Innovation Fund Project

Final Report

Prepared by: The Fred Hollows Foundation

Summary

Name of Organisation: The Fred Hollows Foundation
Project Title: Can using the BOOST app improve cataract surgical outcomes? A prospective study
Project Start Date: 1st June 2018
Project duration: 24 months (including 6-month no-cost extension to 30 June 2020)

Innovation Idea

- Cataract BOOST (Better Operative Outcomes Software Tool) is based on the PRECOG study conducted at hospitals in 40 LMICs, showing that measuring vision immediately after surgery is a valid indicator of the quality of cataract surgical outcomes.
- Developed by a consortium of NGOs and Aravind Eye Hospital, BOOST is a free, simple-to-use app for computers and android smartphones which will guide users and hospital administrators in recording, analysing and benchmarking their results against those of global users in the Cloud.
- Assessment tools provide a vital continuous quality improvement (CQI) opportunity to build surgical capacity, and existing software is cumbersome and inaccessible. BOOST addresses a need for a simple and accessible cataract surgery outcome monitoring tool, and introduces a new opportunity to create a global dataset of outcome data.

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1. Background

Un-operated cataract remains the leading cause of blindness worldwide. Despite significant efforts to increase cataract surgery rates worldwide, a large backlog in cataract cases remains, particularly in developing countries. Quality of cataract surgery and resulting patient clinical outcomes and satisfaction are key determinants of the demand and uptake of cataract services. Despite the critical importance of good surgical outcomes, poor outcomes are still common in many settings and the practice of measuring and using outcome data to improve surgical results remains sub-optimal.

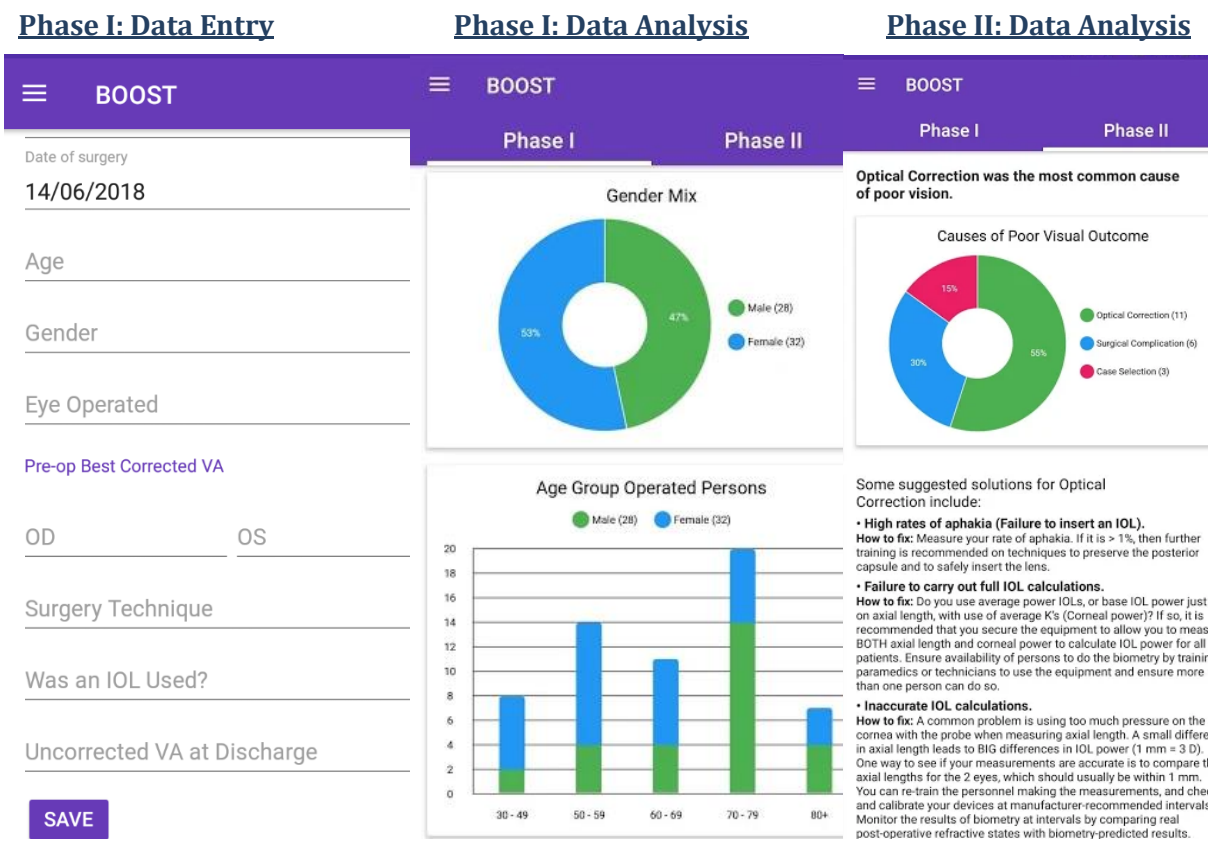
The World Health Organization (WHO)[i] recommends that 80% of patients should have uncorrected visual acuity of ≥6/18 in the operated eye following cataract surgery as an indication of good surgical outcomes. Actual reporting of cataract surgical outcomes varies widely across surgical centres internationally,[ii] and many countries where data is available are not achieving this target.[iii] Visual acuity after cataract surgery has traditionally been measured 6 to 8 weeks after the operation, since wound healing can change glasses power and substantially improve vision. Hence, hospitals and cataract surgical centres with low rates of attendance at follow-up appointments may struggle to collect data needed to assess performance against the WHO standards, let alone achieve those standards.

The BOOST app

To respond to the demand for a low-cost, user friendly software tool that allows surgeons to measure and compare their surgical results with those of other practitioners, [iv] a consortium of eye health stakeholders developed Cataract BOOST (Better Operative Outcomes Software Tool) with support from Standard Chartered Bank's Seeing is Believing (SiB) Innovation Fund. BOOST is a free, simple-to-use app for Android smartphones, and computers which guides users through two rounds of data collection.

Quality assessment in BOOST is achieved through a two-step process using a mobile (Android) or desktop application. During Phase I, uncorrected (without glasses) visual acuity (VA) is recorded 0 to 3 days after surgery for 60 consecutive patients. This allows outcome quality (proportion of patients with good [≥6/18] and bad [≤6/60] VA) to be presented alongside benchmarks. During Phase II, surgeons record the causes of poor outcomes (categorising poor outcomes as relating to refractive problems, surgical complications, or inappropriate case selection/co-morbidities) from at least 20 patients returning for follow-up appointments 4 weeks or more after surgery with presenting VA of 6/60 or less. The app then offers tailored suggestions to surgeons regarding how they might improve their surgical practice, by addressing the main issues they are experiencing and that affect their results. Simple, visually appealing reports (see **Figure 1**) are automatically generated once minimum data collection requirements are met, and results can easily be exported via email or direct download.

Figure 1: Examples of the BOOST interface and feedback functions:



Key Achievement: The Global BOOST Study

Following its global launch at the 2018 World Ophthalmology Congress in Barcelona, partners in the BOOST Consortium set out to assess BOOST as a tool that can effectively capture outcome data, is acceptable to potential users, can be integrated into routine surgical care, and can act to enhance surgeon performance. A global, non-randomised prospective study was launched to test this.

The following key research questions guided the study:

1. Does use of the BOOST app improve surgeon performance?
2. Are any associations observed between degree of performance improvements and: a) level of surgical experience; b) facility size; c) presence/absence of other BOOST users in the facility; d) volume of surgeries performed; e) site location (rural/urban); f) private vs government facility; g) region?
3. Does (and to what extent) use of BOOST influence engagement of surgeons in the collection and use of cataract surgical outcome data?
4. How does use of BOOST influence surgical practice?
5. What are the relative costs associated with introducing and using BOOST in contrast to existing outcome monitoring systems used within participating sites?

6. Do users of BOOST find it easy/difficult to use, and incorporate into clinical practice?
7. What user, service, contextual factors and engagement strategies influence uptake and use of BOOST?
8. What key improvements to BOOST do users recommend?
9. What data sharing arrangements (at the level of site and surgeon) do users view as acceptable?

The current research study has provided a large and comparable dataset to the PRECOG study, providing an important opportunity to assess changes in cataract surgical characteristics over time, including type of surgery, surgical outcomes, causes of poor outcomes, and differences in these characteristics across low and middle income countries. Additional insights were gained on the user, service, resource and contextual factors that support routine monitoring of cataract outcomes through qualitative survey and interview methods.

The study was a pragmatic before-and-after trial, engaging ophthalmologists and surgeons to record data from 140 cataract surgeries in the BOOST app. Repeated measures design was used, whereby the percentage of surgical cases with good outcomes (uncorrected VA ≥ 6/18) was observed at baseline reported in BOOST (Phase I) and via a subsequent round of data collection (Phase I-repeat). This design was intended to measure the differences in surgeon visual acuity score (a function of the proportion of good and poor outcomes) following Phase II of BOOST:

Phase I

- Two rounds in Phase I, each round consisting of 60 consecutive cataract cases, to measure post-operative uncorrected visual acuity at discharge (0-3 days after surgery)
- All patient data is de-identified and includes:
  - Age and Gender
  - Pre-op Corrected VA and post-op Uncorrected VA in operated eye
  - Surgical technique
- Phase II was to be completed prior to the commencement of Phase I Round 2 (repeat)

Phase II

- Twenty cases with poor unaided visual acuity (6/60 or worse) at 4-12 weeks after surgery
- Information about each case, including cause of poor visual outcome were recorded (Inappropriate case selection/co-morbidities; Surgical Complication; Refractive problems)
- BOOST then suggests specific measures to correct issues and helps users determine most common causes for poor outcomes, helping to identify training needs and improve quality

Results from this study will critically inform the current monitoring paradigm of eye health organisations and health care providers in low-resources settings. Traditionally, success in cataract surgery has been assessed by measuring post-operative visual acuity in the operated eye 4 to 6 weeks after operation.[v] In many LMICs, postoperative follow-up rates are very low (20-30% in some cases)[vi] due to poor transportation and other costs, and low motivation of patients to return for

follow up care. In addition, non-government partners or funders have found some surgical partners are resistant to monitoring or reporting quality of surgical outcomes, due to privacy concerns, surgeon resistance, lack of existing outcome monitoring systems, lack of CQI or lack of accessible reporting tools. BOOST provides a low-cost, simple solution for surgeons and hospitals to monitor and anonymously review and report surgical outcomes, with all patient data de-identified.

Over the past 24 months, we recruited 57 surgeons and hospitals from 18 low- and middle-income countries (LMICs) to assess the effectiveness of BOOST. Data collection for the study was completed in May 2020 and a statistical analysis of results from over 4,000 cataracts surgeries has been incorporated into this final report. While the final number of sites included to test the primary hypothesis was lower than the target sample size, the co-investigators now have a substantial amount of data to analyse the effectiveness of BOOST. A series of follow-up interviews with practicing surgeons and hospital administrators or managers have been conducted. Encouragingly, many participants have reported positive feedback about BOOST and their desire to continue using it to monitor quality in their surgical practice:

> *Before using BOOST, I didn't use [sic] to keep any records but after using BOOST, I started keeping good records of the patients and it is easily accessible. I like this about BOOST, it's easily accessible in our phones and after using BOOST, I got a chance to monitor my surgical outcomes and got a chance to improve the quality of the surgeries and assess my surgical outcomes.*
> **Study participant, Nepal**

> *Personally, I liked the app. Installation was not a problem, it was very easy. Data entry was also equally easy for me. I was able to get the reports, you can generate the report, you can see it on the screen, the summary and so forth.*
>
> *I will continue using it (BOOST), I like it. For me it was so simple, I had no issues with it. I gave an orientation to the ophthalmic personnel, the mid-level ophthalmic personnel or frontliners, to share with them about the BOOST and how to enter the data. I think we may continue using it for all districts in my province*.
> **Study participant, Zambia**

> *It is pretty easy to use this app once installed, (surgeons) just need to enter the data. The data is entered immediately after one sees the patient. So that way it is very fast to use and good to see the results over time, age-wise, because otherwise you have to sit and analyse the data, but with this data, it is right in front of you, how the improvement is happening and where is the problem in surgical skills.*
> **Study participant, India**

The BOOST Partnership

The development, launch and roll-out of BOOST was made possible through successive innovation fund grants, awarded through Standard Chartered Bank's Seeing is Believing programme.
BOOST was informed by eye health expertise of several leading organisations, including:

- International Agency for the Prevention of Blindness
- International Council of Ophthalmology
- The Fred Hollows Foundation
- Orbis International
- Sightsavers International
- Aravind Eye Care Systems
- Seva Foundation

The credibility, practical and technical expertise, influence, and networks of implementing partners these organisations provide has been critical to the success of the research study. The app has enjoyed more than 1,700 downloads worldwide, across Android and PC versions. By promoting and supporting cross-sectoral collaboration, these organisations (known as the BOOST Consortia) have helped build the profile of BOOST and highlighted ongoing challenges with systemic approaches to outcome monitoring across the eye health sector. To ensure the BOOST Consortia is sustained beyond the life of the SCB funded project, a formal governance structure has been developed to manage ongoing project management issues, mobilise resources for future updates and enhancements, and support dissemination of the BOOST study results. Negotiations are still to be finalised on the resourcing of this proposal, which is outlined further in this report.

2. Summary against project objectives

The results for this reporting period are presented in two forms: 1) a summary of progress against the project objective and outputs; and 2) the study results (section 3).

Progress against the project objectives and outputs

Outcome/output	Progress	Notes
Objective 1: Before and after study to understand the extent to which the BOOST tool improves surgeon performance and factors that contribute to uptake	Complete.	Activities are described against each output.
Output 1.1: Complete background literature review covering cataract outcome measurement considerations, tools and existing approaches	Complete.	A comprehensive background literature review analysing existing cataract outcome measurement considerations and approaches was completed and integrated into the Research

		Study Protocol (see output 1.2-1.3). A copy of the protocol is included as Attachment A.
Output 1.2: Finalise study protocol, data collection tools, and other study materials (developed and translated)	Complete	The research study protocol was finalised and submitted to the ethics committee of the School of Medicine, Dentistry and Biomedical Sciences at Queen's University Belfast (United Kingdom) for review in September 2018. All study materials, including commencement surveys, consent forms and procedure documents were translated into Spanish and French to support recruitment of partners in LMICs across Latin America and Francophone Africa.
Output 1.3: Ethics application	Complete	The research study protocol received ethics approval from Queen's University Belfast, School of Medicine, Dentistry and Biomedical Sciences on 26 October 2018 (ref 18.48v2). A subsequent ethics variation was submitted and approved on 7 August 2019, to reflect the extension of the study to 30 June 2020, in line with the 6 month no-cost extension granted by SCB. Additional national ethics approval processes were instigated in Uganda, Madagascar, Tanzania and India to support recruitment of partners in those countries.
Output 1.4: 75 hospitals recruited	Recruitment complete, but please note reduced sample size.	Following ethics approval, 58 sites (76%) of the target sample of 75 sites were enrolled in the study across 18 countries in Asia, Oceania, Africa and Latin America. There were several challenges to recruiting the target number of sites, which has been discussed in previous progress reports. The COVID-19 pandemic further compounded these recruitment challenges. Recruitment and retention of participants are known challenges for large, multi-year research studies. Overall, the study investigators are satisfied that the data collected provide a useful dataset to analyse the research questions, described in output 1.6.
Output 1.5: Data collection activities (as per protocol)	Complete	From the 57 surgeons who were invited to participate, 41 commenced data collection (see Figure 1). Data from a total of 4,320 surgeries was included in the analysis.

Output 1.6: Data Analysis, Report Preparation and dissemination activities	90% complete	We present in this report the preliminary results of the study. As per discussions with SiB, due to COVID-19 delaying several key international meetings, dissemination activities will continue beyond the funding period. Several publications and international presentations are planned. Further analysis will be conducted of the study data as these publications are progressed.

3. Study Results

Recruitment

Cataract surgery centres collaborating with The Fred Hollows Foundation, Orbis International, SightSavers International, Aravind Hospitals, and Seva Foundation were approached to participate in the study. The study aimed to collect data from a geographically diverse sample, including countries in East Asia/South East Asia/Oceania; South Asia/Central Asia; Africa; and Latin America/Caribbean. Multiple sites were recruited in each of these target regions. Each site nominated a practicing cataract surgeon or ophthalmologist to participate in the study.

Study Sites

58 sites (76%) of the target sample of 75 sites were enrolled in the study across 18 countries in Asia, Oceania, Africa and Latin America. There were several challenges to recruiting the target number of sites, which have been discussed in previous progress reports. These include:

- **Delay in ethics approvals**. The application and approval for the global study took four months to secure, following the project commencement date. Additional ethics processes were required in some countries. Recruitment could not commence until these were obtained. As such, actual recruitment did not commence until January 2019, reducing the window for enrolment, registration and data collection.
- **Software and translation issues:** Grammar issues were identified in the English version of the BOOST PC app after recruitment commenced. In response, the project team undertook a full review of the PC platform and translated all corrected labels into Spanish, French, Russian, Chinese, Indonesian and Vietnamese versions of the app. All translations were verified by native-speaking ophthalmologists/eye health practitioners. These technical issues detracted from time and resources available to support recruitment and on-boarding of participants.
- **Reliance on proxy partners:** In a number of countries, the study coordinators relied on national partners to facilitate the enrolment, registration and support for sites to commence the study. This created an additional layer in communications and some delays, potentially due to low prioritisation of the study by national partners.
- **Lack of financial or other incentives:** The study did not provide any financial reimbursements to participating sites. These are often used in studies to support recruitment and retention. The study coordinators relied on voluntary enrolments or

requests through NGO partners that the study be annexed to their funded activities. A lack of a consistent incentive system may have negatively impacted recruitment.

- **Concurrent data collection:** As participants were enrolled, they were encouraged to commence data collection as soon as possible. Monitoring and following up with enrolled and potential participants, all at different stages in the study, was resource and time intensive for the coordination team. As the study progressed, attention was shifted to data collection activities rather than active recruitment, to ensure a reasonable sample could be collected within the study timeframe.

Figure 2: Flowchart of participant recruitment and retention

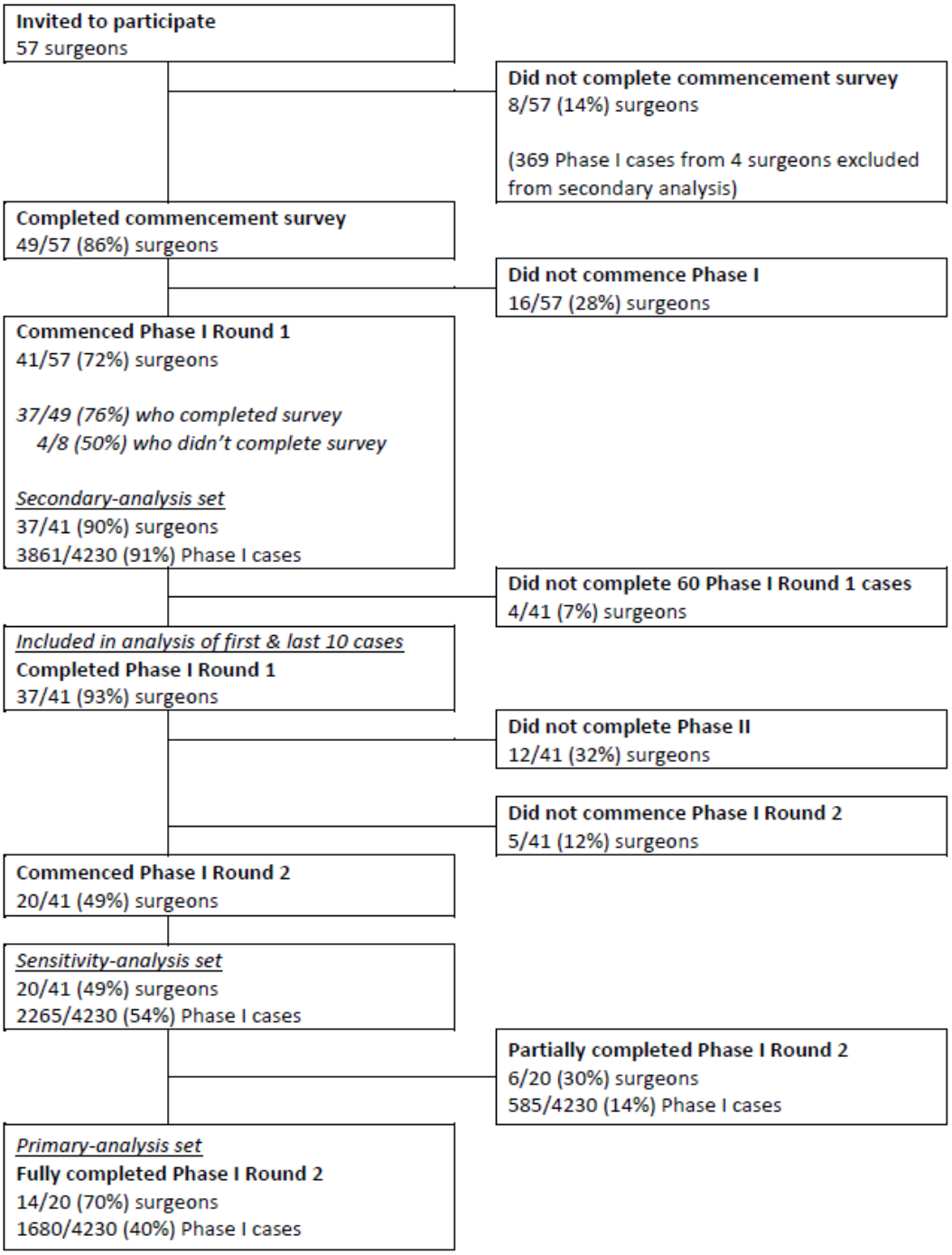


Figure 2 highlights that there was a reduction in participant numbers at each step of the study, so that of the 57 recruited sites, complete data sets (that is, data for each phase of the study) was obtained from 20 sites.

Challenges for retention of participants include:

- **Natural attrition:** The loss of participants almost always occurs to some extent in longitudinal research studies, due to loss of interest in the study, inability to complete required steps and satisfy data collection requirements, lack of support from management, and institutional changes (for example, participants no longer working at the enrolled site).
- **Inappropriate candidates:** Participants may have been inappropriate to enrol due to low-surgical capacity or poor understanding of study requirements.
- **Covid-19:** Late enrolments were impacted by shutdowns or restrictions on elective cataract surgeries because of the ongoing Covid-19 pandemic, limiting their capacity city to complete required number of surgeries
- **Manual tracking:** Each participant had to be monitored by exporting data from BOOST and manually tracking their progression against a simple spreadsheet. This was time consuming and caused some delays in following up with participants who had stalled or failed to complete different phases of data collection.
- **Reminders:** The BOOST app did not allow for prompts within the app to complete different stages of data collection. All communication occurred via email, with some participants using personal accounts and/or not responding to repeated reminders.
- **No financial incentives** for participation or completion, which also affected recruitment.
- **Duration:** The study was extended multiple times to enable more participants to commence. The long duration may have impacted engagement over time with earlier participants.

Commencement survey participants

From the 57 surgeons who were invited to participate, 49 (86%) completed the commencement survey. The majority of the surgeons who responded to the survey were male (n= 37, 76%) and most identified as general or specialist ophthalmologists (n=38, 78%). Most had performed over 2000 cataract operations (n=29, 59%), the majority reported regularly recording cataract outcomes (n =31, 63%) and the recording tool most in use was a spreadsheet (n=11, 22%). The majority did not benchmark their outcomes against others in their organisation (n=33, 67%).

Twelve surgeons that completed the commencement survey did not go on to input surgical outcomes data into the BOOST software. These surgeons were more likely to be from Africa or Oceania, were more likely to be from a low income country, and were less likely to have recorded their cataract outcomes in an electronic database in the past.

Phase I and Phase 2 participants and cataract cases

From the 57 surgeons who were invited to participate, 41 (72%) commenced Round I and 38 out of these 41 (93%) entered the 60 initial cases required. Of these 25 (66%) completed Phase II and 20 (53%) commenced Round 2 of Phase I.

Outcomes for 4,230 cataract cases were collected from participating surgeons. Fourteen surgeons completed both rounds of Phase I and contributed 1,680 cases to the primary analysis. The majority

of these surgeons were located in Asia (n=11, 79% in primary analysis). Only one surgeon from each of North America and Africa were included in the primary analysis-set.

Phase II data were collected from 31 surgeons; with 25 surgeons (81%) recording at least 20 Phase II cases. A total of 574 Phase II cases were recorded. Patient age in Phase II ranged from 30 to 93 years (mean 66 years old) and the majority were female (n=297, 52%).

Primary Outcome

Key Result 1: Compared to Round 1 of Phase I, there was an increase in the proportion of both good and poor outcomes in Round 2 (that is, a lower proportion of cases with mild impairment in Round 2, see **Table 1**). These differences were not however, statistically significant (mean difference 0.01; 95% CI: -0.15, 0.18; p=0.890).

Post-operative unaided visual acuity scores ranged from -0.22 (meaning there were more poor outcomes than good outcomes in a round) to 1.00 (meaning all cases in the round had good outcomes) in the primary analysis. Three surgeons included in the primary analysis recorded worse scores in the second round compared to the first.

Table 1: Phase I outcomes for surgeons in the primary-analysis set

	Round, n (%)		**Difference**
	1	**2**	%
	(n=840)	(n=840)	
Post-op unaided VA, *n (%)*			
Good (6/18 or better)	600 (71.4)	620 (73.8)	+2.4
Mild impairment (6/24 to 6/60 inclusive)	188 (22.4)	157 (18.7)	-3.7
Poor (worse than 6/60)	52 (6.2)	63 (7.5)	+1.3

Secondary Outcomes

Key Result 2: Case selection was recorded as the most common reason for poor visual outcome (n=228, 40%).

Key Result 3: The majority (85%) of cases included were from low and middle income countries (LMICs). Compared to surgeons from countries with middle incomes, surgeons from low-income countries recorded a lower proportion of good outcomes (76% vs 52%) and a higher proportion of poor outcomes (5% vs 9%).

Key Result 4: Increasing patient age was associated with a lower proportion of good outcomes and a higher proportion of poorer outcomes.

Key Result 5: Male and female patients had similar proportions of good outcomes. However, after adjustment for other factors, there was weak evidence suggesting male patients may be more likely to achieve a better outcome compared to females. Overall, there was insufficient evidence of a difference in poor outcomes according to patient sex.

Key Result 6: Among the 1,175 surgeries performed via phacoemulsification, only two were performed in Africa (0.2%) and only 55 had poor outcomes (4.7%). Eight of the phacoemulsification patients did not get an IOL (0.7%). A much higher proportion of good outcomes and far fewer poor outcomes were observed following phacoemulsification compared to other surgical techniques.

Key Result 7: There was a large difference in the proportion of patients with good and poor outcomes between those with and without IOL insertion (difference 39% and 4%, respectively). Among the 166 ECCE surgeries and 2,295 SIC surgeries, patients with IOLs were much more likely to have a good outcome compared to those without. There was insufficient power to show a difference in poor outcomes according to IOL status among those who had ECCE but poor outcomes were less likely for those with an IOL among the subgroup of patients who underwent SICS.

Key Result 8: Sub-specialist cataract surgeons had a higher proportion of good outcomes compared with surgeons with other qualifications (difference ranged between 14% and 30%). However, the estimated differences were attenuated after adjusting for other variables. All non-physician and sub-specialist surgeons were located in lower-middle income countries. Non-physician surgeons had the smallest proportion of surgeries performed by phacoemulsification (9%) and the highest proportion of surgeries without IOL insertion (2%). Adjustment for these factors is likely responsible for the attenuation of association size observed when comparing the proportion of good outcomes between surgeon qualifications. Furthermore, is it possible that non-physician surgeons are more likely to be employed in less well-resourced institutions; this may contribute to additional unmeasured confounding.

Study Limitations

The following study limitations are acknowledged:

1. The number of surgeons included in the primary-analysis set was far fewer than the planned sample size of 75. Issues affecting participant recruitment and retention have been described against output 1.4 and output 1.5.
2. The score based on the relative proportions of good and poor visual outcomes is not widely used and may be difficult for clinicians to interpret.
3. Commencement survey results show that a number of surgeons were already collecting cataract outcome data prior to the study. This may have diminished the observed effect of BOOST if the maximum benefit from recording outcomes had already been achieved.

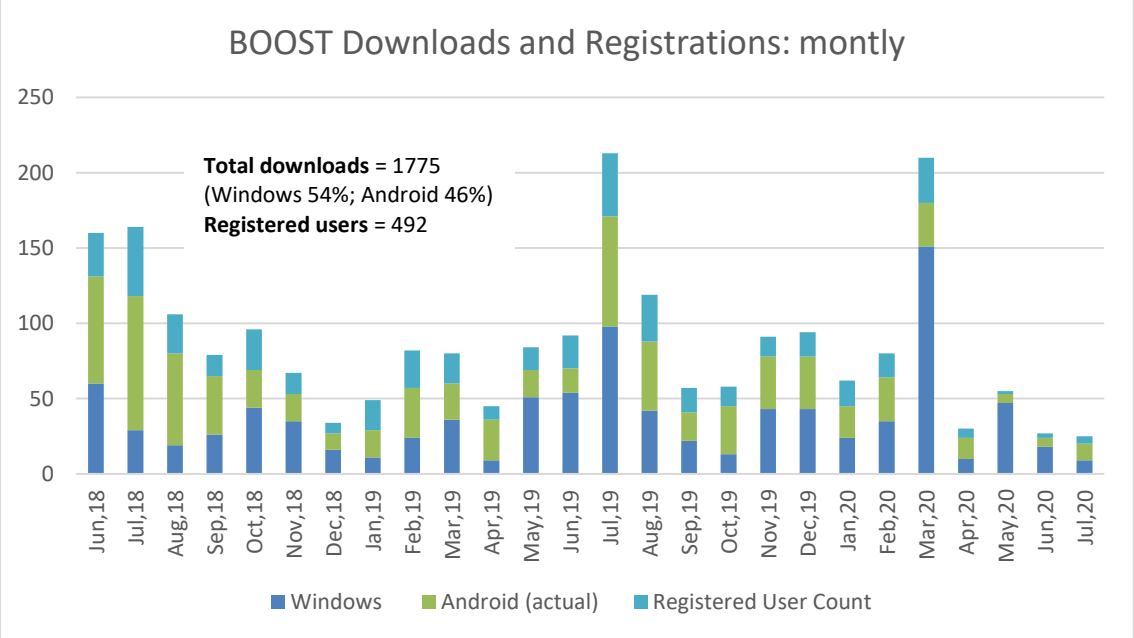
4. Differences in visual acuity testing conditions between surgeons may contribute to biased estimates of the association between surgical characteristics and outcomes. The study protocol did not include any guidance about preferred VA testing approach.
5. No information on other factors that influence the quality of surgical outcomes was collected in the BOOST app, such as the method of choosing intra-ocular lens (IOL) power, target post-operative refraction, IOL power implanted, whether IOLs were implanted in the anterior or posterior chamber of the anterior segment, observed post-operative refractive error or best corrected visual acuity was collected in the study.

4. BOOST Download and engagement data

Indicator 1: Number of centres and patients registered as users of BOOST

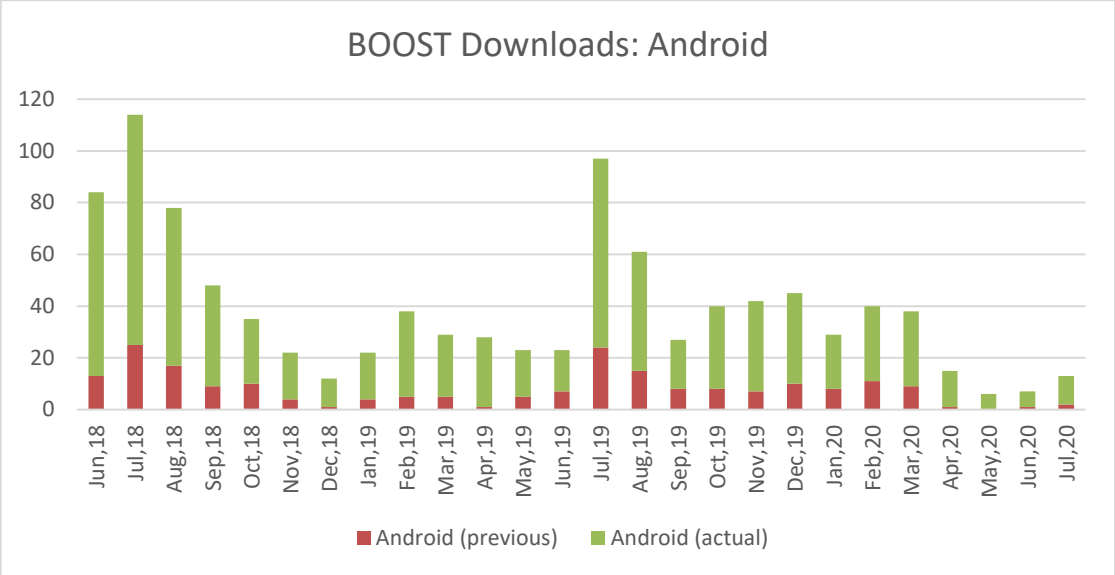
As of July 2020, over 1700 downloads of BOOST have been recorded across all devices (**Figure 3**). BOOST has enjoyed consistent growth in the number of downloads across each reporting period since the global launch at the World Ophthalmology Congress in June 2018.

Figure 3. BOOST Downloads and Registrations – monthly (Jun 2018 to Jul 2020)



In previous progress reports, download numbers for Android devices were significantly under-represented (see **Figure 4**). Previous figures were tracked by measuring the number of 'click-throughs' to the Google play store via the BOOSTcataract.org website, and not via actual downloads of the app from the Google play store. This has been amended in **Figure 3 & 4** and demonstrates positive engagement with both Android and PC platforms since BOOST was launched.

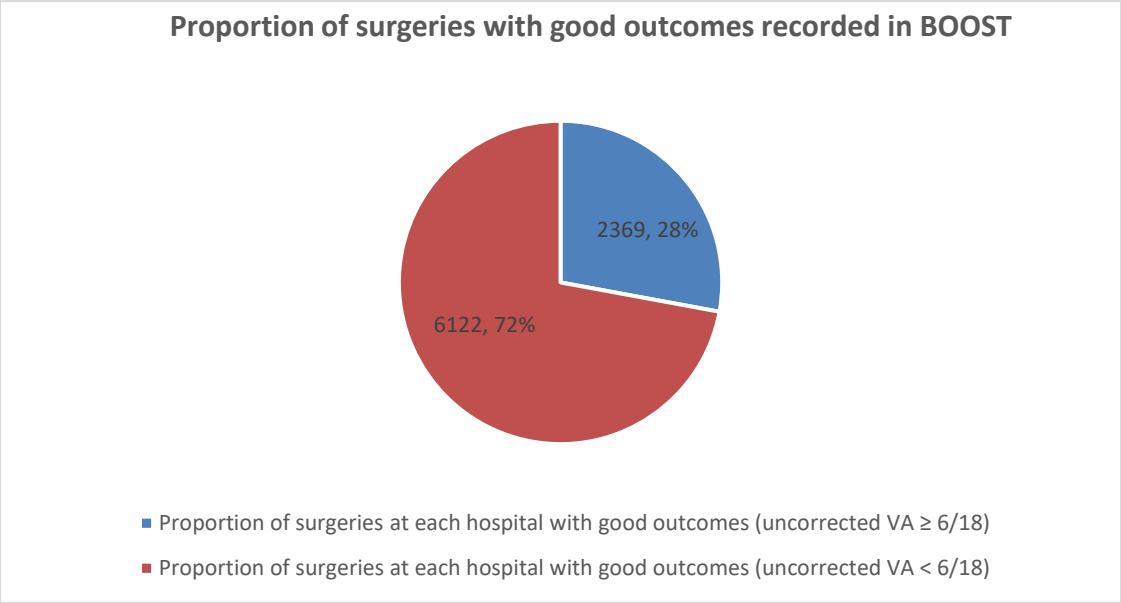
Figure 4: BOOST Downloads – Android



Indicator 2: Proportion of 60 consecutive surgeries at each hospital with good outcomes (uncorrected VA >= 6/18)

Of all data recorded in BOOST, 72% of surgeries reported a good outcome (uncorrected VA ≥ 6/18, **Figure 5**). Data from 8,491 cataract surgeries has been entered into BOOST across all devices. Half of these surgeries (4,230, 49%) were entered by participants in the BOOST study.

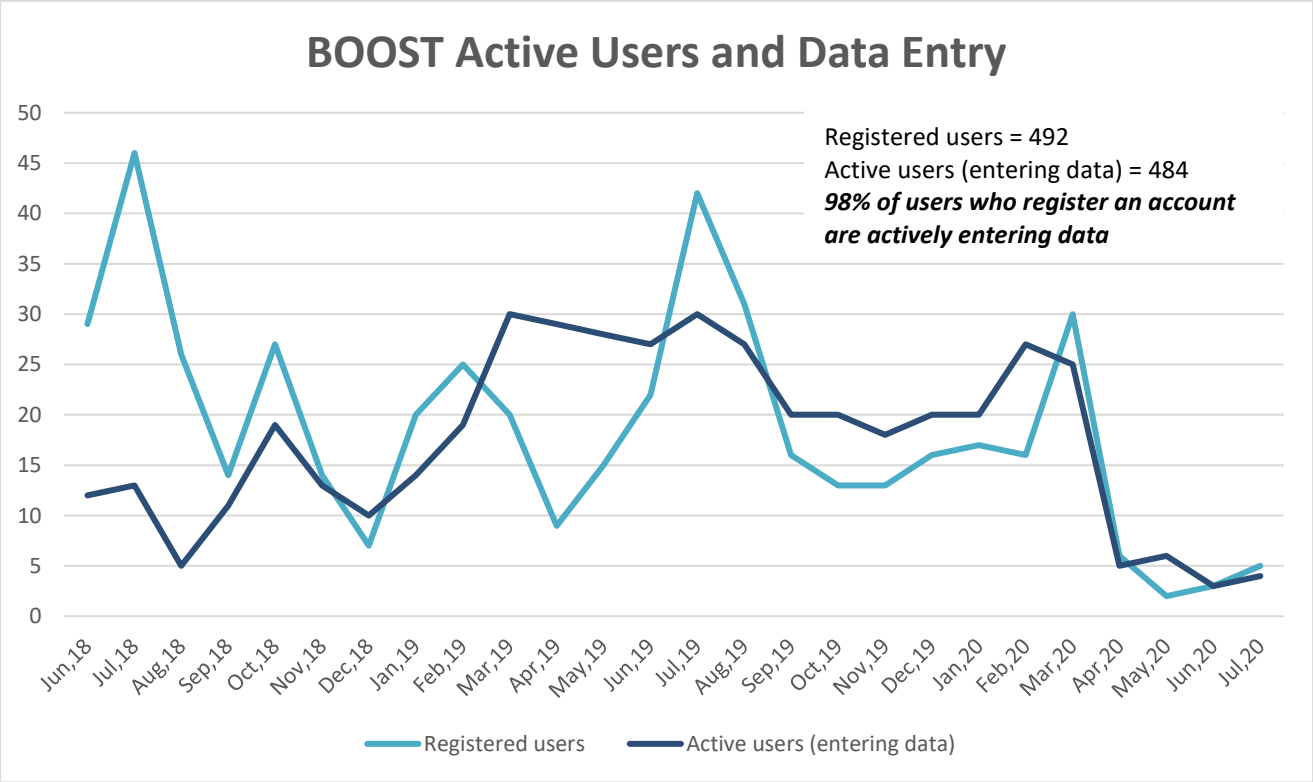
Figure 5: Proportion of surgeries at each hospital with good outcomes



Indicator 3: Degree of surgeon and service uptake of BOOST – numbers of registering services and doctors and degree to which registered surgeons routinely use BOOST to capture outcomes data

Of registered users, 98% (484) are actively entering data (**Figure 6**). This is an increase of 27% compared to the previous reporting period, representing stronger engagement with BOOST over time. That is, there has been consistent growth in the number of downloads, and of those downloads there has been consistent growth in the number of people going on to register an account and start inputting data.

Figure 6: BOOST Downloads and Registered Users – Jan 2018 to Jul 2020



5. Financial commentary

Please provide final figures for your spend against budget. Your actual spend against target should be itemised and recorded separately in the budget tracker with explanation of any variances greater than 10%. Please advise on any significant budget efficiencies or savings[1].

As of July 2020, USD 62,224 has been expended to support project management of recruitment and data collection activities, workshop and ethics approval costs, statistical analysis, and initial communications activities, including development of an online instructional course and revamped website to promote BOOST. All expenditure is described in the Final Implementation and Budget tracker (**Attachment B**). Total expenditure represents 92% of the total grant income of USD 67,867 (which includes USD 61,567 of the original grant and USD 6,300 from a previous innovation grant funded by SiB, which was rolled into the current project).

As per discussions with SCB, an estimated USD 10,000 underspend was expected, due to the impact of the COVID-19 pandemic on several planned communications activities. An abstract for the study was accepted for the World Ophthalmology Congress (WOC), scheduled for June 2020 in Cape Town, South Africa. The conference transitioned to an online format in April 2020, in response the ongoing infection and transmission rates of COVID-19 worldwide and restrictions on international travel. A virtual session was presented during the WOC and resulting savings will be directed to future promotion and dissemination work, including for the 2021 General Assembly (GA) of the International Agency for the Prevention of Blindness. The GA represents the largest international gathering or eye health organisations, and only occurs once every four years. The GA was postponed from October 2020, and the consortia will target the 2021 event, regardless of its format, as a key dissemination and promotion opportunity. At least three articles for peer-reviewed, international journals are planned. Remaining funds will support costs of ensuring any accepted articles are published in open-source format and made widely accessible.

A revamp of the BOOST website, to improve overall design and functionality, has been implemented. This will enhance digital communication and engagement activities and online promotion of the research study results, which has increased in importance given the likelihood of COVID-19 impacting face-to-face dissemination activities over the next 12-18 months. See **Attachment C** for visualisations of the new BOOST website. As a result, USD 5,643 of the original grant remains and will be retained by The Foundation for future publication and dissemination activities. A communication, dissemination and publication plan has been included as **Attachment D**.

[1] Seeing is Believing policy on savings is as follows. We are happy for partners to make use of budget savings to further project aims and do not expect savings to be remitted back to Seeing is Believing. However, we expect that budget savings be used in relation to the benefit of the innovation Seeing is Believing supports. It cannot be reallocated for other purposes. If no use can be found for the funds consistent with the aims for which they were originally granted by Seeing is Believing, they must be remitted back to Seeing is Believing.

6. Lessons Learnt

Monitoring the quality and outcomes of cataract surgeries remains an ongoing priority for eye health organisations, hospitals and health service providers worldwide. To drive continuous quality improvements in cataract surgical services, there must be an increased focus on measuring the coverage and quality of surgical outcomes.

The BOOST prospective study focused on the impact of an innovative, low-cost and simple software tool to capture surgical outcomes at discharge, and monitor and respond to causes of poor outcomes for patients who return for follow-up appointments. The study provides a number of useful insights:

- **BOOST may be useful to support routine monitoring of cataract surgical outcomes**, but monitoring alone and simple prompts relating to strategies to enhance surgical performance may be insufficient to see marked improvement in clinical outcomes.

- **Low-resourced hospitals need simple tools** to support the collection of cataract surgical outcomes and BOOST may provide a viable option for routine surgical outcome monitoring:

> *After using BOOST, I was able to record the data in more people. I looked at visual acuity of patients just after surgery and after one month of surgery. I also assessed why the vision was less in patients and I could go into more detail.*
> **Study participant, Nepal**

- **Low-cost technology** like BOOST can be integrated into practice, but ongoing support is needed for surgeon uptake, training, continuous quality improvement, culture and behavior change. Many institutions maintain their own health information systems, but require support to ensure that surgeons have adequate training or support through data-entry personnel for accurate records. Other centers have no system for monitoring outcomes, and in these instances BOOST provides a useful, 'entry-level' option.

> *At our hospital, we have a hospital system … for all patient information. So it is to monitor cataract surgery outcomes. BOOST only takes visual acuity and post-op cataract surgery like visual acuity and refraction and some complications. In our system, it is quite wide (broad). Not many examinations are [recorded] in it. It takes a long time compared to BOOST.*
>
> *We can continue to use BOOST for our junior residents and registrars, if they want to know their cataract outcome for some period of time and quickly. To use BOOST is very quick.*
> **Study participant, Cambodia**

- **Other centers have no system for monitoring outcomes**, and hence BOOST provides a useful, 'entry-level' option. Regardless, BOOST alone cannot address the root causes of poor outcomes, such as inconsistent surgical protocols, poor patient management systems, poor referral systems, lack of adequate equipment or personnel, surgeon inexperience, and other factors that influence quality.

- **Surgical technique** had the largest impact on post-operative visual outcomes in low- and middle- income counties represented in the BOOST study. Phacoemulsification generally returned better outcomes. However, phaco is often not recommended for low-resource settings, due to the high-costs of required equipment and consumables.

> *Most of the surgeries are performed by Manual Small Incision Cataract Surgery (MSICS) technique. In the rural centres, we do close to 85% MSICS and 15% of surgeries would be phacoemulsification.*
>
> *There are two reasons: one is economic considerations of the patient. For the patients for whom we do surgeries free of cost, it is normally MSICS. Sometimes we will do phacoemulsification. The other reason is when the patient comes to us for cataract surgery, if they are from low socioeconomic background, the cataract in them is very hard and surgeons perform MSICS.*
> **Study participant, India**
>
> *Normally, now our hospital mostly does phaco. But if there are many dense cataract, we have to do extracapsular cataract. Small incision cataract surgery, we normally use at provincial hospitals as they do not have a phaco machine.*
> **Study participant, Cambodia**

- **User experience** and testing has revealed a number of enhancements and clarifications that can be made to BOOST, to improve surgeon uptake and use. This includes expanding the fields provided in Phase II, to analyse causes of poor outcomes, and allow for more detailed or customised fields. For example, BOOST asks users to select from three main causes of poor outcomes: surgical complications, cases selection (presence of co-morbidities), and refraction issues. For each of these causes, there are additional details, such as the type of co-morbidity or factors that contributed to surgical complications, that are not captured. This makes it difficult for surgeons and other users to unpack the various factors that contribute to a poor outcome and identify appropriate responses for their setting.

> *The reasons for poor outcomes, we say it was an optical error or it was a surgical error. It is good to drill it down, was it a PC tear, was it an iris tear? We need to go into details and know exactly what it was that caused surgical complication.*
> **Study participant, Kenya**

> *Phase I is okay. But in Phase II, the cause of poor visual outcomes is categorised into only three main causes. But in our cataract surgery, we have other causes of poor outcomes. And in the report of the poor outcome, we are not provided with the exact reason why the patient got a poor outcome and it would be better if Phase II could provide more options to fill the exact reason, so the data would be more detailed and useful to improve the outcomes.*
> **Study participant, Cambodia**

7. Next steps

What is the future of the innovation? Will it be scaled up/rolled out? Where will it be used in the future? If the innovation was not successful, will it be adapted and further tested?

The BOOST study demonstrated limited success in improving monitoring practice, and highlighted the influence of surgical technique, surgery setting and surgeon training on quality of outcomes. Further investigation is needed to determine whether BOOST alone can improve surgical performance, but the results of this study suggest additional interventions may be required to yield meaningful improvements in outcomes - for example systematic improvements to the ways surgical centres engage with outcome data and identify and implement centre wide improvements to clinical protocols are likely required.

The BOOST platform remains freely available for download via the BOOST website and Google Play Store. The BOOST consortia of partner organisations have commenced planning for the ongoing management of the software. All partners have indicated their commitment to ensuring BOOST continues to be a widely available, free resource for ophthalmologists, cataract surgeons and hospitals. A Memorandum of Understanding is being prepared and will formalise agreed governance and management arrangements for BOOST.

In January 2020, The Fred Hollows Foundation submitted a grant application to the XOVA Innovation fund, to support scale-up and enhancements of BOOST based on the findings of the current study. An outcome of this application is expected in Q3 2020. The consortia partners will continue to explore funding opportunities to enable scale-up and rollout of BOOST for users that can benefit from a simple, low-cost monitoring tool. Further, efforts are ongoing to embed the use of BOOST within programs operated by BOOST Consortia partners.

Finally, a communication, dissemination and publication plan has been drafted to promote the results of the study and the BOOST initiative (Attachment D). The BOOST partners will ensure that SCB and the SiB fund rare acknowledged in all publications emerging from the research.

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