

**Establishing a Perioperative medicine for Older People undergoing Surgery (POPS) service
for general surgical patients at a district general hospital**

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INTRODUCTION:

Patients aged over 60 years are more likely than younger people to develop complications following surgery.¹ With each additional decade of life, postoperative morbidity, mortality, and length of in-hospital stay (LOS) increases.² Co-management between surgeons, anaesthetists and geriatricians is increasingly recognised to improve postoperative outcomes.³ Collaborative perioperative services using Comprehensive Geriatric Assessment (CGA) methodology have demonstrated fewer postoperative complications in patients undergoing orthopaedic,⁴ vascular,⁵ and general surgical procedures.⁶ These observed improvements with consequent shorter LOS may provide a cost-effective approach to delivering services for older surgical patients.

The UK, Royal Colleges of Anaesthetists, Surgeons and Physicians all advocate collaborative models of perioperative care.^{7,8,9} Indeed, the Royal College of Surgeons High Risk Surgical Patient report and National Emergency Laparotomy Audit (NELA) recommend patients aged ≥ 65 years should be assessed by a geriatrician during a hospital episode.^{10,11} Despite these standards, implementation of geriatric medicine services in routine surgical care (excepting hip fracture) remains limited. NELA data show only 23% of older patients undergoing emergency laparotomy are reviewed by a geriatrician, and structured geriatrician-surgical liaison exists in just 4% of hospitals.¹¹

Barriers to establishing perioperative geriatrician involvement include insufficient funding and a limited workforce to deliver collaborative co-management.¹² Furthermore, qualitative research describes human factors and departmental cultures presenting barriers to change.¹³ Despite these barriers, national drivers, education and training opportunities and co-produced medical-surgical business plans have resulted in an increase in geriatrician-delivered perioperative medicine services.^{14,15} Whilst this is encouraging, there remains a translation gap between recommendations and clinical practice. Achieving systematic scale-up requires an implementation science approach to define and address barriers and enablers, ensure fidelity to evidence and facilitate measurement of outcome.

This mixed methods study aims to address this implementation and scale-up gap through effectively and sustainably translating an established model of geriatrician-led perioperative care from the tertiary centre where it was established, to a district general hospital (DGH).

METHODS:

The intervention: POPS@GSTFT

The 'Perioperative medicine for Older People undergoing Surgery' (POPS) service was established at Guy's and St Thomas' Foundation Trust (GSTFT) in 2003. GSTFT is a 1,277 bedded tertiary, academic, hospital with 28,000 elective and 51,500 non-elective admissions annually. Ninety-one percent of emergency general surgical patients were seen by a geriatrician,² with LOS shorter than the national benchmark in 2016. POPS uses CGA methodology, delivered by a geriatrician-led multidisciplinary team to preoperatively assess and optimise in a one-stop clinic with a focus on anticipation of postoperative complications

and shared decision making. Patients are followed-up on surgical units with co-management between geriatricians and surgeons to deliver postoperative medical care, rehabilitation goal-setting and discharge planning. Emergency admissions are identified through proactive case finding and managed (pre and postoperatively) according to CGA principles. The POPS model of care is illustrated in Appendix 1. Single site studies have demonstrated improvements in clinical outcomes, process measures, and staff satisfaction.^{4,5}

The context for scale-up: Dartford and Gravesham Trust (DGT)

Darent Valley Hospital (Dartford and Gravesham Trust, DGT) is a 463 bedded hospital, 16 miles from GSTFT serving a population of 340,000 with a deprivation index of 100/152.¹⁶ Trustwide issues include workforce shortages, financial challenges and an anticipated increase in activity.¹⁷ The surgical department has 2000-3000 emergency and 1100-1500 elective admissions annually. Performance, measured by NELA, showed 8% of emergency general surgical patients were seen by a geriatrician in 2016, and LOS was longer than the national benchmark.²

Funding from the NHS England Acute Care Collaboration Vanguard provided the opportunity to translate POPS@GSTFT to the DGT setting. Over 18 months, £25,000 was provided to support one weekly session of POPS@GSTFT consultant time supervising two days of specialist registrar (SpR) time to implement the POPS@DGT service.

The translation process: POPS@DGT

Improvement science strategies were employed to facilitate the translation of POPS@GSTFT to DGT.^{18,19} The three main phases were;

1. Logic modelling

The core components of POPS@GSTFT were described through development of a modified logic model.²⁰ Logic models specify elements of a clinical programme, and how they translate to care processes and resultant clinical outcomes. They also specify the core elements of a clinical intervention to be delivered with high fidelity,²¹ ensuring the maintenance of effectiveness through the scale-up process. In so doing, logic models offer a practical, action-orientated 'map' for the execution of a translation or scale-up programme.²²

2. Piloting the service

Using the logic model, a pilot POPS@DGT service was established. The first phase of this pilot service provided outpatient, preoperative CGA-based, geriatrician-delivered care for older patients scheduled to undergo vascular surgery. This early service comprised;

- *Staffing*; two days per week of geriatric medicine SpR with expertise in delivering CGA, and a weekly session of supporting POPS@GSTFT consultant time (e.g. review of clinic letters, supervision delivered through weekly multidisciplinary meetings).
- *Supporting clinical infrastructure*; POPS@GSTFT written materials (e.g. clinic proformas, letter templates, clinical guidelines, Standard Operating Policies).
- *Professional development*; mentoring of registrars by POPS@GSTFT team to build resilience and sustainability.

Piloting a small-scale service in one surgical speciality before expanding across other surgical specialities facilitated interdisciplinary relationships, improved understanding of local

processes, and allowed anticipation of enablers and barriers to wider implementation.

Furthermore, it provided the opportunity for 'trouble-shooting', whilst allowing the local team to 'own' and 'invest' in the intervention.¹⁷

3. Iterative evaluation to support embedding of POPS@DGT

POPS@DGT was studied using a clear-box, formative service evaluation. This allowed granular description of how inputs translated into outputs, and provided real-time insight into modification, refinement and tailoring of the intervention.^{23,24}

Quality improvement methodology enabled continual adaptation of the intervention to the local context. Process-mapping with local stakeholder groups provided understanding of how POPS@DGT could be embedded into existing systems. Where areas for improvement were identified, Cause and Effect Fishbone diagrams, the Five Whys approach²⁵ and Plan-Do-Study-Act cycles²⁶ were used to analyse root cause of challenges, identify solutions and trial modifications in a stepwise manner.

Staff feedback, via semi-structured interviews and surveys, was central to service development. For example, the format and content of ward-based multi-disciplinary meetings (MDM) was refined through PDSA cycles, allowing POPS@DGT to make iterative adjustments to time, venue, and frequency of meetings, until staff agreed the MDM was an efficient use of time and improved clinical care.

Improvement steps to facilitate translation, together with the timeline for change, are summarised in Table 1.

Table 1: Summary improvement workstreams within POPS@DGT translation

Through phases 1 to 3, POPS@DGT expanded to include inpatient pre and postoperative care for emergency and elective general surgical patients. Capacity for expansion was achieved through a funding application using preliminary data resulting in the appointment of a surgical directorate funded clinical nurse specialist (CNS).

POPS@DGT: evaluation of translation

In keeping with an implementation science approach, a mixed methods evaluation of the POPS@DGT intervention was used. A hybrid evaluation framework assessing process (clinical and implementation), stakeholder, and patient satisfaction data was used²⁷ to achieve sustainability.

Baseline data were collected on a cohort of 50 emergency and 50 elective general surgical patients aged ≥ 70 . Following introduction of POPS@DGT, quantitative data on all patients seen by POPS were presented in monthly run charts recording LOS, readmissions, medical complications and coding of comorbidities.

Qualitative data was obtained using semi-structured interviews and stakeholder focus groups, analysed using NVIVO 12 software.

RESULTS:

Results are presented in three sections. First, quantitative data allows evaluation of the clinical impact of POPS@DGT (similar to original evidence from GSTFT). Second, qualitative data describes challenges experienced through implementation and allows exploration of

barriers, enablers and coproduction of interventions to overcome these challenges. Third, the process of obtaining substantive funding and the current POPS@DGT service is described.

1. Process measures, staff-reported and patient-reported outcomes:

Uptake (implementation assessment):

In the twelve months preceding POPS intervention, 8% of patients undergoing emergency laparotomy were seen by a geriatrician. During the first twelve months of the POPS intervention, 98% of patients aged over 70 years undergoing emergency laparotomy received CGA (n=62) with one early postoperative death in critical care precluding intervention. Within their first 12 month period, POPS@DGT performed a CGA on a total of 763 inpatients. Initially, CGA and optimisation was undertaken by POPS physicians (geriatric medicine registrars), but capacity was increased through upskilling a CNS to undertake CGA and optimisation.

Clinical outcomes

The incidence of documented postoperative complications increased over the first year of POPS@DGT: delirium from 0% to 26%, acute kidney injury 2% to 14% and pneumonia 10% to 19% (figure a). These increases likely reflect improved recognition of complications, rather than an increase in complication rates. Comorbidities recorded on discharge summaries increased from a median of two to four per patient. Again, this likely reflects improved recognition and documentation rather than increased multimorbidity, and was achieved through measures such as an 'Information to include in the Discharge Note' section in the POPS@DGT CGA proforma.

Within 12 months of introduction of POPS@DGT median LOS for emergency general surgery patients reduced by one day and mean LOS by 2.58 days (Pre-POPS: median 8, mean 14.2, range 2-80 days: Post-POPS: median 7, mean 11.6, range 1-82 days). Within 12 months of introduction of POPS@DGT 30-day readmissions in emergency general surgical patients reduced from 30% to 18% (Figure a).

Figure a: Postoperative medical complications and 30-day readmission rate in emergency general surgical patients

Staff-reported outcomes:

Nine months after service introduction an electronic survey distributed to nurses, doctors and allied health professionals found $\geq 80\%$ of staff reported POPS@DGT had improved the overall care of older surgical patients (n= 28, response rate 71%). In addition, staff reported improved understanding of multi-disciplinary working and enhanced educational opportunities. Interviews with stakeholders demonstrated improved satisfaction with discharge letter documentation, noted particularly by General Practitioners.

Patient reported outcomes:

Patients attending POPS clinics were invited to attend a focus group supported by an independent facilitator. Patients who expressed interest but were unable to attend were invited to complete a survey (appendix 2). This process enabled iterative co-design of the service by rapidly identifying aspects requiring adaptation and facilitating co-produced solutions. Improvements made included changes to the appointments process (specifically

flexibility in appointment times and content of letters), a co-produced information leaflet (appendix 3), and the development of a hospital map. The success of this approach was recognised through the substantive appointment of a Patient Engagement Officer working across DGT, demonstrating sustainable cultural change within the organization.

2. Qualitative evaluation of the translation process

Semi-structured interviews were conducted six months after service introduction with ten senior staff-members involved in POPS implementation at DGT. Staff interviewed were two nurses, two surgeons, three geriatricians, two anaesthetists, and one member of the executive hospital board. Interviews explored individuals' experience of the implementation process: had there been readiness for change, had sufficient stakeholder engagement been achieved, had the intervention been perceived as acceptable and had it adapted sufficiently into its new context? Thematic analysis of these transcribed interviews using NVIVO 12 software allowed an understanding of barriers and enablers to translation and interventions necessary to overcome challenges (Table 2).

Table 2: Implementation process of POPS@DGT: Barriers & Enablers

3. Sustainability

Following the pilot, a business case was submitted and the substantive POPS@DGT service started in November 2017. This service, funded through the surgical directorate, is now provided by 1.0 Working Time Equivalent (WTE) consultant geriatricians, 1.0 WTE Band 7 CNS, 0.3 WTE Occupational Therapist and 0.1 WTE POPS@GSTFT consultant. The inpatient service is delivered through daily POPS consultant and CNS co-management on general

surgical wards, close collaborative working with surgical teams, twice-weekly ward-based MDMs, and referral to community services at hospital discharge. A preoperative CGA based and optimisation based outpatient service has now been established. One session of POPS@GSTFT consultant time continues to provide clinical supervision, collaborative peer support and mentorship.

Effective knowledge mobilisation through adaptation of POPS@GSTFT resources to the local context of POPS@DGT improved efficiency in the set-up phase and ensured consistency in documentation and approach across the vanguard sites. For example with respect to delirium; a pan-hospital delirium working group was established, a high-visibility sticker for use in the medical record was adapted, pop-up training sessions for nurses were provided using GSTFT training materials and dissemination occurred via newsletter articles and an in-hospital promotional event. In addition, the preoperative outpatient service utilises the same CGA tools and letter template as that used by POPS@GSTFT, facilitating seamless transfer of patient level information between centres.

DISCUSSION

Key findings:

Through a mixed methods study, underpinned by improvement and implementation science, the established POPS@GSTFT service was sustainably translated to and substantively funded at a DGH. Within 12 months, POPS@DGT demonstrated a one day reduction in median LOS and a reduction in 30-day readmission rate (30% to 18%) in older surgical patients. Detection of medical complications and comorbidity coding improved. Staff and patient benefits were demonstrated through mixed methods evaluation.

Interpretation:

Successful and sustainable translation of an evidence-based approach to a novel setting requires fidelity to the original model (core intervention elements), adaption to the local context (adaptable elements) and the use of improvement science to underpin iterative change.

Ensuring fidelity to POPS@GSTFT necessitated description and adherence to the core components of the intervention.²¹ The use of CGA and optimisation as an underpinning methodology is essential, as evidenced by previous work, with benefits observed in process and clinician reported measures.^{4,5,6} In contrast, when principles of CGA are not adhered to, the same results are not observed. For example, in a colorectal cancer population, CGA failed to use a timely or multidisciplinary approach and comparable postoperative benefits were not demonstrated.²⁸ Similarly, a recent study examining a 'toolkit' approach to perioperative CGA delivery by non-geriatricians, failed to develop and embed a clinical service and showed no impact on clinical outcomes.²⁹

Whilst core components of CGA are integral to a POPS intervention, the process of translation requires adaption to the local context. In the POPS@DGT programme, local adaption was facilitated through a 'one team' approach supported through collaborative training, upskilling all staff in perioperative geriatric medicine. Co-design and co-production involving stakeholders early in the process was effective in promoting shared service ownership and instrumental in securing substantive funding from the surgical directorate within 15 months of inception. This move towards funding POPS services from surgical as

opposed to medical budgets is increasingly observed in the UK and likely further reflects shared understanding of a 'one team' approach.¹¹

Finally, using a systematic approach to address human factors, known to be barriers to establishing team-based services, was essential. This is pertinent as a recent qualitative study suggests failure to address human factors may contribute to slow uptake of geriatrician-led perioperative medicine services.¹³ Furthermore funded clinical support and mentorship from the established POPS@GSTFT team fostered resilience in POPS@DGT staff. This suggests the need for a national or international POPS network to share best practice, promote resilience and ensure sustainability at scale.¹¹

Limitations:

First a single site translation study lacks the benefit of a control group making it impossible to infer causal attribution of the clinical and implementation outcomes observed. However, undertaking a pilot site translation, such as this study, is an integral first step in wider scale-up. Second, an un-blinded evaluation team was a potential source of bias. Such limitations reflect the pragmatic choice of a formative evaluation, aimed at maximising learning from the implementation process. This necessitates a multi-centre hybrid effectiveness-implementation trial to build on this translation study and evaluate wider scale-up of the POPS intervention.²⁷

Conclusions:

There is a national and international appetite for establishing geriatrician-led perioperative medicine services. This study applied implementation and improvement science methods to

successfully and sustainably translate an evidence-based approach from a tertiary setting to a DGH. Key components included use of a logic model, opportunistic pilot funding, ensuring fidelity to evidence, adapting to the local context and addressing human factors in co-producing services. Such approaches should be used in the wider scale-up and evaluation of POPS services in the future.

SUMMARY BOX:

What is known?

Postoperative outcomes worsen with increasing age. Services using Comprehensive Geriatric Assessment (CGA) methodology throughout the perioperative pathway demonstrate improvement in postoperative outcomes. Despite clear standards of care recommending assessment by a geriatrician in high risk surgical groups, implementation of geriatric medicine services in routine surgical care (other than hip fracture) remains limited.

What is the question?

Is it possible to effectively and sustainably translate an established model of geriatrician-led perioperative care (Perioperative medicine for older people (POPS)) from a tertiary centre to a district general hospital setting?

What was found?

A sustainable and substantively funded POPS service was established at a district general hospital. Within 18 months the service demonstrated reduction in length of stay and readmission rate, and improvement in patient and staff related outcomes.

What is the implication for practice now?

Quality improvement methodology should be used to facilitate the wider systematic scale up of sustainable POPS services.

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Figure a: Postoperative medical complications and 30-day readmission rate in emergency general surgical patients

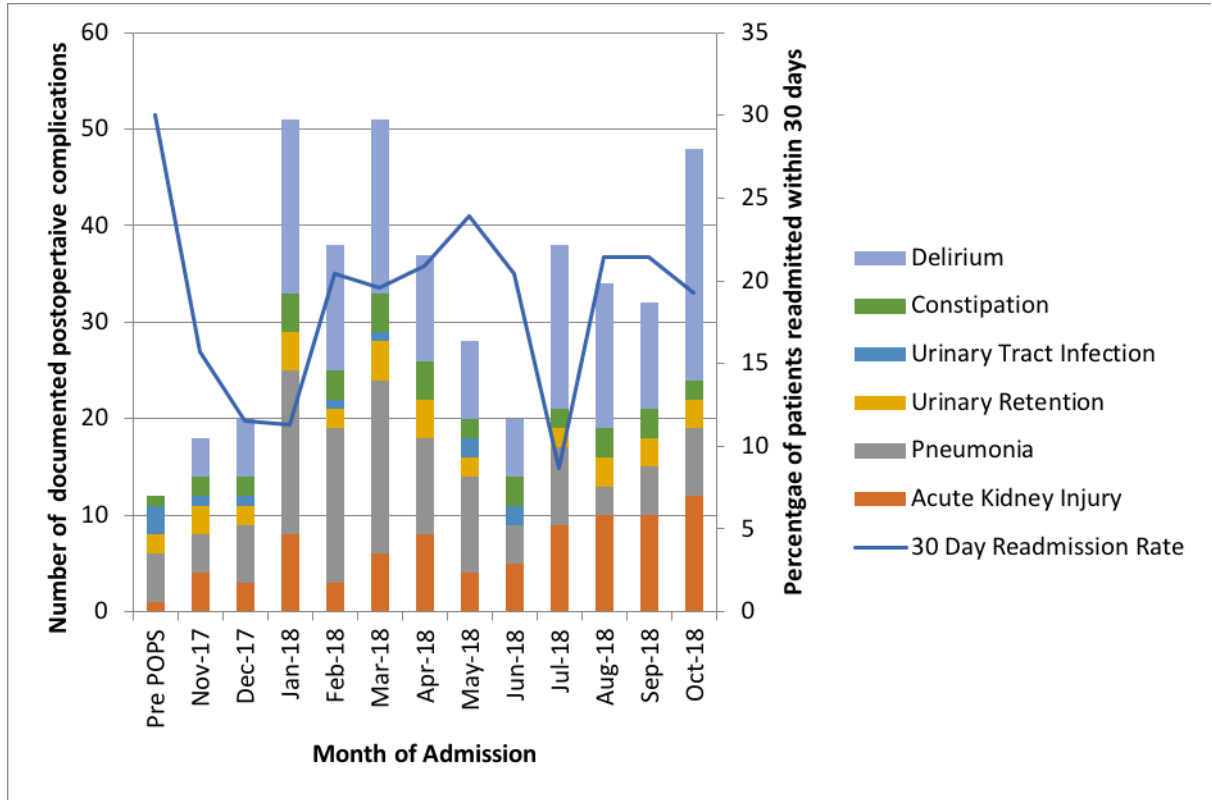


Table 1: Summary of evaluation KPIs and associated improvement steps over time for POPS@DGT scale up

Improvement workstream	Timeline Oct 2017 – Sept 2018												Improvement steps to facilitate translation	
	O	N	D	J	F	M	A	M	J	J	A	S		
Ensuring readiness for change (pre-implementation)														<ul style="list-style-type: none"> Stakeholder interviews to gauge readiness for change Regular attendance at board meetings Establishment of perioperative working group Publicity (intranet site, articles, posters) to spread information and understanding
Service user involvement														<ul style="list-style-type: none"> Patient and carer events Patient surveys
Establishing POPS@DGT outpatient service (early implementation)														<ul style="list-style-type: none"> Process-mapping with different stakeholder groups to inform adaptations for local context Surveying staff to aid the establishment of referral criteria
Establishing POPS@DGT inpatient service (early implementation)														<ul style="list-style-type: none"> Introduction of CGA process to surgical ward Introduction of standardised collaborative care pathways e.g. head injury pathway PDSA cycles to establish MDM on surgical ward Establishment of collaborative working groups e.g. delirium working group Junior doctor led QI projects
Embedding POPS@DGT inpatient service (maturing implementation)														<ul style="list-style-type: none"> Introducing induction session with surgical juniors Introducing teaching sessions with surgical juniors and foundation doctors Pop-up ward nurse education sessions Introducing informal teaching into the MDM Coproduction with patients and carers to improve the inpatient experience

<p>Embedding POPS@DGT outpatient service (maturing implementation)</p>													<ul style="list-style-type: none"> • PDSA cycles trialling ways to refer to POPS clinic • Coproduction with patients and carers to improve the outpatient experience
<p>Quality assuring POPS@DGT inpatient service (sustained implementation)</p>													<ul style="list-style-type: none"> • Run charts to review performance • Refining CGA proforma to improve documentation and communication • Collaboration between clinical and coding teams • Staff surveys to improve induction sessions and teaching sessions
<p>Quality assuring POPS@DGT outpatient service (sustained implementation)</p>													<ul style="list-style-type: none"> • Run charts to review performance • Presentations at departmental meetings to review impact and explore improvements

Table 2: Implementation process of POPS@DGT: Barriers & Enablers

Challenge	Enablers	Barriers
<p>Achieving organisational readiness for change</p>	<ul style="list-style-type: none"> • NHS England money available to pump-prime project funding • Resources i.e. staffing in place • Clinical and implementation expertise on-hand from GSTFT • Chief Executive with belief in benefit of service: “the right thing to do” • Success in National awards i.e. shortlisting for BMJ* and HSJ** awards, raising trust profile 	<ul style="list-style-type: none"> • Negativity regarding the likelihood of investment in new projects resulted in weak belief amongst clinical staff in their ability to deliver change, and therefore poor collective commitment to change
<p>Achieving individuals’ readiness for change</p>	<ul style="list-style-type: none"> • Some staff perceived current service as not adequately addressing needs of older patients, generating desire/tension for change. More pronounced amongst nurses and AHPs*** • Sessions for clinical and management staff demonstrated purpose of service and potential improvements, setting a shared vision • Proactive engagement of staff throughout implementation process (through conception, introduction, and improvement work) facilitated ‘buy-in’ • Individuals with prior experience of working with similar models of care in other centres were early acceptors and advocates of service 	<ul style="list-style-type: none"> • Some staff perceived current service as working adequately, generating limited desire for change. More pronounced amongst doctors. Example comment “We managed before you” • Some individuals described introducing change as synonymous with introducing more work, leading to reluctance to engage • Service implementation encountered individuals resistant to change throughout. The reasons could not always be understood or defined. Commitment to consistently delivering quality clinical work proved more powerful than other methods of persuasion for this group.
<p>Ensuring acceptability of intervention</p>	<ul style="list-style-type: none"> • The intervention being introduced appealed to clinical staff – “common sense” service with strong patient focus 	<ul style="list-style-type: none"> • Evidence for the service (both published and anecdotal) arose from tertiary centre. Some perceived this as irrelevant due to different context of DGH.

	<ul style="list-style-type: none"> • Active process of engaging clinical staff in implementation process demonstrated desire to adapt service to new context • Early and frequent sharing of outcome data demonstrated efficacy of service 	
<p>Achieving multi-disciplinary working over silo working</p>	<ul style="list-style-type: none"> • Close inter-departmental relationships were already in existence within the DGH setting i.e. Anaesthesia/General Surgery • AHPs and nurses were familiar with MDT meeting model and enthusiastic to introduce it into General Surgery • Education and training sessions for junior doctors and nurses encouraged understanding of and engagement with the service • Regular presentations at departmental meetings (Surgery, Anaesthesia, Medicine) maintained high service profile and led to new opportunities to collaborate with improvement projects 	<ul style="list-style-type: none"> • Achieving buy-in from junior surgical doctors was challenging with a 'Surgery vs Medicine' culture. Initially 'medical' jobs were perceived as lower priority than 'surgical' jobs • Different working patterns hindered streamlined communication between teams, i.e. different handover times / consultant ward round times. • Challenging traditional role definition - i.e. geriatricians offering pre-operative assessment provoked mixed opinions, especially from anaesthetists.