Keeping track of colorectal cancer trials with the Dutch Colorectal Cancer Group (DCCG) mobile app

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Abstract

Background and Aim: Both the number and complexity of medical trials are increasing vastly. To facilitate easy access to concise trial information, a freely available mobile application featuring all ongoing clinical trials of the Dutch Colorectal Cancer Group (DCCG) was developed. The aim of this study was to investigate the use and user satisfaction over the first two years.

Methods: The application was launched in January 2015 on iOS and Android platforms. Google Analytics was used to monitor anonymous user data up to February 2017. In addition, an online survey regarding the use and satisfaction amongst healthcare professionals and research affiliates active in the field of colorectal cancer in the Netherlands was conducted.

Results: A total of 6,173 unique users were identified, of which 1,822 (30%) were from the Netherlands, representing a total of 16,065 and 10,987 (68%) sessions, respectively. The median session duration per day was 01:47 minutes (IQR 0:51-03:03). The mobile application was most used on Monday, Tuesday, and Thursday and the number of sessions was highest during the following time frames: 12:00-13:00 (9%), 17:00-18:00 (9%), and 13:00-14:00 (8%). Out of 121 survey responses, most were medical doctors (47%), nurses (25%), or researchers (9%); working either in a teaching (40%), academic hospital (32%), or general hospital (19%). Eighty-three percent of all respondents rated the application 4 or higher for satisfaction on a 5-point scale. Highest reported reasons of use were: urgent trial inquiry (57%) and usage during multi-disciplinary meetings (49%).

Conclusion: The DCCG Trials App is frequently used and the majority of users is highly satisfied.

Relevance for patients: Clustering trial information into one platform, such as DCCG Trials App, has shown to be useful for medical professionals treating patients with colorectal carcinoma in the Netherlands.

Introduction

The number of registered clinical trial protocols on clinicaltrials.gov has increased from 12,020 in 2005, to over 230,000 in 2017 and the yearly number of newly registered studies is approaching 30,000. [1] In the field of colorectal cancer alone, the third most common cancer worldwide, 4,482 trials were registered by the end of 2017 (Figure 1).

Besides the increasing number of clinical trials, there has been an increase in protocol design complexity during the past decade. The incidence of added trial protocol amendments is growing and trial criteria are increasingly specified and complex.[2] Among many others, these factors lead to shortage of both knowledge and time for healthcare professionals to participate in clinical trials. [3,4] The complexity of clinical trials potentially hampers the inclusion of patients, which is the leading cause of problems in the conduction of clinical trials. [5-8] Lack of accrual can lead to trial discontinuation or results in an insufficient sample size, both of which challenge the ethics of the exposure of patients to trial treatment which is often outside of routine clinical practice.

Evidence on effective strategies to improve the conduction of clinical trials is scarce and mostly limited to recruitment for randomized trials. [9] The Cochrane systematic review of interventions to improve trial recruitment included 45 studies of which only 12 were considered to be of low risk of bias.[10] Opt-out procedures, telephone reminders, and open trial designs might be effective strategies to improve patient recruitment. However, these strategies do not comply with the guidelines of good clinical practice. Interestingly, none of these reported interventions targeted medical doctors, who usually assess patient eligibility for trials and ask patients to participate in clinical trials.

This manuscript illustrates the design of a smartphone application that provides easy to access and up-to-date information on ongoing Dutch clinical trials for patients with colorectal cancer. The aim of this study is to investigate the usability and satisfaction of the application two years after its introduction.

Methods

Anonymous user data of the Dutch Colorectal Cancer Group (DCCG) Trials App was collected between

the 1th February 2015 and 1th February 2017 and analyzed using Google Analytics. [11] Additionally,

an online survey amongst healthcare professionals and research affiliates active in the field of

colorectal cancer was conducted.

The DCCG is a research collaboration in the Netherlands between all medical disciplines

involved in the diagnosis and management of colorectal cancer. [12] The DCCG Trials App is a mobile

application containing concise information on all the DCCG multi-center trials open for inclusion. The

application is freely downloadable for iOS and Android. [13] It can also be accessed through the

website: www.trialapp.nl/dccg/dccg-app/ without using the mobile application. Users can find

relevant information for the registration of a patient for a trial. Trial coordinators can be e-mailed or

called directly via the application for questions. The information provided in the application per trial

can be directly updated by the responsible investigators. Trials can be found in two different ways,

either by following a decision-tree based on clinical features or by utilizing the search function. With

the decision-tree users can find trials by answering specific question such as; is the tumor located in

the colon, rectum, or has the patient metastatic disease? Every trial page has six buttons: design,

criteria, requirements, latest news, the trial website, and contact information (Figure 2). The launch of

the app was communicated through the newsletter of the DCCG and at the national DCCG meetings.

Anonymously collected user data by Google Analytics [11] included the number of (new) users,

the number of sessions, the bounce rate (users that opened and closed the app immediately), average

session duration per user per day, geographical location based on IP address, the number and duration

of trial information page visits, the number of times the decision-tree option was used, and the amount

the news option was used.

To measure usability and satisfaction, an online survey was sent either through the DCCG trials

app, in the DCCG newsletter, or by email using the DCCG mailing list, consisting of email addresses of

healthcare professionals and research affiliates. The survey included 10 questions regarding the

respondent's profession, usability and satisfaction of the DCCG Trials app, using a 5-point Likert scale.

For an overview of the online survey see Appendix 1.

Results

In its first two years, the DCCG trials application amassed a total of 16,065 sessions and 89,711 page views by 6,173 unique users worldwide. From February 1th 2015 until January 31th 2016 the application amassed a total of 8,818 sessions and 44.006 pageviews. From February 1th 2016 until February 1th 2017 the application amassed a total of 7,247 sessions and 45,705 pageviews. The median session duration per day was 01:47 minutes (IQR 0:51-03:03). The median number of pages visited per session was 6 (IQR 4-7). In total, the application was used in 102 countries (Supplementary Figure 1).

In the Netherlands, 1,822 (30%) unique users undertook a total of 10,987 sessions that amounted to 68% of all sessions of the application. The median average session duration per day in the Netherlands was 02:00 minutes (IQR 01:03-03:30) and the bounce rate was 3% which was the lowest of all countries (Table 1). The mobile application was most used on Monday, Tuesday, and Thursday and the number of sessions was highest during the following time frames 12:00-13:00 (9%), 17:00-18:00 (9%), and 13:00-14:00 (8%).

Trial information pages were visited 15,896 times and the median time on a trial page ranged from 9 to 47 seconds. The most frequently visited study pages are depicted in Table 2.

Online survey

Out of a total 121 respondents, 76 (63%) answered that they have used the application, whereas 45 (37%) did not. Reasons for not using the application were unawareness of its existence (n = 26, 59%), preference for other resources (n = 8, 18%), or that the responder is not provided a smartphone at work (n = 4, 9%) (Table 3).

Respondents were either medical doctors (n = 36, 47%), nurses (n = 19, 25%), researchers (n = 7, 9%) or data managers (n = 6, 8%), while 8 (11%) of the respondents defined their job as 'other'. Respondents were working either in a teaching hospital (40%), academic hospital (32%), or general hospital (19%), while 9% of the responders defined their working place as 'other'. Eighty-three percent of all respondents rated the application 4 or higher for satisfaction on a 5-point scale, and 86%

recommended the application to a colleague. The highest reported reasons of use were: urgent trial inquiry (57%) and usage during multi-disciplinary meetings (49%).

Discussion

The present study illustrates that a smartphone application with concise information on multi-center trials on colorectal carcinoma is often used and that reported satisfaction with the app is high. More than 70% of the users are medical doctors or nurses and the application is mostly used during multi-disciplinary meetings and during work in the outpatient clinic. The DCCG Trials application was launched as an experimental tool that provides concise information on clinical trials which might benefit patient inclusion. This application also offers insights for implementation in other clinical fields.

Since the DCCG is based in the Netherlands, it was to be expected that most users derive from the Netherlands. The increased Dutch user duration rate supports the suggestion that the application is a useful tool when professionals encounter potential inclusions. The survey illustrated that the majority of the users were physicians in teaching hospitals. [14] Compared to academic centers, these hospitals often have a higher patient turnover but lower awareness of ongoing trials, which could be a potential cause of slow patient enrollment. The application directly offers information on in- and exclusion criteria, increasing the chances of patient inclusion. Additionally, patient inclusion often has a certain momentum in clinical practice. If eligibility can directly be assessed by use of the application or when a potential trial candidate can directly be discussed with the trial coordinator, likelihood of patient enrollment increases. Lastly, the option to directly update users with new trial information, reminds users of the existence of a trial, indirectly increasing the likelihood of including patients in trials.

This is the first study presenting data of an application with the goal to improve clinical trial conduction and patient recruitment. Many applications have been developed in which trial information can be found. [15-18] However, no data are available about the effect of these applications on the conduction and recruitment of clinical trials. Little evidence is available for any intervention on

the effect of patient recruitment in clinical trials. [10] It is difficult to prove the effect of the Dutch Colorectal Cancer Group Trials app on trial enrollment. However, the fact that the application is frequently used by relevant users suggests that an application with relevant information on ongoing trials could have a positive impact on trial enrollment.

The current analyses have several limitations. Firstly, presenting data on the duration of sessions and trial page visits does not necessarily reflect a positive user experience or positive effect on the conduction of a particular trial. Preferably the effect of the application on inclusion rates is investigated but the available data and trials was limited and a direct causal effect of the application on inclusion rates would be difficult to assess. Secondly, the survey was made available online, and respondents were recruited though the app, DCCG newsletter, and DCCG mailing list, which could have introduced a selection bias. It can be assumed that users that are very positive about the application are more willing to submit a survey, yet it could also be assumed that users with a very negative user experience are motivated to express their opinion.

Currently, the application is not available on iOS devices due to new technical requirements which are not met by the current version. The application is still available on Android devices. All DCCG studies from the application can be found in the TrialApp application which is available on all devices. Although the current application does not facilitate actual patient enrollment, future applications could result in a completely digital clinical trial registration and administration. A clear digital paper trail should accompany these applications and should be designed in accordance with clinical research oversight bodies.

In conclusion, we report that our smartphone application with study information of ongoing colorectal cancer trials is frequently used and the majority of users is satisfied. The application provides easy to access and up-to-date information on ongoing clinical trials and is potentially useful to medical professionals in their busy daily practices. These results warrant the development of an application including all registered clinical trials in which users can select their own trials of interest, including all diseases and specialties.
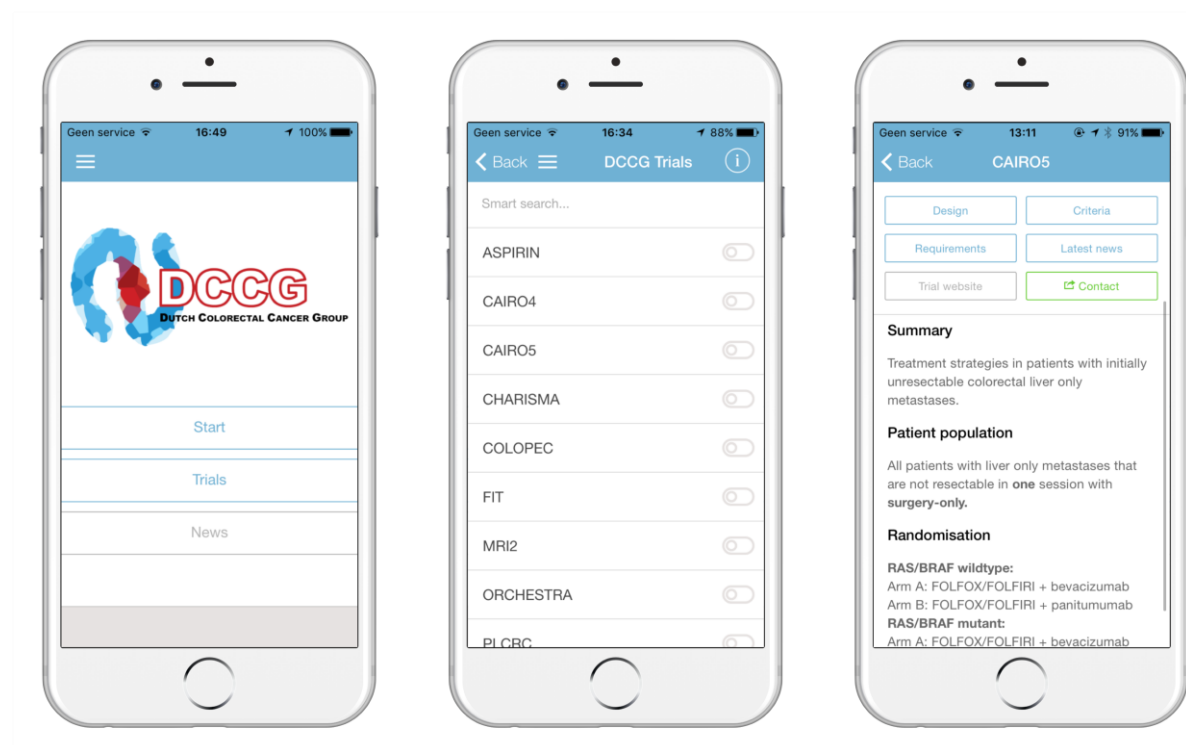
Figures and Tables

Figure 1: Number of registered trials on colorectal carcinoma in clinicaltrials.gov.
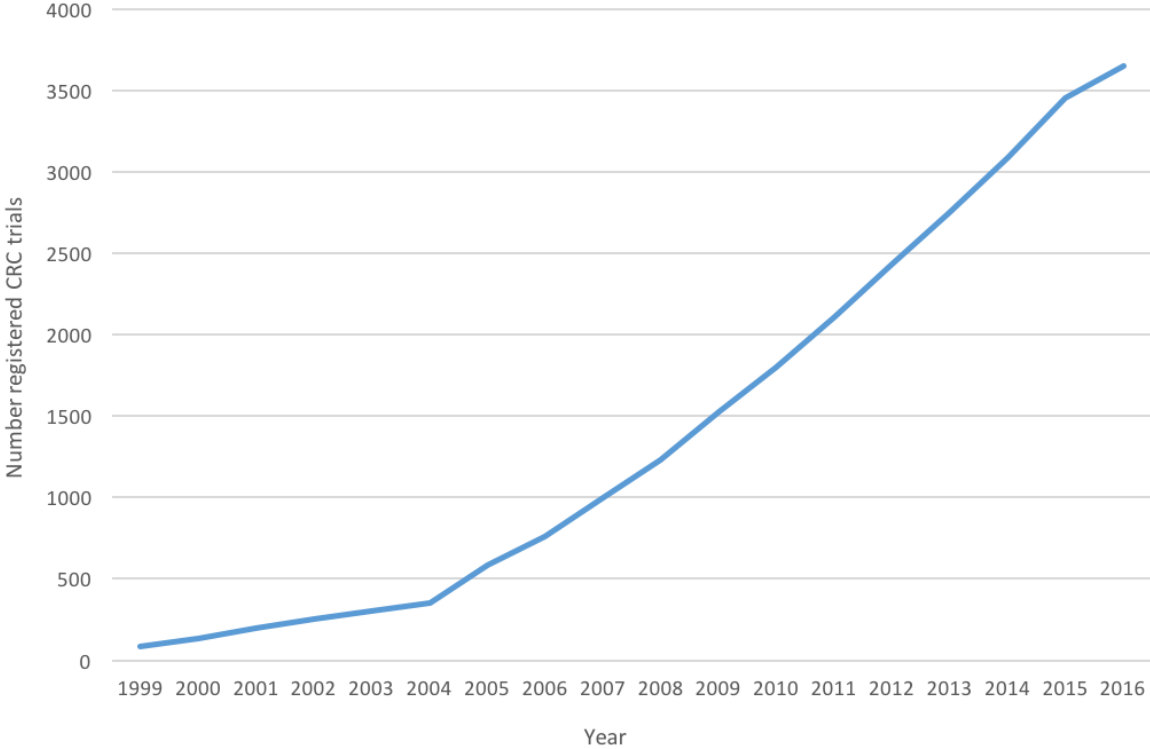
Figure 2: Illustration of the home screen, trials overview and a trial information page

Table 1: List of top ten countries in which the application was used

Country	New Users	Sessions	Bounce Rate	Pages / Session	Median session duration (Min)
Netherlands	1822	10987	3%	7,26	02:51
United States	1313	134879	77%	1,47	00:32
(not set)	964	982	87%	1,24	00:18
United Kingdom	418	469	77%	1,92	00:25
China	219	224	82%	1,16	00:38
Japan	149	151	85%	1,17	00:22
Germany	142	169	62%	2,25	00:46
Italy	116	143	34%	3,96	00:40
Brazil	93	95	89%	1,48	00:08
Russia	54	282	48%	1,62	02:59

Table 2: All available trials in the application

| DCCG Trials	Trial ID	Pageviews: n (%)	Median time on page: sec (IQR)
CAIRO5	NCT02162563	2923 (18%)	47 (18-161)
ORCHESTRA	NCT01792934	2117 (13%)	41 (10-136)
CAIRO4	NCT01606098	1926 (12%)	27 (7-87)
CHARISMA	NTR4893	1591 (10%)	21 (4-74)
COLOPEC	NCT02231086	1575 (10%)	26 (14-71)
RAPIDO	NCT01558921	1125 (7%)	21 (7-58)
ASPIRIN	NCT02301286	1106 (7%)	15 (5-53)
PLCRC	NCT02070146	956 (6%)	11 (5-41)
TESAR	NCT02371304	787 (5%)	19 (5-34)
FIT	NCT02243735	709 (4%)	9 (4-22)
SALTO	NCT01918852	598 (3%)	8 (3-22)
MRI2	NCT01721785	483 (3%)	8 (3-22)
CONSTRUCT	NTR4673	321 (2%)	9 (6-28)
Total		**15896**	

Table 3: Overview of the reasons for application use. 75 out of 121 people answered this question.

Reason	N (%)
When I have a (urgent) question about a specific DCCG trial	43 (57%)
During multi-disciplinary meetings	37 (49%)
During my work at the outpatient clinic	23 (31%)
In preparation for the outpatient clinic	20 (27%)
In preparation for multi-disciplinary meetings	18 (24%)
When I finished work, mostly in the evening or at home	8 (11%)
Other	6 (8%)

Appendix 1 An overview of the conducted survey

Questions	Answer	15
1 Do you use the DCCG Trials App? *	*Yes / No*	
2 Why don't you use the DCCG Trials App?	*Free text*	
3 What is your profession?	a) *Medical doctor* b) *(Research) Nurse* c) *Researcher* d) *Data manager* e) *Other*	
4 What is your age?	*N (years)*	
5 In what type of institution do you work?	a) *Academic hospital* b) *Teaching hospital (STZ ziekenhuis)* c) *General hospital* d) *Other*	
6 Are you satisfied with the DCCG Trials App	*Score: 1-5 (Strongly disagree - Strongly agree)*	
7 Do you agree with the following statement: I would recommend the DCCG Trials App to my colleagues.	*Score: 1-5 (Strongly disagree - Strongly agree)*	
8 When do you use the DCCG Trials App? *(multiple answers possible)*	a) *During multi-disciplinary meetings.* b) *In preparation for multi-disciplinary meetings.* c) *During my work at the outpatient clinic.* d) *In preparation for the outpatient clinic.* e) *When I finished work, mostly in the evening or at home.* f) *When I have a (urgent) question about a specific DCCG trial.* g) *Other*	
9 For how long have you used the DCCG Trials App?	*N (months)*	
10 What is your average session duration when you use the DCCG Trials App?	a) *<2 minutes* b) *2-5 minutes* c) *>5 minutes*	
11 Do you have any feedback that you would like to share?	*Free text*	

*If answer is 'No' only question 2 and 11 could be submitted, if answer is 'Yes' question 2 could not be submitted

Supplementary Figure 1: Overview of all the countries in which the application has been used.
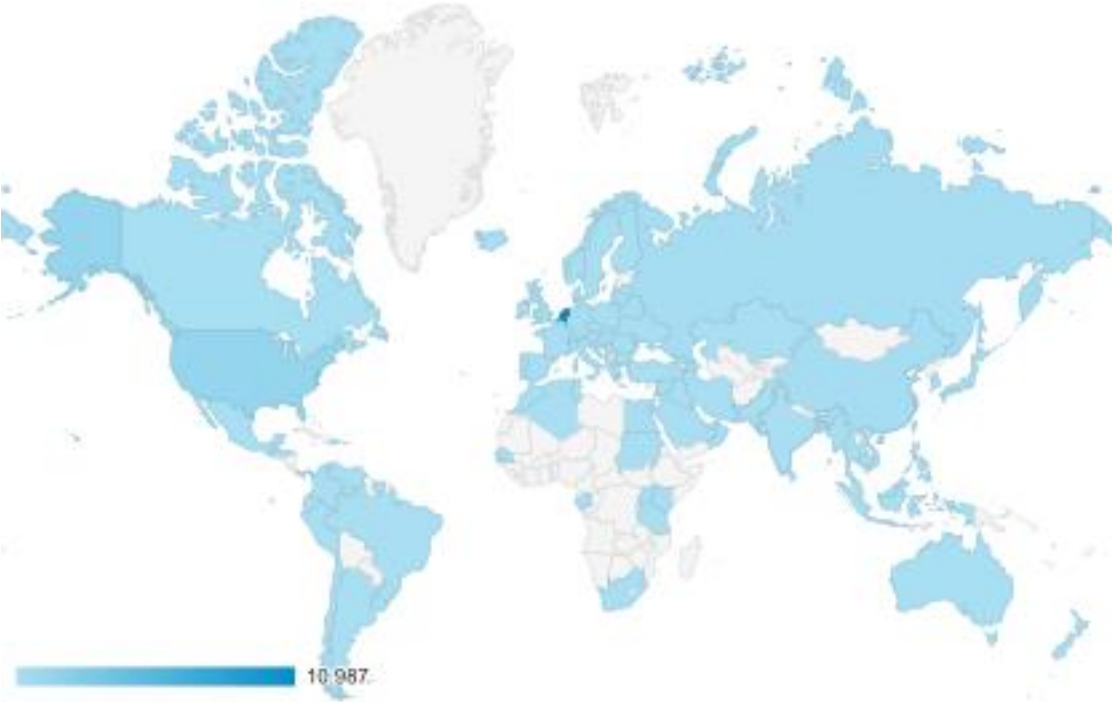
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16   find&learn Ct., https://itunes.Apple.Com/us/app/clinical-trials-find-learn/id809871284?Mt=8.

17   Trials CR., https://itunes.Apple.Com/us/app/clinical-research-trials/id511192008?Mt=8.

18   Resource LOCT., http://www.Emergingmed.Com/support/lilly.Html.