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Evaluation and establishment of a ward-based geriatric liaison service for older urological surgical patients: POPS-Urology (Proactive Care of Older People Undergoing Surgery)

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Abstract

Objective: To assess the impact of introducing and embedding a structured geriatric liaison service, POPS-Urology, using comprehensive geriatric assessment methodology, on an inpatient urology ward.

Patients and Methods: A phased quality improvement project was undertaken using stepwise interventions. Phase 1 - A before-and-after study with initiation of a daily board round, weekly multidisciplinary meeting, and targeted geriatrician-led ward rounds for elective and emergency urology patients ≥65 years admitted over two one-month periods. Outcomes were recorded from medical records and discharge documentation, including length of inpatient stay, medical and surgical complications, 30-day readmission and 30-day mortality. Phase 2 - A quality improvement project involving Plan-Do-Study-Act cycles and qualitative staff surveys in order to create a Geriatric Surgical Checklist (GSCL) to: standardise the intervention in Phase 1, improve equity of care by extending to all ages, improve team working, and streamline handovers for multidisciplinary staff.

Results: Phase 1 - 112 patients in the control month and 130 in the intervention month. Length of inpatient stay was reduced by 19% (mean 4.9 vs. 4.0 days, p=0.01), total postoperative complications were lower (RR 0.24 (0.10, 0.54), p=0.001). A non-significant trend was seen towards fewer cancellations of surgery (10% vs. 5%, p=0.12) and 30-day readmissions (8% vs. 3%, p=0.07). Phase 2 - The GSCL was created and incrementally improved. Questionnaires repeated at intervals revealed the GSCL helped staff to understand their role better in multidisciplinary meetings, improved their confidence to raise issues, reduced duplication of handovers, and standardised identification of geriatric issues. Equity of care was improved by providing the intervention to patients of all ages, despite which the time taken for the daily board round did not lengthen.

Conclusion: This is the first known paper describing benefits of daily proactive geriatric intervention in elective and emergency urological surgery. The results suggest that using a multidisciplinary team board round helps to facilitate collaborative working between surgical and geriatric medicine teams. The GSCL enables systematic identification of patients who require a focused comprehensive geriatric assessment. There is potential to transfer the GSCL package to other surgical specialties and hospitals in order to improve postoperative outcomes.

Key Words: Aged; Frail Elderly; Geriatrics; Interdisciplinary Communication; Perioperative Care; Urology

Introduction

The demand for urological surgical intervention in older people is growing, with two thirds of urological inpatients aged over 65 years [1,2]. The benefits of urological surgery for older people include improving symptoms and quality of life, as well as reducing mortality. However, the older population remains at higher risk of adverse medical and surgical postoperative complications resulting in mortality, morbidity, functional decline, longer lengths of hospital stay (LOS) and higher financial costs [3]. Sub-populations who are particularly at risk of adverse outcome are those with multimorbidity, frailty and cognitive impairment. Whilst these risk factors are well described, current clinical practice fails to systematically identify or modify the risk profile of older patients [4,5].

Comprehensive geriatric assessment (CGA) is an established approach to evaluate and modify risk in older patients [6,7]. It has been used in those undergoing orthopaedic surgery with promising results including reductions in postoperative complications and LOS [8]. However, the potential role of daily CGA interventions specifically for the urology inpatient population, in particular for optimisation of postoperative ward care in elective and emergency admissions, has not yet been evaluated.

A CGA service, POPS (Proactive Care of Older People Undergoing Surgery), has been developed and established at Guy's and St Thomas' Hospitals since 2003. It provides multidisciplinary team (MDT) preoperative optimisation, and postoperative management of elective and emergency admissions. The POPS intervention has been described in an elective orthopaedic population where reduction in postoperative medical complications and LOS were demonstrated [9]. This study aims to describe the effect of the POPS approach on the urology ward. Prior to the intervention inpatient medical and geriatric input on the urology ward was reactive: referrals were made as required to on-call teams e.g. medical registrar, cardiology or intensive care.

Patients and Methods

Aims

We assessed the impact of introducing and embedding a structured geriatric liaison service, POPS-Urology, using CGA methodology, on an inpatient urology ward. A two-phase quality improvement project was conducted: Phase 1 aimed to reduce postoperative length of inpatient stay and Phase 2 aimed to standardize process and improve efficiency in ward working. The specific objectives of Phase 2 were to standardize the board round in order to systematically identify geriatric syndromes and facilitate targeted CGA intervention, to improve geriatric surgical team-working, to improve equity of care by extending input to patients aged <65 years and to reduce duplication of handovers occurring between MDT staff.

Patients

The study was conducted in an inner-city teaching hospital with a tertiary referral practice in urological surgery and included patients admitted for consideration of elective and emergency

urological surgery. In Phase 1, the intervention focused on patients aged ≥65 years, admitted over two 1-month periods. The control period was May 2007 and the intervention period May 2008. In Phase 2, all ages were included over the 6-month study period.

Phase 1

Methods

Phase 1 was a before-and-after study.

Control group: Patient admission data were collected retrospectively for a whole month, 1 year before the intervention period, in order to negate any seasonal influence on admission type. All patients admitted over the 1-month period were included.

Intervention group: A structured geriatric team intervention was established to identify high-risk patients and facilitate coordinated MDT care. The intervention included: (i) a daily board round led by a POPS consultant or clinical nurse specialist in geriatrics with the nurse in charge of the ward and direct liaison with the urology consultant overseeing patients' care. All inpatients aged ≥65 years were discussed; (ii) a weekly MDT meeting led by a POPS consultant/clinical nurse specialist (in attendance: urology junior doctor, staff nurse, ward physiotherapist and occupational therapist); and (iii) a twice-weekly ward round led by a POPS consultant/clinical nurse specialist. Patients reviewed were aged ≥65 years and met at least one criterion highlighted at the board round: referred to the POPS team; emergency admission; acute medical problem; discharge-related problem; or LOS ≥7 days.

Data collection: A doctor, independent of POPS or urology services, retrospectively collected patient characteristics and outcome data from computerized discharge documentation and medical records. The patient characteristics collected were: sex, age, emergency or elective admission, complexity of procedure and comorbidity (Table 1). Complexity of procedure was graded using the British United Provident Association (BUPA) Schedule of Procedures [10], and comorbidity using the Charlson comorbidity index [11]. The outcome variables were: cancellation of surgery; LOS; postoperative complications (divided in to medical and surgical complications); unplanned readmission; and death. These final two outcomes were established using hospital electronic patient records to follow patients for readmission or death within 30 days of discharge.

Statistical analysis: For each of our outcome variables we fitted a multivariable regression model which included intervention status as the main predictor variable, and which adjusted for patient characteristics (sex, age, emergency or elective admission, procedure complexity and comorbidity). We used Poisson regression with robust standard errors for all outcomes except LOS, for which we used linear regression [12]. When examining LOS and postoperative complications as outcomes, patients were excluded if their surgical procedure was cancelled. No patient characteristic or outcome variable had any missing data except for complexity of procedure, missing in 27/242 (11%), and these data were imputed under an assumption of missing at random. All analyses were conducted using Stata 13.1.

Results

A total of 112 patients were evaluated in the control group, and 130 in the intervention group. All characteristics were similar between these groups at the point of admission (all p>0.35; see Table 1). After the intervention the average LOS was 0.9 days shorter (4.9 days in the control group vs 4.0 days in the intervention group, Table 2), corresponding to a 19% relative decrease (95% CI 4%, 25%, p=0.01) in adjusted analyses. In addition there was a four-fold reduction in total postoperative complications (RR 0.24 (0.10, 0.54), p=0.001), which persisted when analysed separately for medical complications (RR 0.26 (0.10, 0.71)) and surgical complications (RR 0.16 (0.05, 0.49); see Table 3 and Table S1).

Table 1: Characteristics of Phase 1 study population at the point of admission (N=242)

		Control group	Intervention group[1]
	Total population	112 (100%)	130 (100%)
Sex	Male	97 (87%)	107 (82%)
	Female	15 (13%)	23 (18%)
Age	65-69	28 (25%)	31 (24%)
	70-74	32 (29%)	31 (24%)
	75-79	31 (28%)	37 (28%)
	80-92	21 (19%)	31 (24%)
Emergency admission	No	80 (71%)	89 (68%)
	Yes	32 (29%)	41 (32%)
Complexity of planned procedure[2,3]	Non-surgical procedure	15 (14%)	15 (14%)
	Minor operation	1 (1%)	4 (4%)
	Intermediate operation	46 (44%)	48 (43%)
	Major operation	39 (38%)	38 (34%)
	Complex major operation	3 (3%)	6 (5%)
Charlson comorbidity index	0-1	47 (42%)	46 (35%)
	2-3	50 (45%)	57 (44%)
	4-5	11 (10%)	19 (15%)
	6-10	4 (4%)	8 (6%)

[1] All p>0.35 in Chi-squared tests for heterogeneity between patient characteristics and intervention/control group status. [2] Surgical interventions were classified using the surgeon's category of the British United Provident Association (BUPA) 'Schedule of Procedures' [10]. Numbers add to less than the total for this characteristic due to missing data on 27 individuals. [3] Comorbidity was graded using the Charlson weighted comorbidity index [11].

Table 2: Comparison of length of stay across intervention and control groups

	N in Analysis[1]	Mean length of stay (SD)	Adjusted analysis[2]	
			Relative percentage change (95% CI)	p-value
Control group	101	4.9 (4.4)	0	0.014
Intervention group	124	4.0 (3.5)	-19.4 (-34.7, -4.0)	

[1] Analysis restricted to individuals whose procedure was not cancelled
[2] Adjusting for age, sex, emergency admission, procedure severity (combining 'minor' operations with 'intermediate' operations due to small sample size) and Charlson index.

Table 3: Comparison of Phase 1 binary outcomes across intervention and control groups

		N in analysis†	% (N) with outcome	Adjusted analysis‡	
				Risk ratio (95% CI)	p-value
Any complication	Control group Intervention group	101 124	24% (N=24) 6% (N=7)	1 0.24 (0.10, 0.54)	0.001
Medical complication	Control group Intervention group	101 124	16% (N=16) 5% (N=6)	1 0.26 (0.10, 0.71)	0.008
Surgical complication	Control group Intervention group	86 110	14% (N=12) 2% (N=2)	1 0.16 (0.05, 0.49)	0.001
Procedure cancelled	Control group Intervention group	112 130	10% (N=11) 5% (N=6)	1 0.46 (0.17, 1.24)	0.12
Unplanned readmission	Control group Intervention group	112 130	8% (N=9) 3% (N=4)	1 0.37 (0.12, 1.10)	0.07
Death	Control group Intervention group	112 130	3% (N=3) 0% (N=0)	[not calculated]	-

CI = confidence interval

† Analysis restricted to individuals whose procedure was not cancelled, when examining associations with 'any complications' or 'medical complications'. Analysis further restricted to those undergoing surgery when examining surgical complications.

‡ Adjusting for age, sex, emergency admission, procedure severity (combining 'minor' operations with 'intermediate' operations due to small sample size) and Charlson index.

Fewer procedures were cancelled in the intervention group (10% vs. 5%), although this did not reach significance (p=0.12, see Table 3). This reduction in cancellations was due to avoidance of medical problems, rather than administrative ones (Table S2). There was also a non-significant reduction in unplanned readmissions (8% vs. 3%, p=0.07). Lastly, the number of deaths was lower in the intervention group (3 vs 0, p=0.1), although interpretation of this finding is complicated by the very small numbers involved. These results were very similar when stratified according to whether the patient was undergoing an elective or emergency procedure (all p>0.5 for interaction).

Phase 2

Methods

Based on the positive effect of Phase 1, intervention continued from 2008 until the start of Phase 2.Phase 2 was a multi-step quality improvement project undertaken in the same setting between December 2013 and June 2014.

Control Group: Ward staff were anonymously surveyed on effectiveness of the board round and team working (Table 4). A record was made of the time taken to complete the board round, and the number of referrals made to the POPS team, over a two-week period.

Intervention: The board round process was transcribed to a read-do Geriatric Surgical Checklist (GSCL - Supplement 1) based on the format of the WHO Surgical Safety Checklist. A detailed list of prompts was incorporated for those ≥65 years or believed to be frail [13]. A package of educational leaflets were distributed to all ward staff containing the GSCL, a user-guide, a glossary of social care terminology, and an introduction to collaborative geriatric and surgical working.

1. The board round members were extended from the POPS doctor/CNS and the nurse in charge of the ward, to include: one junior doctor from each of the four subspecialty urology teams, the ward occupational therapist and physiotherapist, and POPS social worker.
2. Three PDSA (plan-do-study-act [14]) cycles were undertaken, with measurements at baseline, one-month and six-months post intervention. A staff survey was used to explore five specific hypotheses:
    i. The structure of the board round needs refining
    ii. The new GSCL will help the team to integrate well
    iii. The board round improves patient care
    iv. The new GSCL helps identify important geriatric issues
    v. The board round will reduce handover duplication

Results

All members participating in the board round completed the survey at baseline, one-month, and six-months (34, 29 and 19 members respectively). Although there was 100% completion rate, fewer people were eligible to complete the survey as there was less rotation into the role of nurse in charge.

Table 4btableta: Results of the ward survey at baseline (pre-introduction) and repeated at one-month and six-months post introduction of GSCL

		Strongly Agree/Agree			Disagree/Strongly Disagree		
Q	**The new checklist will help the team to integrate well**	**Baseline**	**1 month**	**6 months**	**Baseline**	**1 month**	**6 months**
1	We work well as a team at the BR	76%	76%	100%	9%	10%	0%
2	I feel involved in the BR	88%	93%	100%	9%	0%	0%
3	I feel comfortable speaking up at the BR	79%	93%	100%	6%	0%	0%
	The board round improves patient care						
4	The BR helps me talk to the patient about the management plan	71%	76%	84%	12%	14%	5%
5	The BR helps me talk to my own team about the management plan	94%	90%	84%	6%	7%	5%
6	I think the BR improves patient care	97%	93%	100%	0%	3%	0%
7	The BR helps with timely identification of patients for further review	91%	90%	95%	3%	3%	5%
8	I think the BR lengthens a patient's time in hospital	6%	10%	11%	79%	83%	89%
9	The BR pushes me to make unsafe discharges	6%	3%	5%	88%	93%	89%
	The board round helps identify important CGA issues						
10	Do you think the BR should include discussion on: medical issues	91%	100%	100%	0%	0%	0%
11	estimated discharge date	100%	100%	95%	0%	0%	0%
12	mobility	94%	100%	100%	0%	0%	0%
13	current functional status	94%	100%	100%	3%	0%	0%
14	pain	94%	97%	100%	0%	0%	0%
15	constipation	82%	90%	95%	3%	0%	0%
16	eating and drinking	85%	93%	100%	0%	3%	0%
17	continence	91%	93%	95%	3%	7%	5%
18	delirium (also known as acute confusion)	100%	97%	100%	0%	3%	0%
19	falls	100%	100%	100%	0%	0%	0%
	The structure of the BR needs refining						
20	It is appropriate that POPS should chair the BR	88%	97%	100%	0%	0%	0%
21	I am clear what my role is at the BR	82%	93%	95%	3%	3%	5%
22	We spend too much time discussing patients over 65 years old	12%	14%	5%	71%	79%	95%
23	We spend too little time discussing patients under 65 years old	26%	14%	11%	47%	69%	84%
24	The BR is a waste of my time	3%	3%	0%	91%	97%	100%
25	The BR is too long	15%	24%	0%	59%	48%	79%

BR = board round. CGA = comprehensive geriatric assessment

Hypothesis 1: The structure of the board round needs refining: Over the study period staff had a greater understanding of their role in the board round (82% to 95%, Q21). There was greater approval for the length of time spent at the board round (59% to 79%, Q25), although the maximum time taken for the board round did not change with the introduction of the more detailed GSCL (30 minutes).

Hypothesis 2: The new GSCL will help the team to integrate well: Staff stated they felt more involved (88% to 100%, Q2) and comfortable to speak up at the board round (79% to 100%, Q3). In addition their rating for working well as a team improved (76% to 100%, Q1).

Hypothesis 3: The board round improves patient care: Staff found that the board round helped with timely review of patients and improved patient care (Q6 and 7). When asked if they felt the board round pushed them to make unsafe discharges, one person agreed - this will need to be explored in future studies.

Hypothesis 4: The new GSCL helps identify important CGA issues: There was uniform agreement that the GSCL should include the detailed list of geriatric related prompts (Q10-19).

Hypothesis 5: The board round will reduce handover duplication: Through free text identification of duplicate handovers, five daily meetings were eliminated between the nurses and physiotherapists, occupational therapists, discharge coordinator, bed manager, dietician and ward pharmacist. The Phase 1 weekly MDT meeting was removed. These changes were facilitated through new members joining the board rounds, including discharge coordinator and dietician, through new processes being added that highlighted expected discharges for pharmacy, and through setting estimated discharge dates for bed managers.

Non-inferiority outcome: The length of each board round did not exceed 30 minutes at any point during the study period and the number of referrals to POPS was maintained, although the case mix altered to younger patients with more functional related issues (Table 5).

Table 5: Comparison of referrals seen in the Phase 2 baseline period (pre-intervention) and in the one-month post-intervention group

		Baseline	**1-month**
		n = 24	**N = 26**
Emergency Admission	Yes	12 (50.0%)	13 (50.0%)
	No	12 (50.0%)	13 (50.0%)
Age	Mean	79.5	72.0
	41-65	3 (12.5%)	6 (23.1%)
	65-74	5 (20.8%)	9 (34.6%)
	75-84	5 (20.8%)	5 (19.2%)
	84-96	11 (45.8%)	6 (23.1%)
Reason for review	Discussion around surgery	2 (7.7%)	1 (4.2%)
	Medical issues	11 (42.3%)	5 (20.8%)
	Delirium	1 (3.8%)	2 (8.3%)
	Falls/decline in function	2 (7.7%)	7 (29.2%)
	Discharge planning	5 (19.2%)	0 (0.0%)
	Seen previously by POPS	5 (19.2%)	9 (37.5%)

Discussion

This is the first known paper describing the benefit of daily proactive geriatric intervention in elective and emergency urological surgery. Phase 1 introduced a geriatric liaison service (POPS-Urology) and demonstrated significant reductions in LOS and postoperative complications for elective and emergency admissions. These positive results are in keeping with the previous POPS before-and-after study where a CGA based intervention in elective orthopaedic surgery reduced complications, LOS and improved ward efficiency, particularly discharge-related problems [9]. Likewise, the CO-OPERATE (Co-management of Older Operative Patients En Route Across Treatment Environments) program based in Connecticut, employing a preoperative CGA review plus CNS highlighting geriatric issues on the ward, showed improved rates for discharge directly home in elective and emergency surgical patients [15].

However, neither the previous POPS study, nor CO-OPERATE, explained how to identify the 'at risk' inpatient group who may benefit from a CGA intervention. Age is often used as a screening process due to the incidence of postoperative complications being higher in older people [16]. However, age by itself is not an independent risk factor for adverse outcome, rather poor outcome is more closely linked to recognised geriatric syndromes including frailty, multimorbidity and cognitive impairment. Phase 2 of our study used the GSCL at the board round to systematically identify these geriatric syndrome risk factors, highlighting patients for a targeted CGA. In this phase the GSCL was embedded into routine clinical care using quality improvement methodology. In addition to the GSCL, an educational bundle helped the MDT prepare the information that would be required of them at the board round, placing their specialist assessments in context. The results showed better staff understanding of the importance of identifying geriatric issues on the surgical wards, better team working facilitated through the board round, and a reduction in the number of handover meetings.

A key strength of our Phase 1 study is the inclusion of all patients admitted to the urology ward regardless of presentation: emergency or elective, multimorbidity, or the presence of geriatric syndromes including cognitive impairment. This enhances the generalisability of the findings. Limitations of this study include the fact it was single-centre, a reliance on electronic patient records to measure patient outcomes, and a period of non-measurement between the two phases. If the patient records contained inaccuracies or incomplete outcome entries, the resulting measurement error may have led to underestimation of the true benefit of POPS. Such underestimation is particularly plausible with respect to measurement bias in postoperative complications, since it is plausible that the introduction of POPS may have increased the completeness with which adverse outcomes were noted. In addition, due to using retrospective electronic reporting of complications, we were unable to use a recognised classification such as the Clavien-Dindo. With regards readmissions, the majority of patients were admitted from the local area, and as such, would either have been re-admitted to the study site, or referred back from neighbouring hospitals as the central provider of their urology service. Nevertheless readmissions may have been underestimated if for other reasons patients were admitted to outlying hospitals. Another limitation is that we did not randomise patients. This raises the possibility of unmeasured differences between the intervention and control cohorts, although reassuringly the intervention and control groups were well matched for age, gender, complexity

of surgery and comorbidity. Nevertheless, it will be important in the future to follow up these promising results with randomised trials, perhaps using cluster randomised, or stepped wedge designs in order to minimise contamination due to the ward education component of POPS. We further recommend that future studies examining CGA type interventions should be clear about both the method of identifying patients, but also the intervention employed in order to allow replication of the model.

Conclusions

This is the first known paper describing clinically significant benefits of daily proactive geriatric intervention in elective and emergency urological surgery, and examining the successful translation of such an intervention into routine care. Using the GSCL and educational bundles may allow other units to embed and develop their own tailored CGA interventions in surgery. However, to fully establish the evidence base for the use of CGA in surgical settings, multicentre randomised controlled studies are required.

Conflict of interest

Dr. Harari reports grants from Guy's and St Thomas' Charity, outside the submitted work. Dr. Braude reports grants from British Geriatrics Society, outside the submitted work. No other declarations of conflict of interest.

References

1 Hamel MB, Henderson WG, Khuri SF, *et al.* Surgical outcomes for patients aged 80 and older: morbidity and mortality from major noncardiac surgery. *J Am Geriatr Soc* 2005;**53**:424–9. doi:10.1111/j.1532-5415.2005.53159.x

2 Drach GW. Geriatric urology. In: *Penn Clinical Manual of Urology*. Elsevier Inc. 2007. 919–27.

3 Pearse RM, Harrison DA, James P, *et al.* Identification and characterisation of the high-risk surgical population in the United Kingdom. *Crit Care* 2006;**10**:R81. doi:10.1186/cc4928

4 NCEPOD. *Elective & Emergency Surgery in the Elderly: An Age Old Problem*. National Confidential Enquiry into Patient Outcome and Death 2010. http://www.ncepod.org.uk/2010eese.htm (accessed 18 Mar2014).

5 *Knowing the Risk: A review of the peri-operative care of surgical patients*. National Confidential Enquiry into Patient Outcome and Death 2011. http://www.ncepod.org.uk/2011report2/downloads/POC_fullreport.pdf (accessed 5 Oct2014).

6 Ellis G, Whitehead MA, Robinson D, *et al.* Comprehensive geriatric assessment for older adults admitted to hospital: meta-analysis of randomised controlled trials. *BMJ* 2011;**343**:d6553. doi:10.1136/bmj.d6553

7 Stuck AE, Siu AL, Wieland GD, *et al.* Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet* 1993;**342**:1032–6.http://www.ncbi.nlm.nih.gov/pubmed/8105269 (accessed 2 Nov2014).

8 Partridge JSL, Harari D, Martin FC, *et al.* The impact of pre-operative comprehensive geriatric assessment on postoperative outcomes in older patients undergoing scheduled surgery: a systematic review. *Anaesthesia* 2014;**69 Suppl 1**:8–16. doi:10.1111/anae.12494
9 Harari D, Hopper A, Dhesi J, *et al.* Proactive care of older people undergoing surgery ('POPS'): designing, embedding, evaluating and funding a comprehensive geriatric assessment service for older elective surgical patients. *Age Ageing* 2007;**36**:190–6. doi:10.1093/ageing/afl163
10 Consultants fees explained | Bupa UK. http://www.bupa.co.uk/healthcare-professionals/private-practice/fees-explained (accessed 16 Nov2014).
11 Charlson ME, Pompei P, Ales KL, *et al.* A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987;**40**:373–83.http://www.ncbi.nlm.nih.gov/pubmed/3558716 (accessed 10 Jul2014).
12 Zou G. A Modified Poisson Regression Approach to Prospective Studies with Binary Data. *Am J Epidemiol* 2004;**159**:702–6. doi:10.1093/aje/kwh090
13 Partridge JSL, Harari D, Dhesi JK. Frailty in the older surgical patient: a review. *Age Ageing* 2012;**41**:142–7. doi:10.1093/ageing/afr182
14 Taylor MJ, McNicholas C, Nicolay C, *et al.* Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ Qual Saf* 2014;**23**:290–8. doi:10.1136/bmjqs-2013-001862
15 Walke LM, Rosenthal RA, Trentalange M, *et al.* Restructuring care for older adults undergoing surgery: preliminary data from the Co-Management of Older Operative Patients En Route Across Treatment Environments (CO-OPERATE) model of care. *J Am Geriatr Soc* 2014;**62**:2185–90. doi:10.1111/jgs.13098
16 Patel SA, Zenilman ME. Outcomes in Older People Undergoing Operative Intervention for Colorectal Cancer. *J Am Geriatr Soc* 2001;**49**:1561–4. doi:10.1046/j.1532-5415.2001.4911254.x
17 *Management of Proximal Femoral Fractures*. The Association of Anaesthetists of Great Britain and Ireland 2011. http://www.aagbi.org/sites/default/files/femoral fractures 2012_0.pdf (accessed 23 Nov2014).

Supplementary Material

Table S1: Postoperative complications coded for in electronic discharge documentation

Medical Complication	Control group	Intervention group	Total
Sepsis	6	5	11
Vomiting	1	2	3
Acute kidney injury	3	0	3
Fall	2	0	2
Surgical Complication			
Haemorrhage	7	0	7
Catheter/retention-related	7	2	9
Total medical	12	7	
Total surgical	14	2	

Table S2. Reasons for Cancellations in Phase 1 (Adapted from AAGBI reasons for delaying surgery for hip fracture) [17]

	Control group	Intervention group
Acceptable Reasons (e.g. anaemia, sepsis, electrolyte imbalance)	6	3
Unacceptable Reasons (e.g. theatre administration, awaiting echocardiogram)	3	2
Consent process	1	0
Change of surgical plan	0	1
Not documented	1	1
Total	11	6