Zero cost approach to fostering multidisciplinary engagement and innovation in an academic medical centre during COVID-19: experience from the Jugaar Innovation Challenge

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INTRODUCTION

The COVID-19 pandemic, without an end in sight, has posed critical challenges to healthcare systems around the globe. The increasing severity of the pandemic and the need for rapid scaling of healthcare systems makes a strong case for community sourced innovation to help bridge the gap.

Hackathons have become an increasingly well-known tool for innovation globally.[1] Widely considered an effective medium to bridge diverse, multidisciplinary groups,[2] hackathons have helped teams to conceptualise and develop new, innovative approaches to healthcare challenges.[3] With the rampant spread of COVID-19 in Pakistan, and its associated risks, hackathons could very well provide the needed bridge by fostering multidisciplinary collaborations and innovation output.

Given the current restrictions on in-person meetings and travelling, collecting to collaborate and innovate are not as seamless as it once used to be.[4] Yet, given the urgency to innovate and remain proactive during the COVID-19 pandemic—the need to build multidisciplinary teams, and exchange information has never been higher.

Furthermore, the lack of availability of personal protective equipment, ventilators and other key resources exposed the fragility of Pakistan's health system in its ability to manage the spread and treatment of COVID-19.[5] If Pakistan was to build any momentum in its fight against COVID-19, it would have to start with building closer synergies between innovators in the community. A key part of making this possible would be to ensure quick availability of information on different initiatives ranging from development of low cost ventilators, and securing COVID-19 testing booths, to the three-dimensional (3D) printing of masks, among key stakeholders and decision-makers to allow for their seamless collaboration if needed.

Summary box

What are the new findings?

- Quality of team mentorship is a key vulnerability in virtual hackathons, and this can easily be managed through more curated engagement via free online collaboration tools.
- Virtual hackathons present the opportunity for wider engagement; however, wider engagement should not be pursued at the expense of quality of engagement.
- Virtual hackathons may be conducted at zero additional cost.

How might it impact on healthcare in the future?

- Virtual hackathons may add to the much-constrained capacity of medical centres, which can be incredibly valuable to healthcare providers, especially during pandemic times.

It is with the above motivation, that the Critical Creative Innovative Thinking (CCIT) forum at the Aga Khan University in Karachi, Pakistan, launched the Jugaar Innovation Challenge (JIC), a virtual hackathon. Jugaar in Urdu refers to unconventional, frugal and inexpensive innovation, often called a 'hack'.[6] Consequently, the COVID-19 outbreak sparked the wave of Jugaar Innovation across Pakistan with JIC being an extraordinary example of this effort. This paper reflects on the methodology, execution and learnings of the JIC; and makes the case for virtual hackathons as effective tools for multidisciplinary team building and knowledge exchange.

METHODOLOGY

Study design and settings

We conducted this study to evaluate execution of the JIC, in order to benefit future iterations of it through empirical learnings and insight.

We sought to evaluate performance on the measure of three indicators—community outreach, innovation output and a shift in attitude change. We achieved this by engaging participants from diverse backgrounds for a period of 3 weeks. Data were collected from Facebook Insights, milestone tracking and a postevent survey.

Inclusion and exclusion criteria

All the hackers, mentors, collaborators and judges, who were part of the 'JIC 2020' Facebook group were included in this study. However, only the participants with project submissions were included in a postevent survey to capture the effectiveness of JIC at the level of hackers and innovators.

Study procedure

The JIC was launched as a national call for innovations, through which all members of civic society in Pakistan were invited to share their ideas and efforts that addressed the various problem areas of COVID-19.[7]

The JIC took place from the 23 March to 10 April 2020 and was open to all. As such, the only prerequisite to participate was reading the JIC resource packet, which included guidelines for participation, team building, mentoring, COVID-19 factsheet and instructions for submissions. The event itself was conducted at zero additional cost—the JIC organisers were all budgeted employees of AKU's CCIT forum, and the mentors were all volunteers. The JIC itself was not a planned, or budgeted event for CCIT's 2020 fiscal year, however, due to the need of the hour and evolving situation at the time—the CCIT team felt that it was necessary to execute this event to facilitate innovators and entrepreneurs in adding value, and contributing to Pakistan's COVID-19 recovery.

The 'JIC 2020' Facebook group served as the primary resource centre for team building, knowledge exchange, community engagement, mentorship requests and live coaching sessions.

The process of entry was intentionally kept simple to encourage maximum participation and the participants were recommended a structure for team building and hacking. Teams were encouraged to have up to six multidisciplinary members with adequate technology representation to facilitate the process of development and prototyping. Use of collaboration tools such as Google docs, Zoom and Slack were strongly recommended for remote/virtual work and the JIC organising team held daily information sessions on remote working as well.

Additionally, it was advised that participants make their submissions within 6–7 days of joining the JIC 2020 group. The first 2 days would be devoted to identifying and understanding the nature of the problem and the scope of intervention. Days 3 and 4 would include prototype development, or at the minimum defining process of development, and use. The last 2 days would include defining the economics of the intervention which included identifying further developmental costs such as testing and clinical validation. Mentorship would be available to participants throughout this process.

The idea submission criteria were:

1. Problem statement: relevant to COVID-19, with impact metrics and validation.
2. Innovation scope: the process of development and process of use. Extra points for validated solutions.
3. Sustainability model: nature of supply and demand—costs associated with each.
4. Developmental milestones and budgets.

During the 3 weeks of JIC, daily sessions were conducted on various topics, ranging from the state of knowledge and innovation on COVID-19 testing practices to the importance of creativity and frugal innovation in the era of COVID-19.

Once participant teams made their submissions, their projects were reviewed and shared with JIC ecosystem partners and judges. The latter were expected to provide feedback on and collaborate with and champion projects and teams that they felt had potential and were relevant to their mandate. After the launch, the organising team conducted aggressive outreach and engagement, at a minimum three times a day and addressed queries and requests within 30 min. This proactive engagement contributed to a high number of participants in the JIC, and also increased the level of interaction within the CCIT forum's Facebook page.

Data analysis

The data were collected retrospectively using Facebook insights and milestone's tracking of our JIC teams. A posthack survey of the project submission teams was also conducted to evaluate the increase in awareness and hopefulness around the pandemic. We further matched this data with the innovations that emerged

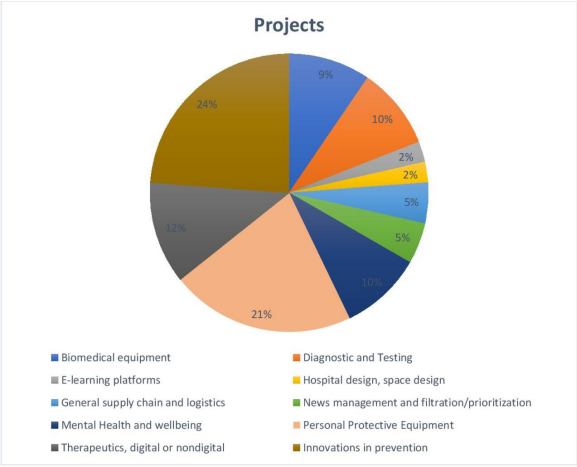

Figure 1 Forty-two total submissions were received that could be categorised into 10 themes as shown in this pie chart.

out of the JIC and progress made by the teams. For analysis, the data were tabulated using Microsoft excel. Means and SD were calculated for continuous variables.

RESULTS

Overview of demographics of JIC participants

Within 2 weeks of the event, JIC had a total of 1441 participants from across the world. Although a majority of the participants were from various cities in Pakistan, we had 100+ participants from different countries from across the globe. A majority of the participants were female (58%), of which almost half belonged to the 25–34 years old age group.

JIC project submissions: innovation output

Within the first week of its launch, JIC had already provided support to the Emergency Department, Biosafety, Procurement and Project Management and Construction teams at AKU. This was in part, made possible due to the diversity and continuous engagement of the 1400+ member group which included participants from across Pakistan, and collaborators from Habib University, Karachi University, DHA Suffa University, as well as start-ups in mental health, telehealth and local incubation centres. There was a rich diversity among our participant groups as well—with technology, academia, healthcare, community sciences, biomedical technology, pharmaceutical sciences and business being adequately represented. Most teams used the JIC Community Facebook Page to source technical information and expertise. Additionally, team members were primarily coordinating among themselves through WhatsApp groups, Slack and Google Drive.

A few innovations coming out of JIC were already live, within the second week of the challenge, and began demonstrating impact—two examples are corVETTE—a COVID-19 patient triage classification tool and Pukaar, an online support group promoting community through collective participation in online activities inspired by the pandemic. In addition, a team working on developing a low-cost ventilator, PakOxygen, was able to get access to an AutoCAD 3D design of a PEEP valve from a Polish biomedical engineer. This collaboration helped them address a limitation that could have potentially halted their progress. The same team is currently in the process of validating their ventilator in a clinical setting. These are some of the examples where JIC was able to facilitate cross border, multidisciplinary collaborations towards innovation output.

By the end of the challenge, there were 42 submissions across 10 categories; these are summarised in figure 1.

While submissions were being reviewed, and select teams were being progressed towards judging rounds on a rolling basis, the JIC organising team conducted feedback sessions with all 42 project teams at the close of the JIC. During these meetings, select teams were identified to work closely with the CCIT forum to further develop their idea towards the pilot, and apply for grant funding. Some teams were referred to other incubation centres for progression.

Postevent survey gauging attitude shift

The JIC organising team conducted a postevent survey to capture the effectiveness of the event in inculcating a proactive approach to COVID-19 at an individual level. The teams which were selected for postevent incubation were requested to fill out the postevent survey. The survey had 24 respondents, all of whom were part of project submissions.

As per the survey results, the following key insights were found:

- The average age was 25.8 years (SD=7.6), with 83% being female participants.
- More than half (58.3%) of the participants attended mentorship sessions and (66.7%) attended speaker sessions organised for their facilitation.
- More than half (54%) of JIC participants felt that being part of a project team increased their awareness about the effects of coronavirus, and as a result, helped them to be better prepared, both physically and mentally.
- More than half (54%) of JIC participants felt that being part of the JIC Facebook group gave them hope that the negative impact of coronavirus could be successfully addressed through teamwork and collaboration.
- Forty-two per cent of participants felt they had access to more credible information on the management of COVID-19, whereas 33% of participants did not feel they had access to more credible information on the management of COVID-19.
- Half of the participants felt that projects and innovations being discussed on the JIC group helped them better manage their fear and uncertainty around coronavirus.

Table 1 Postevent survey administered to the hackers at the JIC, 23 March to 10 April 2020

S. no	Question or statement	Mean score (SD)
1	Did you feel any anxiety as a result of coronavirus and reporting on coronavirus before joining the JIC group?	2.4 (1.01)
2	As part of the group, did you feel you had access to more credible information on management COVID-19?	3.0 (1.44)
3	Did the projects and innovations being discussed on the group help you better manage fear and uncertainty around coronavirus?	2.86 (1.39)
4	Did the engagement and interactions within the group give you hope that the negative impact of coronavirus could be successfully addressed through team work, and collaboration?	3.63 (0.96)
5	Did you feel the office hours were helpful in guiding you and your team to develop your innovations?	2.7 (1.23)
6	Did you feel the speaker sessions were helpful in guiding you and your team to develop your innovations?	2.92 (1.14)
7	If yes to above, did being part of a project team increase your awareness about the effects of coronavirus, and as a result, help you to be better prepared, both physically and mentally?	3.5 (1.06)

Each statement could be scored from 1 to 5 on a Likert scale, with 1 being the most unfavourable to 5 being the most favourable response. The mean scores as well as the SD of each score are shown in the table for the 24 hackers.
JIC, Jugaar Innovation Challenge.

The rest of the survey results are summarised in table 1 below.

DISCUSSION

To the best of our knowledge, our study is the first of its kind describing the outcomes of a virtual, although frugal innovation challenge through an online hackathon for COVID-19, for Pakistan. A key philosophy of the JIC organising team was that an idea from anyone, delivered at the right time, has the potential to change the world. While retrospectively, this remains a noble motivator—there was a definite opportunity for the JIC to have curated its community engagement in a manner that would favour quality over quantity. It could also have benefitted from better participation engagement and management, and therefore yielding better outcomes across attitude and innovation output. A key learning from our experience with the JIC was that participant to mentor ratios in virtual hackathons should be the same as they would be in traditional hackathons. The JIC participation was higher than any of our previous hackathons that were conducted by the CCIT forum, yet the level of mentorship did not increase in proportion, as described in table 2. This may have limited JIC's potential impact across shifting attitudes and innovation output.

Our key finding was that the quality of engagement taking place in an innovation challenge is driven by several interactions with fewer groups, as compared with engaging participants en masse. Our finding is consistent with a study by Mcourt and Carr, where they measured the effectiveness of small group tutorials on student retention and engagement; the authors concluded that managing engagement in small groups is effective as it encourages participation, provides feedback and improves retention.[8] Although the JIC organisers conducted daily engagement sessions, it lost out on the opportunity to engage participants in closer quarters before project submission. Here was an opportunity to proactively schedule mentorship sessions through zoom breakout rooms—such engagement might have retrospectively contributed towards a larger positive response rate and quality of innovation output. This is supported by Hossain *et al* in which they make the case for technology, particularly collaboration and web conferencing tools, that have significantly contributed to their success of conducting a virtual hackathon.[9]

Additionally, the mentors that were available were not adequately used as few teams requested mentorship, even though it was available to them. This was likely due to overly depending on a push mechanism for mentor engagements—where mentor engagement is request driven, as opposed to a pull mechanism—where appointments and mentor sessions are proactively scheduled and

Table 2 Hackathons organised by the CCIT forum from 2016 to 2020

Hackathon	No of participants	No of mentors	Total budget (US$)	Reference
Emergency medicine	81	9	26 000	1a
Paediatrics	114	11	15 000	1a
Medical education	116	20	7200	1b
Global surgery	109	20	7500	1c
School preparedness for emergencies	144	20	10 000	1d
Jugaar Innovation Challenge	1441	8	0	This paper

This table lists the hackathons organised along with their participation and budget used for their execution. We have compared the participants, mentors and budget utilised at each of the hackathons.[10–13]
CCIT, Critical Creative Innovative Thinking.

opened for first come first serve booking. As per Hossain *et al*, in their experience of conducting a virtual hackathon, the latter method of engagement has proved successful in effectively using mentor time, prioritising demand for their skills and also upholding quality of interaction through one on one, or small group engagement.[9] Moreover, a systemic challenge to virtual collaboration was poor internet access, and sporadic electricity outages in Pakistan. Although the process of collaborating and working virtually was already well defined through the availability of popular free platforms such as Slack, Zoom, WhatsApp and Google Drive—some participants claimed that internet outages due to electricity load shedding broke their team momentum, and impacted productivity. Additionally, participation from the Northern Areas of Pakistan was low primarily due to inadequate internet access.

The JIC organisers were primarily focused on the quantity of participants and submissions, versus the quality of engagement and community interaction. This unintentional neglect resulted in the JIC community group having more than 1400 participants and 42 submissions—with few clear, ready-to-deploy winners and innovators even though there was definite potential to do so, given the diversity and quality of the participants. Hence, we feel that the JIC platform did not fully maximise the diversity and potential of its participants.

While the findings of the JIC are credible, and adequately captured, the quality of those findings may have been improved in the absence of the following limitations:

- The participant feedback survey was disseminated and filled several weeks after the close of the JIC. As a result, there might have been a risk of incomplete or inaccurate recollection of the actual event.
- The JIC Facebook group had several members, with different levels of engagement. While the survey captured participants, whom were involved with project submissions, it is not clear if they had a leading role.

Moving forward, these retrospective insights would make for very quick fixes for the second rendition of the JIC, therefore, ensuring that it lives up to its fullest potential. Moreover, as a tool to rapidly engage the community in times of crises, and mobilise teams and resources towards intellectual output, the JIC proved to be successful in demonstrating proof-of-concept abilities. The JIC organising team had less than a week to plan for this 3-week engagement, and several lessons were being realised and implemented where possible during the execution phase of the JIC.

CONCLUSION

This paper highlighted the JIC impact across outreach, attitude change and to a limited degree, innovation output in COVID-19. As such, it has proven to be an effective tool for cross-disciplinary collaboration, team building and knowledge exchange in a high stress and fluid environment. The learnings shall benefit Academic Medical Centres, and similar educational entities with focused domains, to foster and develop collaborations and knowledge exchange within multidisciplinary groups through similar virtual innovation challenges during times of unprecedented disasters or otherwise.

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