The pop-up research centre – Challenges and opportunities

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Abstract

Objectives

This article sets out to describe the concept of the “pop-up” research centre as a means to promote and develop radiography research locally, nationally and internationally, and to empower professional colleagues to set up similar initiatives in the future.

Key findings

A detailed overview of the development and management of “pop-up” research is provided based on the experiences of the authors, including specific examples. Matters such as study design, approvals, equipment and software, environment, participant recruitment and management, research teams and activity costs are discussed. Quantifiable benefits of “pop-up” research such as resultant peer reviewed publications, development of researchers' skills and potential collaborations are described. A number of “soft skill” benefits are also apparent and include enhanced organisational profiles, team building and the development of leadership skills.

Conclusions

“Pop-up” research centres are a valuable option for conducting research and offer the radiography profession an achievable mechanism to increase and enhance research activity. However, careful planning and execution are essential.

Introduction

Medical imaging is, fundamentally, reliant on decision making. Despite the emerging evidence that machine learning can contribute in many ways,[1] radiographers, radiologists and other imaging professionals continue to make certain crucial decisions. For instance, imaging professionals must decide if examinations are justified, optimise patient imaging, decide whether images produced are of an acceptable standard, and consider how to communicate the findings.

Decisions requiring human reasoning are at the core of the imaging process, and therefore imaging research often requires human participants. However, recruiting sufficient numbers of busy clinical staff to take part in research can be a significant challenge for researchers. This problem is exacerbated where research requires equipment or an environment that is not easily transferrable across multiple sites. Accessing sufficient participants to run a study can be prohibitively difficult, costly and time-consuming when relying upon the availability of potential participants during clinical service delivery hours and across clinical centres.

In this article, we describe “pop-up” research centres as a solution for this problem. In these centres, the research is brought to a single large gathering of potential participants, rather than the other way around. We have been successfully gathering data through this mechanism in different settings since 2006. Based on our experiences, “pop-up” research centres can not only facilitate researchers in accessing large numbers of research participants, but also offer a wide range of other benefits and opportunities.

We aim in this article to:

- Outline the concept of the “pop-up” research centre
- Advise on suitable research types and experimental design for the “pop-up” setting
- Describe the benefits of “pop-up” research centres
- Inform interested readers on ways to access existing centres/schemes
- Empower researchers to set up their own initiatives

In doing this, we draw both heavily on the experiences we have gained as participants in, and organisers of, “pop-up” research centres.

The importance of the involvement of radiographers in research has been recognised for many years has been increasing,[2–4] although there continue to be calls for further development and development of a research culture within the profession.[4–6] It is our aim that this will inspire others to perform high-quality studies and the information provided will assist further expansion of this activity across radiography research teams internationally.

What is a “pop-up” research centre?

Any “pop-up” initiative by its nature is temporary. It appears for a period of need or opportunity, then disappears again. A “pop-up” research centre, unlike traditional laboratories, appears at a location close to a population of participants that are gathered for a specific activity who can be invited to engage in the research studies in a time-managed manner. Successful medical imaging “pop-up” research initiatives already take place at large conferences for example at both RSNA and ECR. However, local and national venues or events might also fit under the remit of “pop-up” research centres and the information provided in this paper is relevant to a broad spectrum of research centre scenarios.

Past and current examples

Radiography-lead “pop-up” research centres date back over 15 years. An early example was the decade-long collaboration with the American Board of Radiology (ABR) pioneered by Patrick Brennan (University of Sydney, Australia) and the ABR. Prior to the introduction of computer-based ABR examinations, radiologists acting as board certification examiners gathered at a single hotel for up to a week, biannually, to perform oral examinations. The ABR provided a room in which research could be conducted, and examining radiologists were invited to participate in short research projects during their breaks. Over the years, several universities conducted research at the ABR centre; all research activity was approved by the ABR in advance and promotion of the research activity was circulated to the examiners. The response from participants was overwhelmingly positive, and hundreds of radiologists generously participated. Similarly, Patrick Brennan established a similar relationship with the Royal Australian and New Zealand College of Radiologists (RANZCR), in which RANZCR provided a research space for perceptual experiments.

In recent years a Medical Image Perception Lab, funded by the NIH National Cancer Institute and led by Professor Jeremy Wolfe (Harvard University) and Professor Todd Horwitz (NIH National Cancer Institute), has been run at RSNA and has provided a valuable setting for image perception research. In 2018 a total of 487 participants contributed to such projects (personal communication, M. Nartker, 2019). At RSNA 2018, a research experiment requiring radiographer participation (rather than radiologists) was offered for the first time.

Aware of the potential to drive radiography research and improve accessibility of research involvement for our profession, a “pop-up research hub” event was proposed to the European Federation of Radiography Societies (EFRS) by University College Dublin. The inaugural EFRS Radiographers' Research Hub took place at ECR 2019 and attracted 249 participants from over 30 countries participating in seven radiography-focussed projects resulting in 437 separate contributions to research.

The research initiatives mentioned above have resulted in the publication of large numbers of journal articles and conference presentations for radiographer authors, along with contributing to data collection for many PhD students, including radiographers. While it is difficult to establish an exact figure, we estimate that radiographers have authored approximately 100 full-length journal articles/proceedings papers, a similar number or higher number of conference presentations, using data from “pop-up” centres. While studies that have specifically targeted radiographers as participants have been fewer than those targeting radiologists to date, there have been several initiatives in the last year and multiple publications and conference presentations are expected to arise from them.

The authors of this paper have all been involved in running projects at multiple centres described above and in leading the overall management of these initiatives. It is on this basis that we now describe key areas requiring consideration in the development and planning of “pop-up” research centres and reflect on our experiences.

Study design and suitable study types

"Pop-up" research centres offer opportunities for a broad spectrum of research methods to investigate, addressing a diverse range of research questions. For example, studies using data gathered at "pop-up" centres have investigated areas from image perception and factors influencing diagnostic accuracy[7–10] to CT dose optimisation[11]; from avoiding wrong-patient errors[12] to evaluating factors influencing research methods/findings[13,14]; from assessment of technical knowledge[15] to the impact of displays on examination.[16]

To date, the most common study types we have encountered have required professionals to review images to identify pathologies, rate a feature, test the image viewing environment or evaluate image quality. However, one could potentially also employ surveys, focus groups or interviews (once any bias introduced by sampling is considered), investigations of radiographer practice, draw-and-write methodologies and various other approaches – an array of quantitative and qualitative methods may be suitable. Care should be taken to consider whether bias could be introduced to studies by virtue of the type of participants attending the event (for example, radiographers at a particular training event might have different levels of training, experience of interest in certain areas than the "average" population in their profession).

The nature of "pop-up" research centres requires careful research design. Participants are on site for a different reason - e.g. conference attendance – and will be taking time away from that purpose to volunteer. Therefore, for studies to recruit large numbers of participants, studies should ideally be both short and engaging to complete as well as scientifically rigorous. To create a truly engaging experimental design takes time and can involve rewarding the participant with some new knowledge or insight into their own performance. This encourages positive word-of-mouth advertising and repeat visits.

The balance between time-per-participant and participant numbers should be considered in advance for any study design. For example, observer performance studies which are commonly analysed using a form of receiver operating characteristic analysis or visual grading analysis, one can usually achieve the required statistical power through either fewer participants viewing larger sets of images, or more participants viewing fewer images. However, recruiting even a modest number of participants to assess and rate large numbers of images can be challenging and bring with it its own difficulties. Therefore, the "pop-up" model of more participants/fewer images might be a good option to achieve sufficient power. At the ABR examinations, we ran many observer performance studies, typically including only 30–40 images in a set and allowing radiologists to complete a focus task in about 10–15 min – comfortably achievable during a break of lunch period.

It is important to consider participant instructions; "pop-up" research centres may involve several researchers running the same study, and participants from different language groups, professions and backgrounds. It is therefore wise to have concise written instructions next to each research station. The use of appropriate language is required (for instance, consider whether terminology differs between countries where participants may be international) and the need to keep text to a minimum is important, particularly at international conferences where participants may not share the researchers' first language. The incorporation of a training set of images or tasks can also be provided to allow participants become use to the research tool without negatively impact of the study findings.

Ethics and study approvals

As in any other research setting, "pop-up" research involving human participants requires appropriate Human Research Ethics committee approval or equivalent, and researchers should be cognisant of any ethical dilemmas raised by their study designs and the circumstances of the pop-up centre (for example, studies conducted abroad may require consideration of local regulations, customs etc.). An in-depth review of research ethics is beyond the scope of this paper, but ethics are of course of paramount importance.

Proposed research must also be approved by the professional organisations or societies facilitating a "pop-up" research centre. This ensures that the research aims, content and recruitment are appropriate to the research facilitators and aligned with their mission. It is also important that the host event/organisation are aware of the project details in sufficient time to advertise it to their membership in advance if applicable.

Equipment, software and environment

Suitable environment, equipment and software are, of course, essential for any research project; however, the "pop-up" research setting can introduce an added layer of complexity. The equipment needed will vary with experimental design from the straightforward and usually available on-site (tables and chairs) to the more challenging (multiple computers, medical grade displays) or highly specialised imaging equipment. The special concerns include deciding how much is needed, of what specification, and how it can be sourced and transported.

Where larger equipment is needed, research teams may need to ship it or arrange some other means of getting a set on site. It is worth asking whether the event organisers, a local company or other source might be able to loan equipment, or offer a cost-effective rental. Equipment vendors are often also generous; however advance negotiation is important for larger conference venues as companies plan shipping many months in advance.

If shipping is necessary, we cannot emphasise enough the importance of planning early and allowing extra time for problems to be addressed; despite experience and advice, we have of multiple occasions been confronted with unforeseen shipping and customs problems which can be costly in terms of both time and money. Ensure that all equipment is shipped in plenty of time, track the delivery carefully, and allow ample time in advance of the opening of the

“pop-up” centre to address any issues – this may require one or more team members to arrive on site early, but we believe the additional cost in accommodation/subsistence is minor when compared to a worst case scenario of equipment failing to arrive as anticipated.

“Pop-up” venues in countries away from your home institution require attention to small details such as electrical socket availability. There may be multiple pieces of equipment requiring either a constant supply or at least intermittent battery charging; knowing how many sockets you can access or reasonably (and safely) make available via extension cables and international plug adaptors in advance can mitigate against unexpected problems when arriving on site. We also urge caution in bringing overloading power requirements – one particular power-hungry “pop-up” centre we attended had two power failures in the study room simply because the current requirements for all the equipment could not be met.

Many software packages used in research experiments require access to the internet. Even if this access is only for the purposes of validating licences, this can cause issues. It is important to test whether the experiment will work in the absence of internet. If experiments require internet access, one may have to negotiate access to the internet with the conference venue. This can be very straightforward, but in some situations might prove very costly.

Because “pop-up” research centres are not usually in buildings designed for radiological image viewing, research teams for whom viewing conditions like ambient lighting are important have an added layer of complexity to consider. If one can view the location in advance this is ideal, but not always feasible – in this case, we have always found early contact with event organisers to be extremely helpful. A little ingenuity and Do-it-Yourself is sometimes also required; we have found that low-tech options such as duct tape and dark craft paper or dark bed sheeting can be cost effective method of shading windows (although it must be ensured that an appropriate approach to health and safety is taken at all times). Thought needs to be given to printing facilities also; onsite conference printing may be expensive, so it is important to plan all required printing in advance. Additionally, considerable thought needs to be given to how data will be collected and stored. Flexibility and problem-solving skills are certainly required by the team organising a research pop-up centre!

Participant management

Due to the nature of “pop-up” centres, they tend to have times when they can be extremely busy, with multiple volunteers arriving at the same time. In these cases, it is in the interests of the researcher to be able to accommodate as many as possible. This poses the conundrum of weighing the costs of supplying enough resources (e.g. people, equipment, software licences etc.) to run multiple iterations of a study in parallel with the benefits of larger participants numbers and positive participant experiences – turning away volunteers can be demoralising for both researcher and potential participants. Our experience suggests that putting thought into streamlining equipment/space requirements can be helpful in managing this. For example, where data are to be collected in digital format, it can be worth considering what equipment specification is truly needed and how this will impact how much can be brought to the research centre. For example, running studies on handheld devices can allow multiple devices to be transported in standard aircraft baggage allowances, while multiple computers and displays could cost large sums of money to transport or rent. Where internet access will be reliable, a web-based version could even be completed on participants' own devices if appropriate for the study.

Researchers should consider any issues particular to their own study design; for instance, in qualitative studies, is privacy a potential issue, and can it be suitably addressed in the setting of the pop-up centre?

A sufficient number of researchers are required to support a “pop-up” research centre, and professionalism is fundamental. The set up and dismantling of a hub can be a significant task and needs to be accounted for. To facilitate rest breaks and possible other commitments (e.g. researchers' involvement in the hosting event or conference), administrative tasks etc. a substantial research team may be required depending upon the size of a planned pop-up research centre; of course this can (with adequate forward planning) be shared where multiple institutions are running experiments at the “pop-up” centre.

Recruiting participants

The success of a “pop-up” research centre rests of its ability to attract volunteers. The approach to participant recruitment must be clearly communicated clearly both to the host event's organisers and in ethical review, and practice on site must follow the approved approach.

Visibility and advertising are key in attracting volunteers. Support from the organisers of the event at which the centre will take place is central to achieving this; early planning and a professional approach are needed. The physical location should ideally be one that is both highly visible to the target audience and easily accessible. For example, the inaugural EFRS Radiographer's Research Hub at ECR 2019 was located in a room next to the Radiographer's Lounge area, where radiographer conference delegates were likely to spend time. The support of relevant professional societies in promoting the research activity on their booths can allow a further reach out to conference attendees. The permission of conference organisers to promote at the close of scientific sessions can also assist in participant recruitment.

Advertising of the centre can take place through a range of methods, and is worth an investment of time, effort and sometimes money. A good working relationship with the organisers of the hosting event may facilitate advertising to registered delegates before the event; however, effective on-site recruitment is essential. Pop-up centres have also increased visibility through high-impact t-shirts worn by researchers (Fig. 1) or other visible signs e.g. badges for participants advertising their participation. The “ribbons” which are distributed at RSNA for participation at various activities including the Image Perception Lab, for instance, prove very popular.

Figure 1 PhD student Catherine Chilanga and Dr Kristin Bakke Lysdahl (PI) of Universitet I Sorost-Norge at the EFRS Research Hub ECR2019.

alt-text: Figure 1

Our experience has been that word of mouth is one of the most effective ways to attract participants – either through researchers speaking with potential volunteers, or through volunteers relating their experience to friends or colleagues. As in any other setting, researchers must be able to confidently and clearly explain the goals of the centre and research projects taking place, and should be prepared to do so.

Studies which offer some form of feedback or a score are also, in our experience, more attractive to participants, and encourage further participation and positive word-of-mouth advertising. For example, in experiments involving pathology detection, simply providing a percentage correct or simple area under the ROC curve immediately after participation (which of course requires a software which makes results available in a suitable format) adds a layer of interest to a study and makes a talking point which participants carry out to the rest of the conference, meeting or event. Participants reporting that "*it was fun*" is very useful, provided of course that the scientific integrity of the experiment is not compromised.

Offering physical or financial incentives for participation may be possible in some circumstances; however, it may present ethical issues, and researchers must ensure that they practice within the restrictions of their institutions and the law. Certificates of research participation are one simple option participants may appreciate, particularly as Continuous Professional Development (CPD) forms an integral part of professional practice across many international radiography and other professional societies.[17] Professionally certified activity can fulfil annual CPD requirements; however, advance liaison with those accrediting activity is required. A good example is the University of Sydney collaboration with RANZCR; participants in studies could receive a substantial contribution towards their annual continued professional development requirement.

Costs

It is probably clear to the reader by now that running or taking part in "pop-up" research centres can incur significant costs (Table 1).

Table 1 Summary of potential "pop-up" research centre costs.

alt-text: Table 1

Researcher time (salaried individuals attending will obviously be withdrawn from other duties while attending)
Researcher costs (flights and transport; accommodation; subsistence; possibly conference registration fees etc.)

Equipment/software costs (purchase/rental; transport)
Advertising and marketing (flyers, posters etc.)
Miscellaneous costs (international phone calls, international plug adaptors, stationary, batteries)

While these costs may seem intimidating, however, in our experience they represent value for money; the cost in researcher time to complete equivalent studies with similar levels of rigour and participation in a different setting would often be prohibitive, if the research would be possible at all. The research can also be useful in supporting grant applications and producing publications, which can attract funding to institutions and research groups, mitigating the costs and potentially attracting more postgraduate students or researchers. The “soft” benefits of participating can also be highly valuable, although hard to attach a monetary value; these are discussed more deeply later.

Personal and team challenges

As well as the technical challenges outlined above in terms of experimental design, organisation and set-up, the actual running of “pop-up” projects requires a huge amount of teamwork and a positive attitude. Invariably, all research projects hit snags, and these can be amplified in a time-pressured situation. The ability to think on one's feet and solve problems quickly is therefore invaluable. Away from of the supports of university or home institution IT services, researchers need to have a good working knowledge of the connectivity of equipment. At a basic level, researchers need to ensure they can dismantle and reassemble the research equipment. Forgetting to pack a wire to connect an essential piece of equipment can mean last minute visits to technology stores.

Furthermore, “pop-up” research initiatives tend to be intense experiences, often involving long hours over several days. Both individuals and team leaders should be conscious of the effects of fatigue,[18] and that mutual support can assist in maintaining momentum. It has also been suggested that the effects of fatigue on problem solving are reduced for teams versus individuals,[19] so maintaining a team approach is helpful.

Where researchers from more than one team or institution are running projects at the same event, equitable sharing of time and resources are paramount; this can be managed in different ways, but should be transparent and planned in good time by the organisers. For example, in the Medical Image Perception Lab at RSNA, multiple booths with equipment are available and research teams are allotted space and time, with a central team assisting in directing volunteers to appropriate projects fairly. In other initiatives, it may make sense for researchers to assist one another, especially during times of high participant traffic. In any case, the organisers on the ground should takes steps before and at the event to promote a sense of camaraderie rather than competition, and for individual researchers to take initiative also. Strong leads with collaborative approaches are essential for centres involving multiple research teams. The involvement of different groups is also essential to develop research activity in our profession and those teams with strong research ability have a responsibility to assist the development of others.[20]

Benefits of participating in “pop-up” research initiatives

We would not be writing this article if we did not believe that the benefits outweighed the investments required to attend or run “pop-up” research centres. Some benefits can be measurable – for instance, grants won based on pilot data from experiments, numbers of journal publications and presentations, number of PhD studies completed etc. While some of these will be achieved through undertaking research in any setting, “pop-up” centres can facilitate faster completion of studies, or larger-scale studies, which might not otherwise be possible. Other benefits are intangible, such as experience, contacts with other groups and individuals, camaraderie and inspiration. These “soft” benefits are indeed, sometimes the most rewarding. While they are, of course, not exclusive to pop-up research, our experience has been that working closely with others, often away from everyday distractions etc. can be particularly fruitful in this regard. Some of the benefits the authors have gleaned from our experiences attending or running pop-up centres are summarised in Table 2.

Table 2 Summary of “pop-up” research centre activities.

alt-text: Table 2

Quantifiable Benefits	“Soft Skills” Benefits
Peer reviewed journal publications and conference outputs	Raised profile of our organisations
Completion of research which form chapters within PhD studies	A wide array of professional contacts made either with fellow researchers, organisation and vendors or participants, which have been extremely valuable and can lead to further collaborations
Development of skills and research capabilities	Reinvigoration of enthusiasm for research and inspiration for new projects
Exposure to the research methods of other groups	Leadership opportunities for staff

Large data sets that can be mined away from the “pop-up” research centre	Excellent team-building opportunities, strengthening research teams

Summary

We would like to finish with a final thought for those considering getting involved in research in any form, based on our involvement in “pop-up” research centres. While we have had consistently very good experiences at events organised by ourselves and others, with hugely supportive participants from across a range of professions, we particularly would like to note the remarkable response of radiographers to research demonstrated at the recent inaugural EFRS Radiographers' Research Hub. Over 10% of all radiographers/radiography students attending ECR took part in studies, and some in several, yielding an exceptional 437 study participations. This is an overwhelmingly positive rate of volunteering and a testament to the appetite amongst radiographers for development in the profession and expansion of our evidence base. To those who took part in this and other initiatives – our sincerest thanks once again. And to all readers – we hope that you are as inspired and encouraged about the future of radiography research as we are, and that the pop-up research centre might create opportunities for your further involvement.

Conflict of interest

None.

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