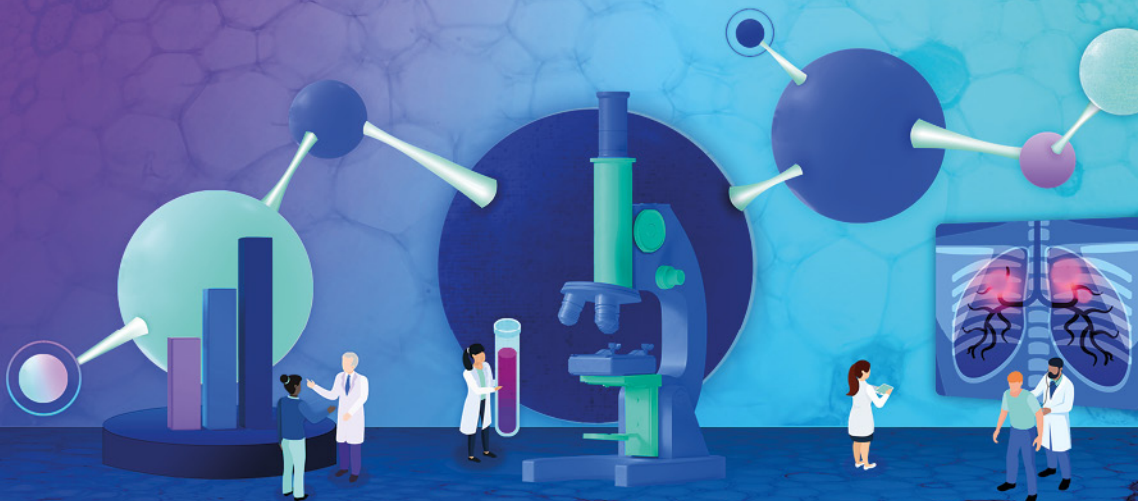AI for Health® | Capgemini ● invent

HEALTH & AI
NOW AND NEXT

2022 EDITION

HEALTH & AI
NOW AND NEXT

Foreword

Since 2016, tech leaders are developing their collaborations with healthcare institutions: Google launched 12 projects, Microsoft 7 and Amazon 5. More recently, COVID paved the way for a massive interest in data and AI domain, stakeholders are now fully embracing it, learning and sometimes succeeding on their way.

In 2022, we are celebrating the **5th edition of the AI for Health Summit**. 5-years is quite young, but old enough to see changes in this **fast-evolving industry** that is catching up at such a speedy pace.

After the success of the two first editions, we come back this year even stronger to **report on where healthcare organizations stand** in their data and AI journey. We have extended our scope and we now cover **Pharmas, MedTechs, Tech providers, Startups, Hospitals, Research labs, Insurance, Patients** and **Regulators**.

As part of the "**AI for Health Global Conference**", held on November 16, 2022, this report gathers a large panel of **140+ respondents** into an online survey, along with **22 deep-dive interviews** with field change makers that bring their expertise in the domain. We have reached some statistical significance and international stature. We would like to thank our panel for their precious insights.

Similar to 2021, the ambition of this work is to **help stakeholders get more familiar** with data AI strategic stakes and main applications, get a grasp of the industry's **level of maturity**, while providing them with insights on the main **roadblocks, ethical considerations**, and **operating choices** they may face in their journey to implement data and AI use cases. This year, we also provide an "how to guide" to reach the next level of data and AI literacy depending on your profile.

We take away from this edition that healthcare stakeholders are **mid-way in their data and AI journey**, at the **crossroads of their ambition**. They are getting their hands dirty with concrete use case delivery, sometimes meeting success and often facing challenges.

We built this report as a **reference** but also as a **mind shaker** of this rich **ecosystem**, that works more and more all together around an overarching common goal: **delivering the best possible care to individual patients** in their diversity and to **society as a whole**, at an affordable and sustainable cost.

We reiterate our ambition to have this report fully leveraged to ensure **patients, practitioners** and **authorities** get the most out of the on-going revolution of data and AI in healthcare. More than ever, we are on a mission to democratize a topic that every player can have a role in, either coming from a business background, a technical background or simply as a citizen.

Make no mistake! The wind of change is now blowing everywhere across this industry.

We hope you will enjoy reading and using this report as much as we appreciated working on it.

Join us in shaping the future of AI for Health!

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We would like to give a special thanks to the partners of **AI for Health**®

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Executive Summary

First, we notice a **continuity of the trends** observed back in 2021.

Data and AI are still considered as **key by organizations**, although employee **acculturation is lagging behind**. While **dedicated units** to address the matter are being deployed, they are still **too far away from decision** to drive the necessary impact. Offering the **best patient care** in terms of outcome and journey remains the top priority especially for Hospitals. Resource-wise, **data scientists** and **data engineers** are still the most requested profiles on the marketplace.

On maturity, the overall perception of the panel remains a **feeling of a medium maturity level. Data availability** - data not always complete nor made accessible - and **data quality** - data not perceived reliable enough - still prevail as the key barriers for use cases industrialization.

Organizations are still on their way **towards more robust data foundations. Data transformation** and most importantly **data interoperability** (in and out) especially when working in ecosystem, show great room for improvement. **Data visualization** and **machine / deep learning** are still the most commonly used processing techniques. **Quantum** technology, although booming in terms of hype especially for drug discovery, is still in its infancy.

When it comes to ethics and privacy, **privacy** can now be considered as an area where stakeholders **master the regulatory** space and systematically address it.

At the same time, **new trends** are emerging this year.

The remit of data and AI organizations in healthcare clearly focuses on **mastering the roadmap** and more and more managing the **collection, qualification and prioritization** of use cases. **Ecosystem plays** have always been game-changing in the sector to create value, and they now accelerate with Startups and Hospitals at the forefront. As maturity for data profiles' need evolves, organizations know how to **split core** vs **non core resources**, that they would tend to externalize.

If maturity flattens, the **commitment taken on industrialization** for the years to come show a great level of ambition. We can be confident in this ambition materializing, since **more and more use cases** are on in the pipelines. As more stakeholders are engaged in those use cases, it can go with a **difficulty to engage the business**.

As for technical arbitration, we observe a **progressive move to cloud** from players beyond Startups, for whom this shift has always been a no brainer. **Hospitals** and **Research organizations** are clearly accelerating there while Pharmas and MedTechs, that are more advanced, pursue their journey. We introduced this year the topic of **sustainability** in the discussion: although not considered central (yet), the dimension is gaining importance in decision-making.

As for ethics and privacy, the panel echoes the **call for greater model explainability** especially for Hospitals and Research organizations. Finally, **data sovereignty** stands out as a growing concern in choices, reinforced by the context of growing political instability.

We propose a **maturity pattern** in this year barometer, where we address the "*how to reach the next stage*" question. For **large organizations**, improving **employee acculturation** and **infusing innovation outside-in** seem to be the most impactful levers. Also, moving from the medium state ("transitional") to the most advanced one ("experienced") would be easier for Startups than for others, which can be a great source of inspiration for large organizations.

When taking the different panel stakeholders one by one, we notice that they will now very much **concentrate on their core capabilities** in their effort to develop and scale data and AI use cases:

- **Pharmas/MedTechs** focus their efforts on big data drug discovery and on cracking the code of efficient developments to hit the market faster, cheaper and with more sucess;
- **Hospitals & clinics** are still very much into improving care organizations inside their walls and more and more into managing their transition to care out of the hospital, especially for chronic disease management;
- **Research organizations** become more and more open to their ecosystem and are mixing fundamental and applied research, hence getting closer to value for the end users;
- **Startups** would address big Pharmas/MedTechs and Hospitals as their main clients with SaaS models. They tend to internalize the full data process lifecycle, especially when it comes to cutting edge data science;
- **Insurance**, also not statistically represented in this panel, favor marketing & sales and services for their clients.

Beyond the buzzwords, we wanted to emphasize **a couple of hot dimensions** that we believe are central to how the AI for health ecosystem evolves:

- **Patient centricity** is a concept that has been around for years. Not only that stakeholders now do have a better understanding of what patients - really - want in their diversity, but they also feel better equipped to address their needs;

- **Care systems** are being impacted by data and AI, and hence progressively introducing shifts. Use cases are growing in Hospitals around care delivery and care efficiency improvements, and outside of Hospitals with care coordination. The focus is on techniques that are the most mature (data visualization, Machine Learning);

- Startups, Big Pharmas and Research organizations are reshaping the **panorama of R&D**. While in Research, we see more and more in silico approach to down-select the most promising drug candidates, sometimes leveraging Quantum, the race for a more efficient Drug development generates excitement around revisited processes, new data sources and value adding use cases addressing patient and practitioners pain points;

- After COVID, there will be no going back to the old model of regular visit to the practitioners with limited differentiation. Content, channel, timing and frequency should fit into the doctor's agenda, leveraging techniques that are used in more mature industries to shape the **next generation engagement model**;

- **Connected health**, defined as the way to harness the power of new technology to improve patient engagement and health outcomes is a play where Pharmas, MedTechs and Startups have heavily invested over the years and still have a way to go before getting value in return;

- Building a **solid data foundation**, no matter the origin and type of data, is a necessary condition to unleash the power of healthcare data. If all players recognize that the matter is key, they also acknowledge that they are mid-way, with most of them already having a tech platform, that now needs to be fed with quality data serviced as-a-product, at the intersection of data, IT and business;

- With data and AI entering in healthcare, we are dealing with an in-depth **cultural change**, that will not happen overnight. Many organizations are developing their own acculturation initiatives to develop the data and AI literacy of their resources in formats that are appealing. AI goes far beyond technical considerations;

- All of the above cannot fully materialize without the **full support of the authorities** that regulate products (e.g: drugs, devices), services (e.g: software, care intervention) and process (e.g: consent management, algorithm re-training) delivery and pricing. There is an overall call for simplification and co-construction so that regulation can be more supportive of the innovation effort of the whole industry.

Study Objectives

Artificial Intelligence (AI) is defined as the attempt to replicate human cognitive capabilities through advanced technology, and to reach goals in an autonomous way by considering the constraints and obstacles of the environment.

Healthcare is defined as the improvement of health via prevention, diagnosis, treatment, amelioration or cure of disease, illness, injury, and other physical and mental impairments in people.
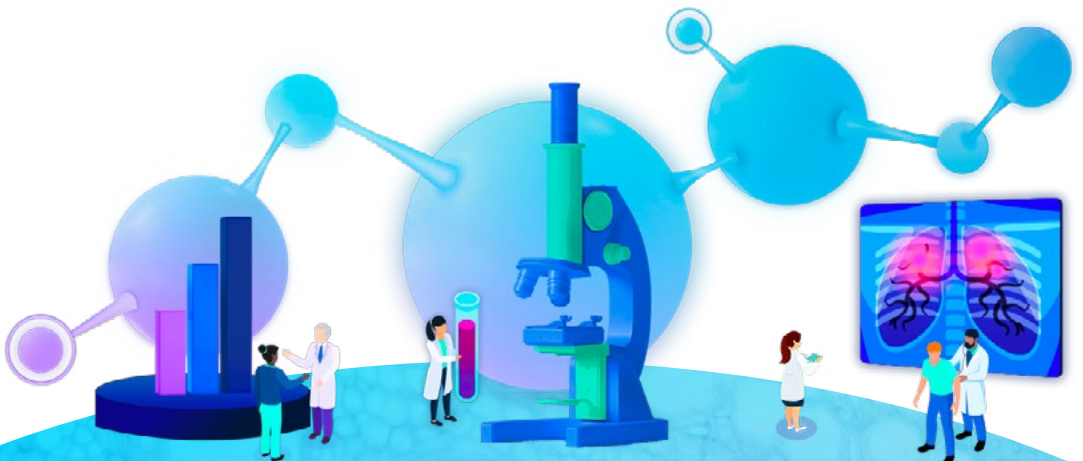
AI for Health refers here to **data and AI issues** aiming to **transform the healthcare sector** through the development and the deployment of use cases. Therefore, not only does this study comprises **AI use cases**, but it also considers the underlying **data lifecycle** (ingestion, storage, transformation, activation) together with **data governance** to be put in place.

As for our 2021 edition, the aim of this book is to provide a **system-wide view** of how data and AI are being used today in the healthcare sector at large. It also highlights **opportunities** for greater use and **barriers** to further adoption.

The following key items of AI development in healthcare are covered:

- **AI strategy and operating model**
- **AI maturity and use cases**
- **Technological choices**
- **Ethics and privacy**

It also encompasses key players involved in the development of AI for Health:

- **Pharma and MedTech companies**
- **Tech providers**
- **Startups**
- **Insurance companies**
- **Hospitals**
- **Research labs**
- **Patients**
- **Regulators**

This third edition of AI for Health also provides additional deep-dives on hot topics of interest in the field.

In the next concluding edition, we pivot to compare like for like insights with those gathered last year.

Methodology

AI strategy and operating model

Strategies and operating models to AI for health implementation and development

AI maturity and use cases

Maturity KPIs and segmentation, use cases of interest (today and tomorrow) in AI for heath

Technological choices

Infrastructure and solutions to support data ingestion, storage, cleansing, algorithm build and visualization

Ethics and privacy

Roadblocks to greater development of AI in healthcare, focus on privacy and ethics considerations

Types of organizations

- Pharma companies
- MedTech companies
- Startups specialized in AI for health solutions
- Insurance companies
- Hospitals & clinics
- Research labs
- Patient associations
- Regulator

Method

Quantitative online survey with **141 respondents**

1-hour interviews with **22 key opinion leaders** & doers from the AI for Health ecosystem

Interviewee profiles

- CEO
- Head of Innovation
- Head of Research labs/ ecosystems
- Head of Data / Data Science department
- Clinical Operations leaders
- Head of Digital health

The healthcare ecosystem is moving fast, and in particular some topics on which we decided to focus on in this edition. We do not intend to be exhaustive here, but rather to put the spotlight on some key topics, since we believe that this is where the future of data-driven healthcare is taking place. Who better than field experts and doers in the field can take the mic? Read on to learn more.

Patient centricity: getting there?

- What are the actions taken to greater patient centricity and the challenges and barriers faced when doing so?
- What are the patient key needs and expectations?
- Any evolution to anticipate in patient needs?

Next Healthcare system paradigm

- What is the perception on hospital care delivery transformed by data and AI today?
- What are the perceived challenges in the paradigm shift of healthcare towards more digital innovation?
- What are the initiatives that leverage data and AI to manage healthcare at a broader level?
- What are the main AI techniques currently used?

Future of R&D

- What are the key ongoing data driven R&D initiatives?
- What are the main challenges/ barriers encountered when implementing?
- What are the data types that are mostly leverage?
- Which future for clinical trials in the coming 5 years?

Next generation engagement

- What has COVID changed in the way private actors interact with practitioners?

- How are contents and channels managed?

Connected health

- Where do we stand on digital health?

- How does digital health support therapies?

- Where do we stand in terms of digital therapeutics (DTx)?

Data foundations

- How important are data foundations to organizations' strategy?

- What are the main data domains organizations are dealing with?

- What are the challenges and barriers encountered when developing a data foundations?

- What are the upcoming trends?

AI/Data acculturation & training

- How critical is AI and data acculturation and training to organizations?

- What are the initiatives deployed and the challenged faced when implementing AI and data culture?

- What trends are anticipated in the field?

Regulator's viewpoint

- Which regulations are at stake?

- What are the main challenges/ barriers encountered when applying them?

- How will the role of the Regulator evolve in the coming years?

Study panel

This study is based on insights provided by 141 respondents to an open online survey, together with deep-dive discussions conducted together with 22 one-to-one interviews.

RESPONDENTS TO THE ONLINE SURVEY

141 Survey respondents

133 Companies surveyed

Scope

- Global — 28%
- Europe/ EMEA — 59%
- APAC — 7%
- Other — 6%

Categories (n=141)

- 29% OTHER
- 18% PHARMA/ MEDTECH
- 2% INSURANCE
- 9% RESEARCH LAB
- 9% HOSPITAL
- 33% STARTUPS

Size (n=141)

43% WITH MORE THAN 100 EMPLOYEES

- 29% >500
- 25% <10
- 20% 10-50
- 12% 50-100
- 14% 100-500
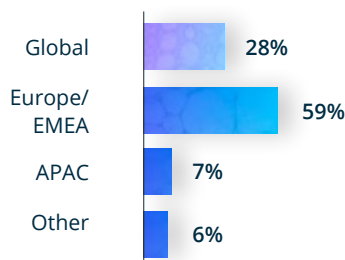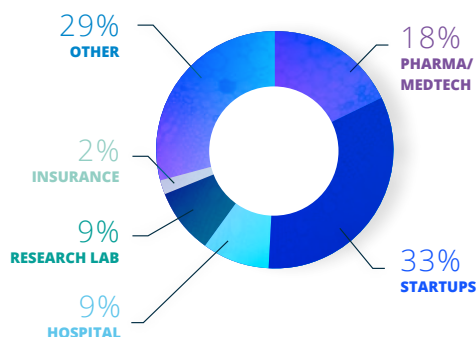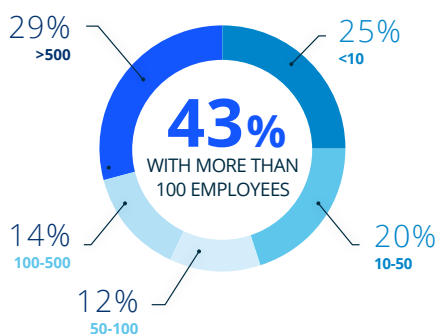
INTERVIEW PANEL

AI Strategy and Operating Model

This first section provides insights on how healthcare players get structured to address their AI agenda.

How critical is AI to the healthcare organization's strategy?
How literate are C-suite members on the matter?
How do players get organized to deliver their roadmap?
What are their business priorities when leveraging AI?
How do they lead innovation, going solo from leveraging ecosystems?
Which profiles do they pursue on the talent market?

AI for health is evolving at a fast pace. In this section, we will see how players are reinventing their business models to better address their users' needs.

AI STRATEGY & OPERATING MODEL

KEY TAKE-AWAYS

1 **Level of executive engagement & acculturation**

In continuity with 2021 and reinforced by COVID 19, AI is **still considered a key top topic by organizations** (3.1/4). However, the level of **acculturation of C-level executives is lagging**, especially for organizations that would need it the most, i.e., Pharmas/ MedTechs and Hospital.

2 **AI leadership**

In this dimension, we do not see major progress from 2021. **Two thirds of players have put a Data and AI organization in place**, one **positioned at C-level** but still away from Exco. Those departments, when existing, will oversee the data and AI roadmap.They are also increasingly responsible for demand management process, i.e., the process of collecting, qualifying, and prioritizing the use cases.

3 **Business priorities**

Enhancing the Patient Care pathway and improving Care delivery remain on the top of the organizations' agenda. In particular, this is a priority for Hospitals and Research organizations. Despite patients becoming more mature on their access to qualitative medical information, **patient information has a priority by only one third of the panel.**

4

Partnerships and open innovation

Collaboration between actors is very frequent. **Two-third of the panel say they rely at least sometimes on partnerships** to deliver Data and AI use cases. Collaborations are **split between business** (Academics going slightly down, Startups going up) and **technical collaboration** (Technology, IT & less frequently data). When adopting open innovation frameworks, **Startups and Hospitals are the ones that contribute the most** to the construction of the ecosystem.

5

Focus on Startups

As the main clients, **big private companies (Pharmas/MedTechs) and Hospitals come first. The subscription business model represents half of the panel**, Pay-as-you go comes second and freemium went up by a factor of five from 2021. When selling digital products, **Software as a Service (SaaS) is still the main mode**, but PaaS (Platform as a Service) is catching up.

6

Data profiles

In line with 2020 and 2021, **data scientists and data engineers are still positioned as the two must-have profiles** across all organizations. We see a shift in large organizations' e**xternalization of more commoditized and non-core data profiles**. As for Startups, they tend **to integrate the full data management process in-house** as their core differentiator. In particular, they need high profile-data scientists that are knowledgeable in both the domain (biology, patient journey management, et cetera) and the techniques (Machine Learning, NLP, quantum, and so on).

Level of Executive engagement and Acculturation

Reinforced by the COVID-19 crisis, AI is still recognized as a strategic priority by executives. However, the level of acculturation of C-level executives is lagging behind, especially for organization that would need it the most.

How important is AI to your organization's strategy?

Not important ———— Average **3.1/4** Very important

	Research Lab	Pharma MedTech	Hospital	Insurance
	3.0	3.1	3.3	2.7

3.1
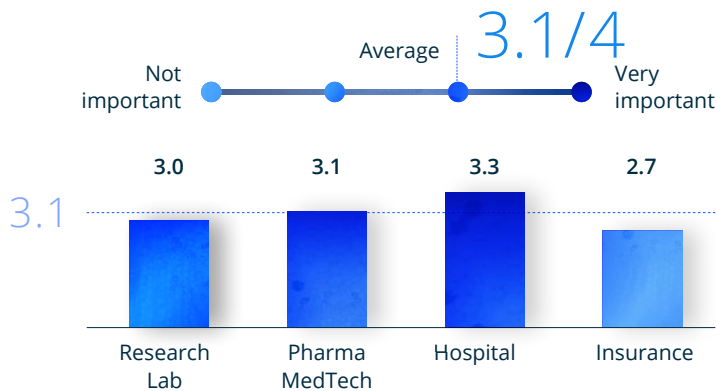
How would you evaluate the current Data and AI acculturation of your C-level executives?

Low acculturation ———— Average **2.6/4** High acculturation

	Research Lab	Pharma MedTech	Hospital	Insurance
	2.8	2.5	2.4	3.5

2.6
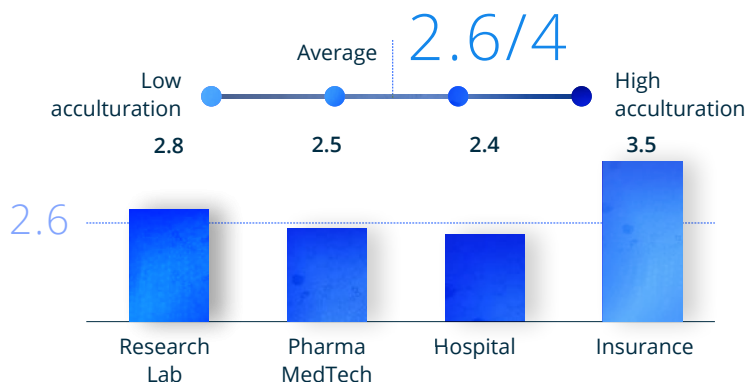
Are there any initiatives launched or ongoing to secure management acculturation on Data and AI topics? (Training program, Learning expeditions, challenges...)
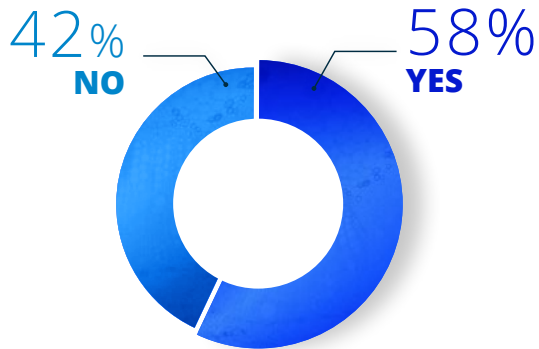
42% NO

58% YES

Based on a set of 55 respondents (incl. 26 Pharmas/MedTechs, 12 Hospitals, 14 Research Labs and 3 insurances).

With no surprise, AI remains a strategic priority

Among organizations, AI is still considered as a strategic priority with an average of three quarters considering it as an important topic. Hospitals seem to be the most engaged (3.3/4), but they are also facing difficulties in acculturating their staff at the same time.

Executives level of acculturation is intermediate

The level of acculturation of 2.6/4 can be considered intermediate, similar to last year, which implies that the needle has not changed that much. It is noteworthy that Hospitals lag behind the cohort (2.4/4), while Research labs have accelerated their acculturation (2.8/4 vs 2.0/4 in 2021). On a positive note, we also notice a far higher engagement level in companies of more than 500 employees.

Efforts are maintained to secure this acculturation

Despite an intermediate level of AI acculturation, the initiatives deployed to secure knowledges have not grown (58% in 2022 versus 57% in 2021), except for Research Labs (from 50% to 79%).

AI leadership

On AI leadership, we do not see major progress vs 2021. Around two thirds of players have put a Data and AI organization in place, one that still remains away from the Exco. Only the capability to collect, qualify, and prioritize the use cases have positively evolved.

Do you have a dedicated department or team who is responsible for data, AI, or digital technology?
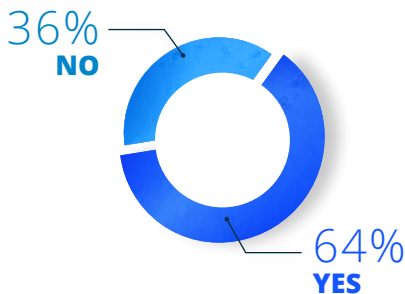
36% NO
64% YES

Based on a set of 55 respondents (incl. 26 Pharmas/MedTechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

Where are these roles positioned in the organization structure?

29%   38%   33%

Exco level | C-level (not at Exco) | Under C-level
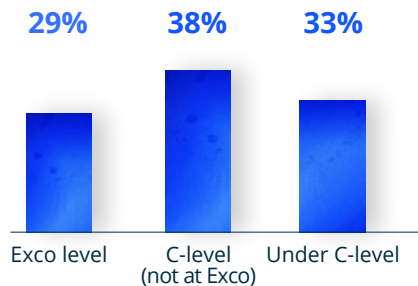
Based on a set of 27 respondents (incl. 10 Pharmas/MedTechs, 7 Research Labs, 8 Hospitals and 2 Insurances)

Does this department have one (or two) dedicated role(s) to lead the Data and AI roadmap?

23% NO
77% YES
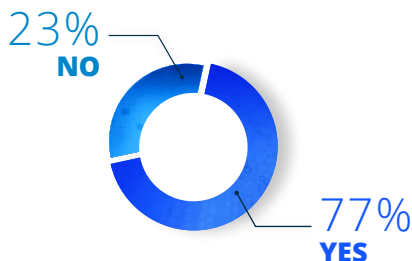
Based on a set of 35 respondents (incl. 15 Pharmas/MedTechs, 8 Hospitals, 9 Research Labs and 3 Insurances)

Have you set up an organization to collect, qualify, and prioritize the use cases ("demand management")?

63% YES
37% NO
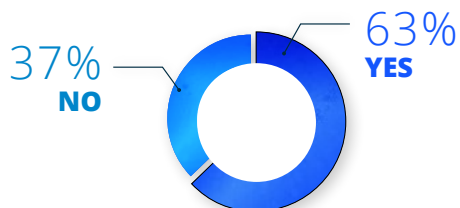
Based on a set of 32 respondents (incl. 18 Pharmas/MedTechs, 11 Research Labs and 3 Insurances)

Dedicated departments are not yet a common place and are still on step away from the Exco

Two respondents out of three claim to have a dedicated department for Data and AI, one that is stable when compared to 2021. 58% of Pharmas/MedTechs respondents and 67% of Hospitals have such departments in place. Research Labs have doubled their efforts, with 64% of respondents having a dedicated department (33% in 2021).

That being said, such departments suffer from being too distant from Exco - across most of the organizations that are below 500 employees. In most cases, Data and AI departments will be in the hand of C-level executives, even sometimes under C-level in Pharmas/MedTechs.

When such departments exist, they master roadmapping and demand management

Data and AI roadmap and use cases demand management are part of their key attributes.

Roadmap definition and steering seem to be the starting point, rather than the cornerstone of a company's strategy. Almost all players would have a roadmap in place, but some small and mid-size Pharmas/MedTechs are still reluctant though.

63% of the respondents have set up a 'demand management' process aiming to identify and qualify use cases. This represents a 17-point increase from 2021. A positive correlation can be noticed between the size of the company and the presence of a demand management process, probably to deal with the complexity that goes with it. We observe a turnaround in Research labs that begin to structure this model. They are now are up 40%, having set up such process (compared to none in the 2021 panel).

Business priorities

Enhancing the Patient Care pathway and improving the Care delivery remain at the top of the agenda.

💡 Top 2 priorities (% of total): **60% Care quality - 54% Care delivery**

What are the main business objectives of the projects/products you deliver?
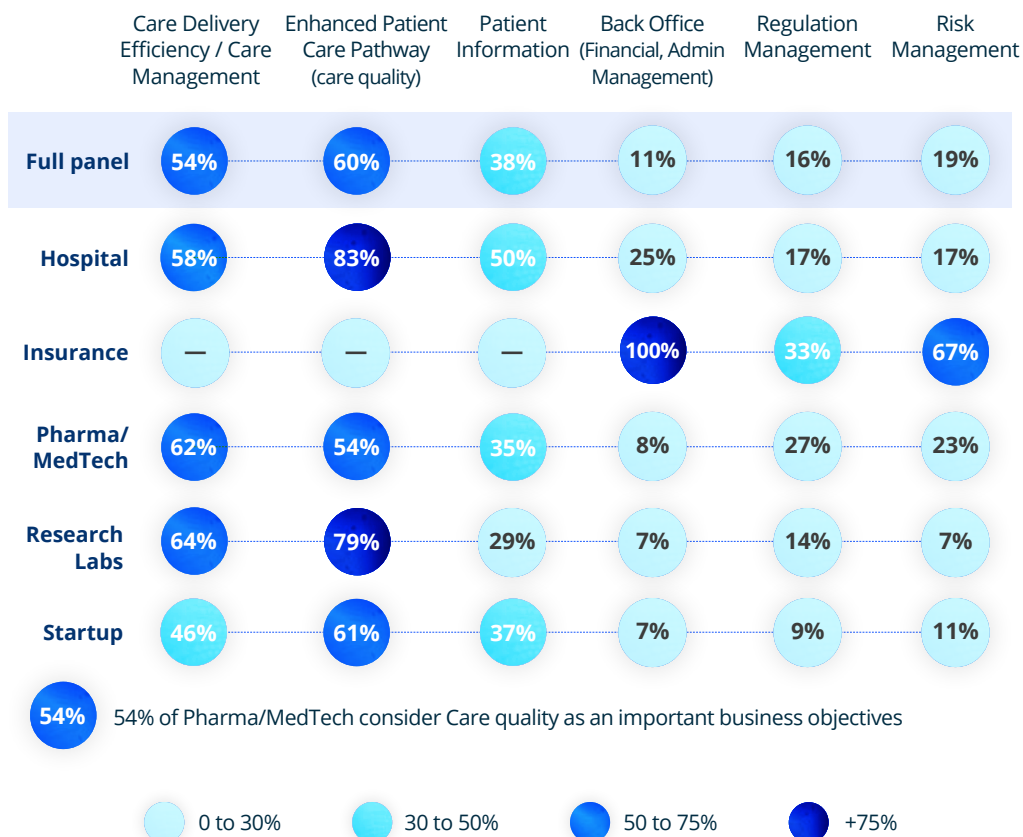
	Care Delivery Efficiency / Care Management	Enhanced Patient Care Pathway (care quality)	Patient Information	Back Office (Financial, Admin Management)	Regulation Management	Risk Management
Full panel	54%	60%	38%	11%	16%	19%
Hospital	58%	83%	50%	25%	17%	17%
Insurance	—	—	—	100%	33%	67%
Pharma/ MedTech	62%	54%	35%	8%	27%	23%
Research Labs	64%	79%	29%	7%	14%	7%
Startup	46%	61%	37%	7%	9%	11%

54% 54% of Pharma/MedTech consider Care quality as an important business objectives

⬤ 0 to 30%　⬤ 30 to 50%　⬤ 50 to 75%　⬤ +75%

Based on a set of 141 respondents (incl. 46 Startups, 26 Pharmas/MedTechs, 12 Hospitals, 14 Research Labs, 3 insurances and 40 others)

Care quality and efficiency: patient still at the center of the game

In line with 2020 and 2021, delivering better care from a quality and efficiency standpoint comes out as a top objective for most respondents (respectively 60% and 54% of the panel). This is particularly strong for Hospitals with no surprise (83% and 58%), and more surprisingly for Research labs (79% and 64%). Overall, Pharmas/MedTechs would focus more on care efficiency, where Startups are more prone to working on care quality.

Patient information: toward new sources?

Patient information has been considered a key business objectives by only 38% of the panel, with Hospital as the core information provider (50%). One third of Pharmas/MedTechs and Startups also consider bringing information to the patient vital to their mission. Patients would indeed more readily go and find the information they need on their own (e.g., internet, social media, peer interactions)

Back office and risk mitigation: a priority for Insurances

Insurance respondents cited both back-office improvements (100%) and, to a lesser extent, risk management (67%) as top of their business priority list for their Data and AI projects.

Partnerships and Open innovation

Collaboration is spread wide across the ecosystem, with a focus on IT and technological services providers.

> 💡 Top 2 priorities (% of total): **55% being technology provider - 55% being Academics / Researchers**

Do you work with external actors to deliver data/AI use cases?
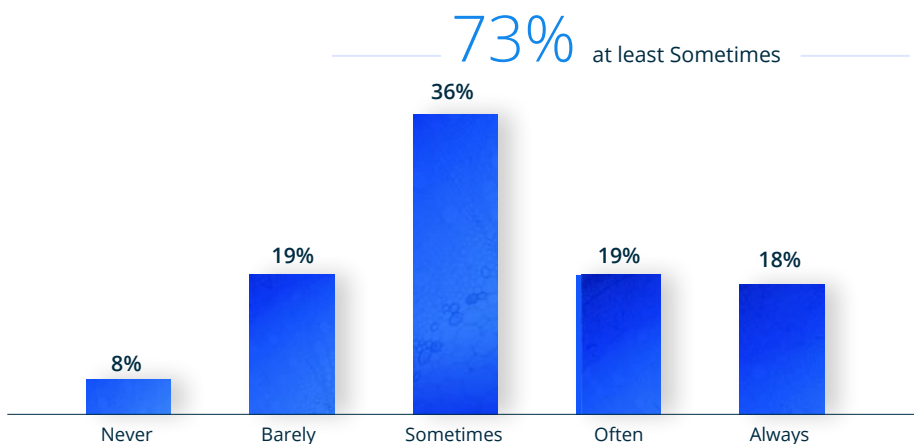
73% at least Sometimes

Never	Barely	Sometimes	Often	Always
8%	19%	36%	19%	18%

Based on a set of 141 respondents (incl. 46 Startups, 26 Pharmas/MedTechs, 14 Research Labs, 12 Hospitals, 3 Insurances, 40 Others).

Working in an ecosystem is now a given

A majority of the panel (73%) declares collaborating sometimes, often, or always with other industry players to develop use cases around data and AI. This trend can be embedded in all types of organizations but will be particularly strong for Research labs (92%) and Pharmas (78%). These two parties would collaborate extensively. Compared to 2021, the number of organizations that would collaborate on a systematic basis has tripled since last year, going from 6% to 18% of the panel.

If yes, with which actors?

	Technology providers	Data providers	IT service providers	Academics / Researchers	Startups	Other
Full panel	55%	36%	48%	55%	47%	8%
Hospital	36%	27%	100%	27%	64%	9%
Insurance	67%	33%	33%	0%	67%	33%
Pharma/ MedTech	60%	30%	60%	50%	25%	0%
Research Labs	67%	33%	33%	92%	67%	8%
Startup	42%	36%	28%	58%	31%	6%

60% 60% of Pharma/MedTech collaborate with Technology providers when developing use cases

0 to 30% 30 to 50% 50 to 75% +75%

Variation in percentage points vs. 2021

Slight increase vs. 2021 (between 15 and 25 pts)

Slight decrease vs. 2021 (between 15 and 25 pts)

Strong increase vs. 2021 (>25 pts)

Strong decrease vs. 2021 (>25 pts)
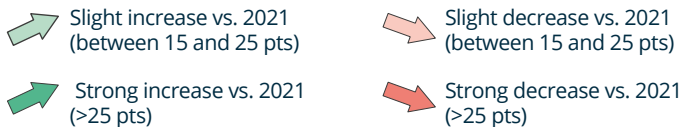
Based on a set of 120 respondents (incl. 41 Startups, 24 Pharmas/MedTechs, 14 Research Labs, 11 Hospitals, 3 Insurances, and 38 Others)

Less academic, more practical collaborations

In 2021, collaboration with Academic/Research was the primary source of collaboration covering 70% of the panel. It now represents just 55%.
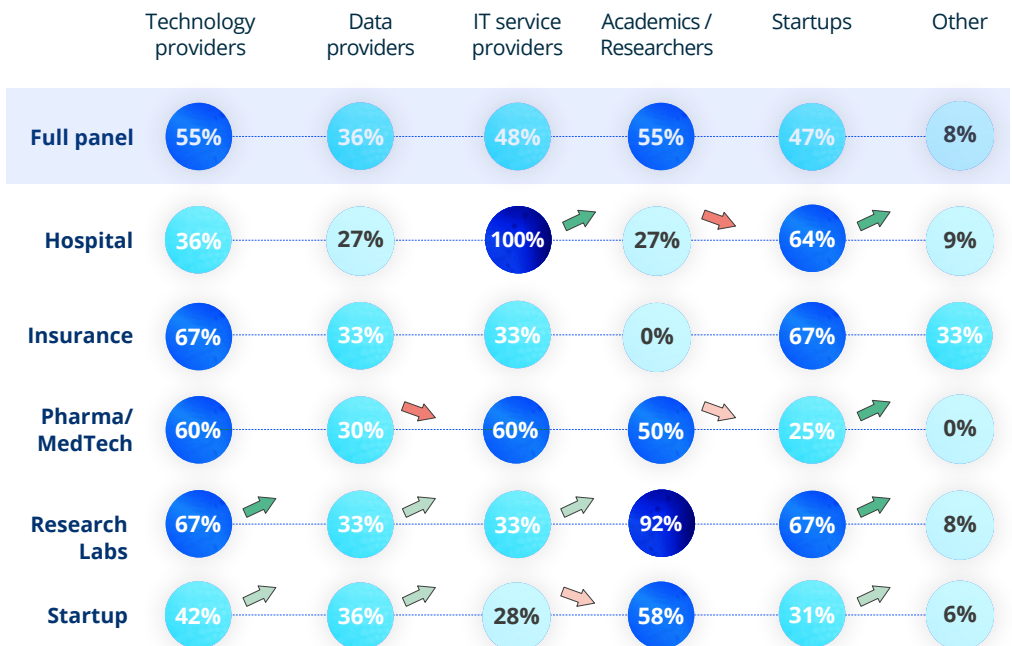
Widespread work with Startups stands out as the main evolution, especially for Hospitals, Pharmas/MedTechs, and Research lab.

Also, 55% of the panel declare to work with Technology providers. The use of data providers, despite not having grown overall compared to last year, grew for Research labs and Startups. Most organizations now seem to realize how important it is to have relevant tooling to ingest, store, process and leverage data is.

We also notice a clear increase of the use of IT providers at Hospitals that get organized to structure their datasets (patient data and care journey, collaborating with other structures) in the relevant technologic infrastructure and ecosystems of applications.

When practicing open innovation, what type of actors are you collaborating with to develop use cases?

Half of the panel is collaborating with Hospitals, Startups and to a lesser extent Pharmas/MedTechs.
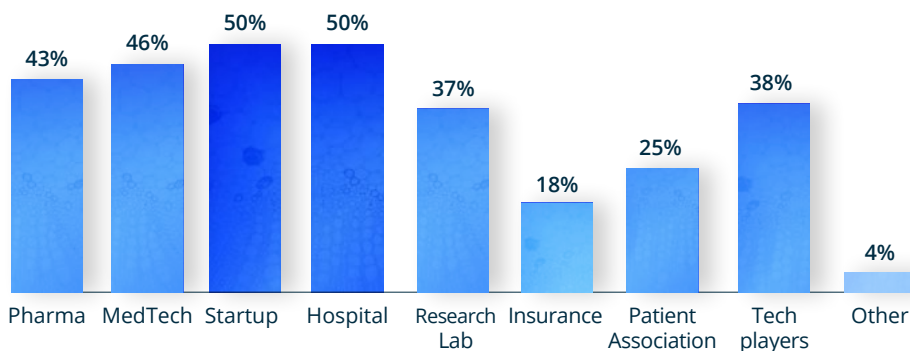
Based on a set of 138 respondents (incl. 26 Pharmas/MedTechs, 12 Hospitals, 14 Research Labs, 45 Startups, 3 Insurances, and 38 Others) .

What are the challenges that you usually face when working on open innovation projects?

Dealing with open innovation can be difficult, especially for small structures like Startups.

Of all the challenges, data access and quality come on top of the list. The panel mentions dataset heterogeneity, access to granular medical data, and the usage of different standards as the main hurdles to further go into open innovation.

Also, small structures like Startups stated the share of ownership as an important issue, either for developing a product or service or the differences of work cultures between companies, which harnesses collaboration.

Of note, only 25% of respondents work with patient associations when doing open innovation, which can be perceived as an area for improvement if organizations want to develop their patient centricity.

Focus on Startups

When we focus on Startups, big private companies (Pharmas/MedTechs) and Hospitals are their main clients. We observe several business models across the panel, with subscription model representing half of the panel and freemium going up by a factor of five when compared to 2021.

> 💡 Top 2 Business models (% of total): **50% Subscription – 28% Pay as you go**

Who are your main type(s) of clients and prospects?

- Major companies (Big Pharma, Biotech, MedTech): 40%
- Insurance: 3%
- Patients: 9%
- Hospital/ Group of hospitals: 31%
- Other: 17%
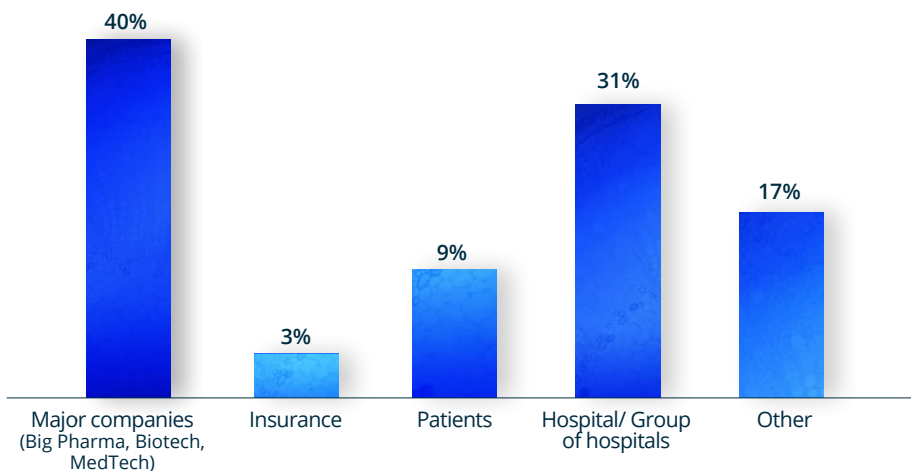
Based on a set of 75 respondents (incl. 46 Startups, 26 Pharmas/MedTechs, 3 Insurances)

What is your business model?

Incl. a set of 46 Startups respondents

13%
NO BUSINESS MODEL YET

9%
OTHER

7%
ADVERTISING

7%
BROKERAGE

24%
ONE-OFF

28%
PAY AS YOU GO

50%
SUBSCRIPTION

17%
FREEMIUM
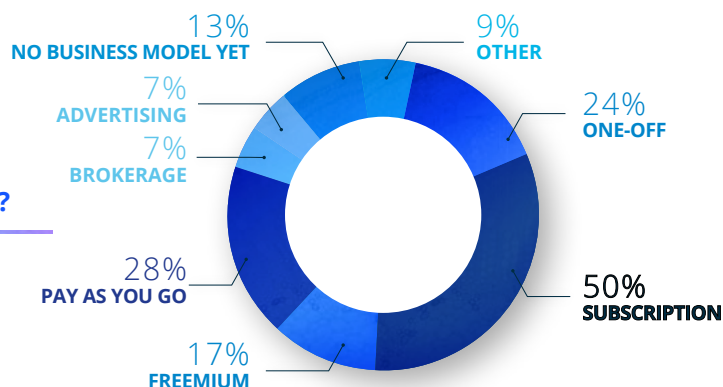
Major companies and public institutions remain the privileged clients of Startups

Most respondents target either Pharmas/MedTechs (40%) or Hospitals and group of Hospitals (31%). Direct to patient businesses are still far less represented (9%).

Startups mostly sell SaaS in a subscription mode, but new business models are emerging with fees for services and freemium

Most of those Startups would sell Software as a Service (SaaS – 62%) and Platform as a Service (PaaS – 20%). In some cases, they could also provide drugs, hardware or care services.

Overall, we see that subscription and pay-as-you-go models stand out (i.e., charge for actual usage of the product) (respectively 50% and 28%), closely followed by the fixed-fee models (24%). Compared to 2021, we also noticed an evolution towards the freemium model to speed up user engagement in a competitive environment (respectively 3% in 2021, 17% in 2022).

Data profiles

In line with what has been observed over the past, data scientists and data engineers are still positioned as the two must-have profiles across all organizations. While data profiles in Startups have not changed since 2021, we see a shift of large organizations' externalizing more commoditized and non-core data profiles.

Top profile (% of total): **74% of non-Startups and 58% of Startups have data scientists in their data department**

Do you have the following profiles in your data department (if applicable)?

	Startups	Non-Startups
Data Manager	43%	48%
Data owner	28%	18%
Product Owner	52%	30%
Front-end Developer	50%	28%
Data Scientist	74%	58%
Data Engineer	52%	42%
Data Architect	41%	30%
DevOps / Machine Learning Ops	46%	31%
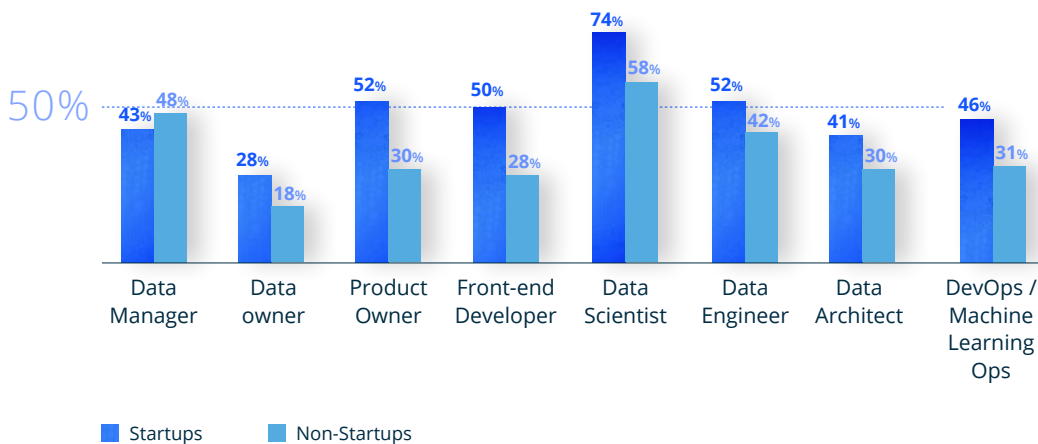
Based on a set of 113 respondents (incl. 46 Startups, 10 Pharmas/MedTechs, 7 Research Labs, 8 Hospitals, 2 Insurances, and 40 Others).

Data engineers, data scientists and data managers are still key to data departments

Data engineers, data scientists and data managers were already the most represented profiles in data departments in 2021. This is still the case this year. This shows that companies still consider mastering data lifecycle end-to-end as instrumental in implementing their transformation. At the same time, data owners are under-represented compared to other data profiles (only 18%), leading in organizations suffering from poor data governance and unclear roles and responsibilities.

Besides, large organizations do not hesitate to externalize some profiles such as product owners, data engineers, data scientists, and front-end developers.

Startups tend to integrate the full data management process in-house as their core differentiator

Startups mainly have data engineers (52%) and, most importantly, data scientists (74%), from where they derive their competitive advantage. This list can be completed by other diversified profiles, such as product owners (52%), front-end developers (50%), or DevOps and Machine Learning Ops (46%). Beyond data profiles, Startups focus on having more profiles oriented on data architecture than non-Startups (41% of Startups have data architects; whereas 30% of non-Startups have one).

Bottom line, although they increasingly work in ecosystems, Startups are more prone to master the end-to-end data processing cycle than large organizations.

AI Maturity and Use cases

This second section provides insights on the players' maturity level where Data and AI are concerned. It also examines players' ability to run their use cases in a way that enables them to scale-up

What are the use cases of interest players are working on?
How mature are they?
What are their ambitions in terms of use cases scaling-up and what are the barriers they face?

Unsurprisingly, maturity varies between actors and companies' size. In this frame, we will see where players stand on and what their main area of focus is.
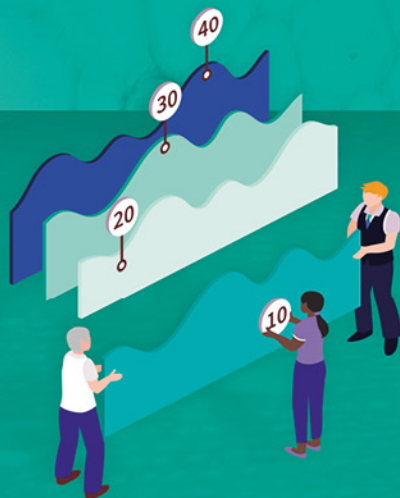
AI MATURITY
AND USE CASES

KEY TAKE-AWAYS
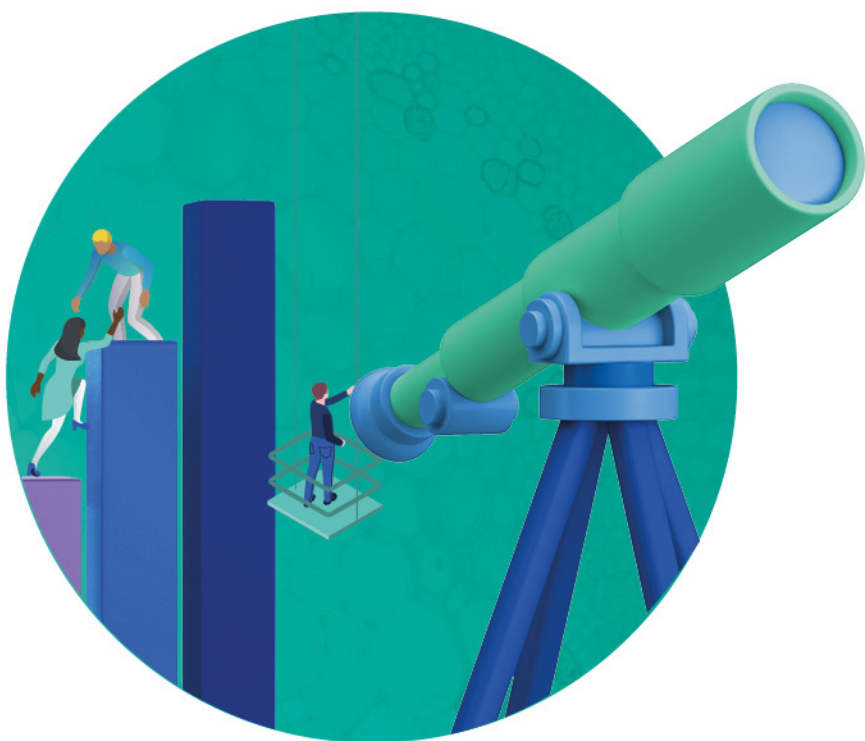
1

Industrialization of use cases

The **overall perception is of medium maturity**, in line with results from last year (2.7 in 2021 versus 2.8 in 2021). Similarly, companies expect to **industrialize more use cases** in the next 3 years than they did in 2021, which may happen soon, since more use cases are now on the table. **Small companies are less confident** in their capacity to scale up.

2

Maturity patterns

We have designed a set of criteria to define learners, transitional and experienced organizations. To progress from one maturity state to another, learners and transitionals that are not Startups could focus on areas where a leapfrog is a synonym of increased maturity (acculturation and work in ecosystem). They also can take some inspiration from Startups.

3

Use cases of interest

Pharmas/MedTechs, and **Research labs** are concentrating their efforts on R&D: **drug and device development (53%) and drug discovery (46%).**

Hospitals are mainly focused on optimized **care organization (78%)**.

Insurances mainly work around **Marketing and sales (78%)** and **customer services (67%)**.

4

Barriers to use case development

Companies in the sector recognize **data accessibility and quality as the main barriers**, with an emphasis on **the reliability and completeness** of datasets they handle. Other barriers are becoming increasingly important, such as the **ability to engage business stakeholders** or to a**dopt AI-enabled solutions**.

Industrialization of use cases

Among the panel, the overall perception is of medium maturity, in line with results from last year.

Evaluate on a scale from 1 to 4 your organization's capacity to scale-up and industrialize data use cases (i.e. getting from POC – Proof-of-Concept - to deployed Product with live end users)

Average **2.7/4**

Lowest confidence — Highest confidence

	2.7	3.3	2.7
2.7	Pharma MedTech	Insurance	Research Lab

2.3	2.8	2.6	2.6	2.9
<10	10-50	150-100	100-500	>500

2.7
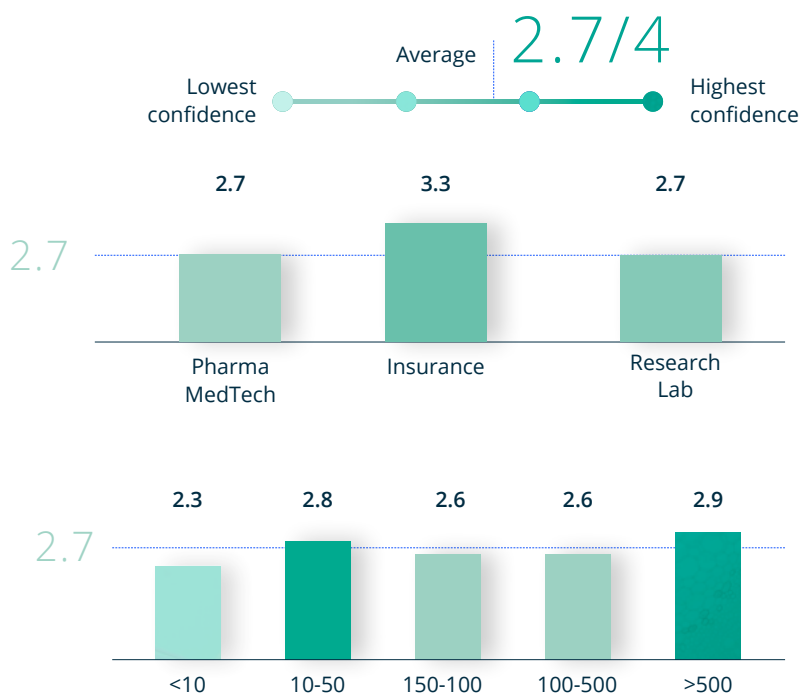
Based on a set of 41 respondents (incl. 25 Pharmas/MedTechs, 13 Research Labs, and 3 Insurances).

Which proportion of your POCs has been industrialized?

Based on a set of 89 respondents (incl. 46 Startups, 26 Pharmas/ MedTechs, 14 Research Labs, and 3 Insurances).

21%
26 to 50%

34%
More than 50%

45%
0 to 25%
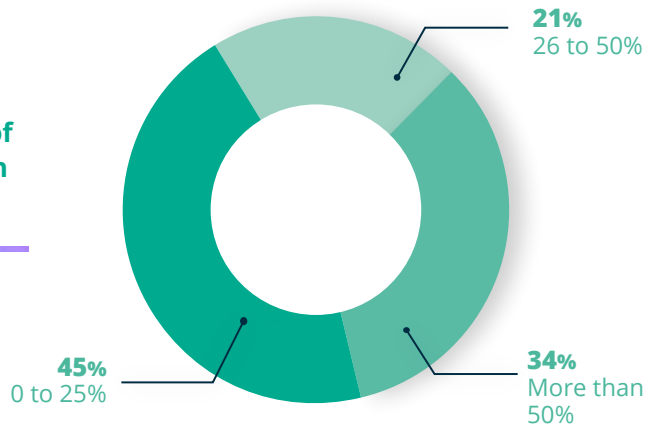
How many use cases do you plan to deliver at scale (scale defined as Product with 100 plus end users) in the next 3 years?

41%

26%

33%

Less than 5   5 to 10   More than 10
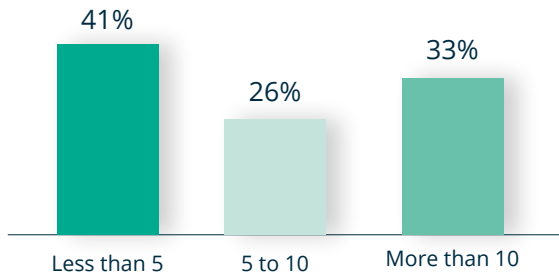
Based on a set of 87 respondents (incl. 45 Startups, 25 Pharmas/ MedTechs, 14 Research Labs, and 3 Insurances).

Insurance and organizations with up to 500 employees are more confident in their scale-up capability

The capacity to industrialize use cases remains a challenge for Pharmas/ MedTechs and Research labs (2.7/4 each) although their perception has improved since 2021 (2.3 for Pharmas and 2.5 for Research labs). If they still experience some barriers, they will probably find their way toward industrialization.

As for Insurance companies, it is the second year in a row where they evaluate themselves as quite mature where data and AI is concerned. They grade themselves as 3.3/4. However, the sample is small (3 respondents), which prevents us to generalize here.

Small companies are less confident in their capacity to scale up

Small companies feel less confident than before (average of 2.3 in 2022 versus 2.6 in 2021). It may imply that organizations understand that they are many barriers to develop AI or data-based solutions. After a period of high expectations, they identify some problems they need to cope with (e.g., data quality and availability, stakeholders' engagement, et cetera).

On the contrary, larger organizations (>500 employees) feel in general more confident in their capacity to scale. Thanks to their experience and growing overall acculturation, barriers seem to have become achievable now.

More use cases are being addressed than before

Across the panel, more use cases are planned to be delivered than before. Indeed, 72% of respondents planned to deliver less than five use cases in 2021. This number drops to 41% in 2022. 26% plan on delivering 6 to 10 use cases within three years in 2022 (12% in 2021).

Even more surprising, in 2021, only 16% of the panel planned to deliver more than 10 use cases in the next three years. In 2022, this number rises to 33%. Although it shows a clear enthusiasm, we may challenge the capability of all these players to reach this objective.

More Proofs of Concept have been industrialized

Even if they plan to deliver more use cases, respondents are still facing major issues to industrialize PoCs, showing an interesting room for improvement. A majority (66%) industrialize less than 50% of their use cases. It might be the sign that companies are identifying more accessible use cases and are finding ways to overcome some barriers.

Assessing maturity: a methodology

To determine the level of maturity of an organization, we have built maturity states across seven dimensions. Based on the answers of each organization that have been normalized, it is possible to define the profile to which the organization is the closest (i.e., a low, medium, or high maturity level).

	LEARNERS	IN TRANSITION	EXPERIENCED
Level of priority of AI	Low - Medium	High	Very High
Capacity to industrialize use cases	Low	Medium	High
Number of use cases developped	Less than 5	5 to 10	More than 10
Sensitivity to roadblocks	High	Medium	Low
Data sovereignty is a topic of interest	Not really	Yes	
Partnership with external actors	Occasionally	Often or Always	
Partnership with cloud providers	Occasionally	Often or Always	
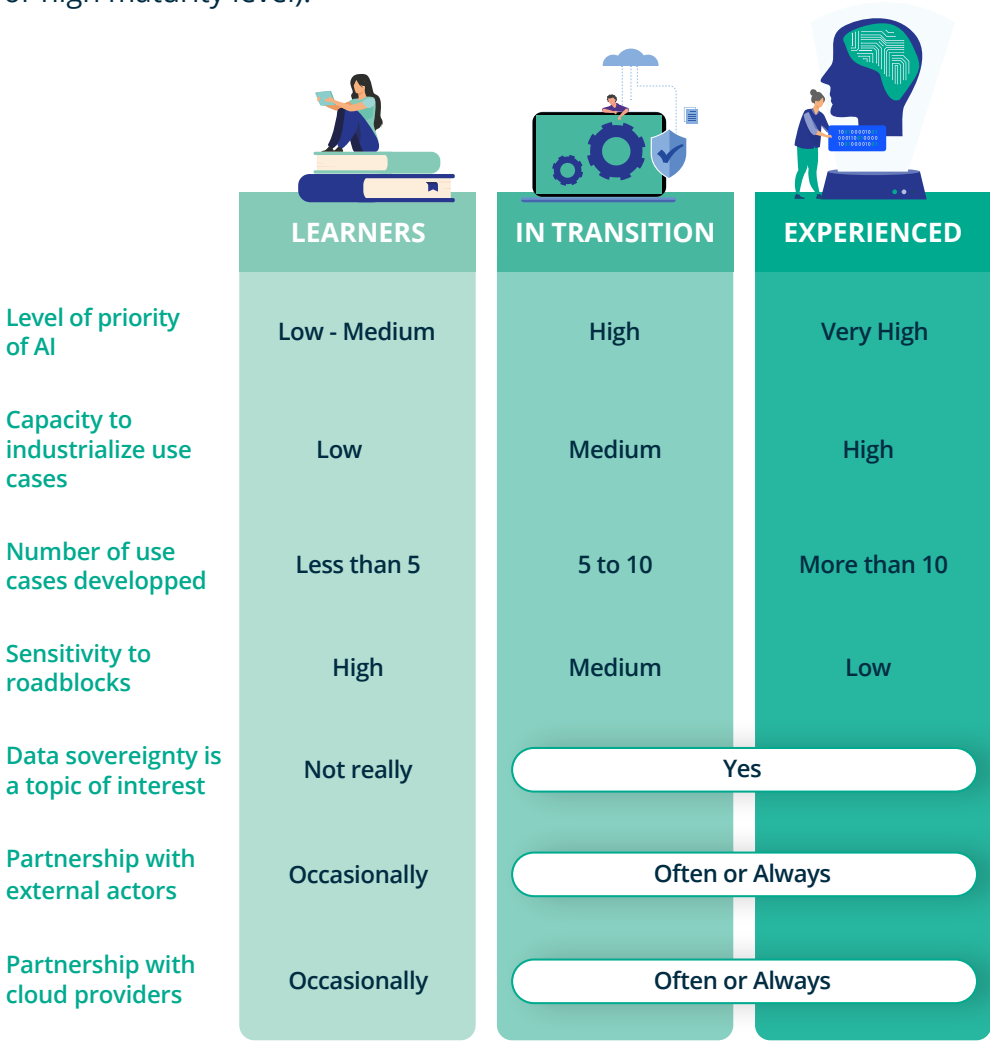
Maturity patterns

To determine the level of maturity of organization, we have built maturity states across seven dimensions. Based on the answers of each organization that have been normalized, it is possible to define the profile to which the organization is the closest (i.e., a low, medium, or high maturity level).

25%	43%	32%
Learners	**In transition**	**Experienced**

Learners are companies that recently started to leverage data and AI capacities. That is why learners are mostly small companies (60% of learners have less than 50 employees) and are relatively young (65% of learners have five years of experience maximum). Like in 2021, they are still a heterogeneous group. Even though they are low in terms of maturity, most of those companies reveal that data and AI is an important component of their strategy, but few say it is critical (only 17%). Learners have high hopes and can be overconfident about their capacity to scale-up their use cases.

Transitionals are defined as organizations that are more advanced in their journey and have more capabilities to develop and successfully industrialize use cases. They can be all kinds of organization but are generally of bigger size than learners (40% of transitionals have more than 100 employees).They have also been in activity for longer time (51% of transitionals have been in activity more than 5 years). They usually consider data and AI as a key component of their strategy but are still struggling to overcome challenges.

Experienced organizations are the most advanced structures with regards to leveraging data and AI capabilities to generate value. Organizations from various sectors can be considered as experienced but they are mainly of bigger sizes than transitionals and of greater experience (78% of are older than 5 years). They consider data and AI as a critical piece for their overall strategy and they have developed processes and tools to deal with the complexity of creating value from data.

Based on a set of 83 respondents (incl. 33 Startups, 9 Pharmas, 4 MedTech companies, 2 Insurances, 8 research labs, 10 Hospitals, and 17 others)

Maturity level: overall population

Legend: ■ AI Priorization ■ Use Cases development ■ Roadblocks ■ Data Sovereignty ■ Partnerships

Axes: Acculturation of C-level executives, Management acculturation initiatives, Department dedicated to AI, Capacity to scale-up use cases, Proportion of industrialized use-cases, Number of use cases developped, Overcoming roadblocks, Importance of data sovereignty, Partnership with cloud providers, Partnership with external actors

Scale: 0% 20% 40% 60% 80% 100%

■ Experienced ■ Transitionals ■ Learners

Transitionals and learners must focus their efforts on specific areas to improve

In general, learners are less advanced on all dimensions such as the capacity to scale-up use cases and to overcome roadblocks where they only slightly lag behind. They are probably overconfident in their capacity to industrialize use cases and have not yet integrated all the barriers that will show up over time.

To progress from one maturity state to another, learners and transitionals should focus on areas where a leapfrog is a synonym of increased maturity pattern. For example, they need to close the gap in terms of acculturation of their C-level executives and to work more regularly and deeply with external actors. Learners are especially behind on that matter and must focus on building specific structures to deal with data and to catch up with more advanced structures.

Split Startups vs non-Startups

Non-Startups

Non-Startups radar chart: Capacity to industrialize use cases, Number of use cases developped, Sensitivity to roadblocks, Partnership with cloud providers, Partnership with cloud providers, Importance of data sovereignty. Scale 0%–100%.

Startups

Startups radar chart: Capacity to industrialize use cases, Number of use cases developped, Sensitivity to roadblocks, Partnership with cloud providers, Partnership with cloud providers, Importance of data sovereignty. Scale 0%–100%.

Legend:
- Experienced
- Transitionals
- Learners
- Data Sovereignty
- Partnerships
- Use Cases development
- Roadblocks

Startups: a model to be followed by other organizations?

Startups seem to be more confident about their ability to industrialize use cases than non-Startup. This may be due to overconfidence, but maybe also a greater focus on fewer use cases. Startups seem to collaborate less than non-Startups would do. Because of their size and the impossibility of developing in-house technical solutions, Startups rely more on cloud providers.

Transitional and experienced Startups have relatively similar profiles. Learners, while less mature in many respects, have a similar skill set distribution to their more advanced counterparts. Learners are even as sensitive as other categories to the challenges posed by AI and data. In order to progress, Startups should therefore focus on other aspects, such as creating partnerships in order to progress in their use of data.

Differences are more important for other types of companies

On the contrary, non-Startups have different profiles, depending on the level of maturity. In particular, experienced companies are much more likely to collaborate with other players in the sector. This allows them to work with other entities that bring different and new skills to the table and increases their ability to industrialize use cases.

Learners are clearly laggards, especially when it comes to developing new use cases, not to mention their industrialization capabilities. As a source of inspiration, we can encourage them to analyze what their more mature peers are doing and leapfrog developing value-adding collaborations.

Use cases of interest
Pharma and MedTech

Epidemiology, drug discovery and drug and device development are the three main categories of use cases developed by Pharma and Medtech companies.

💡 Top use case (% of total): **53% of use cases on drug and device development**

Macro repartition of use cases currently under way, their potential value, and their perceived accessibility

	Use cases under way[1]	Potential value[2]	Perceived accessibility[3]
Epidemiology	44%	32% ➡	26% ➡
Drug discovery	46%	37% ➡	19% ➡
Drug/device development	53% ➡	37% ➡	25% ➡
Market access	32%	19% ➡	13% ➡
Manufacturing and supply chain	24%	16% ➡	10% ➡
Marketing and Sales	26% ➡	21%	15% ➡
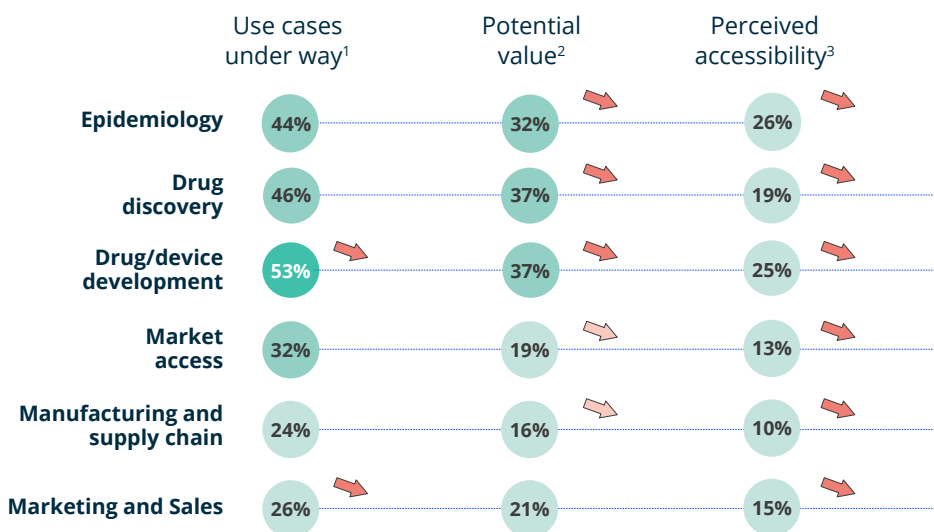
53% 53% of Pharma/Medtech companies have use cases under way related to Drug/ Device development

⬤ 0 to 30%   ⬤ 30 to 50%   ⬤ 50 to 75%   ⬤ +75%

Variation in percentage points vs. 2021

➡ Slight decrease vs. 2021 (between 15 and 25 pts)   ➡ Strong decrease vs. 2021 (>25 pts)

Based on a set of 68 respondents (incl. 28 Startups, 26 Pharmas/MedTechs, 14 Research Labs)
[1] % of companies with 'some projects' and 'many projects' - [2] % of companies rating as 'rather high value' - [3] % of companies rating as 'rather accessible'

Potential value and perceived accessibility record consistent decrease in all areas compared to 2021

Compared to 2021, all use case categories show significant declines in perceived value and accessibility. These decreases are generally more than 30 points compared to 2021 across almost all types of use cases. This indicates that barriers are becoming more challenging in the delivery of use cases. However, companies in the sector continue to initiate and progress use cases in pretty much the same proportions, showing their continued confidence in their interest.

Epidemiology, drug discovery, and drug/device development are the three main categories of use cases

R&D use cases (drug discovery and drug and device development) are supposed to generate the most value across the panel with a comparative accessibility, while other use cases are less valuable. They are also the most represented use cases among the panel. All in all, efforts will certainly go in that direction in the years to come.

Marketing and Sales are less attractive to organizations than they were before

With a decrease of 26% compared to 2021, fewer companies develop use cases focused on marketing and sales. Despite this, it is the only category where the perceived value remains the same when compared to 2021 (around 20%). Pharmas/MedTechs believe they should probably re-allocate their data and AI investment in other buckets.

Use cases of interest
Hospital

As of 2021, efficient management of patient flows and resources remain the main axes although the perceived accessibility seems to decrease.

💡 Top use case (% of total): **78% of use cases on care organization**

Macro repartition of use cases currently under way, their potential value and their perceived accessibility

	Use cases under way[1]	Potential value[2]	Perceived accessibility[3]
Surgery	34%	22%	17%
Ambulatory care	54%	34%	29%
Emergency ward	49%	32%	29%
Care organization (in/out patient)	78%	51%	32%

34%   34% of Hospitals have use cases under way related to Ambulatory care

● 0 to 30%   ● 30 to 50%   ● 50 to 75%   ● +75%
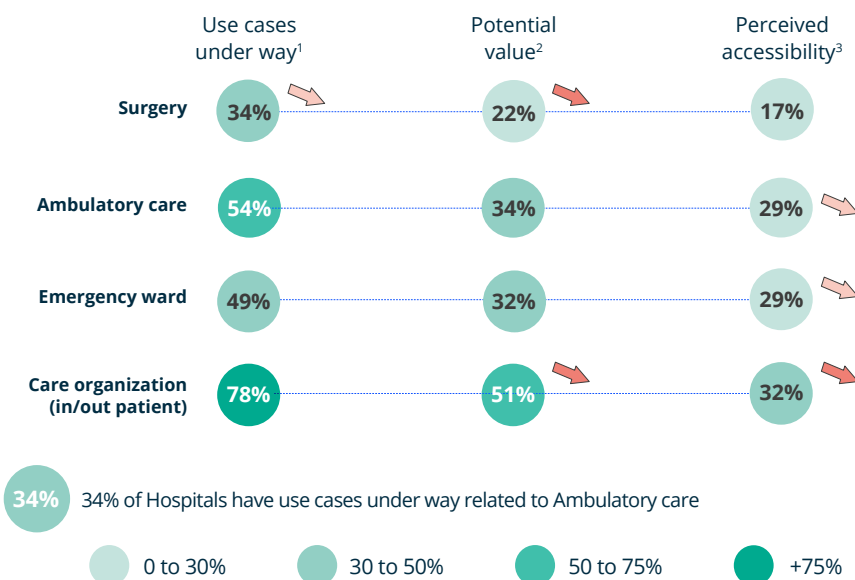
Variation in percentage points vs. 2021

➜ Slight decrease vs. 2021 (between 15 and 25 pts)   ➜ Strong decrease vs. 2021 (>25 pts)

Based on a set of 41 respondents (incl. 29 Startups and 12 Hospitals)
1 % of companies with 'some projects' and 'many projects' - 2 % of companies rating as 'rather high value' - 3% of companies rating 'rather accessible'

Care organization: still a prevalent use case but challenged

Although use cases focusing on care organization remain at the top of the list for Hospitals, two-third of the respondents consider the development of use cases in this area as difficult to access (32% believe that such use cases are accessible vs. 68% in 2021). Only half of the panel believe in the value it could bring to Hospitals.

Ambulatory care: continuous progress

Interest for ambulatory care management keeps progressing in small increments (+4 points). This progression is counterbalanced by a perceived decrease in accessibility (-21 points), which is probably due to Hospitals not accelerating fast enough in their chronic conditions and post-operative transformation. As the technology landscape is now here, we assume that reimbursement schemes are next step here.

Emergency ward

Similar to Ambulatory care, emergency management is a promising area: from intervention at incident level to patient urgent care. Given that the level of risk taken by practitioners is usually higher in that field than it is for ambulatory care, use cases are still progressing slowly.

Surgery: yet to be proven

Compared to 2021, organizations continue to work on augmented surgery in spite of a sharp decrease in the value perceived. They are probably awaiting the appearance of the first use cases. Indeed, considering time and efforts to transform the OR, potential value tends go down significantly (-28 points versus 2021), which correlates with the low perceived accessibility (17%).

Use cases of interest
Insurance

Marketing and sales, and customer services are the most common use cases, but not necessarily the ones showing the greatest potential for value.

💡 Top use case (% of total): **78% of use cases on marketing and sales**

Macro repartition of use cases currently under way, their potential value and their perceived accessibility

	Use cases under way[1]	Potential value[2]	Perceived accessibility[3]
Actuarial analysis	56%	44%	33%
Marketing & Sales	78%	22%	56%
Claims & payments	33%	33%	22%
Customer service	67%	44%	33%
Population health management	56%	44%	11%

33% 33% of Insurances have use cases under way related to Ambulatory care

- 0 to 30%
- 30 to 50%
- 50 to 75%
- +75%
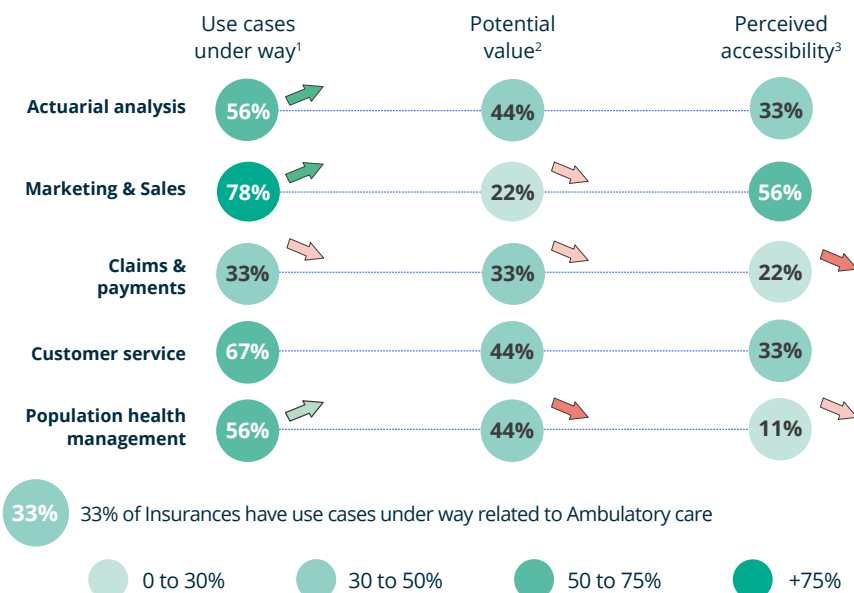
Variation in percentage points vs. 2021

➜ Slight increase vs. 2021 (between 15 and 25 pts)

➜ Slight decrease vs. 2021 (between 15 and 25 pts)

➜ Strong increase vs. 2021 (>25 pts)

➜ Strong decrease vs. 2021 (>25 pts)

Based on a set of 9 respondents (incl. 6 Startups & 3 Insurances)
1 % of companies with 'some projects' and 'many projects' - 2 % of companies rating as 'rather high value' - 3 % of companies rating 'rather accessible'

High progression for marketing, sales and actuarial analysis use cases

The use cases being developed in marketing, sales and actuarial analysis fields have experienced a strong increase since 2021 (+35 points, +27 points respectively).

Claims and payments use cases are relayed to the background

Insurance process can be complex and lengthy. The industry has worked on process improvements for years now. Hence, the marginal added value that could be brought to those processes is probably now too low to see value coming in from use case delivery.

Population health management: still high but not proven yet

A vast majority of respondents say they are working on stratifying and monitoring patient population with an evolution of +17 points since 2021. Nevertheless, we observe a negative correlation between number of use cases under way and associated potential value (from 86% in 2021 to 44% in 2022). Also, related accessibility is very low when considering only 11% of organization can perceive it. Outside the US, where there is a clear business case for Population Health Management (PHM), could there be a way in Europe?

Results from this section should however be taken with caution due to the limited numbers of respondent (n=9).

Definitions

Actuarial analysis:
- Product profitability simulation
- Business case development
- Market analysis
- Customer segmentation

Marketing & Sales:
- Branding,
- Communication,
- Distribution strategy,
- Operational excellence
- Underwriting

Claims & payments:
- Claim process management
- Payment of claims steering
- Fraud management

Customer service:
- CRM
- Call center
- Data driven marketing

Population health management:
- Health factors (genetics, physical environment, access to care, individual behavior, social environment)
- Health outcome (mortality, morbidity)
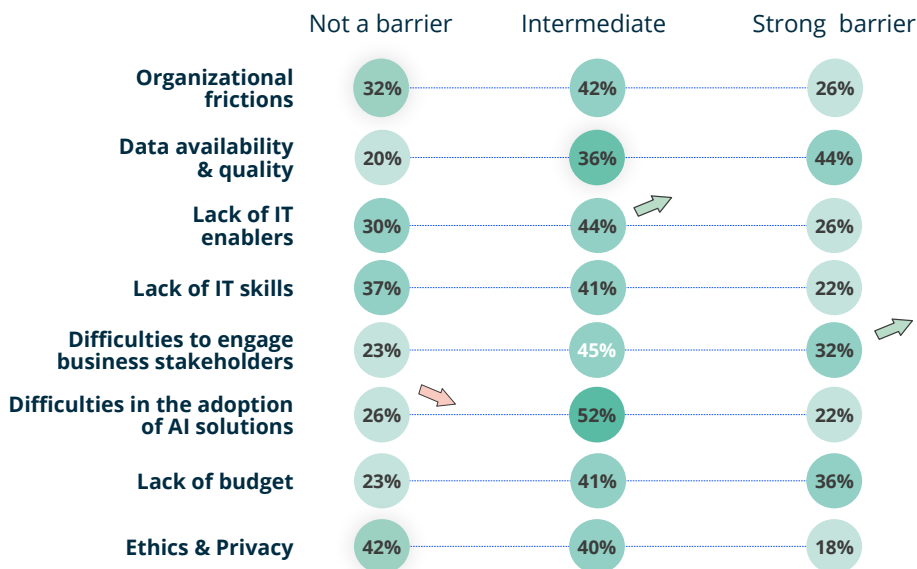- Disparity: ethnicity, geography, gender, socio-eco status

Barriers to use case development

Overall, we notice that most of the barriers are constant this year vs last year. Compared to 2021, some barriers become increasingly problematic such as the ability to engage business stakeholders. Only the difficulty of adopting AI solution can no longer be consider a blocker.

💡 Top barrier (% of total): **44% see Data Availability & Quality as a strong barrier**

What are the main barriers that slow down the delivery of your Data and AI initiatives?

	Not a barrier	Intermediate	Strong barrier
Organizational frictions	32%	42%	26%
Data availability & quality	20%	36%	44%
Lack of IT enablers	30%	44%	26%
Lack of IT skills	37%	41%	22%
Difficulties to engage business stakeholders	23%	45%	32%
Difficulties in the adoption of AI solutions	26%	52%	22%
Lack of budget	23%	41%	36%
Ethics & Privacy	42%	40%	18%

41% 41% of companies declare that lack of skills is a moderate barrier

⬤ 0 to 30%   ⬤ 30 to 50%   ⬤ 50 to 75%   ⬤ +75%

Variation in percentage points vs. 2021

➡ Strong increase vs. 2021 (>25 pts)   ➡ Slight increase vs. 2021 (between 15 and 25 pts)   ➡ Slight decrease vs. 2021 (between 15 and 25 pts)   ➡ Strong decrease vs. 2021 (>25 pts)
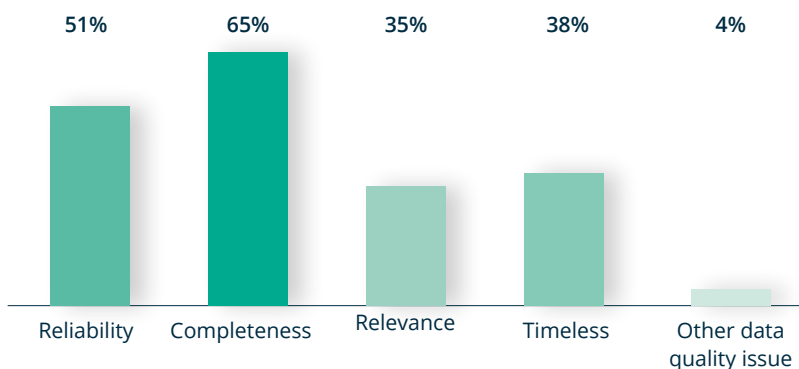
Based on a set of 141 respondents (incl. 46 Startups, 26 Pharmas/MedTechs, 14 Research Labs, 12 Hospitals, 3 Insurances, and 40 others)

Did you encounter any data quality issues (reliability, completeness, relevance, timeliness) while working on use cases development?

| 51% | 65% | 35% | 38% | 4% |

Reliability · Completeness · Relevance · Timeless · Other data quality issue

Based on a set of 108 respondents (incl. 34 Startups, 20 Pharmas/MedTechs, 12 Research Labs, 11 Hospitals, 3 Insurances, and 28 others)

Some barriers are getting even more problematic for organizations

Some barriers are becoming more and more important for the whole panel. Difficulty in engaging business stakeholders is becoming the second most important concern after data availability and quality, which remain a constant. This could indicate that AI and data initiatives have not yet sufficiently proven they can deliver business applications in a way that makes them a no-brainer for the business.

Lack of budget is also still a priority barrier for the entire panel (71% in 2021 versus 77% in 2022). Moreover, this concerns all types of organizations, and the causes probably differ depending on the players. We can think of allocation difficulties for large companies and search for funding regarding Research institutes and Startups.

Data accessibility and quality remains the number one challenge

Data accessibility and quality remain the main barriers encountered by players when developing use cases. In 2022, 80% of respondents think it is a barrier (incl. 44% considering it as strong barrier). Although this belief is shared among the panel, it seems that some players are finding solutions to overcome this issue (20% think it is not a problem vs. 10% in 2021).

Data-wise, completeness and reliability are the killers

Among the four main characteristics of data quality, data completeness and reliability are the most challenging for organizations since 65% and 51% of the panel respectively mentioned them. Thus, the question of the data collection method arises, since this would result in data that is qualified as not sufficiently reliable and, above all, incomplete, making it more difficult to use.

Furthermore, the panel's responses did not show any correlation between these variables and any type of organization, which shows that all actors are confronted with these issues, regardless of their type, size, or business model.

New constraints are becoming increasingly challenging

The lack of IT skills is becoming a problem for many more organizations. Indeed, only 30% (vs. 41% in 2021) consider it as not a barrier. This illustrates the challenge organizations are facing to recruit (and probably even more to retain) top notch data and AI profiles.

Finally, the question of the acculturation and training of healthcare stakeholders (patients, healthcare providers, medical organizations, etc.) arises. This might mean that even when an AI solution proves to be effective, the lack of knowledge can prevent the targeted population from using these solutions correctly.

Technological choices

Transformation happens in the background, too. This section provides insights on options that have been made by organizations when it comes to data, systems and applications.

What is the comfort level regarding technology to build efficient data foundations (i.e. ingestion, storage, processing, usage)?

Where do healthcare organizations stand today in their journey to Cloud?

Which analytics techniques are commonly used (data viz, machine learning, natural language processing...) or less used?

If the maturity of individual players tend to generally increase on this matter, data interoperability remains the main issue preventing players from efficiently working together.

TECHNOLOGICAL CHOICES

KEY TAKE-AWAYS

1 **Maturity in the data lifecycle**

Companies are quite confident on their capacity to build efficient data foundations across the data lifecycle. However, they are struggling with **data interoperability** which hinders data sharing initiatives both within organizations and between them.

2 **Move to Cloud**

Healthcare is progressively moving to Cloud. For Startups, this is a no brainer. For Pharmas/Medtechs, it's a transition. Hospitals and Research labs are clearly accelerating in their cloud agenda. AWS seems to be the most popular cloud provider in the healthcare sector, followed by Azure and GCP.

3 **Data processing techniques**

Data visualization and **Machine/Deep Learning** are the most commonly used tools. Yet immature techniques (quantum computing, reinforcement learning) and more surprisingly mature ones (robotic process automation) present room for greater leverage.

4 **Sustainability**

Sustainability is an important criterion for making technological choices although not considered critical (yet). Some organization types such as Hospitals and Startups consider it to be less critical than others likely due to other priorities such as building and scaling their use cases.
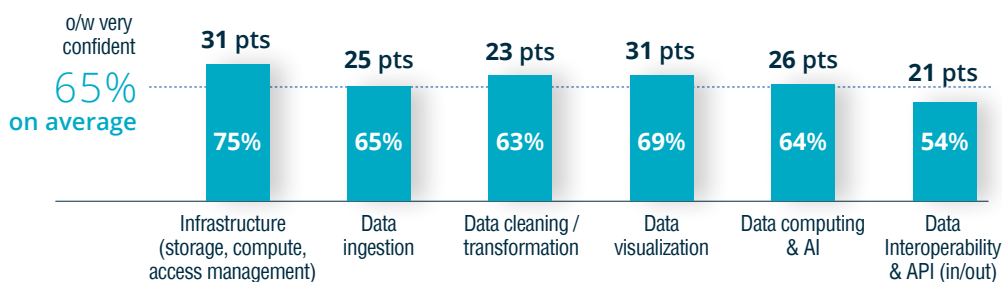
Maturity in the data lifecycle

In line with what has been observed over the past, organizations are quite confident in their capacity to deal with the data lifecycle. But while stakeholders express comfort with infrastructure and data visualization, when it comes to data interoperability, they experience difficulties.

> Top confidence layers (% of total): **75% Infrastructure** and **69% Data visualisation.**

What is the comfort level of your organization for each technology platform layer?

o/w very confident

65% on average

	Infrastructure (storage, compute, access management)	Data ingestion	Data cleaning / transformation	Data visualization	Data computing & AI	Data Interoperability & API (in/out)
pts	31 pts	25 pts	23 pts	31 pts	26 pts	21 pts
%	75%	65%	63%	69%	64%	54%

Based on a set of 141 respondents (incl. 46 Startups, 40 'others', 26 Pharmas/Medtechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

Data interoperability remains an issue for many stakeholders

Overall, organizations feel confident about their capabilities to manage data lifecycle from start to finish. Respectively 75% and 69% of organizations state that they are "confident" to "very confident" on the bottom layer of infrastructure and on data visualization techniques, probably since it has now become a commodity. On the other side of the confidence spectrum, however, data interoperability remains a major issue with only 54% feeling confident (including only 21 pts very confident). More and more data is coming from various sources, with different norms and levels of quality. Being able to gather this data and make it interoperable between systems is of the utmost importance to enhance sharing inside organizations, and outside with users, partners and soon with Regulators.

The other dimensions i.e., ingestion, transformation and model training could be considered as average across the panel.
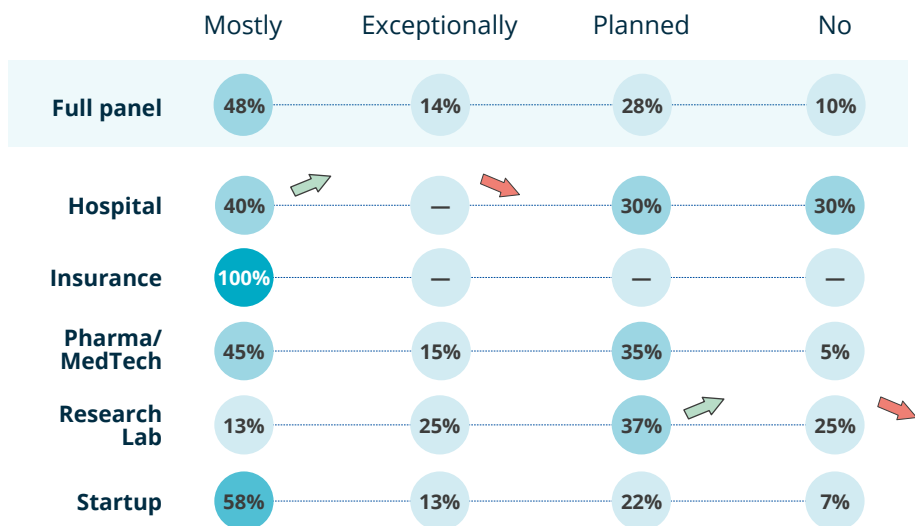
Move to Cloud

Healthcare is progressively moving to Cloud, but at a slower pace than other industries. For Startups, this is already a no brainer. Pharmas/ MedTechs are transitioning. Public players (Hospitals and Research labs) are beginning to change their perception on the matter.

💡 **Hospital are now 40%** to mostly rely on Cloud (vs 20% in 2021)

Do you rely on cloud providers for your data and AI infrastructure needs (ingestion, data cleansing and storage, data computing and AI, end-users' exposure)?

	Mostly	Exceptionally	Planned	No
Full panel	48%	14%	28%	10%
Hospital	40%	—	30%	30%
Insurance	100%	—	—	—
Pharma/ MedTech	45%	15%	35%	5%
Research Lab	13%	25%	37%	25%
Startup	58%	13%	22%	7%

25% — 25% of Research Labs declare relying on cloud providers for Data and AI infrastrucure need

0 to 30% — 30 to 50% — 50 to 75% — +75%

Variation in percentage points vs. 2021

Strong increase vs. 2021 (>25 pts) — Slight increase vs. 2021 (between 15 and 25 pts) — Slight decrease vs. 2021 (between 15 and 25 pts) — Strong decrease vs. 2021 (>25 pts)
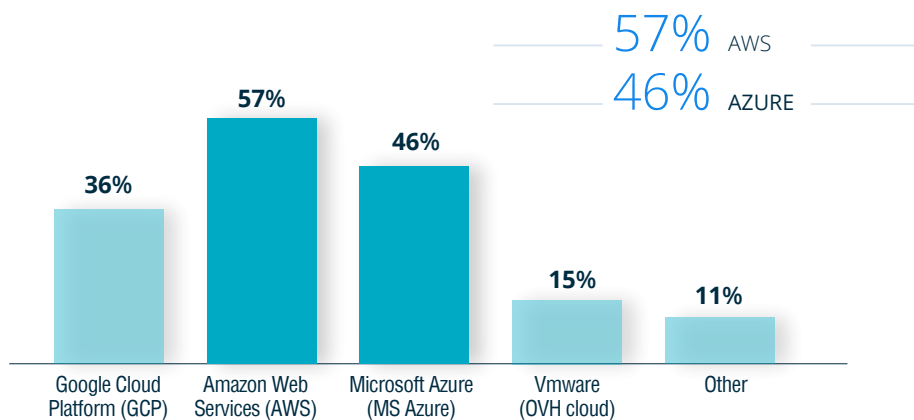
Based on a set of 141 respondents (incl. 46 Startups, 40 'others', 26 Pharmas/Medtechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

What cloud structures does your organization leverage?

57% AWS
46% AZURE

57% — Amazon Web Services (AWS)
46% — Microsoft Azure (MS Azure)
36% — Google Cloud Platform (GCP)
15% — Vmware (OVH cloud)
11% — Other

Google Cloud Platform (GCP)	Amazon Web Services (AWS)	Microsoft Azure (MS Azure)	Vmware (OVH cloud)	Other

Based on a set of 95 respondents ((incl. 39 Startups, 25 'others', 16 Pharmas/Medtechs, 7 Hospitals, 6 Research Labs and 2 Insurances)

Companies still moderately rely on Cloud providers

Compared to 2021, the proportion of organizations using Cloud providers is stable. Indeed, as in 2021, approximately 50% of companies mostly rely on cloud providers. Nonetheless, Hospitals appear to rely more and more on Cloud providers. In fact, in 2021, only 20% of Hospitals relied extensively on a Cloud provider. By 2022, that figure doubled. Hospitals and clinics are on a journey to structure their data in a way that improves day-to-day care and makes the best use of it for later purposes. Research labs too have planned their journey to the Cloud, progressively moving away from an on-premises strategy.

American hyperscalers remains the preferred option

Amazon Web Services (57%), Microsoft Azure (46%) and Google Cloud Platform (36%) are the top 3 Cloud providers for healthcare organizations. We see more and more initiative on sovereign Clouds to bring alternatives.
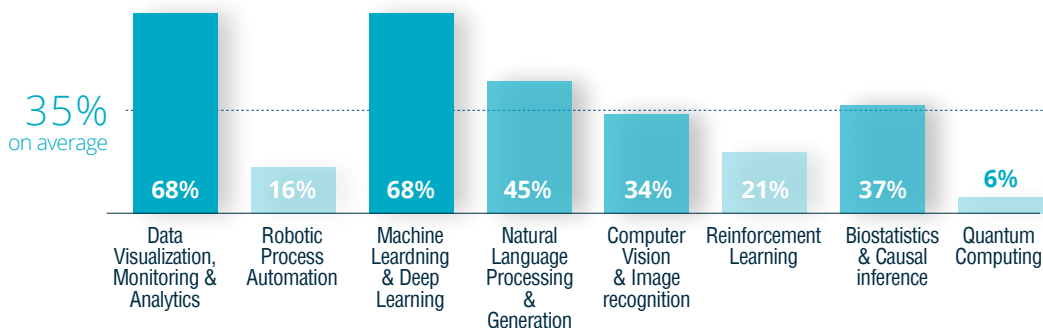
Data processing techniques

Data visualization and Machine/Deep Learning are the most commonly leveraged techniques. Robotic Process Automation, Reinforcement Learning, and Quantum are not widely used yet.

> Top 2 Analytics techniques (% of total): **68% Data visualization and Machine & Deep Learning**

Which of the following Analytics techniques have you leveraged to develop your use cases?

35% on average

Technique	%
Data Visualization, Monitoring & Analytics	68%
Robotic Process Automation	16%
Machine Leardning & Deep Learning	68%
Natural Language Processing & Generation	45%
Computer Vision & Image recognition	34%
Reinforcement Learning	21%
Biostatistics & Causal inference	37%
Quantum Computing	6%

Based on a set of Based on a set of 141 respondents (incl. 46 Startups, 40 'others', 26 Pharmas/Medtechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

Some techniques are widely used among the panel while others remain confidential

Data visualization and Machine/Deep Learning techniques are the most frequently used, with nearly 70% of use cases developed. This comes as no surprise as the solutions are mature. On the contrary, quantum computing (6%), and reinforcement learning (21%) techniques are much rarer but are also at a much less advanced stage. Robotic process automation (16%) comes as a surprise in the panel, as solutions are mature. Startups are the category that claims to have the most control over these analytical techniques. They generally are at least 10 points above the other organizations.

Sustainability

Sustainability represents an important criterion in the agenda of the organizations. We do not notice striking differences between organizations.

To what extent does sustainability represent an important criterion in your technological choices?
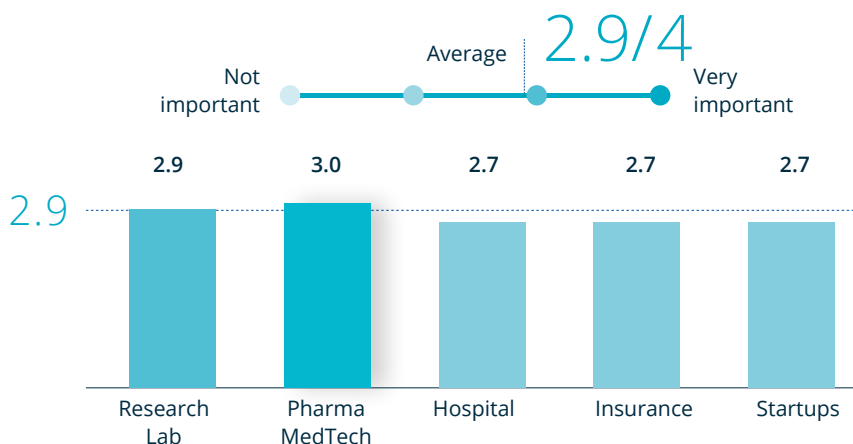
Most companies take sustainability into account when making their technological choices

Almost 70% of the panel consider sustainability as an important or critical topic when making their technology choices. Only a very few (6%) do not take it into consideration at all.

Among company types, Startups are slightly lagging with 58% of them considering sustainability as an important or critical criteria. We can interpret that as due to the fact that Startups are usually cash-strapped and that their first goal is to build an efficient and working product.

67% of Hospitals consider sustainability to be an important criterion, but few (8%) consider it as critical which is the lowest among the types of organizations.

Zoom in

#1 Use of unstructured data (text, voice...)

Around 80% of healthcare data is unstructured. This encompasses clinical records, imaging records, bio signal data, and more. Some companies such as OpenAi, Nuance or 3M develop tools based on Natural Language Processing (NLP) technologies to transform unstructured data into structured data usable for analysis. Many use cases are being developed around this technology. For healthcare professionals, Nuance DAX saves time for clinicians and increases patient experience by automatically writing clinical analyses.

For insurance companies, 3M 360 Encompass detects mismatches of clinical content and diagnostic that cause claim denials. On social media, it is possible to detect early signs of mental illness by sentient analysis, including weak signals of an impending suicide attempt. This could be used to warn healthcare professionals.

The acquisition of Nuance by Microsoft, for a deal value of **$20Bn**, was cleared in March 2022.
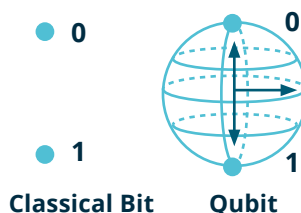
Satya Nadella
Chairman & CEO

" **Together we will usher in a future of outcome-based AI where healthcare professionals can spend more time with patients and less time on documentation.** "
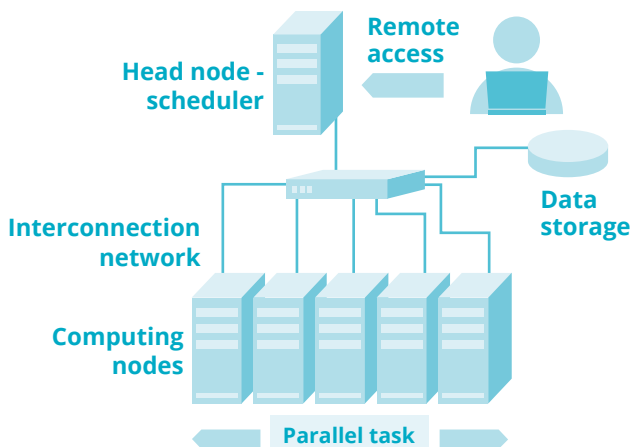
#2 High-power computations

High Performance Computing (HPC) is an aggregation of computing power to solve too large or too long calculations for standard computers. HPC works with a cluster of computers (nodes). In healthcare, it helps on several fronts, including genomic analysis, precision medicine, medical imaging or simulated clinical trials. Complementary to HPC technology is quantum computing. Quantum computing is based on Quantum technology to deal with large problems differently than HPC technology does. It requires quantum computers, that substitutes the binary "bits" of classical computing with something called "qubits", that operate according to the laws of quantum mechanics. Quantum Computing use cases are mostly in drug discovery stages.

Quantum computing: from "bits" to "qubits"

Classical Bit   Qubit

High Performance Computing (HPC): how it operates

Head node - scheduler

Remote access

Interconnection network

Data storage

Computing nodes

Parallel task

Ethics and Privacy

This section provides insights on how the ethics & privacy issues are managed by healthcare organizations when working on their use cases. We have seen in the "AI maturity & use cases" section that the topic is not considered as representing a high barrier compared to other dimensions such as data issues, budget allocation and stakeholders' engagement. We now look at some of the nuances behind the complexity -and the opportunity- offered by ethics & privacy.

How do players perceive accountability, fairness, explainability and privacy? How are those dimensions tackled day-to-day?

How important is data sovereignty to the different stakeholders?

If privacy remains the most important topic, we see a growing focus on other dimensions, with a will to anticipate and go beyond regulation.

ETHICS AND PRIVACY

KEY TAKE-AWAYS

1   **Ethics and privacy: a challenge?**

Ethics related roadblocks are considered impactful by most organizations across the panel, but **less so than privacy**, although processes to master this challenges seem well in place, as regulation is now mature. Other ethics-related topics are also considered by organizations such as **explainability** (esp. for Research labs), **fairness** (esp. for Pharmas/MedTechs as trainers of models) and to a lesser extent accountability (esp. Hospital in front the line of diagnosis and follow-up).

2   **How are ethics and privacy tackled?**

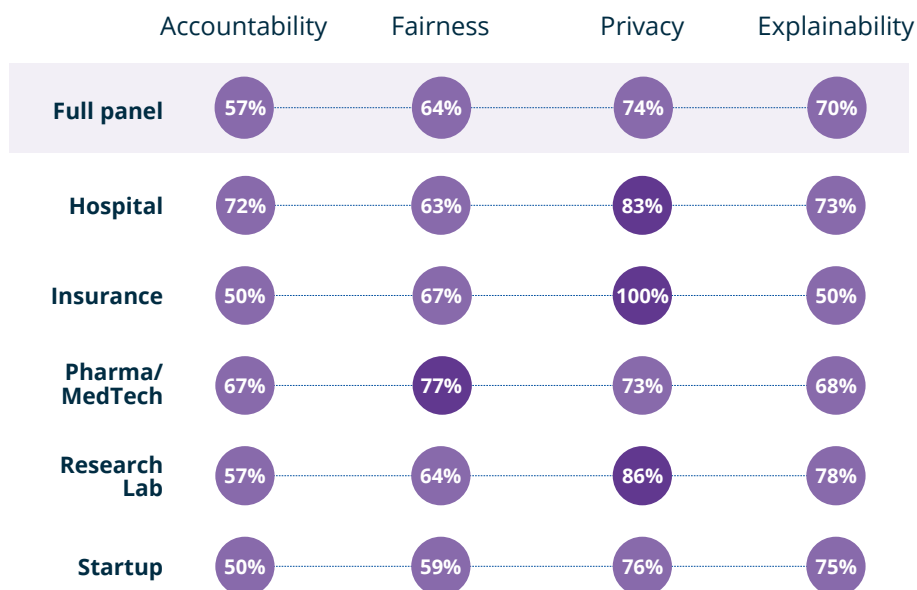**All of the ethics & privacy related topics are analyzed during projects** by most organizations. They are not systematically considered though. Among those considerations, **privacy is almost consistently analyzed**. This is probably because it is a topic with significant exposure to media and public opinion in general. So is **data sovereignty** with a growing concern of the stakeholders of what is at stake with health data.

Ethics and privacy: a challenge?

Although ethics and privacy is not considered as a top barrier by the respondents (40% not considering it a barrier), we do notice a specific concern regarding privacy and model explainability.

> 🔆 Top 2 barriers (% of total): **74% Privacy and 70% Explainability**

What are the barriers with regards to Ethics & Privacy according to your experience?

	Accountability	Fairness	Privacy	Explainability
Full panel	57%	64%	74%	70%
Hospital	72%	63%	83%	73%
Insurance	50%	67%	100%	50%
Pharma/ MedTech	67%	77%	73%	68%
Research Lab	57%	64%	86%	78%
Startup	50%	59%	76%	75%

72% 72% of Hospitals declare that Accountability is a barrier

○ 0 to 30%   ○ 30 to 50%   ○ 50 to 75%   ● +75%

Based on a set of 141 respondents (incl. 46 Startups, 40 'others', 26 Pharmas/MedTechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

How are ethics and privacy tackled?

Ethics and privacy do matter to organizations. Dimensions are mostly screened on a systematic basis, especially privacy which is heavily regulated, while sovereignty pops up an emerging topic.

Are the following dimensions analyzed during projects?

70% analyse Privacy systematically

	Accountability	Fairness	Privacy	Explainability
Systematically	53%	47%	70%	47%
Ad hoc	36%	41%	22%	41%
No	10%	12%	8%	12%

Legend:
- No
- Ad hoc
- Systematically

Do you consider data sovereignty as an important topic to address?

Data sovereignty in healthcare means that health data is subject to laws and governance structures of the nation where it is collected.

51% of all respondents believe it is critical

	Hospital	Pharma	Start-up	Insurance	Research Lab
Critical	55%	43%	48%	67%	54%
Important	36%	57%	33%	33%	23%
Somehow important	9%		17%		23%
Not important			2%		

Legend:
- Not important
- Somehow important
- Important
- Critical

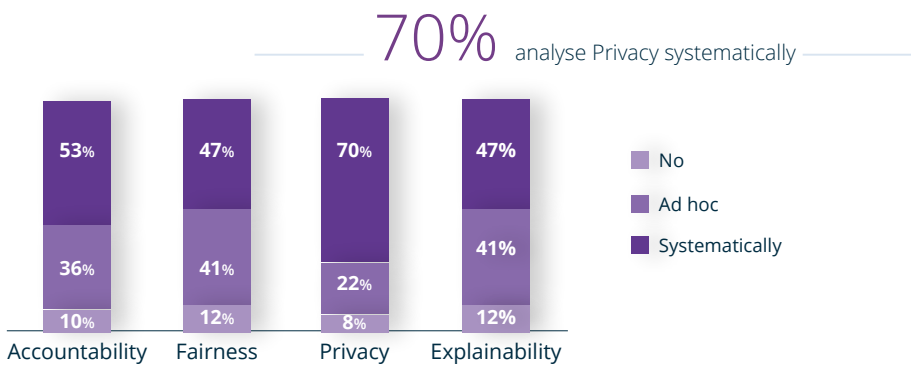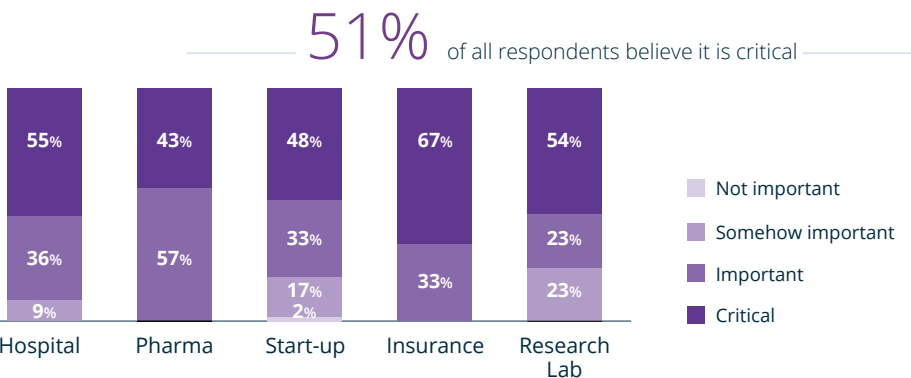Based on a set of Based on a set of 141 respondents (incl. 46 Startups, 40 'others', 26 Pharmas/MedTechs, 14 Research Labs, 12 Hospitals and 3 Insurances)

Ethics related topics are considered as effective barriers

All topics of ethics and privacy are screened by organizations when they develop use cases but with different intensity. Explainability looks like a sensitive topic (70%), in particular when it comes to Research labs given the nature of the data they handle. Only 57% of the panel believe that accountability is a barrier, probably because there are still few cases of autonomous algorithm not backed by a human taking the ultimate responsibility, maybe excepting the Hospitals. Fairness (64%) sits in between but appears as a growing concern especially when it comes to mastering bias, which is particularly true for Pharmas/MedTechs.

Privacy: under high scrutiny

Privacy is considered as a must-have. 70% of organizations systematically consider it during projects and they sometimes struggle with 74% of the panel tagging it as a barrier. Regulation is now well established and understood (e.g: GDRP in EU, HIPAA in the US) but organizations sometimes struggle on when and how to apply regulation, especially when it comes to collect of consent and its scope of application.

Data sovereignty: a growing concern

Data sovereignty is perceived by the panel as an emerging topic to focus its attention on. More than 50% of Research labs, Hospitals and Insurance companies even consider it a critical issue. Even international companies such as big Pharmas consider it to be an important or even critical issue (100%). For European stakeholders, the choice to go to hyperscalers goes with some warranties that are required with regards to data sovereignty.

Zoom in

#1 Recent hacks on health data

In the recent years, more and more healthcare structures have been hacked resulting in paralysis of computer systems and theft of administrative information and patients' personal information. Hackers threaten to sell or publicly publish the data. This is what happened to Dallas-based Conifer Revenue Cycle Solutions or Centre Hospitalier Sud Parisien (CHSP) this year. In 2021, around 40 million Americans have seen their personal data stolen in 578 breaches. In 2020, it concerned "only" 20 million people. The modus operandi are ransomwares that access internal networks after finding a breach, generally coming from a person. Considering the personal and private nature of health data, it is important to increase the level of data security, both in the architecture of networks and in procedures on how to handle them.


This September, medical examinations and other information related to serious pathologies such as cancer… from hospital of Corbeil-Essonnes were put online by Lockbit 3.0 hackers. For 10 days, this data was accessible through a simple Google search.

#2 Federated models

The traditional approach for training an algorithm pooling locally-collected training data is not always feasible in practice, for reasons of data protection or intellectual property. Thus, technological solutions exist such as federated learning. This architecture is composed of several peripheral units called «nodes» and a central unit. Each peripheral unit has a different set of data and will use this data to train an AI model. Then, the results of the training will be consolidated and optimized in the central unit. The operation will then be repeated with new configurations. The advantage is that this technology allows for better protection of the data for remaining decentralized. This distributed architecture also allows for better data governance.
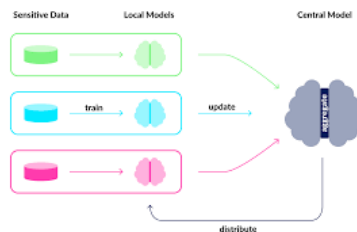
Fedederated learning: how it works

KEY AI TOPICS :
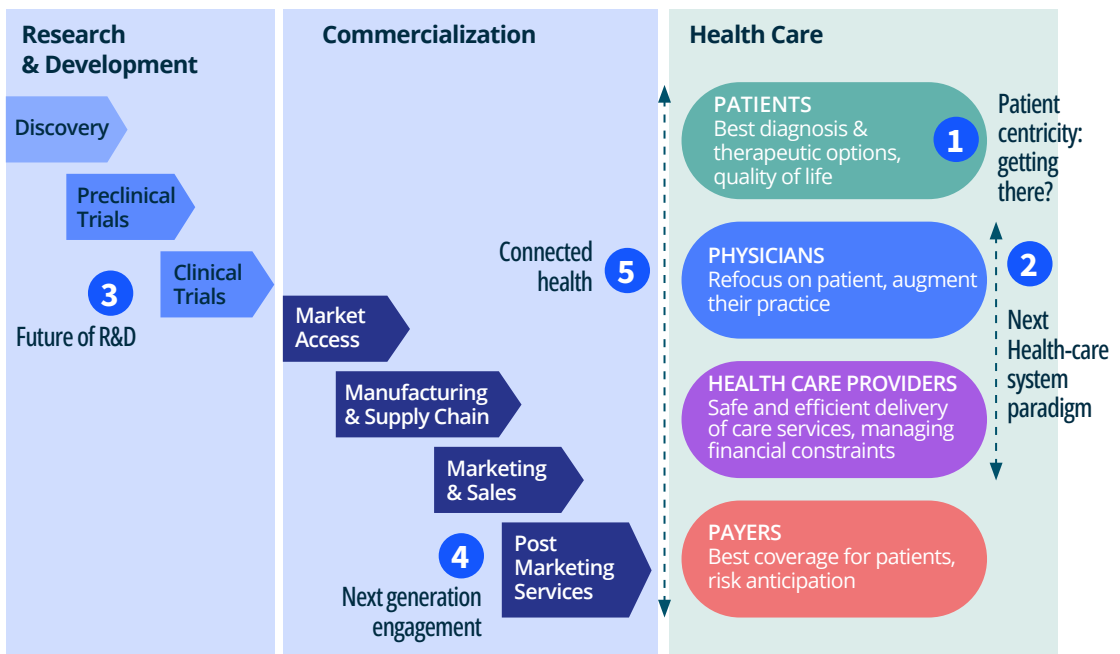# a panorama

AI in health: zoom on 8 topics

In this final section, we will synthetize our discussion with the **22 field experts** spread across a series of **eight areas of interest**. These topics are distributed at different points along the Life Science and Healthcare value chain. For ease of navigation, we offer a simplified version of the value chain from drug discovery to patient management.

LIFE SCIENCE

HEALTHCARE

6 Data foundations   **7** AI/Data Acculturation   **8** Regulators viewpoints

Research & Development

Discovery

Preclinical Trials

Clinical Trials

3

Future of R&D

Commercialization

Connected health **5**

Market Access

Manufacturing & Supply Chain

Marketing & Sales

4 Post Marketing Services

Next generation engagement

Health Care

PATIENTS
Best diagnosis & therapeutic options, quality of life **1**

PHYSICIANS
Refocus on patient, augment their practice **2**

HEALTH CARE PROVIDERS
Safe and efficient delivery of care services, managing financial constraints

PAYERS
Best coverage for patients, risk anticipation

Patient centricity: getting there?

Next Health-care system paradigm

① PATIENT CENTRICITY: GETTING THERE?

Patient centricity is the set of activities whose goal is to **put the patient at the heart** of healthcare interactions. It is a notion that patients themselves have created, as they want to have the industry refocused on their needs, drivers and behavior. Although the concept has been democratized in recent years and can sometimes be challenged, a lot remains to be done.

Patient expectations

These days, patients expect **much more than medical support** from health care professionals. They expect them to be considerate, empathetic and really care for them and their daily life. These concerns go **way beyond their disease** and extend to their personal and professional lives. They would like to be mentally supported in what they are going through. In this respect, more than just information, patients ask for an **understanding of their personal situation**, whether it is the design of a clinical trial or the management of a chronic disease.

Patients also expect their **care pathway to be less fragmented**. They want to be able to access **the right care service** when they need it the most, and to do so seamlessly. Of course, patients want to be better taken care of, i.e. to have access to the best possible diagnostics, treatments and services on the market. Finally, **care affordability** is also a key issue, particularly for the most advanced diagnostic methods or treatments, which are sometimes not fully covered by insurance policies.

Main barriers & challenges

Being patient centric is not an easy task. The first barrier is having **access to a representative panel of patients** to collect their feedback. This entails a profound change in the way organizations and the system operate, **moving from a doctor-centered system to a patient-centered paradigm.**

Virgine Rio
President

BAMP

❝ Bamp is the French Association for medically assisted reproduction. We provide testimony, reassurance and action! In that very personal field, patients are looking for quality information, support in their own journey, and transparency about the outcome. ❞

Adel Mebarki
CEO

Kap•Code
FROM DATA TO HEALTH

❝ From our experience, the first issue that comes up from patients is a request for information. And 80% of patient questions remain unanswered to date! ❞

That being said, **finding the right balance** between the flexibility given to the patients in their care pathway and the necessary rigor required by protocols and prescriptions is a complex topic.

Initiatives to become more patient-centric

Organizations are creating **departments** specifically dedicated to patient centricity. Such departments would represent the **voice of the patient**, for instance when it comes to designing clinical trials. Partnering with **Patient associations** is also a common solution. Some advanced organizations would incorporate patients or volunteers in the research process or during the (re)design of treatment protocols.

Helping patients can also be done by **assisting health care staff** to refocus on the patient. It can be done by granting some trainings, providing them tools to ease their daily practice or means to better communicate with patients.

Trends for the coming years

Participatory medicine is seen as a strong underlying trend for the years to come. Patients will become more and more active – and demanding - in their treatment.

Patient data will be collected through different channels that will encompass multiple aspects of the patient's life going beyond treatment endpoints (i.e. diet, physical activity, sleep, etc.), serving the purpose of a **better predictability** at the patient level. This data collection can be done via "non invasive" devices to secure a **continuum of follow-ups**, particularly for frail, elderly, or isolated patients. Thus, patients will be more aware of their health status and reach out to their healthcare professionals outside of their medical visits. Patients will also be the owner of their health data and will decide with whom and for what purpose they share it (or not). **Blockchain** could also ensure data integrity and trackability for patients and healthcare practitioners.

2 NEXT HEALTHCARE SYSTEM PARADIGM

Data and AI have the ability to deeply change the way care is delivered to patients. It covers **improving the quality** of diagnosis, intervention and treatments, **improving care efficiency** and **smoothening complex patient journeys** inside and outside hospitals.

A step-by-step adoption journey

The adoption of AI within Hospitals is taking **longer than anticipated**. Players will start with data structuring and retrieval first, before going into AI. In AI, the latest progress is concentrated around the **optimization of resources** (human, financial, equipment), **patient interactions**, and **screening of chronic diseases** (e.g., screening for diabetic retinopathy). Although solutions are coming, the value of AI remains to be demonstrated at scale in other areas such as **prevention**, **diagnosis**, and **treatment**.

In addition to improving patient management in the hospital, AI has the potential to greatly improve the **patient journey on complex care pathways** involving hospital, general practitioners, lab tests, et cetera. Digital tools can provide continuity of care outside of the hospitals' walls. We talk about "phygital" care. The basis remains care delivered at hospital, but with the addition of digital solutions to an eye on the patients and detect early signs of a condition getting worse. In order to be really **patient-centric**, the system also needs to be **caregiver-centric**. To be adopted, digital tools need to propose use cases that provide actual benefits to healthcare professionals as well.

Finally, we can notice some innovation in the **sustainability** space. As an example, a tool developed by the CHUM (Centre Hospitalier de l'Université de Montréal) calculates the costs and carbon footprint of an operating room to make surgeons and their clinicians aware of the waste related to interventions. Costs saved are then put back into the department for other missions of the CHUM (e.g.: research, education, innovation).

Kathy Malas
Director for
Innovation & AI
CHUM

" More than culture, we need funding, specialized profiles and a dedicated team to anchor data and AI to the hospital. "

Dorothée Moisy
Innovation
Director
ELSAN

" To generalize data and IA, the innovations should be at the service of the healthcare professionals and support them on their daily practice. "

But barriers to adoption remain

In order to integrate data and AI within the Hospitals, it is still difficult to bring all stakeholders around the table, in particular doctors and nurses due to the little time they can dedicate. A majority still lack **prior knowledge** on the fundamentals of data and AI together with **no clear conviction** on what it could benefit to their daily practice. They definitely need to be convinced. This underlines the importance of training on the matter in order to reduce fear and engage them in the design, testing and deployment of solutions. **Funding** could play into the equation, as arbitration would not necessarily go in favor of such investment over other priorities in the context of inflation in Hospitals. Finally, at the organizational level, **departments are still siloed**, but it is transversality that will accelerate the adoption. Such transversality can be brought by cross-functional teams fully dedicated to the topic.

Which technologies are leveraged?

Data is now well integrated into hospitals and leveraged for admin and care processes. **Machine Learning** is at an advanced stage with some use cases focused on process optimization, diagnosis and clinical outcomes improvement. **Deep Learning** use is not well developed yet, with the exception of imaging where algorithms are embedded in PET Scan, MRI, CT etc... Other techniques are more confidential and have not reached the scale-up phase. **Natural Language Processing** has applications such as chatbots or document scanning. **Augmented reality** and the **metaverse** are still early in their testing phase.

Ángel
Alberich-Bayarri
CEO

Quibim

" **The biggest change in the coming years in AI for imaging is to go from diagnosis to prediction. To deliver that promise, new algorithms should be built and deployed around clinical outcomes (e.g.: survival, relapse, etc.).** "

3 FUTURE OF R&D

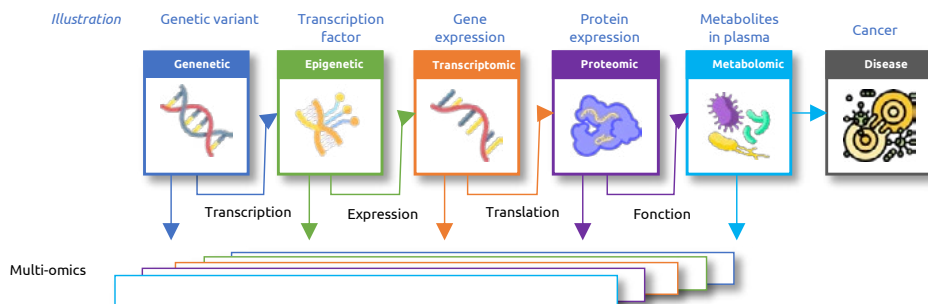The old era of **multi-billion-dollar drug blockbusters** is fading away, resulting in a **growing pressure** on success rates, timelines and cost.

PRIVATE R&D

In research

Leads identification and optimization can now be done **in silico**, in a more systematic manner. Researchers increasingly focus on the **most promising candidates;** iterative time-consuming steps in labs can be partially removed. Addressing yet undruggable targets or going for new ones is now open. Alphafold appears as a valuable insight source starting point.

Beyond speed, **biological specificity** is also key. To unleash the potential of the genome, players should be able to have access to the different families of **omics** data (see figure below), master the technologies to ingest, store, and process them; and have the skills and resources to interpret, analyze, and value them for the appropriate use cases (e.g., biomarker finding).

David Del Bourgo
CEO

WHITELAB GENOMICS

" **From curation of omics data, we have built an "atlas" of human tissues supporting cell and gene therapies towards more specificity and less immunogenicity for candidates.** "

Quantum computing has been generating some interest over the past years, but is still limited in terms of funding. It can **bring a lot with high dimensionality computation** but there are roadblocks like: access to scarce hardware and a war on talents that need to pile up several skills (chemistry, biology, physics, data science). It can be expected to scale-up in 3-5 years, when hardware and hyperscalers will be ready.

Robert Marino
CEO

Qubit pharmaceuticals

" **Access to hybrid HPC-quantum computers will unlock new targets in drug discovery and allow to develop better drugs, faster.** "

In pre-clinical

Pre-clinical makes the transition between research and clinical. In this field, what is at stake as a target state is the **complete removal of animal testing**, using for instance organoids that would mimic animal models.

In development

Use cases for improving the efficiency clinical trials show a **great level of maturity** and have a reasonable time to value.

More intelligence is coming in the development space. **Optimal protocol design** (e.g.: personalizing treatment, selection the right endpoints, working around inclusion / exclusion criteria...), **virtualizing patients** (in silico 'what if' hypothesis generation, synthetic control arm...), speeding up **patient recruitment**, expediting **submission** or getting near **real-time visibility** and predictive power on a full R&D portfolio stand out as the hottest areas in discussions.

Decentralized clinical trials (trials no longer at the sponsor site but switched to patients' homes) are ramping up, driven by patients' needs and encouraging feedbacks. It introduces a radical change in the way Pharmas, doctors, centers and CROs have been working over years, with new processes (e.g: patient support...) and new data points coming into play.

Post-market authorization

Real World Data (RWD) is generated by Hospitals (eHR), by insurers (claims), and more and more by patients (digital health). Industry values RWD more and more, to **generate hypotheses** for protocol design, to build synthetic control arms and to bring safety and efficacy evidence to the health authorities.

Regulator acceptance

Pharma and medical devices are heavily regulated industries. Nothing can be done without the **authorities stamp and guidance**. More and more, we see private players work by their sides to shape the future.

Luca Finelli
Global Head Data
& AI and Digital

NOVARTIS

66 **We as a company are "data rich". However, getting to insights in R&D is highly difficult, especially when it comes to managing multi-modality.** 99

John Reites
CEO

THREAD

66 **With DCT, we can bring a 5x improvement and 30% efficiency gain compared to industry clinical trial standards. Over time, DCT will just become CT!** 99

Cyril Schreiter
Director in Clinical
Operations

Roche

66 **We are heading towards flexibility, agility and adaptation to patients preference in the context of their disease, in a variety of national regulations.** 99

PUBLIC R&D

Public research clearly accelerates, with high ambition and collaboration within their ecosystem, be it public or private players.

INSTITUTE CURIE

In the 2000's, Curie was the **1st French institute in cancer to digitalize its medical records** and research resources.

In 2017, we created a **data team** with the main objectives to enable researchers to make the best use of our data, optimize cancer diagnoses, and discover new treatment pathways.

We work in close collaboration with the ecosystem, e.g., with the Health Data Hub (HDH) recently, with whom we launched a project around **response to targeted therapies in lung cancer** - PRECISION PREDICT. This project aims to better predict the overall survival of patients, which can vary from six months to five years.

Pr. Nicolas Girard
Head of Thoracic Oncology
Thorax Institute Curie
Montsouris

institut Curie

❝ **The data we use at Curie can be segmented in two categories: prospective, collected with patient consent versus retrospective, with constraints going with real-life data collection (e.g., variety of medical devices used, missing data, and such).** ❞

IUCT-ONCOPOLE

Pr. Jean-Pierre Delord
Managing Director
IUCT-Oncopole

INSTITUT UNIVERSITAIRE DU CANCER DE TOULOUSE
Oncopole

❝ **We work on two different timeframes. In the short-term, we bring improvement to care quality and efficiency in diagnostics, treatment journey, and surgery to our 30,000 patients. We also prepare for the future with our fundamental research cancer center that manages a portfolio of fifty patents.** ❞

IUCT-Oncopole is a care, research and training center focused on **complex and rare cancers**, bringing together 1,800 professionals in Toulouse. Our activity spans from **fundamental research** to the **improvement of care practice**. In fundamental research, we mostly work with omics data to understand the biological mechanisms responsible for the development, progression, and spread of cancers, as well as their response to treatment. In care practice, we have been tracking Patient Reported Outcomes (PRO) over the past ten years. We develop projects around care quality and efficiency in diagnosis and treatment.

Our approach with AI and data management goes well beyond healthcare and we are very much **inspired by aeronautics**. In March 2022, we signed a two-year partnership with Airbus to support our effort in fundamental research, bringing on the table the best of both worlds!

④ NEXT GENERATION ENGAGEMENT

Again here, the **COVID-19 crisis marked a turning point** in the way private players interact and share content with health care practitioners. Being able to identify needs and act appropriately in terms of **channel, frequency and content** will make the difference.

A transformation to a smarter model of engagement vis à vis of practitioners

COVID has made **access to care centers and practitioners way more difficult**. From there, promotion models have become more **hybrid** combining both physical and digital touchpoints.

As a direct result of this transformation, Pharmas and MedTechs are now focused on providing the HCP with the **most relevant information**, at the **right time** and based on the **most efficient activation channel** adapted to the doctor's profile (e.g: HCP portal, webinar, email, virtual event, call, and emerging channels like WhatsApp or WeChat in China).

Some healthcare practitioners and some medical sales representatives / medical science liaison show some **reluctance** regarding this new model. The next step will be to prove based on facts and figures and in a nominal state which new models **work on the ground**. The step change is huge since a mixed model of 50% face to face compared to 50% of Digital can be anticipated.

Rémi Chossinand
Analytics Products Lead
for General Medicine

sanofi

❝ Compared to more mature industries, Pharma is still late on marketing activation. Indeed, we need to activate other levers than Sales to track impact at practitioner level: mostly attention, engagement and recommendation. ❞

It's all about content to start with

Pharmas are making considerable efforts to **produce**, **centralize** and **manage quality medical content**. The goal is to optimize and broaden the generic content provided by corporations. to allow each market to enrich and adapt it to their local context and most efficient channels.

To accompany this evolution, new initiatives are being developed, especially in **feedback collection**. This has a double objective: to target the most relevant profile and to be able to adjust the information according to the HCPs' feedback.

Thus, based on data and the ability of the algorithm to detect the HCP's topics of interest, the content will be able to progressively evolve and be **more and more personalized**, creating an ever-higher level of engagement.

Identifying and activating the groups of interest

Pharmas are starting to pay attention to **groups of interest and networks of KOLs**, given their large-scale audience and their subject matter authority. The identification and then proper activation of these communities will be the next key challenge to go a step further, beyond individual activation.

5 CONNECTED HEALTH

The COVID-19 pandemic has rapidly accelerated the openness to and use of digital technologies in healthcare. Connected health – which sits at the intersection of digital and traditional care – is regularly discussed as **a way to harness the power of new technology to improve patient engagement and health outcomes**. Numerous companies have taken up the topic, mostly major Pharmas, MedTechs and Startups. Connected health is still in its **infancy** though, especially when it comes to demonstrating value.

Where is connected health relevant?

There are two approaches to connected health: **patient-oriented** and **healthcare professional-oriented** connected health, that could be combined. But both approaches serve the same purpose: improving the patient experience and care. For the care teams, the objective is to support them in their core mission: **bringing the best possible care to their patients**. This may involve teleconsultation, tools that allow remote monitoring of patients suffering from chronic diseases or after surgery. There are also tools whose objective is to increase productivity, e.g.: enhancing the throughout in radiology. Down the line, the objective is to save precious time for practitioners. As for the patients, connected health spans from **beyond the pill services to a treatment in itself** ("digital therapeutics"). Beyond the pill, services can be education, medical information, self-tracking, and financial support.

Short-term, value-adding solutions are more focused on treatment/monitoring. Medium to long term, use cases will more likely be focused on awareness/prevention and diagnosis.

Jeanne Kehren
SVP Digital & Commercial
Innovation & CIO

66 During summer 2022, Bayer launched Calantic™, a digital solution to optimize the workflow execution for the Imaging Health Care Professional and help address radiology industry challenges. This equipment-agnostic, cloud-based platform includes a suite of apps to reduce frictions and loss of time while getting more information and value out the images captured 99

Connected health growth still has a long way to go before reaching scale

In most cases, connected health does not replace the expertise in diagnosis and follow-up of a doctor or the intake of drugs by patients that have already proven its efficacy and safety. It comes more as a **"companion"** supporting doctors and patients along the way. Value created would in many cases be indirect. Hence, **finding connected health business models** is instrumental. Value drivers have therefore to be thought through from the ideation phase to avoid surprises in delivery. Another reason for the very gradual expansion of connected health solutions is the **difficulty for organizations to create an environment of trust** around data collection. Connected health certainly needs data, data that patients can be reluctant to give from a privacy protection standpoint or because it could become too invasive in their daily lives. Finally, we can mention the topic of **reimbursement**. There are only a handful of countries (e.g.: USA and Germany) and solutions (e.g.: remote patient monitoring on some conditions) that have their own reimbursement, at a level that is attractive enough for solution providers to engage.

Arnaud Rosier
CEO & Co-Founder

implicity

" **Our vendor neutral and cloud-based SaaS solution enables monitoring of patients with a Cardiac Implantable Electronic Device and heart failure patients. We develop AI algorithms to reduce healthcare professionals' workload and allow them to potentially predict patient health status. We protect more than 70K patients in 100 medical centers across the United States and Europe. "**

Emre Ozcan
VP, Global Head of Digital Health

MERCK

" **The success route of Connected Health from periphery to core of Biopharma business goes through patient-directedness solutions ultimately impacting the P&L of key players in healthcare systems. Scale follows adoption which requires sustainable, synchronized, and extractable value generation. An example of is Merck's Saizen: Growth hormone (HGH) therapy for disorders in children. We offer globally scaled and business owned portfolio of connected health solutions centered on patient needs, HCP preferences, payor interests in outcomes "**

6 DATA FOUNDATIONS

Building a solid data foundation is a necessary condition for the proper usage of data downstream. With no exception, all players on the panel recognize that **data foundation is a key component** in their future development but acknowledge that they have a **long way to go**.

How is data leveraged in healthcare?

When designing data foundations, it is important to consider from the start the **nature of data** (sensitive-/-non-sensitive, complex-/-simple, etc.). The players insist on the fact that data foundations must be built in parallel of their use cases to have an architecture that corresponds to the needs of the business at a given point in time.

Data used by healthcare organizations can be very diverse. Indeed, data has **different structures**: some data is structured (e.g., IoT, efficacy and safety date), and others would be unstructured (e.g., imaging, voice, social network data). Data comes from **different sources** (clinical trials, medical records, biological data, and omics, ...). Data also has different **application domains** (e.g., epidemiology, clinical trials, marketing, and reimbursement). Finally, data have a **temporal character** and must therefore be updated frequently. From there, we can easily understand the complexity of building and maintaining a solid data foundation. Without a proper foundation, there is no possibility to scale use cases up.

Romain Bey
Head of Data
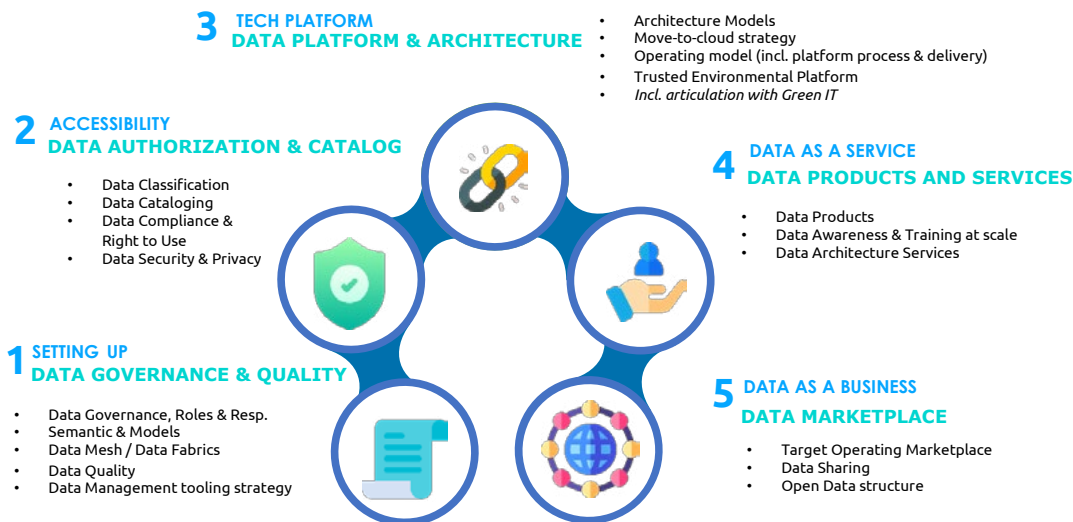Science Department

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

❝ The data warehouse of APHP was first approved in France, in 2017. From a strong backbone of patient medical records, we have built a marketplace that fed 200 projects approved by our scientific committee. The initiative even has some impact on day-to-day practice, for instance in data inputs or additional labeling that we can request. ❞

Organizations are halfway through their journey

We can consider data foundations as a **5-step cycle**. The **first step** corresponds to the implementation of processes to **ensure basics**. Organizations that exploit data have all built such processes. The **second step** of the cycle corresponds to **data accessibility**. It is about giving access to the right data to the right actors through a convenient searchable experience. This can be done by creating data catalogs, setting up data compliance and ensuring good data security, especially for personal health data. Here again, the players have generally put these procedures in place. The **third step** of the cycle corresponds to the creation of a **data platform** (generally on the cloud, even though some players would still prefer it to stay on-site) that allows serviceable data usage along the cycle (ingestion, storage, transformation, usage). Most small and medium-sized companies are at this stage. The **fourth step** of the journey corresponds to the use of **data « as a service »**, notably through data products. Only the most advanced companies, such as big Pharmas, are at this stage and are starting to create value from data, often for internal use. Lastly, the **fifth step** corresponds to the use of data to **create value for third parties**. Very few structures would be there. This is also where the healthcare Regulator could play their full role of orchestrator.

3 TECH PLATFORM
DATA PLATFORM & ARCHITECTURE
- Architecture Models
- Move-to-cloud strategy
- Operating model (incl. platform process & delivery)
- Trusted Environmental Platform
- *Incl. articulation with Green IT*

2 ACCESSIBILITY
DATA AUTHORIZATION & CATALOG
- Data Classification
- Data Cataloging
- Data Compliance & Right to Use
- Data Security & Privacy

4 DATA AS A SERVICE
DATA PRODUCTS AND SERVICES
- Data Products
- Data Awareness & Training at scale
- Data Architecture Services

1 SETTING UP
DATA GOVERNANCE & QUALITY
- Data Governance, Roles & Resp.
- Semantic & Models
- Data Mesh / Data Fabrics
- Data Quality
- Data Management tooling strategy

5 DATA AS A BUSINESS
DATA MARKETPLACE
- Target Operating Marketplace
- Data Sharing
- Open Data structure

Data mesh promise is to get value from data at scale in complex and large-scale organizations. It is based on 4 principles: domain oriented and decentralized, Data as a product, federated computational governance, self service architecture.

Coming next: data mesh, new regulations, and multi-modality

Decentralized governance models in the form of « data mesh » are growing, where the responsibility of data products will be left to the edges, that are the closest to the data. **Regulatory changes** are also to be expected, especially regarding AI, data sovereignty and sustainability. To date, there is no reference regulation (except GDPR for privacy) that governs the use of data in healthcare. For a healthcare data market to emerge, it is necessary to create a suitable set of regulations. Finally, the volume of data and its **multi-modal aspect** will continue to increase. More and more data will be exploited but with a specific objective. This requires **increasingly robust architecture** capable of ingesting large quantities of data while allowing great **flexibility and control** in their use.

Thibault Antoine
Chief Analytics Officer

SCOR

❝ **Data foundation is key. Data is increasingly strategic for SCOR and we continuously improve its governance (integrity, security, availability, et cetera). As a target, data mesh is very much where we are heading.** ❞

SMARTONE

Shahysta Hassim
Co-founder

SmartOne

❝ **We are looking to optimize the time of data science teams who spend a lot of time doing labeling. The goal is to free up their time and increase the quality of the data they use.** ❞

SmartOne is a company specializing in the **creation, preparation and enrichment of data for AI**. Our solution optimizes the time your data science teams need to manage the transformation of your **raw data into ready-to-use data** for training your models.

Accompanying the main players in the health sector for **more than 5 years,** we have developed a team dedicated to these subjects. Composed of expert operators supervised by **managers with medical degrees,** this team allows us to cover almost the entirety of specialties. The combination of the expertise of our medical team with the implementation of a unique quality control protocol, guarantees a **minimum quality level of 95% on each of your projects.**

NETAPP

NetApp is a global, cloud-led, data-centric software company that empowers organizations to lead with data in the age of accelerated digital transformation.They provide first-party services and natively integrated storage solutions for each of the major public cloud providers.

NetApp provides **compatibility** and **interoperability** between on-premise footprint and the cloud storage systems, meaning **one integrated experience in any location for hybrid multi-cloud experience**, so workloads can be easily moved to the cloud with a common approach while enabling seamless data movement. This capability does not exist anywhere else. Hybrid cloud environments offer **flexibility, scalability, agility**, and **control**. Customers can expand or contract with ease, move workloads to the public cloud, and pull them back on premises as needed. For Life Sciences clients in particular, costs reduction on IT spendings means more investments on their R&D to accelerate the drug discovery, development, and clinical trial processes, while being compliant with local and international regulatory requirements.

At the edge, data is being ingested from various equipment such as sensors, microscopes, mass spectroscopy, patient wearables, et cetera. Some of their clients are running edge-level AI. **At the core** data is aggregated, normalized, explored, and deployed. Model training and model serving happens at the core as well. Data then is moved to the cloud for further analysis or tiering. ML training happens in the cloud as well to take advantage of cloud flexible capacity. Using NetApp's data fabric, we are able to move the data to the right place at the right time.

Linda Kallfa
Life Science
Vertical Lead

NetApp

❝Hybrid cloud environments offer flexibility, scalability, agility, and control. Customers can expand or contract with ease, move workloads to the public cloud, and pull them back on-premises as needed. ❞

7 AI/DATA ACCULTURATION AND TRAINING

Data and AI transformation is a major **cultural shift**. The starting point of maturity may vary from one actor to another, but many healthcare organizations are developing their own **acculturation initiatives** to develop the data and AI literacy of their resources.

Acculturation of teams: a burning platform

Data and AI acculturation are now **needs that are shared across the board**. Training is no longer considered simply "nice-to-have".

Major private organizations invest more and more in their talent development to advance their data and AI skills, starting with the executive population.

Public actors also launch acculturation initiatives, working closely with their ecosystem, particularly universities. On contrary to the private sector, they face a challenge in talent recruitment and retention.

Najat Khan
Chief Data Science officer, Head Strategy & Operations R&D

JANSSEN
PHARMACEUTICAL COMPANIES OF
Johnson&Johnson

❝ Data science is fundamentally transforming how things are done in the healthcare space. Changing the status quo isn't always easy. But what people see is the impact of data science – how it makes things we couldn't do before possible. ❞

Lifelong learning and a variety of formats

First, there are more and more expectations on **initial training** from organizations, as data and AI become common place. **Continuous learning** will then raise the bar by embarking on profiles in real-life situations to make them learn, practice, and then apply them to their professional lives. It can take the form of certified programs, that would be recognized by the market.

From a format perspective, we see more and more **hybrid models** (a combination of face-to-face and remote) and split of content in small capsules that are easy to consume "on-the-go" on different devices (computers, tablets and smartphones).

Some acculturation initiatives we came across

CHUM

The launch of the **School of AI in Health in 2018**, supports the community in developing AI in a responsible and ethical manner.

3,000 students,

30,000 learners through conferences,

75 organizations

www.eiaschum.ca/en

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

Development of **training courses for clinicians** (including training related to tools) and **training addressed to actors from technical fields** to understand **Hospitals and biology challenges.**

institut Curie

Structuration of an **ad hoc committee** (DPO, legal advisor, researchers,...) and set-up of **associated governance.**

Janssen PHARMACEUTICAL COMPANIES OF *Johnson-Johnson*

Launch of a **data science academy** to acculturate executives in 2021.

5,000 executives acculturated to date.

ELSAN

Intrapreneurship program allowing **employees to propose projects** and be selected for **the most important digital hackathon in Europe** (Hackathon Health Camp).

www.hackinghealth.camp/

8 THE REGULATOR'S VIEWPOINT

Depending on the services and/or products they develop, organizations must comply with **various regulations** at regional (e.g., EU and US), national and sometimes sub-national levels. This regulation landscape would vary over time. Privacy (regulated by GDPR in the EU) is a top consideration, given the sensitivity of healthcare data. We also see **new areas of regulation** popping up like AI and sustainability.

A complex regulatory framework...

For most of the past decade, concerns about digital have focused on the **potential abuse and misuse of data**. Those concerns led Regulators to create measures in the United States and European Union guaranteeing the user to have some level of control over their personal data (GDPR and Privacy Act). In addition to this privacy concern, organizations also must comply with regulations regarding **products, services, and processes** at every step of their value chain. Those regulations can be national, European or international. This makes their implementation even more complex.

... with AI now being reviewed

While the benefits of AI in healthcare is not to be proven, patients still need protection from **defective diagnoses, unacceptable use of personal data**, and the **elimination of bias** that could be built-in unintentionally within healthcare algorithms. As an answer to this, the legal framework is entering a new phase. As organizations increasingly embed AI in their products, services, and processes, and decision-making Regulators' attention is shifting to how data is used by the AI application.

EU has drafted the **EU AI Act**, first of a kind for a major regulator. The project assigns applications of AI to **three risk categories**: applications and systems that create an unacceptable risk, high-risk applications and finally applications not explicitly banned or listed as high-risk that are largely left unregulated. Healthcare falls under the category of high-risk applications, with a fear from the industry that the regulation could pile-up compared to others.
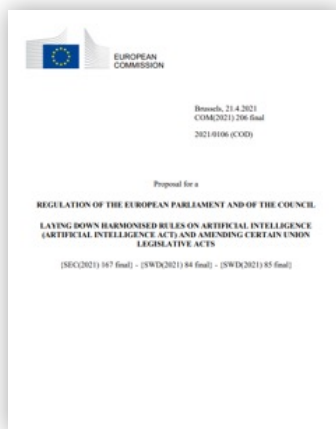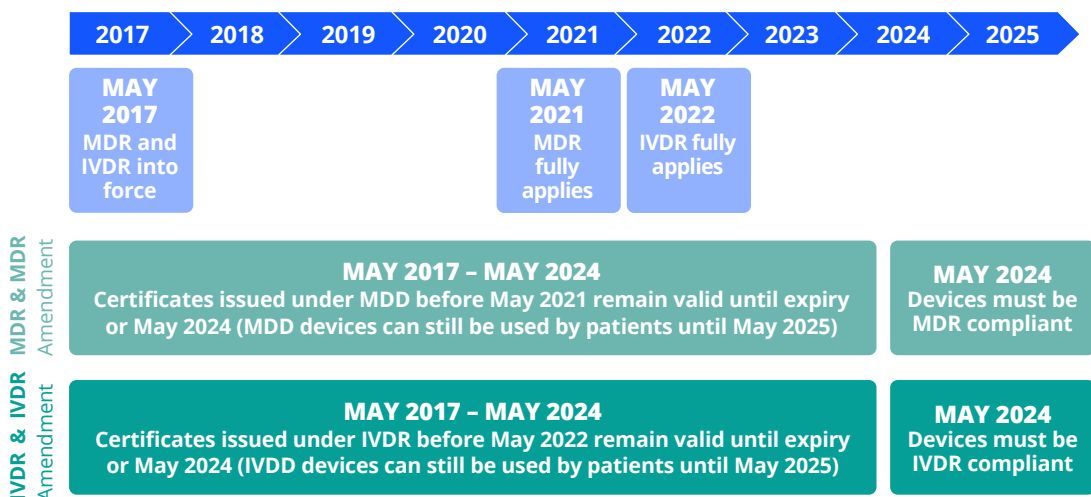
A call for support and co-construction

This legislative acceleration leads to a need for clarification: **which regulation to comply with**, under **which timeline**? Due to the co-existence of several regulations, organizations need resources and guidance to support them in reaching legal compliance. That is particularly true in the field of medical devices, and even more for software as medical devices. In most cases also, Regulators would set high objectives without defining methodologies to get there. Organizations are looking for a "**how-to-guide**" to get there. Finally, organizations are also expecting an evolution from the Regulator in terms of international equivalence / bridges between Europe and the USA, where cross go to market is quite usual.

Cécile Vaugelade
Director of Technical & Regulatory Affairs

snitem
LE DISPOSITIF MÉDICAL

❝ **The division between local and regional regulation is evolving towards more international programs in order to avoid re-demonstrating in all parts of the world what has already been successfully demonstrated somewhere.** ❞

Illustration: simplified overview of the regulation panel for medical devices (MD) and In vitro diagnostic devices (IVD) in the EU

| 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |

| **MAY 2017** MDR and IVDR into force | | | | **MAY 2021** MDR fully applies | **MAY 2022** IVDR fully applies | | | |

MDR & MDR Amendment

| **MAY 2017 – MAY 2024** Certificates issued under MDD before May 2021 remain valid until expiry or May 2024 (MDD devices can still be used by patients until May 2025) | **MAY 2024** Devices must be MDR compliant |

IVDR & IVDR Amendment

| **MAY 2017 – MAY 2024** Certificates issued under IVDR before May 2022 remain valid until expiry or May 2024 (IVDD devices can still be used by patients until May 2025) | **MAY 2024** Devices must be IVDR compliant |

MDR (Medical Device Regulation) and IVDR (In Vitro Diagnostic Medical Device Regulation) set new rules for CE marks for MD and IVD. They replace MDD (Medical Device Directive) and IVDD (In Vitro Diagnostic Medical Device Directive).

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- **Novartis**
- **Roche**
- **Sanofi**

Startups

- **Implicity**
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- **Quibim**
- **Thread**
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Research Labs

- **Institute Curie**

Tech

- **NetApp**
- **SmartOne**

Insurance

- **SCOR**

Professional Syndicate

- **SNITEM**

Patient Association

- **BAMP**

... and to the respondents to the 2022 AI for Health online survey.

About
the contributors

About Capgemini Invent

As the digital innovation, design and transformation brand of the Capgemini Group, Capgemini Invent enables CxOs to envision and shape the future of their businesses. Located in nearly 40 studios and more than 60 offices around the world, it comprises a 10,000+ strong team of strategists, data scientists, product and experience designers, brand experts and technologists who develop new digital services, products, experiences and business models for sustainable growth.

Capgemini Invent is an integral part of Capgemini, a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 325,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2021 global revenues of €18 billion.

Visit us at www.capgemini.com/service/invent

About AI for Health and Startup Inside

Founded in 2018, AI for Health is the European ecosystem of reference for the democratization of AI and Data in the health sector, with 200 members working in open innovation: startups, research labs, public institutions, pharmaceutical companies, hospitals, etc.

We are thrilled to organize in 2022 the 5th edition of the summit gathering 2000 experts in AI and Healthcare with innovative formats, world-class key opinion leaders and disruptive topics.

The AI for Health initiative is operated by Startup Inside, leader in creating international conferences and think tanks on Artificial Intelligence and Data. Our unique approach to open innovation, which brings together startups, large corporations and research institutions to innovate, has enabled us to create benchmark ecosystems : AI for Finance, AI for Industry, and AI for the Planet ecosystem initiatives.

Visit us at www.startupinside.com and www.aiforhealth.fr

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NetApp

NetApp is a global, cloud-led, data-centric software company that empowers organizations to lead with data in the age of accelerated digital transformation. The company provides systems, software and cloud services that enable them to run their applications optimally from data center to cloud, whether they are developing in the cloud, moving to the cloud, or creating their own cloudlike experiences on premises. With solutions that perform across diverse environments, NetApp helps organizations build their own data fabric and securely deliver the right data, services, and applications to the right people—anytime, anywhere.

Janssen
PHARMACEUTICAL COMPANIES OF
Johnson&Johnson

At Janssen, the Pharmaceutical Companies of Johnson & Johnson, we never stop working to create a future where disease is a thing of the past. We tackle society's most pressing health challenges, connecting big ideas to the resources we need to make them a reality. Our goal is to advance access to good health for all. By seeking out medical breakthroughs wherever they occur, leveraging internal expertise and embracing external science, we aim to bring the best solutions to the people who need them.

NOVARTIS

Novartis' purpose is to reimagine medicine to improve and extend people's lives. We use innovative science and technology to address some of society's most challenging healthcare issues. We discover and develop breakthrough treatments and find new ways to deliver them to as many people as possible. We also aim to reward those who invest their money, time and ideas in our company.

Institut Curie, French leading center for the fight against cancer, has an internatio-
nally renowned research center and a state-of-the-art group that treats all types of
cancer, including the rarest. Founded in 1909 by Marie Curie, Institut Curie employs
more than 3,700 researchers, physicians and healthcare professionals on three sites
(Paris, Saint-Cloud and Orsay) who contribute to its three missions that are treat-
ment, research and teaching.

The IUCT-Oncopole, a cancer care, research and training center in Toulouse, combines
the expertise of 1,800 professionals on a single site labeled «Comprehensive Cancer
Center». It combines several state-of-the-art clinical facilities for the treatment of cancer
with a world-class research infrastructure, on an integrated campus that brings together
public and private stakeholders, including industrial partners. The IUCT-Oncopole, which
includes the Claudius Regaud Institute (ICR) and several teams from the Toulouse Uni-
versity Hospital, treats more than 10,000 new patients every year, and more than one in
eight patients is enrolled in clinical studies.

Founded and operating in the US market since 2012, SmartOne is a company spe-
cializing in data creation, preparation and enrichment for AI. Their solution op-
timizes the time of your Data Science teams by managing the transformation of
raw data into ready-to-use data for training your models with a team of expert
operators.

Notes