference.

The top ten resources used by residents differed slightly depending on data source. Both sources included GP, district nurse, specialist nurse, out of hours GP, physiotherapist, paramedic, dietician and podiatrist as the most used whilst GP records reported more use of phlebotomist and practice nurse than care home records which recorded more use of chiropodist and optician visits. Thus these items are likely to be important to collect in future economic evaluations in this setting where an intervention might be likely to change their utilisation.

Some resource items were only recorded in one data source, for instance GP records logged visits with community matron, the falls team, GP by telephone, nurse prescriber, phlebotomist and specialist GP that were not recorded in care home records. Equally care home records logged items that were not captured in GP records including community geriatrician, dentist and music therapist contacts as well as recording significantly more contacts with community facing services such as dietician, district nurse, mental health team, optician, physiotherapists and social workers. Although there is no gold standard to guide which data source is accurate, previously the higher value has been assumed to be the more accurate (Byford et al., 2007) such that this suggests care home records might be a better source of data for many resource items. However, whilst GP records tended to have a more restricted range of resources, they did tend to record more use of services that they directly provide to residents.

Cumulatively, there was a mean difference in total cost of £-140.18 (95% CI £-206.38 to £-73.98), meaning that if GP records were used instead of care home records estimated costs per resident would be £140.18 less on average than had care home records be used. Most of this differential is driven by the significantly larger number of district nurse contacts recorded by the care home.

Table 2 presents the results for the per cent agreement. Per cent agreement ranged from 0.00 per cent for 11 resource items which were either not frequently used or only captured by one data source to 19.66 per cent for GP contacts.

The CCC values are also reported in Table 2, whilst there is no clear guidance as to how to interpret ρ_c values (ρ_c = shorthand for concordance correlation coefficient) only one resource item appears to show substantial agreement: GP visits ($\rho_c=0.775$ (95% CI 0.736 to 0.815)). Podiatrist and total contacts seem to show moderate agreement whilst dietician, health care assistant, out of hours GP, SLT and social workers seem to show fair agreement (reversed agreement in the case of negative ρ_c). All other resource items showed poor agreement. The 95 per cent limits of agreement show individual differences are likely across almost all resource items.

Table 2: Level of agreement between health and social care service use data collected from GP records and care home records for those residents with one or more contact recorded in either data source

Resource Item	Number of residents with recorded contacts	Number in agreement (per-cent agreement)^	Concordance correlation coefficient ρ_c (SD; 95% CI)†	95% limits of Agreement
Total visits	361	24 (6.65)	0.399 (0.038; 0.324 to 0.474)	-31.994 to 24.804
Audiologist	8	1 (12.5)	*	*
Care of the elderly physician	2	0 (0.00)	*	*
Continuing health care review nurse	35	5 (14.29)	-0.167 (0.111; -0.384 to 0.051)	-2.430 to 1.287
Chiropodist	187	1 (0.53)	0.004 (0.005; -0.005 to 0.014)	-7.471 to 1.119
Community geriatrician	1	0 (0.00)	*	*
Community matron	1	0 (0.00)	*	*
Dentist	29	0 (0.00)	*	*
Dietician	41	7 (17.07)	0.310 (0.110; 0.094 to 0.526)	-3.154 to 1.447
District nurse	291	23 (7.90)	0.123 (0.048; 0.028 to 0.217)	-34.523 to 26.667
Falls team	4	0 (0.00)	*	*
GP	351	69 (19.66)	0.775 (0.020; 0.736 to 0.815)	-5.367 to 7.982
GP by telephone	1	0 (0.00)	*	*
Health care assistant	18	0 (0.00)	-0.280 (0.114; -0.504 to -0.056)	-1.986 to 4.097
Mental health team	7	0 (0.00)	*	*
Music therapist	8	0 (0.00)	*	*

Resource Item	Number of residents with recorded contacts	Number in agreement (per-cent agreement)^	Concordance correlation coefficient ρ_c (SD; 95% CI)†	95% limits of Agreement
Nurse prescriber	1	0 (0.00)	*	*
Optician	59	2 (3.39)	-0.144 (0.033; -0.209 to -0.080)	-1.870 to 0.209
OT				
Out of hours district nurse	8	0 (0.00)	*	*
Out of hours GP	107	29 (27.10)	0.395 (0.066; 0.266 to 0.525)	-1.435 to 2.880
Paramedic	88	18 (20.45)	0.008 (0.107; -0.203 to 0.218)	-2.461 to 2.302
Phlebotomist	42	0 (0.00)	*	*
Physiotherapist	49	9 (18.37)	0.005 (0.042; -0.077 to 0.088)	-9.266 to 4.245
Podiatrist	45	1 (2.22)	0.417 (0.116; 0.189 to 0.645)	-3.460 to 3.238
Practice nurse	25	0 (0.00)	-0.058 (0.031; -0.119 to 0.002)	-0.185 to 2.425
Psychiatrist	9	2 (22.22)	*	*
SLT	19	4 (21.05)	-0.206 (0.189; -0.578 to 0.165)	-1.862 to 2.915
Social worker	22	1 (4.54)	-0.357 (0.143; -0.638 to -0.077)	-3.306 to 1.852
Specialist GP	1	0 (0.00)	*	*
Specialist nurse	112	12 (10.71)	0.091 (0.068; -0.041 to 0.224)	-2.480 to 5.016

Notes: *Resource item used too little to estimate or only recorded by one data source. ^ Level of agreement unadjusted for chance.

Discussion

This study adds new evidence to inform the identification and measurement of resource use in economic evaluations conducted in the care home context. As the main cost drivers, it is likely to be important to capture GP, district nurse, specialist nurse, out of hours GP, physiotherapist, paramedic, dietician, and podiatrist resource use where the interventions being evaluated could change the resource use levels. Very few resource items had substantial agreement between GP and care home records suggesting that choice of data source may have important implications for the results of cost effectiveness analyses, this seems most likely where there is differential recording of low cost but frequently used items or of high cost items. Certain resources were found to be recorded in only one source (GP or care home records) and as such if a particular resource item is deemed important for a particular study the results of this study may help inform the best source of this data.

Two other trials conducted in the UK care home population have been published since the inception of the CAREMED trial (Underwood et al., 2013a & 2013b; Sackley et al., 2015). However, this is the first study we are aware of that compares resource use captured in two administrative data sources for the same residents in a care home context. Whilst it is largely not clear what caused the discrepancies observed, one would not expect any lag in reporting as both records are captured contemporaneously and data were extracted retrospectively. The largest difference observed was for district nurse contacts. Discussion post-study suggests that care home records are likely to be more accurate for this resource item since GPs are likely to only record district nurse visits which were planned or had significant input, not those which happened ad hoc as and when a district nurse happened to see an extra resident because they were in the home anyway. It was also noted that district nurses in the area keep their own records and given the scale of contacts recorded with hindsight it might have been more accurate to try and access these records. Further work needs to be undertaken to explore the discrepancies observed for other resource items.

A strength of this study is the collection of the same resource use data from two sources, for the same residents from multiple care homes over a reasonably long time period. Secondly, by not stating what resource use should be extracted, all visits were recorded, allowing this study to help researchers designing future trials in the care home setting to determine which resource items are potentially important for inclusion. Care home records tended to include a wider range of resource items but many of these were not widely used during the study period.

Due to time and personnel constraints, the original objective of dual data collection for the whole study period in all care homes was not feasible, particularly for control care homes. This could be a limitation if recording of resource use improved with the extra attention given to intervention homes such that the results presented may not be representative of control homes. A second limitation is that whilst it is believed most contacts recorded were those provided by publicly funded services, we cannot rule out that some contacts recorded in the care home records might have been privately financed by the residents themselves. Thirdly, despite having reasonable total resource use recorded for the average resident over the study period, some resource items had very little recorded use, such that level-of-agreement could not be meaningfully analysed.

Conclusion

To conclude, the study highlights the feasibility of undertaking research into the methods used to identify and measure resource use. This paper has provided evidence to help inform the identification of resource items to include and identified potential disparities when using two different sources of the same data in a care home population. Further research is needed to strengthen the methods for recording resource utilisation.

Declarations

Ethical approval was granted from the Norfolk Research Ethics Committee:

09/H0310/96 Multi-professional clinical medication reviews in care homes for the elderly. A randomised controlled trial with cost effectiveness study

Governance:

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Trial registration

Current Controlled Trials ISRCTN90761620.

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Supplementary Table 1: Unit costs in 2016/2017 UK pounds sterling (for the online copy only)

Resource Item	Unit cost	Source
		2011/2012 unit costs (as used in the original CAREMED economic evaluation) were inflated using the hospital & community health services (HCHS) pay & prices index to 2016/2017 prices (Curtis & Burns, 2017).
Audiologist	£100.75	NHS reference costs 2011/2012
Care of the elderly physician	£187.25	NHS reference costs 2011/2012
Continuing health care review nurse	£4.49	PSSRU 2012
Chiropodist	£43.87	PSSRU 2012
Community geriatrician	£187.25	NHS reference costs 2011/2012
Community matron	£23.58	PSSRU 2012
Dentist	£21.60	NHS choices Band 1 charge
Dietician	£75.98	NHS reference costs 2011/2012
District nurse	£41.73	PSSRU 2012
Falls team	£81.33	Irvine et al. 2010
General practitioner (GP)	£42.80	PSSRU 2012
GP by telephone	£27.82	PSSRU 2012
Health care assistant	£26.75	PSSRU 2012
Mental health team	£136.97	PSSRU 2012
Music therapist	£23.00	Assumed AfC band 6, 30 minutes
Nurse prescriber	£23.54	PSSRU 2012
Optician	£31.44	NHS reference costs 2011/2012
Occupational therapist	£73.84	PSSRU 2012
Out of hours district nurse	£65.28	PSSRU 2012
Out of hours GP	£108.08	PSSRU 2012
Paramedic	£246.12	PSSRU 2012
Phlebotomist	£3.16	PSSRU 2012
Physiotherapist	£50.29	PSSRU 2012
Podiatrist	£43.87	PSSRU 2012
Practice nurse	£12.44	PSSRU 2012
Psychiatrist	£341.36	PSSRU 2012
Speech and Language therapists	£79.19	PSSRU 2012
Social worker	£83.47	PSSRU 2012
Specialist GP	£42.80	PSSRU 2012 (assumed same as GP)
Specialist nurse	£64.32	NHS reference costs 2011/2012