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Legacy of COVID-19 – the opportunity to enhance surgical services for patients with colorectal disease

The ACPGBI Legacy Working Group[†]

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Introduction

The COVID-19 crisis has undoubtedly taken a toll on the care of patients with colorectal disease. Elective services, be that face-to-face contact, endoscopy or operations, all but ceased during the pandemic [1]. As we move into the recovery phase the return to normal care is likely to be slow, with a huge backlog of patients and ongoing limitations to services. Some of the changes in care and new ways of working enforced by COVID-19 will be permanent. However, this ‘legacy’ of COVID-19 is not entirely negative. The pandemic has thrown into sharp relief some of the poorly thought through systems and practices that were in place previously and forced change to certain areas of practice that have proved beneficial. If we can identify, nurture and embed these positive changes there is an opportunity to improve patient care.

The psychology of a crisis is well defined. The initial ‘heroic’ phase is followed by a honeymoon phase, both characterized by clear shared goals and a sense of urgency that energizes the workforce to be focused and productive. The disillusionment phase follows, in which uncertainty about the future reduces any sense of purpose, and productivity falls. Finally, there is the reconstruction phase, in which we begin to revise our goals, expectations and roles and to focus on moving beyond ‘just getting by’ [2–4].

This document aims to define the positive outcomes from the crisis and to explore how the colorectal community can reframe its future direction. It is hoped this will serve as a catalyst to move us swiftly and effectively through to the reconstructive phase and guide priorities accordingly (see Appendix S1).

The patient

Our overarching aim is to improve care for patients. Any legacy from the COVID-19 crisis must clearly have patients’ interests ‘front and centre’ with other factors feeding into this central theme (Fig. 1). We have, at best, only a notion of what patients really want from their health service, and welcome initiatives such as the recently described ‘citizen juries’ [5] to redress this knowledge gap. Nevertheless, we can make some clear suggestions, starting with the realization of the importance of high-value care during the crisis – in other words, the opportunity to make the biggest differences to patient care with the minimum resources available. With reference to colorectal diseases, pre-COVID-19 systems were typically overburdened with huge numbers of referrals of patients whose symptoms, whilst clearly troublesome to them, were not eventually associated with the finding of significant pathology. The ‘old’ paradigm involved invasive and expensive investigation of such patients with a near exclusive focus on the exclusion of cancer – to the extent that the primary reason the patient attended in the first place, namely management of their problem, was often neglected or forgotten. This is a grossly inefficient way of working; it puts patients at unnecessary risk of investigation and has little benefit for those who need treatment for conditions other than bowel cancer. Attempts to rectify this situation, pre-COVID-19, had been limited to small changes such as modified referral criteria to try to control the influx of patients. We now have an opportunity for major and meaningful change. Obvious examples are modifications to the 2-week-wait and straight-to-test pathways. Both are leading to an ever-increasing drain on limited endoscopy resources, a decreasing efficacy in identifying significant pathology as only cancer detection is prioritized and often inappropriate discharge of patients symptomatic from other pathologies. Rapid integration of proven adjunctive diagnostic tools such as the faecal immunochemical test (FIT) in cancer detection pathways will allow more focused high-value care [6].

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Figure 1 Summary of the 'legacy' of COVID19. ERAS, enhanced recovery after surgery; FiT, faecal immunochemical testing; EGS, emergency general Surgery.

Coupled with this high-value care is the concept of 'realistic' and 'personalized' medicine approaches [7]. The clinician should refocus on shared decision-making with the patient when planning investigations and treatment. The risks and benefits of testing or treating should be discussed in detail and the patient allowed to decide what is best for them. This personalized approach can deliver efficiencies that will keep the healthcare system sustainable in the face of rising costs. It requires honesty about expectations, including the description of all alternative treatment options. Patients

may have accepted during the crisis that there was a virtual shutdown of services, but lack of resources is not new and even after the recovery is likely to be worse than in the pre-COVID-19 era.

Given the universal backlog of patients awaiting endoscopy and surgery in the recovery period, there is an opportunity to apply the realistic medicine principle to those who, for instance, have been waiting a long time; they may not need or want the intervention planned at all (e.g. those on polyp surveillance with only a diminutive polyp burden). High-value care must

be inclusive, applying to both suspected and proven malignant diagnosis and to diseases that are less common. For instance, some patients with faecal incontinence had been effectively self-isolating for years before COVID-19 came along and are now at the back of an even longer queue despite having a condition that radically reduces their quality of life.

Another issue highlighted during the crisis was the obvious motivation for patients undergoing elective surgery to leave hospital rapidly. Experience from Lombardy suggests the median length of postoperative stay was reduced by over 1 day, despite a pre-COVID-19 enhanced recovery policy, with no obvious adverse sequelae [8]. Their experience implies we can push the enhanced recovery process even further provided patient motivation can be instilled and there is adequate safety netting.

The health system

Reconfiguration of services

Over many years, and with the best of intentions, several initiatives have been introduced to streamline patient care. Many were scientifically based but political influence and greater patient expectations have not been matched by a resource-constrained National Health Service (NHS). The consequence was overwhelmed services and significantly reduced efficiency. There may be an opportunity to reset and reconfigure some services.

The 2-week-wait referral pathway for suspected colorectal cancer has already been mentioned. Of all patients investigated on the colorectal cancer pathway, only 3% have bowel cancer [9] and the majority of patients with bowel cancer are still diagnosed outside of the 2-week-wait investigation pathway. Add to that the fact that referrals for colonoscopy due to symptoms exceed those through bowel cancer screening by a factor of 7:1 and it is no wonder the colonoscopy services are overwhelmed [9]. Solutions include diagnostic innovations such as the FIT already implemented in the symptomatic referral pathway in Scotland, but also other novel diagnostic tools such as the colon capsule [10].

Working closely with primary care allows the effective delivery of alternative cancer detection pathways. There may be additional ways in which assessment and rationalization of investigations can occur in primary care and reduce some urgent referrals that place pressure on secondary care with little tangible patient benefit. For instance, frailty scoring in the primary setting could identify patients who are never going to be fit enough to benefit from surgery and who would be

better served with palliative input or a more routine surgical opinion. The most frail, for whom surgery is unlikely to be an option, may benefit from a virtual appraisal by the hospital colorectal team, possibly avoiding the need for hospital attendance. If investigation is deemed appropriate, it may be tailored to the individual. CT abdomen/pelvis protocols including faecal tagging alone (minimal preparation CT) in much older and frail individuals, in whom the primary aim is to exclude major pathology, may be more appropriate than subjecting them to full oral bowel preparation [11] whilst remaining mindful of not overburdening radiology services.

A considerable amount of resource goes into bringing frail, elderly patients to hospital for appointments. Political pressures allied with medicolegal concerns have undoubtedly resulted in a more defensive attitude in medicine. There is fear across both primary and secondary care of missing a cancer diagnosis. These approaches will reassure primary-care clinicians and reduce the need for hospital resources and the carbon footprint of the NHS. This footprint could be further reduced by the use of virtual clinics for all age groups as it is increasingly apparent that much of secondary care can be delivered without hospital attendance. Permanent integration of virtual clinics to reduce inconvenience to the patient is an essential component of future patient-centred care [12].

Ready access for general practitioners to specialist advice will further aid stratification of patients at primary-care level. Front-of-door services such as consultant-led 'hot' clinics and telephone advice results in reduced hospital foot fall and more rapid discharge.

Integration of services

Integration is a sensitive subject, particularly when it is taken to mean centralization of services. COVID-19 has brought a sharp focus on preexisting inequalities in quality of healthcare provision as some regions have been able to continue essential elective colorectal services, primarily due to integrated service provision [13]. In view of this, there is now more than ever a compelling argument to move beyond considering hospital walls as a boundary to clinical care and investigating models that view a waiting list by regional population, rather than hospital, to improve outcomes. In many respects, the UK has led the way with national patient registries and publication of colorectal cancer outcomes in the public domain (e.g. National Bowel Cancer Audit), multidisciplinary teams, training (total mesorectal excision, Laparoscopic Colorectal Surgery Programme, Low Rectal Cancer Programme) as well as

data on screening. Both the Republic of Ireland and Denmark have copied these initiatives and further built on them by reducing the number of centres treating rectal cancer [14,15]. Similarly, surgery for advanced pelvic malignancy is carried out in even fewer Danish centres and only five centres perform elective surgery for patients with parastomal hernias in a country of a similar population and size to Scotland. The UK still ranked bottom for colorectal cancer survival in a league table of seven high-income countries in 2019 [16] and compares poorly in terms of commitment to improving outcomes by centralizing expertise. For instance, almost all UK acute hospitals offer rectal cancer surgery but only 85 institutions in England and Wales carry out more than 25 elective rectal cancer resections each year, and just 34 have a caseload greater than 40 per year; too many also claim to carry out pelvic exenteration [17]. The data for ileoanal pouch surgery are even more stark; recent data suggest that in more than 80% of NHS Trusts less than one pouch procedure is performed each year [18]. The data-driven, evidence-based approach to rationalizing services to achieve high-quality care in Denmark has highlighted the lack of progress in the UK over the same time frame.

Barriers to integration are complex and multifactorial. Some fault inevitably lies with the vested interests of healthcare professionals and managers, but political forces also exist where hospital services in any particular constituency are considered to be under threat. The COVID-19 crisis has in some regions, particularly London, removed some of these barriers, allowing a smarter and more rational use of constrained resources. The likely differing speed of recovery in different hospitals strengthens regional solutions to waiting times. Patients appear to be willing to travel to get better care [19]. The possibility of being able to deliver high-value care by a system that integrates care across hospitals is therefore appealing provided there is fair collaboration of hospital managers and healthcare boards. This may be aided further by the digital revolution that has occurred during the pandemic, allowing easier communication between specialists in different hospitals (see below).

There are strong caveats to promoting such a change. It is easy to criticize conflation with COVID-19 and that such integration is the wish of self-serving opportunists. However, resistance to change may be perceived as protectionist, reactionary and blind to quality outcomes for patients.

A final point is that integration of services into regional pathways offers an opportunity to provide some redress for patient groups that, pre-COVID-19, have been commonly disenfranchised from hospital care, either in terms of access to, or wait for, specialist

treatment. Patients with faecal incontinence, other pelvic problems such as rectal prolapse, temporary stomas and stoma problems have already received a raw deal from the NHS in terms of long waiting times. Most will not be excited about returning to a 'normal' that treats them as a 'less profitable' inconvenience in comparison to mainstream disease pathways such as cancer. A separate initiative led by the UK Pelvic Floor Society is developing a report with particular focus on these issues, but the remarks above apply to many bowel diseases that are chronic and difficult to cure.

Emergency surgery

During the COVID-19 pandemic, the number of patients attending emergency departments or seeking help from primary care fell dramatically. Within the surgical community there were widespread concerns about the risks of emergency surgery, based mainly on the Chinese and Italian experiences [20,21].

A key theme of the advice issued by Public Health England, Joint Royal Colleges and Specialty Associations was to avoid unnecessary surgery due to the unknown (at that time) risks of COVID-19. Conservative management of emergency conditions was advised whenever possible, with increasing use of radiological drainage and antibiotics. As we return to more standard management algorithms, the effect of this change on management of conditions such as appendicitis, cholecystitis and diverticulitis is being assessed in a series of national research projects. Initial results suggest it may be safe to continue this more conservative approach in selected individuals [22] thereby potentially reducing patient harm and use of hospital resources.

The workforce

Culture

The culture of the workforce has in many respects changed beyond recognition. In some hospitals, the temporary freedom from bureaucratic norms led to tremendous advances in a short period of time. Examples included rapid procurement, implementation of modern IT hardware and even relocation of whole departments overnight. Remote working was possible and the 'PA counting' attitude was temporarily dropped. COVID-19 highlighted what good teamwork between management and clinical staff can achieve. Progress was built on respect, trust and overall professionalism. Both parties should reflect on this nonadversarial approach, as it was clearly productive. We need to avoid a return to a normal characterized by bureaucratic hurdles and glacial slowness; rather, mutual

trust should continue so that both managers and clinicians can push things forwards. There is also need for honesty in speaking out where clinicians are unable to deliver existing standards of care (e.g. National Institute of Health and Care Excellence) due to resource constraints without fear of persecution for failing to deliver preexisting standards in a constrained environment over which they had no professional control.

The positive cultural changes between clinicians and management have not been universal. In some hospitals, inadequacies have been magnified by COVID-19 with an increase in bureaucracy and paralysis of services due to both clinical and nonclinical management incompetence. There have been instances of surgeons being bullied regarding PPE and perceived risk. The surgical leadership shown by the Royal Colleges working with the speciality societies including the Association of Surgeons of Great Britain and Ireland, the Association of Coloproctology of Great Britain and Ireland (ACPGBI) and the Association of Upper Gastrointestinal Surgery of Great Britain and Ireland has been impressive in providing a joint voice for clinicians to stand behind in this respect, and future close collaboration should persist [23].

Working as a team

The COVID-19 crisis has highlighted the tangible benefits of working in a close surgical team, particularly when providing continuity of care. Communication has been enhanced with more efficient handovers utilizing the resources available within each department. Engagement has happened with all tiers of doctors within the surgical department and has redefined referral pathways with other hospital specialities, moving away from consultant to consultant conversations and empowering all surgical team members to have different and flexible roles.

Although this structure has allowed for much needed moral support, the mental strain on surgeons should not be underestimated. Our leadership traits of organization, emotional stability and a capacity to think fast should naturally place us in a position to respond positively to a pandemic [24]. However, rapid and sustained overload as occurs in a pandemic can lead to burnout, especially if patient outcomes are poor and there has been an experience of loss of control [24]. Whilst we rely on colleagues, family and friends to support us during these times, professional bodies need to consider embedding wellness and mental health into their personnel strategies with immediate effect as the consequences from this pandemic may only just be beginning. This moral injury has still to fully play out and may cause another challenging 'wave' in healthcare.

In many hospitals, restoration of a structure resembling the old 'surgical firm' has been possible with a consultant-led service allowing proper and timely decisions to occur with continuity of care paramount. The concern about such a model is its sustainability and this includes the flattening of hierarchy, which has good and bad points. In the past firms required long hours to generate continuity. In the current model of consultant-led practice with consultant expansion this may not be sustainable in the long term. One option is to consider job planning flexibility, which for many of us happened naturally during this pandemic. Whilst by no means supporting any form of consultant hierarchy, one example of flexibility could be using the experience of the older consultant more wisely and acknowledging that role. Older consultants are more likely to have refined decision-making skills and wisdom to impart to newly appointed colleagues that can facilitate efficient patient care and optimize outcomes. There is a danger that many older consultants move to the psychological disillusionment phase and elect to retire [2]. If not countered this may have dire consequences for the expected workforce gap that is expected in the near future [25]. Ideally a department should use its consultant body to best effect as younger consultants may bring new ideas and innovation in service provision to benefit patients in other ways. Lifelong learning is very much a part of the career surgeon's make-up. We believe that job planning reviews should be significantly restructured to allow flexibility according not only to departmental needs but also to the needs of the individual surgeon at that time. Careers should be considered like chapters in a book. Discussions should include flexible working hours, part-time working, sabbaticals with a culture change that embraces this, rather than the view that long difficult hours is 'just something to get through' because 'we have all done it'. Implementation and demonstration of such a culture change may encourage more medical students to become surgeons and help address the urgent decline in the numbers applying for surgical training.

The importance of stable colorectal nursing teams both on the ward and in theatre has been critical. Our nursing colleagues took great pride in working more closely with us and we with them; this should not be forgotten. The World Health Organization theatre checklist came into its own more than ever before as a means of focusing on the challenges of delivering surgical care in a constrained theatre environment and with a theatre team drawn from multiple backgrounds. In addition, expansion of the nondoctor, nonconsultant workforce is key, allowing colleagues to practise to the limit of their licence. This could be called the 'Special

Air Services approach'; it does not matter what your cap badge or rank, if you are an expert at delivery you can do the job.

Health Education England (HEE) has worked with the Royal College of Surgeons of England to develop a programme to improve surgical training (IST) within the context of the Shape of Training [26]. Concurrently the Royal College of Surgeons of England articulated the importance of the extended surgical team (EST) [27]. Given the experience of both IST and EST over the last 5 years the time is right to recognize their inter-dependence. It is hoped that a combined approach will meet trainees' needs, increase time for training and support the development of the multi-professional workforce. The aim of these changes is to improve surgical care for patients. The COVID-19 pandemic has illustrated the need for a broad-based clinical team with more general clinical skills. Redeployment of surgical staff to support critical care was best facilitated in centres able to provide team members from medical and nonmedical backgrounds. Continuing to enhance the skill mix of the surgical workforce by replicating this model with new roles and advanced clinical practitioners will require financial support but ultimately will benefit surgical trainees and patients. Plans by HEE to formalize this initiative are currently in discussion.

Training

The crisis had, and continues to have, a huge impact on trainees. There have been no examinations or face-to-face educational conferences. Dual consultant operating led to lack of operating experience. Many trainees lost access to training due to relocation of elective major cancer surgery to the independent sector, though this issue is currently being addressed at national level. Endoscopy training completely disappeared and is only just returning for the most senior trainees closest to Joint Advisory Group accreditation. On top of this there are new curriculum changes planned, although implementation of the new curriculum has been sensibly deferred to August 2021.

Training and training systems need to be revised to reflect the needs and skills of its end-users – surgical trainees. Modern-day trainees are innovative, versatile and digitally enabled and need a training system which reflects this. Apprenticeship-based training alone is an outdated modality of training. There needs to be a movement towards delivering the key building blocks of training across a range of trainers and hospitals using a combination of training methods, including simulation, virtual reality, robotics, telemedicine and gaming. Training programmes need to be meritocratic to enable

trainees to thrive and guide their own career pathways, whilst ensuring that the wider needs of the health service are appropriately met. This is essential towards developing a future dynamic workforce with a broad-ranging skills set.

We should recognize and applaud the flexibility and adaptability demonstrated by our trainees during the pandemic. Consultants and trainees alike have gained many nontechnical skills including stress management, support structures and team work.

Innovation

The digital revolution

The COVID-19 pandemic has acted as a catalyst for the advancement of telemedicine and digital healthcare. In just a few months there has been widespread lightning-fast adoption of virtual consultations, meetings and conferencing platforms. The way we now conduct the everyday business of healthcare in terms of meetings for any purpose has changed for the better. Face-to-face meetings could now be reserved for difficult decision-making only when there is a defined and explicit purpose for that approach. We envisage much more efficient use of time as we remove the need for unnecessary travel to attend committee, management, research and educational meetings that were traditionally face-to-face. The etiquette of well-chaired videoconference meetings may lead to them becoming of much greater value than before due to quieter voices having a much greater chance to be heard, especially if attention is paid not just to what is said but what is communicated to the meeting via 'chat' functions [28]. Conferences will now have wider reach for those not able to travel or attend an entire educational event, as recently demonstrated by the entirely virtual ACPGBI 2020 annual conference. Conferences may now be attended live but catch-up on-demand is also readily available. This may help with the fact that postgraduate educational budgets are virtually nonexistent. Nevertheless, the power of peer support and professional interaction will still mandate need for face-to-face conferences but there will be greater freedom and choice in both participation and attendance. Societies who base a significant proportion of their income on revenue from annual events may have to rethink their financial model.

The advent of this new era of digital technology will perhaps deliver the greatest difference for the patient–surgeon interaction. Clearly, there are patients who need to be seen in person: symptoms and signs to be diagnosed, difficult decisions to be made with patients and their families and some who will not be able to

embrace the technology. However, getting to the hospital, finding somewhere to park, locating the clinic and waiting to be seen often involves a half day out for many patients. When this level of effort is just for a 10 min follow-up consultation or explanation of normal results it is impossible to justify during a time when we are trying to reduce footfall in our healthcare institutions and deliver sustainable healthcare. Initial concerns that the elderly will be disadvantaged by not being able to use the technology have been unfounded as baby boomers became 'baby zoomers' during lockdown to keep in touch with friends, children and precious grandchildren. The expansion of technologies into preassessment, prehabilitation and rehabilitation indicates that the time has come for a sea change in the way we deliver perioperative healthcare services.

However, it is noted with regret that the implementation of digital technology has been difficult in some hospitals. The existing IT infrastructure has been simply inadequate, reflecting years of under-funding. Computers without a camera, out of date browsers, firewall blocks on downloading software and updates and long waits for IT services have been common experiences. Given the clear advantages of digital medicine, it is essential to remedy these deficiencies as a top priority. Without investment in connectivity the digital revolution will grind to a halt.

There is also a potential minefield of data protection and legal issues to consider. The General Medical Council (GMC) published a report entitled 'Regulatory approaches to telemedicine' in January 2018 [29]. The executive summary noted that the requirements applicable to the provision of telemedicine usually include ensuring the same standard of care as that of face-to-face healthcare, obtaining patient consent for telemedicine in provision of medical services and confirming patient identity. Nevertheless, it is clear that telemedicine brings so much potential to the future of surgical care that it is imperative not to miss the opportunity to embrace and implement it into everyday practice.

Research

Clinical and translational research forms the cornerstone of the surgical knowledge base and is fundamental to improving patient outcomes. Traditional research methodology provides rigour but the recent crisis has highlighted the limitations of evidence-based medicine. During the crisis, evidence was lacking in almost every important decision faced by surgeons and healthcare leaders. Researchers, clinicians and journals have worked to accelerate the pace of progress, driving our

traditional research models more rapidly to provide an early evidence base on which to base clinical recommendations. This accelerated process has resulted in an evidence base of variable quality, both high and low, with some lamentable missteps that were fortunately quickly and publicly acknowledged by both authors and journals [30]. Despite the obvious challenges, a positive impact of the COVID-19 pandemic has been the removal of some barriers to research, resulting in a more dynamic research environment characterized by a more streamlined ethical approval framework and greater collaboration. A healthcare system that values learning from research endeavour must retain and embrace swift mechanisms to foster and champion a research climate that allows researchers to move at pace through traditional administrative research funding and ethical approval bureaucracy. Many researchers have justifiably used the unusual opportunity of the natural experiment provided by COVID-19 to pursue large-scale observational research on recommended changes from standard practice through prospective cohort study designs. Although cohort studies are considered internationally to be low risk, they still typically require extensive paperwork and interminable delays for approval in current systems but this has been rapidly overcome in adversity, and should not revert to 'standard practice' hereafter. Several colorectal researchers have made observations on the utility of various alternative treatment strategies (or absence of usual treatments) in a timescale that would be unimaginable before COVID-19, and we should seek to continue this legacy of rapid implementation of necessary research studies.

Randomized controlled trials retain an important role in advancing knowledge of best practice but surgeons must also embrace and adapt rapid cycle methodologies to increase our capacity to learn collectively from rapidly changing circumstances in varying real-world scenarios [31]. COVID-19 has precipitated a renewed appreciation of research activity with engagement from clinicians not ordinarily involved in clinical research. It is imperative to utilize the opportunity to expand the large body of research-active surgeons who collaborate to set priorities and develop test sites for evidence-based change in the way we practice. While this body of work remains largely invisible in the surgical literature, surgical journals and editorial boards have an important role in developing a new research culture that recognizes the work of surgeons who lead change. Research that ensures that surgical practice over the coming decade is as safe as possible and that focuses on outcomes that matter to patients must be supported [32].

Concluding remarks

The expression ‘never let a good crisis go to waste’ is apposite for our time. There was a crisis and we as a community of colorectal surgeons weathered the storm, were pushed to the front and got on with it. The majority stepped up and were creative and responsive. This was particularly the case when not managed by sessional working, just by getting the job done professionally and doing the right thing. There was fulfilment of working in a cohesive team. Despite the dangers involved, many colorectal surgeons, trainees and nurses have thrived in the atmosphere of just being allowed to work in a professional manner.

The inadequacies of many aspects of the current healthcare system are now exposed, papering over the cracks will no longer be acceptable, and the need for fundamental change to provide a patient-centred approach should now be realized with reorganization and integration of services. Innovation has enabled aspects of care to be delivered more conveniently for patients and should be embedded in our vision for future colorectal care. Training has suffered, but opportunities abound to change the ethos and context of training to suit the demands of modern trainees and their trainers.

In colorectal surgery we are not alone as a speciality in recognizing that healthcare workers have suffered during COVID-19. While it is acknowledged that the positives highlighted here are far from ubiquitous, we hope that we may collectively learn from and implement some of the amazing opportunities that have been presented. If we translate these views into improvements in delivering patient-centred realistic personalized care, research, professionalism and sustainable practices we set an impressive blueprint for delivering a future of enhanced healthcare in colorectal surgery.

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Conflicts of interest

The authors have no conflict of interest.

Author contributions

NSF conceived the project. NSF and SRB developed methodology, administered, resourced and supervised the project. SRB provided the first draft of the manuscript. TA, AB, SRB, SC, FD, DH, CHK, DM, SM, NS, GT, JT, CW, AW and NSF contributed to investigation, analysis, writing, reviewing and final editing of the manuscript. NSF prepared the summary figure with feedback from other authors. RA wrote the lay summary with the support of ACPGBI Patient Liaison Group.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Patient lay summary.