REPORT OF THE HARVARD HEALTH SYSTEMS INNOVATION HACKATHON 2024

HEALTH SYSTEMS INNOVATION LAB
AT HARVARD UNIVERSITY

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH | HEALTH SYSTEMS INNOVATION LAB

About the Report

This report was developed to reflect on the experiences of the 5th Harvard Health Systems Innovation Hackathon, '*Building High-Value Health Systems: Harnessing Digital Health and Artificial Intelligence'*. The event took place on April 5th and 6th 2024, with organization led by the Health Systems Innovation Lab (HSIL) at Harvard University (Boston, USA), in collaboration with eight Hackathon Hubs based at the HIVE Innovation (Buenos Aires, Argentina), the World Health Organization Ukraine Country Office (Kyiv, Ukraine), KeroLab, the health policy innovation Laboratory of Roche Perú (Chiclayo and Lima, Peru), King's College London (London, UK), Centro para la Prevención y el Control del Cáncer (CECAN) (Santiago, Chile), and Fundação Getulio Vargas (FGV) and Inova HC (São Paulo, Brasil). This report was developed under the guidance of Professor Rifat Atun, Professor of Global Health Systems at Harvard University and Director of the Health Systems Innovation Lab, and implemented by a team consisting of Dr. Caroline A. Bulstra, Dr. Jake Figi, Luke Brothers, Dr. Che L. Reddy, Dr. Gabriela Borin, Nour Sharara and Dr. Bukhtawar Azhar, and reviewed by all Hub coordinators.

Insights from this report will be used to guide the design, coordination, and implementation of future hackathons by outlining and summarizing key learning points and effective strategies to facilitate further improvements in the event. We also hope this report will be able to serve as a resource to promote local innovation ecosystems by helping other institutions organize their own hackathons.

Suggested citation

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Acknowledgements

We would like to convey our heartfelt appreciation to the distinguished leaders and collaborators whose contributions made this Hackathon possible. Our deepest gratitude goes to all Hub coordinators who dedicated their time and efforts to the local organization of the Hackathon at one of the Hubs: **Boston**: Dr. Bukhtawar Azhar, Dr. Caroline Bulstra, Dr. Jake Figi, Dr. Che L. Reddy, Luke Brothers, Eunsoo Cho, Jonathan Gong, Kiana Beheshtian, Senthujan Senkaiahliyan, Assel Ibadulla and Caleb Kumar; **Buenos Aires**: Andrés Anania and team; **Chiclayo** and **Lima**: Ramiro Rodrich, Penelope Brou, Sandra Valdiviezo, Jimy Inoue and team; **Kyiv**: Nataliia Piven, Iuliia Novak, Inna Bulchak, Iryna Tarnavska, Iurii-Volodymyr Blavt, Nataliia Kravtsova, Olena Shershun, Mariia Romanova, Anastasiia Romanova, Andrii Zaikin and Marharyta Chernyshova; **London**: Prof. Josip Car, Lei Lu and Simon Mengzhe Xu; **Santiago**: Prof. Carolina Goic Boroevic, Dr. Gabriela Borin and team; **São Paulo**: Prof. Adriano Massuda, Dr. Prof. Giovanni Guido Cerri, Alessandro Bigoni, Érico Theodorovitz and team.

Their commitment and dedication were instrumental in ensuring the success of the event. We extend our sincere thanks to the global organizing team, including Nour Sharara and Dr. Caroline Bulstra, who co-led the organization of the event and whose efforts and leadership were central to the coordination and execution of the Hackathon on a global scale. We are also immensely grateful to all mentors and judges who generously shared their expertise, guidance, and support with the participants, helping them navigate challenges and unlock their potential. Your invaluable contributions have made a lasting impact on the success of the Hackathon and the participants' experiences. Finally, we convey our appreciation to all participants who made this Hackathon a unique and energetic experience. We are eager to engage with all partners in the organization of future Hackathons.

Executive Summary

This report reflects on the experiences of the 5th annual Harvard Health Systems Innovation Lab's Hackathon, held on April 5th and 6th, 2024. The event, themed 'Building High-Value Health Systems: Harnessing Digital Health and Artificial Intelligence', took place across eight global Hubs: Boston, Buenos Aires, Kyiv, Lima, Chiclayo, London, Santiago, and São Paulo. Organized under the guidance of Professor Rifat Atun and a dedicated team, the Hackathon aimed to foster innovation in healthcare systems by bringing together diverse participants to develop practical solutions to critical health challenges.

The Hackathon featured three tracks: Cardiovascular Diseases and Diabetes, Cancer, and Mental Health. Out of over 1100 applications, about 500 participants were selected to join the hackathon across all Hubs. Participants, supported by mentors, developed and pitched their solutions to local and global judging panels. All teams pitched to the local judges, with 20 teams advancing to the global judging. The global judges selected the final winning teams, who joined the HSIL Venture Incubation Program.

Key recommendations for future hackathons include early engagement with Hubs, supporting new hubs through partnerships with experienced ones, leveraging social media for participant recruitment, and building strong partnerships for support of teams during and after the Hackathon. Participant feedback indicated high satisfaction, with an overall event rating of 4.32 out of 5.

The 2024 HSIL Hackathon successfully facilitated collaboration, innovation, and knowledge exchange, reinforcing its mission to create ventures that add value to health systems globally. Future hackathons will focus on strengthening partnerships and expanding the network of hubs to enhance global impact.

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1. Introduction

The Health System Innovation Lab (HSIL) at Harvard University organizes an annual Hackathon in collaboration with global partners. The HSIL Hackathon is a transformative event with a clear mission: to empower innovators to develop innovative solutions that create value in health systems. This dynamic and collaborative event brings together students, professionals, and experts from diverse fields to address critical health system challenges through innovation. By fostering an environment that encourages unconventional thinking and practical solutions, it catalyzes positive change in health systems worldwide. Teams are supported to develop groundbreaking solutions that can challenge the status quo and transform healthcare, bridging the gap between theory and practice. The HSIL approach to venture creation extends beyond the Hackathon, with successful teams receiving targeted support to build their ventures, helping to drive the broader mission of value creation in health systems.

The HSIL Hackathon aims to foster a culture of collaboration and cross-disciplinary learning and exchange with enduring effects. Teams collaborate intensively during the event and establish relationships and networks that extend beyond its duration. This collaborative ethos promotes knowledge exchange and the potential for future partnerships, helping to support innovators and entrepreneurs driving value in health systems. In summary, the HSIL Hackathon is a powerful platform for innovation, practicality, and collaboration, dedicated to transforming healthcare systems worldwide for the better.

The 2024 HSIL Hackathon was the 5th iteration and took take place on **Friday 5th and Saturday 6th April 2024**. The theme was **'Building High-Value Health Systems: Harnessing Digital Health and Artificial Intelligence'**. The Hackathon had three tracks:

- Cardiovascular Disease and Diabetes
- Cancer
- Mental Health

2. Organization

Set-up of the Hackathon

The Hackathon was organized as a **two-day in-person event** in eight Hubs across Central and South America, Europe, and the UK. Over the two-day Hackathon, the goal is for teams to identify a health system challenge they want to tackle and develop an innovative solution to address the challenge. Teams had access to in-person and remote mentors with clinical, business, policy, and technical expertise. Mentors advised the teams, challenged their assumptions, and provided teams with feedback on their pitch. At the end of the two-day Hackathon, teams pitched their solution to a Hub judging panel. Judges from each Hub selected a winning team for each track, with larger Hubs (those with approximately 15 teams or more) additionally selecting two teams as runners-up from any track to receive a certificate for their achievement. The stages and activities during the Hackathon and post-Hackathon are shown in **Diagrams 1 and 2**. The organizational structure and partners of the Hackathon are shown in **Diagram 3** and **Table 1**.

Diagram 1: The Different Stages During the Health Systems Innovation Lab Hackathon

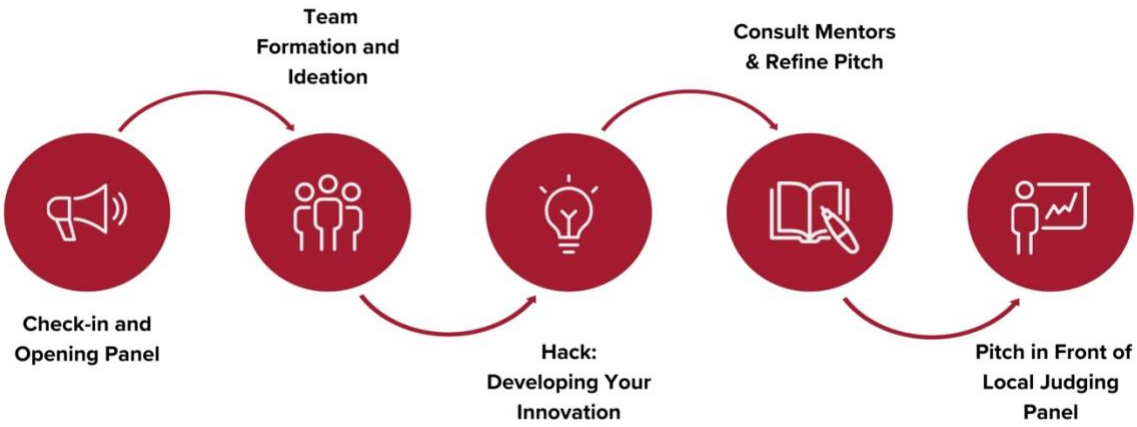
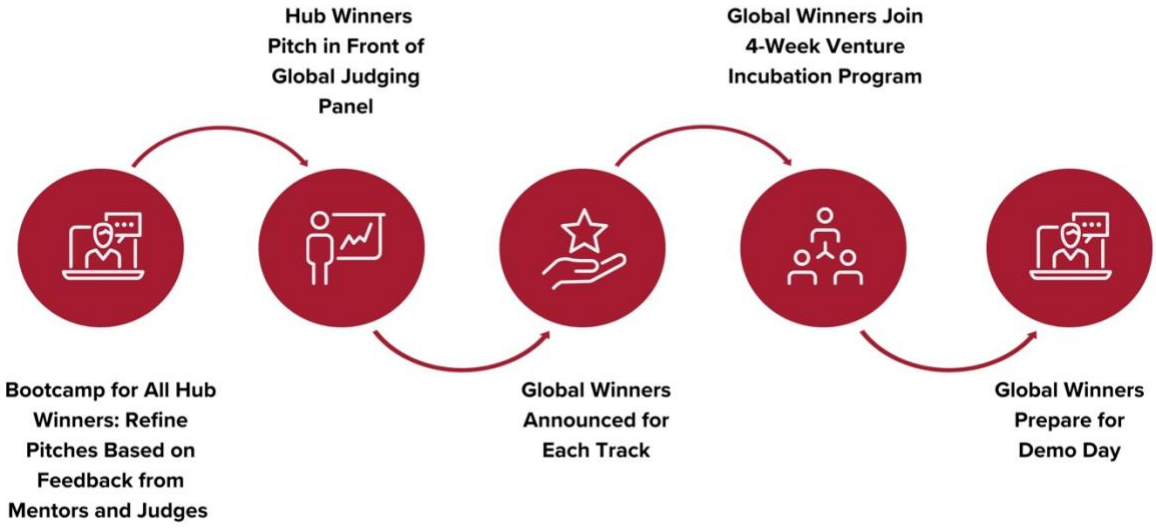


Diagram 2: The Different Stages After the Health Systems Innovation Lab Hackathon: Post-Hackathon Venture Creation Approach



Across all eight Hubs, 20 teams were successful and made it to the second round of judging that took place on April 30th, 2024. Four teams were selected in the final global judging round, which took place on May 3rd, 2024. Winning teams entered a Bootcamp to prepare them for several rounds of pitches in front of global judging panels. The final winners join a 4-week incubation program hosted by the Harvard Health Systems Innovation Lab and collaborators (online).

Partnerships with Country Hubs and Recruitment of Participants

HSIL contacted potential Hubs six months before the start of the hack and had fortnightly meetings with each Hub to support with the organization.

Recruitment of participants for the Hackathon was done by each Hub locally as well as through the HSIL social media channels and via emails to the HSIL network. Registration was done through a centralized application form. In consultation with the various Hubs, HSIL selected participants on a rolling basis and established the maximum number of participants per Hub in relation to the capacity of each local venue and Hub capacity.

Diagram 3: Diagram Depicting the Organizational Structure of the Hackathon

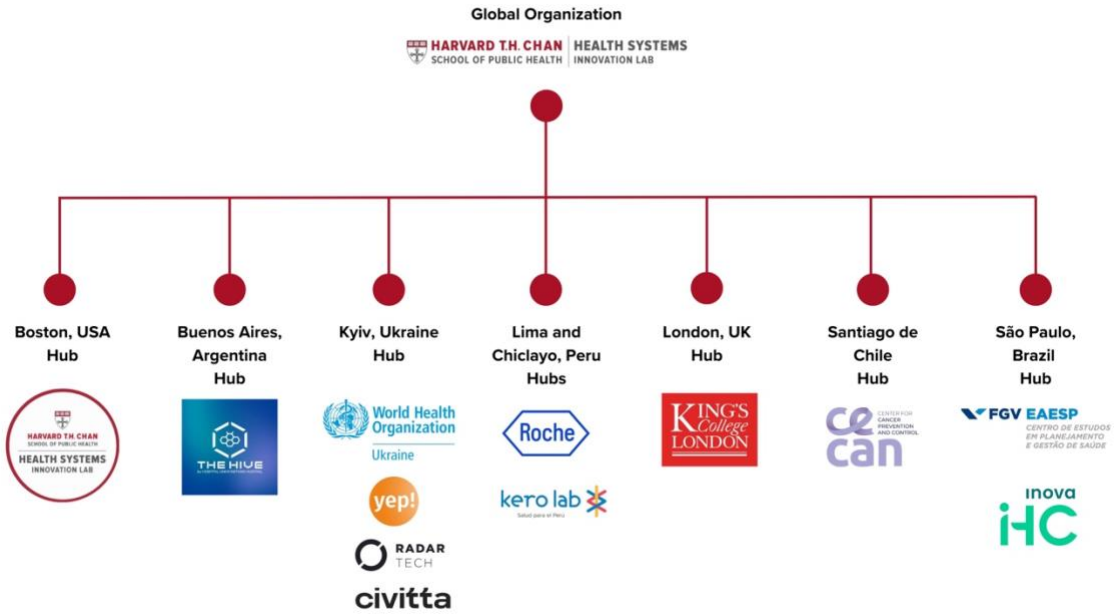


Table 1: Hackathon Hubs

Location	Organizers
Boston, USA	Harvard Health Systems Innovation Lab
Buenos Aires, Argentina	The HIVE Innovation
Kyiv, Ukraine	World Health Organization, Ukraine Country Office
Lima and Chiclayo, Peru	Roche Peru Office, Universidad Señor de Sipán
London, UK	King's College London
Santiago, Chile	Centro para la Prevención y el Control del Cáncer (CECAN)
São Paulo, Brazil	Fundação Getulio Vargas (FGV) and Inova HC

Organization and Management of Hackathon

Two Hackathon Leads from the Harvard Health Systems Innovation Lab were responsible for the global organization and coordination of the Hackathon across all Hubs. Each hub was assigned a coordinator from the Harvard Health Systems Innovation Lab, who interfaced with the Hub organizing team regularly (initially at longer intervals and in the final 4-6 weeks before the event in weekly or twice-weekly meetings) to assist in coordination, to check in on deadlines and provide any clarification necessary for hackathon preparations.

Each Hub appointed an organizing team consisting of a local host (usually senior faculty of the institution), who was responsible for gaining approval for the event at their site and

recruiting volunteers to organize and run the event; senior volunteers (faculty and senior researchers) who coordinated the majority of the on-the-ground activities and communications with participants; and junior volunteers (researchers and students) who assisted in running the event on the day, including event registration, information technology (IT) and facility set up.

3. Applications

Review of Applications

The Hackathon generated substantial interest, with 1,121 applications to participate in the Hackathon globally (**Table 2**). The total number selected from the application list was at the discretion of each Hub. There was variation in the acceptance rate across Hubs, ranging from 36% in London to 73% in Buenos Aires and São Paulo.

Table 2: Applicants and attendees per Hub

Hub	Number of Applications	Number Participants	Acceptance Rate
All Hubs	1,121	532	47%
Boston	200	80	40%
Buenos Aires	109	80	73%
Chiclayo	58	17	29%
Kyiv	290	115	40%
Lima	205	75	37%
London	42	15	36%
Santiago	41	22	54%
São Paulo	176	128	73%

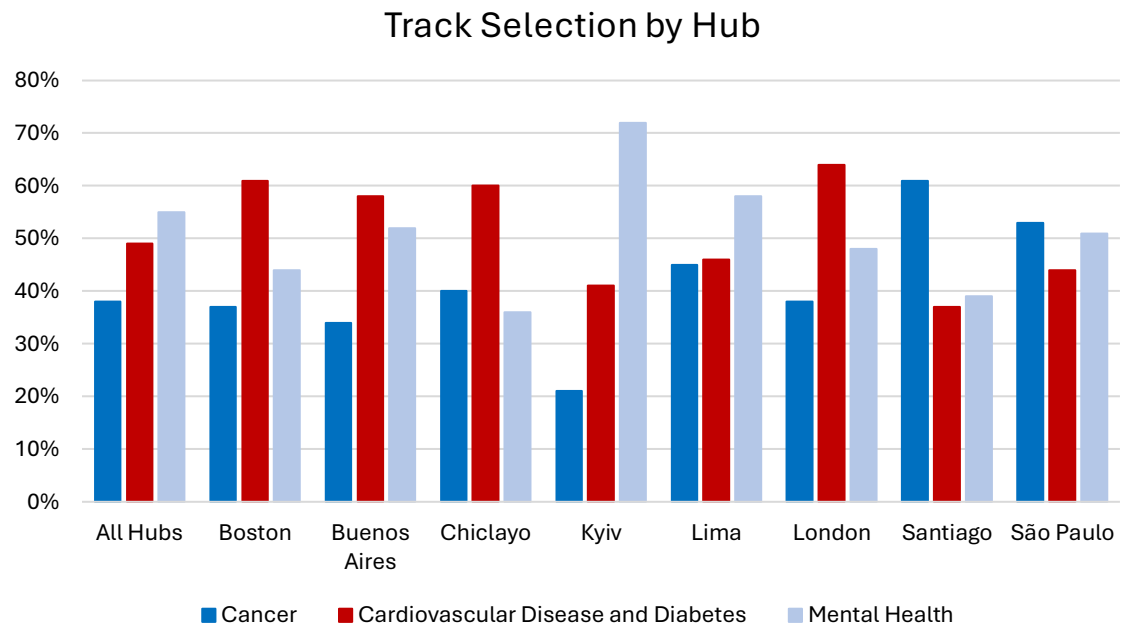
Number attended includes participants who attended only one or both days of the Hackathon.

Applicants were asked to indicate their track preference before the start of the Hackathon to assist in the preparation and allocation of resources and mentors respectively across each Hub. Applicants were invited to select all tracks that they were interested in, with 28% opting to select more than one track (**Figure 1**). The most selected track was mental health, with 614 applicants (55%) including it as an option, and 356 applicants selecting this as their only option. The track with the next highest interest was the cardiovascular disease and diabetes track with 548 (49%) including it as an option and 281 selecting it as their only option. Finally, 422 applicants (38%) included the cancer track as an option with 167 selecting it as their only option.

Overall, 28% of applicants opted to select more than one track as their track of interest, and 14% of applicants indicated an interested in all three tracks. There were variations in track preference across Hubs (Figure 1), with clear preferences in Hubs such as Kyiv with 72% of

applicants selecting mental health, Santiago with 61% selecting cancer, and London with 64% selecting cardiovascular disease and diabetes. These may represent interest due to country health system challenges and demands or could be a reflection of the recruitment styles of each Hub.

Figure 1: Track selection by Hub



Applicants were invited to indicate an interest in multiple tracks at the point of application, which occurred in 28% of cases. This table shows the percentage of participants who showed an interest in each individual track.

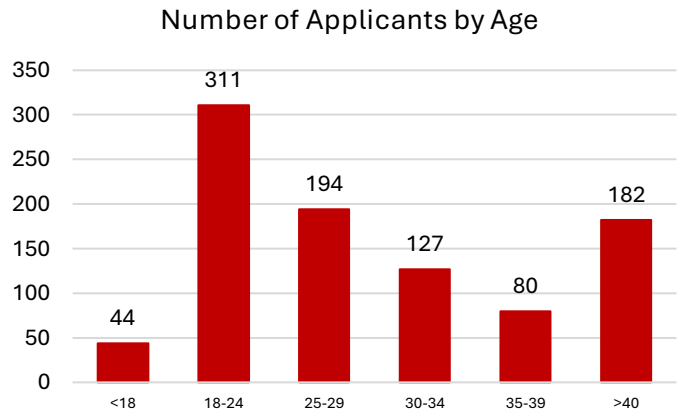
Applicant Profiles

Amongst applicants, there was a general skew towards younger age ranges with the most common age range being the 18-24 group with 311 applicants (**Figure 2a**). The over-40's group was also a significant proportion of the applicants, at 19%. This demographic brought in a great deal of experience and expertise that all participants were able to benefit. The mean age in each Hub varied substantially, with the highest mean age in Buenos Aires Hub at 38 years and the lowest mean age in Lima and São Paulo Hubs, both 27 years (**Figure 2b**). Across the applicants, there was an equal split between male and female applicants at 558 each, with 2 applicants identifying as non-binary (**Figure 2c**).

Students comprised bulk of Hackathon applicants at 44% (**Figure 2d**). As all Hackathon Hubs were based at universities, this was expected. However, the breath of backgrounds reached was a promising statistic, with a good spread of industry professionals (16%), medical providers including doctors, nurses, dieticians (13%), and researchers (12%). The range of backgrounds and experience is precisely the goal of healthcare innovation Hackathons, to bring together a diverse group that can share its experience and viewpoints to lead to more creative innovation.

Figure 2: Applicant Demographics

a.



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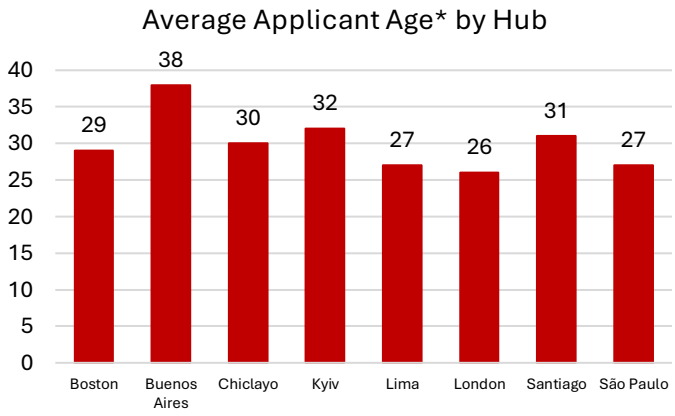

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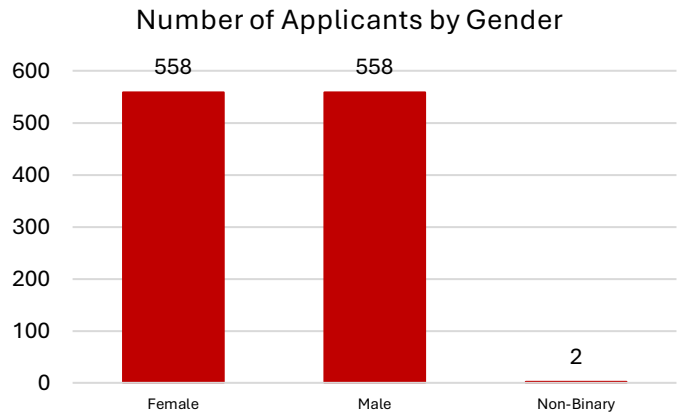
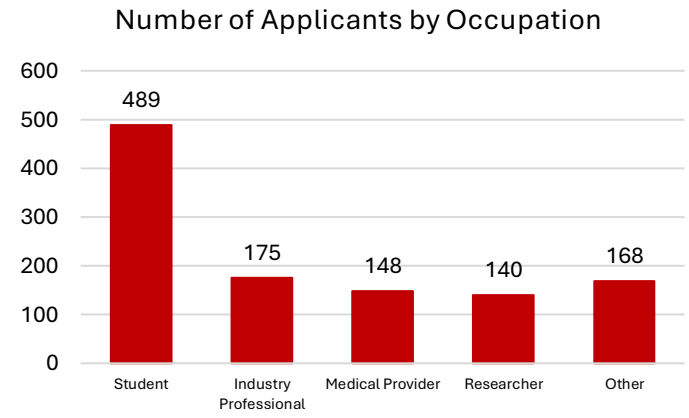


d.



**Mean age calculated using mid-value from age ranges and age 50 for those who selected >40 years old*

How Applicants Discovered the Hackathon

The majority of applicants found the Hackathon through recommendations from their friends or colleagues (n=529), closely followed by social media (n=407), **Table 3**. This highlights the

effectiveness of both local connections at each hub and the usefulness of social media to spread this information to potential applicants.

Table 3: Hackathon discovery

How did you hear about the Hackathon? (n=1119)	**Number of Applicants**
Friends or Colleagues	529
Social Media	407
Harvard or HSIL Website	186
Mailing List	128

Options that were selected multiple times by a single applicant were included.

4. Selection and Hackathon Winners

Local and Global Judging

Each local Hub selected local winners at the end of the Hackathon, based on the final pitches. The 20+ winning teams received two weeks of mentoring by members of the Harvard Health Systems Innovation Lab on how to refine their innovation and improve their pitch in preparation for the global judging. The global judging was done by Prof. Rifat Atun, colleagues from the Harvard Health Systems Innovation Lab, and partners from The Mentors Fund. The judging panel selected four winning teams:

- 1st: Winner: SNIFF
- 2nd: ZophIA.tech
- 3rd equal: SweetAudio and AI Pathology

The final winners partake in the month-long **Venture Incubation Program**.

Who are the Health Systems Innovation Hackathon winners of 2024?

SNIFF

S.N.I.F.F. (Smart Neoplasm Identification by Fume Fingerprinting) is a non-invasive test that aims to revolutionize breast cancer surgery by decreasing the rate of incomplete surgical excision of positive margins. The test utilizes multiple parameters derived from gases emitted by the electrocautery device during tissue ablation. These parameters are used to discriminate between malignant and benign tissue in the resection zone using artificial intelligence algorithms. The test is a Point of Care Test that provides real-time intraoperative feedback to the surgeon about the margin status in the area being excised, enabling immediate modification of the surgical plan and wider excision if indicated.

The S.N.I.F.F. team consists of five medical students from the Pontificia Universidad Católica de Chile, two of whom are pursuing parallel studies in engineering and one of whom has a degree in chemistry.

ZophIA.tech

ZophIA.tech is a support tool for diagnosing and evaluating mental disorders through speech. It uses AI enhanced by Geometric Analysis to reach into the hyperspectrum of mental health data. The solution aims not to replace mental healthcare professionals but rather to equip them with assertive screening tests to improve diagnosis accuracy. Through speech recognition, ZophIA.tech uses geometric and physical analysis methods in addition to classical AI. This allows it to characterize speech patterns assertively even with little data collected.

ZophIA.tech is the result of the combined efforts by team members affiliated with the Federal University of Pernambuco in Recife, Brazil with expertise in Medicine, Mathematics, and Statistics/Informatics.

SweetAudio

SweetAudio is a groundbreaking, non-invasive method for glucose monitoring utilizing voice analysis. Leveraging the power of AI and the correlation between vocal biomarkers and blood glucose levels, the platform offers a personalized, accessible, and affordable solution that simplifies diabetes management worldwide.

SweetAudio team members include professionals and students from Harvard and MIT with expertise in biomedical engineering, biotech, AI/ML, medicine, public health and epidemiology.

AI Pathology

AI Pathology Tech harnesses innovative AI technology to address the growing incidence of skin cancer. Nevo, their flagship web application, facilitates early skin lesion screening using smartphone photography. Tailored to accommodate diverse ethnic backgrounds, it focuses on the broad range of skin tones found in Brazil. The application employs a deep learning model to analyze skin lesion images, thus streamlining the screening process and fast-tracking consultations with dermatologists.

The AI Pathology team includes pathologists, developers, an AI specialist, and a lawyer, all dedicated to tackling this significant health issue in Brazil.

Support from Local Innovation Hubs

Each Innovation Hub autonomously developed its own strategies for engaging with local winners, tailoring their approaches to best fit regional needs and circumstances. Hubs were strongly encouraged to provide comprehensive mentorship and support to these local winners, ensuring they received the necessary guidance and resources to maximize their potential and success.

5. Evaluation

Reflections on the Hackathon by the Organizing Team

The HSIL Hackathon organizers met hub one week after the Hackathon to reflect on the event organization and outcomes. Their recommendations for the organization of future Hackathons:

(I) **Connect to Hubs early:** Begin contacting local Hubs at least six months ahead to allow for thorough preparation. A few of the Hubs had to opt out this year due to insufficient time to prepare for the Hackathon. Allowing Hubs more time will increase the likelihood of onboarding Hubs in every world region, which is desirable.

(II) **Consider Hackathon Hub experience:** Hubs that had prior experience organizing Hackathons had a clear head start; they knew what to expect and needed less support. For future Hackathons, the organization should dedicate more time to supporting new Hubs with their organization. We could consider linking more experienced Hubs to new Hubs to coordinate their Hackathon organization together.

(III) **Socialize early and share widely:** We sent emails to HSIL's network, to members from most schools in Boston as well as from the individual post-graduate schools at Harvard including Medicine, Engineering, and Public Health, and shared the Hackathon widely on HSIL's social media channels. This resulted in the recruitment of participants from diverse backgrounds and we recommend other hubs recruit similarly in future events.

(IV) **Support Hub engagement:** Hosting an engaging and energizing event at each of the Hubs with only virtual connection between the HSIL and the hub proved to be challenging. For the future years it may be worth having a Harvard Health Systems Innovation Lab associate at each Hub who moderates the Hackathon and ensures a high-quality event.

(V) **Participant recruitment:** One common observation across all hubs is that some of the participants who applied to take part in the hackathon already had fully fledged ideas, teams and in some cases existing products. Such teams are better suited for an accelerator program (if their solution seems promising) and not a hackathon. One question that would be interesting to investigate is why such teams applied in the first place – what were they seeking to gain from a hackathon given the advanced stage of their team and solution? To meet people and potentially recruit them? Win a hackathon so they can say that they won a Hackathon associated with Harvard?

It is incumbent on the local hubs to do their due diligence correctly before admitting participants into a hackathon. A hackathon's main purpose is to spur innovation and create a proof-of-concept level of an innovative solution to a problem in a short amount of time.

Feedback from Participants

The evaluation was conducted using an English language survey sent to all participants via Slack (the official communication channel for the event), which remained open for two weeks post-Hackathon. Participants were required to complete the feedback survey to receive a participation certificate, which helped generate a representative sample for evaluating participant feedback (**Table 4**). Overall, responses were gathered from 246 participants from a total of 532 attendees, yielding a 46.24% response rate.

The participant feedback will be used to guide the improvement of future Hackathons. Through this, we have been able to highlight Hubs which may be underperforming relative to the rest of the Hubs. With this knowledge, in future events we will provide a greater level of support to those who scored less highly. Additionally, from this feedback we can determine the long-term potential benefits of the Hackathon through an understanding of participants future intentions for their innovations.

Table 4: Respondent demographics

Location (n=246)	**Number of Respondents**	**%**
Hubs (n=246)		

Boston	38	15%
Buenos Aires	33	13%
Chiclayo	21	9%
Kyiv	21	9%
Lima	80	33%
London	9	4%
Santiago	12	5%
São Paulo	32	13%
Gender (n=244)		
Male	129	53%
Female	115	47%
Track (n=241)		
CVD+D	93	39%
Cancer	74	31%
MH	74	31%
Age (n=244)		
<18	8	3%
18-24	80	33%
25-34	98	40%
35-44	33	14%
>44	25	10%

CVD+D: Cardiovascular Disease and Diabetes; MH: Mental Health

While there were a range of scores across each Hub, overall, the event was very well received (all Hubs, except one, received only scores above 4.0) (**Table 5**).

Table 5: Overall respondent scoring

	The Venue	The Panelists	Organizing Committee	The Mentors	The Judges	Overall event	Would you recommend the event?	Average
All Hubs	**4.32**	**4.36**	**4.21**	**4.38**	**4.18**	**4.30**	**4.49**	**4.32**

Participants were asked to score the above options using: "Extremely Satisfied", "Somewhat Satisfied", "Neither Satisfied nor Dissatisfied", "Somewhat Dissatisfied" and "Extremely Dissatisfied", except for the "would you recommend the event?" question which went from "Extremely Likely" to "Extremely Unlikely". These were converted to a 1-5 scale with 5 representing the "Extremely Satisfied/Likely" option and 1 representing the "Extremely Dissatisfied/Unlikely" option.

6. Innovation through Partnerships

Partnerships are imperative to fostering innovation and expanding our reach using the HSIL Hackathon approach. Looking ahead to future events, we aim to strengthen the HSIL Hackathon network by deepening HSIL's relationship with existing Hubs and forging new Hubs worldwide – to make future iterations more global each year. To facilitate this objective, HSIL will map existing and potential partners for global Hubs to identify opportunities for collaboration and growth. Exploring avenues for collaboration with other innovation institutions within the Harvard and MIT ecosystem could further enrich the Hackathon experience for participants and complement existing efforts. Furthermore, considering partnerships with other WHO regional offices, in addition to WHO Europe, presents an exciting opportunity to maximize the benefit of Hackathon solutions in addressing critical global health challenges and Member State policy priorities.

We encourage current and potential future collaborators to reach out if you are interested in hosting a local Hub during the next Hackathon via hsinnovationlab@hsph.harvard.edu. By prioritizing strategic partnerships and fostering meaningful collaborations, we can ensure the continued success and impact of future Hackathons.

7. Concluding Remarks

The 5th Harvard Health Systems Innovation Hackathon has been a remarkable journey, and an enriching opportunity for cross-country collaboration, bringing together diverse talents, expertise, and perspectives to tackle pressing challenges in health systems. As reflected in this report, the event has witnessed enthusiastic participation, innovative solutions, and invaluable learnings. The dedication and collaboration of Hub coordinators, organizers, mentors, judges, and participants have been instrumental in making this event a resounding success. Continuously learning and striving for improvement collaboratively, we remain committed to enhancing future HSIL Hackathons, ensuring that we achieve HSIL's mission of creating ventures capable of creating value in health systems worldwide.