

IVY *Insights*

KEYSTONE

Whitepaper

Opportunities and challenges of digital adoption in the healthcare industry:

Perspectives from leaders and healthcare professionals.

Authors

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CHAPTER 18 Thorax and Lungs 471

Adventitious Lung Sounds

Description	Mechanism	Clinical Example
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Discontinuous Sounds

These are discrete, crackling

Crackles are short, discontinuous sounds that are heard during inspiration. They are often described as "popping" or "crackling" sounds. Crackles can be heard in various parts of the lung, but they are most commonly heard in the lower lung fields. They are often associated with conditions such as pneumonia, heart failure, and chronic obstructive pulmonary disease (COPD). Crackles can be heard in the upper lung fields in conditions such as asthma and emphysema. Crackles can also be heard in the lower lung fields in conditions such as pulmonary edema and pulmonary fibrosis. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure.

Crackles are produced by the sudden opening of small airways that have collapsed during expiration. This occurs when the airways are partially blocked by mucus, inflammation, or other factors. When the airways suddenly open during inspiration, the air rushing through them creates the crackling sound. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure. Crackles can be heard in the lower lung fields in conditions such as pneumonia and heart failure.

Early inspiratory crackles occur with obstructive disease: chronic bronchitis, asthma, and emphysema. Early inspiratory crackles (s) are crackles that appear with a change in the pattern of the breath sounds.

Evidence of conduction delay/heart block or premature beats:



QRS complex: present/absent -- regular/irregular
P waves: present/absent -- regular/irregular
PR interval: _____ normal/abnormal
Pacemaker site: _____
Name of Rhythm: _____
Evidence of conduction delay/heart block or premature beats: _____



QRS complex: present/absent -- regular/irregular
P waves: present/absent -- regular/irregular
PR interval: _____ normal/abnormal
QT interval: _____
QRS width: _____ normal/abnormal
Ventricular rate: _____
Evidence of conduction delay/heart block or premature beats: _____

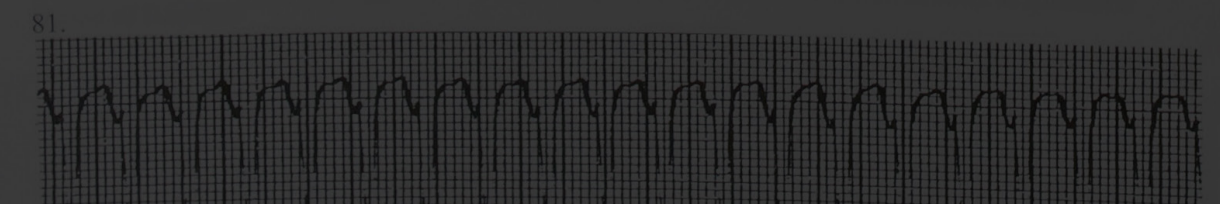


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About Ivy Insights

Executive Summary

We carried out a survey of key decision makers in the healthcare delivery space to determine their attitudes and opinions about the relevance of digital solutions for the space. Our goal was to explore which technologies excite them and are deemed especially useful, as well as to understand challenges that they foresee with the implementation of these. Ultimately, we seek to provide guidance to design and marketing teams on how to approach building and marketing of digital tools for healthcare providers.

The responses showed that while digital solutions are widely accepted as critical to drive efficiency and improve patient outcomes, there is a lack of confidence around which solutions would help and whether these solutions can be adopted without compromising on patient privacy. The Covid-19 pandemic necessitated adoption of some semblance of digital solutions, and many of our respondents

opined that data analytics and telehealth platforms were expected to persist beyond the pandemic. Improving patient outcomes, and patient satisfaction with quality and access to care emerged as the key considerations. On the flip side, respondents foresaw challenges with integration of any new solution with existing systems and the pushback that disruptive changes may get from their stakeholders. When it came to using aggregate data for decision-making, privacy concerns and inundation with too much data instead of useful insights were the key concerns.

We segmented these opinions by the kind of task the tool is intended to accomplish, whether it be an administrative tool or a clinical assistant. In this article, we delve into the specifics of the use cases, stakeholders' eagerness to adopt and key concerns that need to be addressed to enable digital adoption.



Introduction

The acceleration of science and technology has resulted in widespread innovation and disruption in almost every industry. The healthcare industry is no exception and has seen significant changes in its landscape in recent years. Even though healthcare delivery is fraught with regulatory complexity, privacy concerns, and integration and adoption challenges, the digital health market is forecasted to grow significantly, by 17.9% from 2021 to 2030. Additionally, we've seen major acquisitions of health tech companies in the last few years, such as telemedicine company Teladoc's acquisition of Livongo, a health coaching program, and United Healthcare's acquisition of Change Healthcare for \$13 billion. Change Healthcare owns and operates one of the largest electronic data interchange networks (which facilitates billing for payers and providers) and sells billing and adjudication solutions. This global expansion of digital healthcare solutions is a

large enabler of faster innovation across the healthcare industry.

Within this rapidly changing landscape, we wanted to investigate the trends and sentiments with regards to digitalization and adoption of new technologies among healthcare professionals. We conducted a survey of leaders in the healthcare space to identify key opportunities and concerns for digital adoption. In this paper, we highlight their motivations for adoption, deep dive on the various use cases for digital solutions, explain their concerns about adoption, and provide insights to companies/solution providers about what factors they should keep in mind while designing and marketing their product. The data shows exciting insights that can help accelerate the industry's technology transition and shape user-centric digital innovation for the sector.



Need for innovation in healthcare delivery

The impetus for innovation in healthcare delivery in the US comes from a disproportionately high healthcare expenditure without commensurate returns. The US spends the highest proportion of GDP (18.3% in 2021) on healthcare as compared to any other country in the world. This however does not translate to vastly superior clinical outcomes, as many countries with lower proportion of GDP spent on healthcare have similar or better clinical outcomes. Furthermore, the per capita

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Despite clear costs associated with adopting new tools, 93% of 1,300 surveyed physicians felt that digital tools provide advantages to care for patients across all age groups. With clear benefits to patients, providers were enthusiastic to adopt and integrate new technology solutions to address their healthcare pain points.



expenditure on health insurance administrative costs is unreasonably high for the US: the US spends \$737 per capita on administration, compared to \$94 per capita in the median OECD country. This untenably high expenditure without proportionate returns provides an impetus for implementing technology that can drive efficiency and productivity gains.

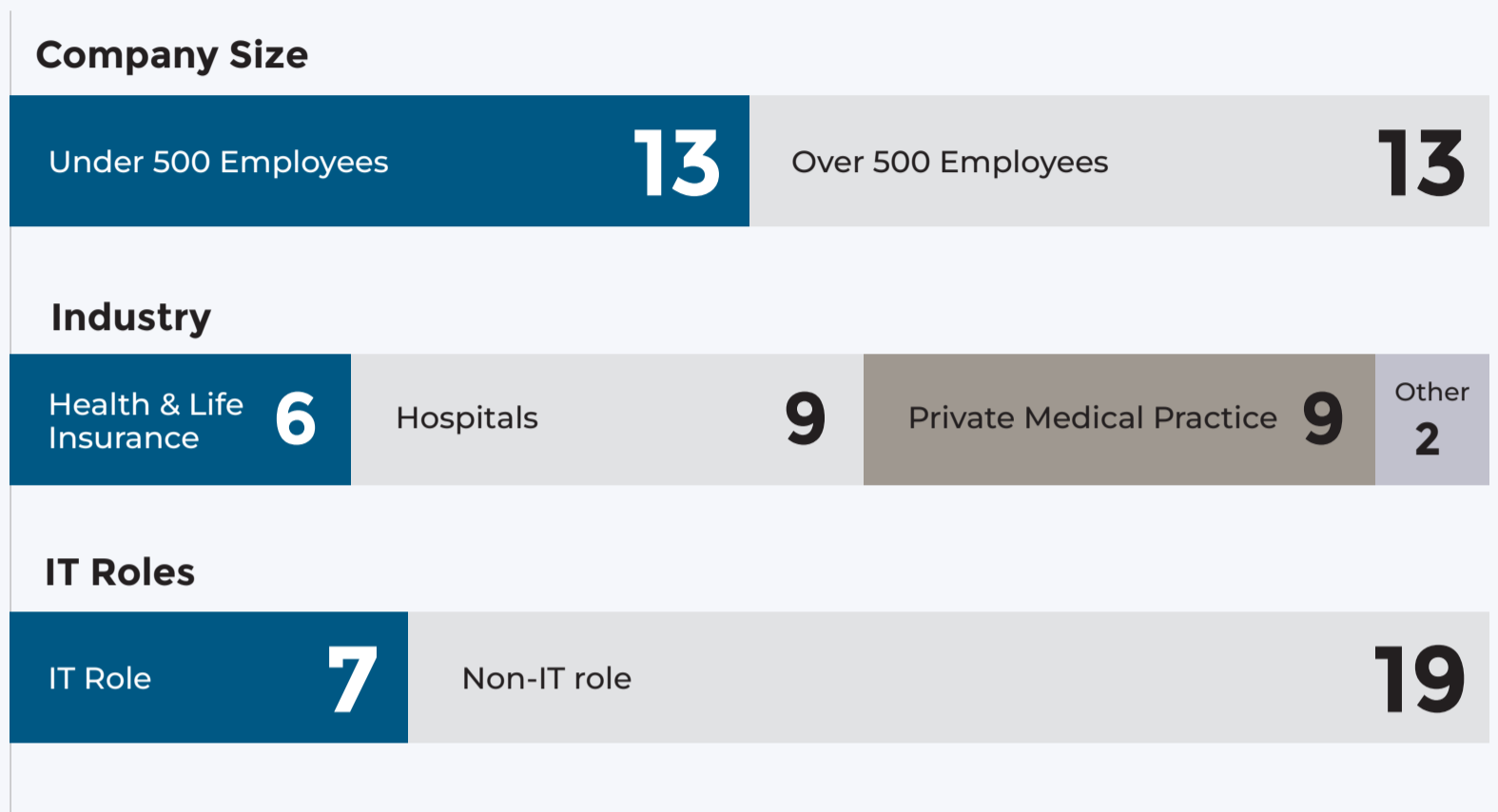
When one considers the current state of digital adoption, the trend of accelerating adoption is quite apparent. In terms of aspects of care delivery that are getting transformed, on the clinical side patient-provider interactions have seen rapid changes due to adoption of technology. It is no secret that irrespective of the scale of operations, hospitals face massive administrative burdens, and for both new and incumbent health tech companies, improving these administrative tasks is a huge opportunity. Technology is not only changing how providers and patients interact, but how providers interact with the entire healthcare ecosystem, including payers and pharmacies.

Last September, the American Medical Association (AMA) released the results of its Digital Health Research survey that seeks to determine the motivations and needs for physicians to adopt new digital tools. Despite clear costs associated with adopting new tools, 93% of 1,300 surveyed physicians felt that digital tools provide advantages to care for patients across all age groups. With clear benefits to patients, providers were enthusiastic to adopt and integrate new technology solutions to address their healthcare pain points. The AMA found that the average physician uses 70 percent more digital tools than they did 6 years ago, regardless of their gender, specialty, or age. The consequences of the AMA's findings are substantial and varied. At the highest level, the survey helped to characterize general sentiments of the industry: the anticipation for innovative thinking and the increasing appetite to adopt digital health solutions.

Our survey of healthcare executives confirms these sentiments in the industry and sheds light on key issues that health care executives face, gleaned valuable insights for solution providers on how to design and market their digital health products.

Overview of survey participants and questions

Figure 1 shows demographics of the respondents. Half of the respondents work at organizations with fewer than 500 members, and 27% of the respondents are in the IT department of their organization.



We surveyed 26 leaders and executives in the healthcare space, including representatives from the insurance sector, hospitals, and private practices.

The survey asked respondents about the types of technologies they saw introduced at their companies during the previous year and their expected permanence beyond the COVID-19 pandemic. It further sought to explore the key drivers and barriers for adopting digital health solutions, preferred approaches for developing and deploying these solutions, and therapeutic areas which the respondents envisaged could maximally benefit from adopting technological solutions. Additionally, the survey sought opinions from key decision makers about increasing access to real-time patient data, the possible uses of this data, and the potential privacy pitfalls.

We grouped the responses into two themes. The first captures technologies and solutions that can help opti-

mize administrative tasks, and the second is around solutions that seek to optimize clinical care and patient outcomes. The huge expenditure on administrative tasks and lack of efficiency in this function presents a great opportunity for healthcare services to increase efficiency and address cost pressures. Furthermore, the negative impact that confusing and difficult steps involved in seeking care can have on patient experience, can be addressed by creating more intuitive digital solutions. In terms of clinical care, technology can help in decision making or double-checking proposed treatment regimen for any lacunae. It can also help to increase coverage through telehealth solutions or reduce redundant and time-consuming steps, allowing care providers to focus on more value-adding tasks. To do this effectively the solutions have to be co-created with the end users. Towards this end we dive deeper into the key insights for the two categories listed above. Finally, we also explore the opportunities and challenges perceived with access to aggregate patient data.

Digital solutions for enhancing administrative efficiency

The types of technologies that saw the greatest increase in adoption over the past year are administrative tools such as scheduling or payment processing software (16 mentions) and telehealth platforms (21 mentions). Notably, all respondents affiliated with private practices (9 respondents) indicated introduction of telehealth platforms, as well as 78% of respondents affiliated with hospitals (7 of 9 respondents). Telehealth platforms are also top ranked across the board for their likelihood to remain relevant after the pandemic. The COVID-19 pandemic has doubtlessly accelerated adoption of and access to telehealth services, and by all accounts these changes are here to stay. This indicates a promising trend towards making healthcare services more accessible and lowering costs for providers and patients alike.

Top drivers for adoption of digital health tools

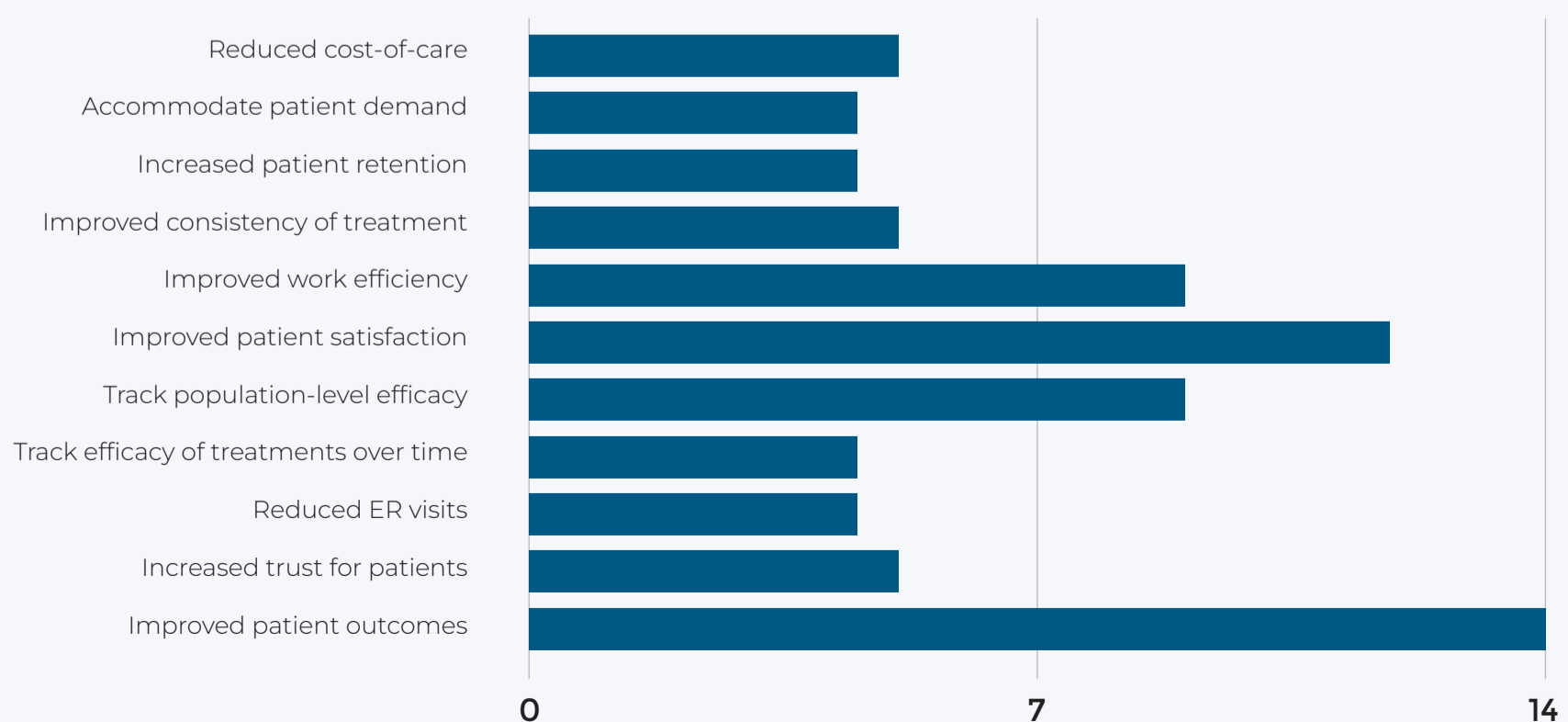
This trend is also reflected in the top drivers that respon-

dents specified in adopting digital health solutions, see Figure 2. While improving patient outcomes was the single most important factor, selected by two thirds of respondents, the runners-up were ease-of-use and efficiency-related motives (improved patient satisfaction, improved work efficiency, and reduced cost of care).

Top barriers to adoption

When looking at the top challenges that executives identified to adoption of digital tools, impact on process and operations as well as difficulty of integration with existing systems were the most commonly named concerns. There is a notable split by organization size (see Figure 3), where over 60% of respondents from companies with over 500 employees name difficulty of integration with current systems and difficulty of change management as top barriers, compared to smaller companies, for which lack of budget or avenues for reimbursement are considered equally important as integration issues. This may be due to the fact that larger companies have more established systems and processes in place. Marketers of new tools should keep organization size in mind and be knowledgeable about which systems their tool needs to interact with. Digital health solutions should also be customizable, where based on customer type certain features can be turned on or off depending on utility and ease of operations. Furthermore, ease of integration and onboarding will be key selling points that are vital to continued use of the product. Offering different pricing tiers and options to expand use over time may lower the barrier to entry for smaller companies.

Figure 2: Top 3 drivers for adopting digital health solutions

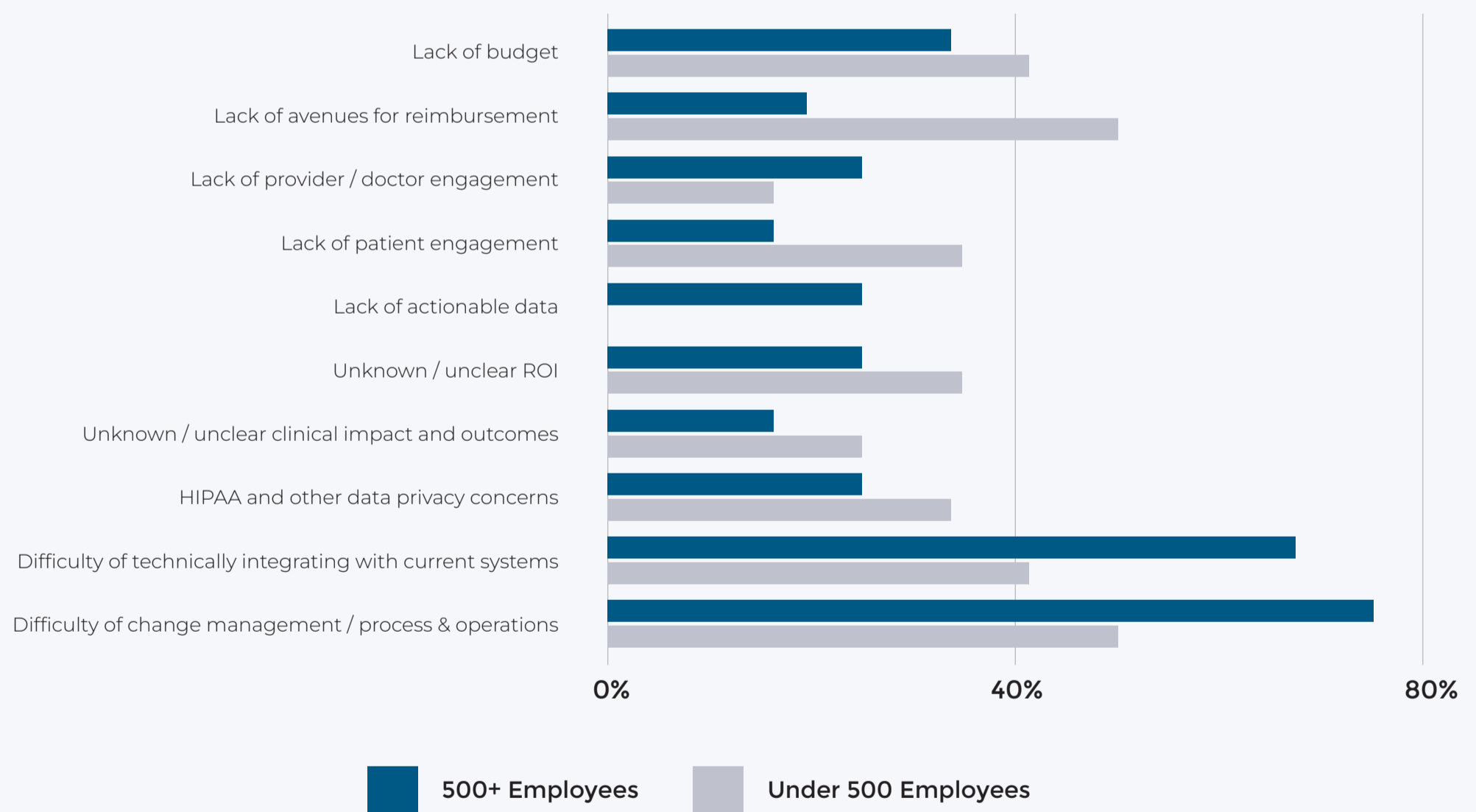


Significance of and perspectives from IT teams for driving digital adoption

We analyzed the survey responses of IT professionals separately as well, as IT is often the chief customer or custodian for implementing digital health solutions at hospitals. Therefore, we wanted to identify any key insights on their specific buying behavior. Among employees working in IT, cost reduction, improved efficiency, and improved patient outcomes were the most important factors for driving adoption of digital health tools. Lack of budget is cited by almost 60% of IT personnel as a significant barrier. Over 70% cite impact on process and integration with workflows as a critical challenge as well. This is intuitive as IT personnel are often at the forefront

of the rollout of new tools and are aware of pushback or unwillingness to adopt process changes in a very traditional industry like healthcare. Any support a digital health company can provide to streamline transition or integration of tools into existing workflows (such as flexibility with respect to data formats, interfaces for state-of-the-art relevant health software) will be crucial for obtaining buy-in from this group which is vital for a successful rollout. Marketing material with sample use cases of how a digital solution integrates seamlessly with major electronic health record (EHR) systems can help demonstrate the ease of integration. This would translate to a show-not-tell kind of marketing pitch where the customer can see the attention to minutiae and thus focus on utility of the solution, rather than getting bogged down with worries about integration capabilities.

Figure 3: Top 3 barriers to adoption of digital health solutions



Digital solutions for clinical care delivery

Clinical areas most amenable to digital adoption

When asked about the most promising therapeutic areas for adoption of digital health approaches, mental health and psychiatry (13 nominations), as well as post-treatment care (18 nominations) were the most commonly named categories. Specializations like cardiovascular disease and oncology were seen as promising by one third of respondents in the hospital sector, but not by representatives of the insurance sector.

Digital tools for mental health came into prominence during the pandemic as people were facing a very stressful situation, while prevailing circumstances made in person access to therapists a challenging proposition. Post-treatment care and ensuring patient compliance to post-discharge instructions is critical in ensuring long term efficacy of hospital-based treatment and continued good health for the patients. Current procedures for providing post-treatment care are archaic and cumbersome, and gaps in these were exacerbated further by the challenges created by the pandemic.

It is notable that the top areas are ones where traditionally out-patient settings are utilized or home visits are needed. These are clearly areas where remote provision of services, monitoring, and support are extremely beneficial. This is in line with the broad enthusiasm about telehealth tools and indicates that increased flexibility and access to care are seen as the greatest benefits of digital health tools.

Design by function and clinical specialty

The responses to this question also indicate that pro-

viders generally expect the greatest gains to be made on the administrative or monitoring side compared to diagnostic and clinical tools and point to a possible preference for tools that alleviate administrative tasks rather than replace patient interactions and diagnostic work. This could reflect a lack of trust in such diagnostic aids, or a concern about being taken out of the loop at crucial steps in the patient journey. This could also be a result of the highly specialized nature of these clinical areas where a person not deeply versed with the day-to day functions may not be able to identify key areas where digital solutions can add efficiency. To address these concerns, it is crucial to understand and make clear the limitations of a diagnostic tool or a clinical helper, and design these to support a physician rather than substitute their expert opinion.

Since our respondents did not have a lot of representation from these specialized medical areas, we propose taking a user-centric approach to designing and marketing digital solutions for these specialties. Expert interviews to understand how software can best assist their work and what types of issues may be the most severe (for instance, false positives or false negatives for a clinical classification tool) should inform design and optimization of a tool and key findings should be highlighted during demos and pitches. Developing these tools through close interaction with end users will increase utility, help accurately identify customization needs and help build confidence in the end product. It is also key to gaining trust to make clear how a physician can incorporate the tool into their workflow and that the physician's authority is not undermined by any such tool.



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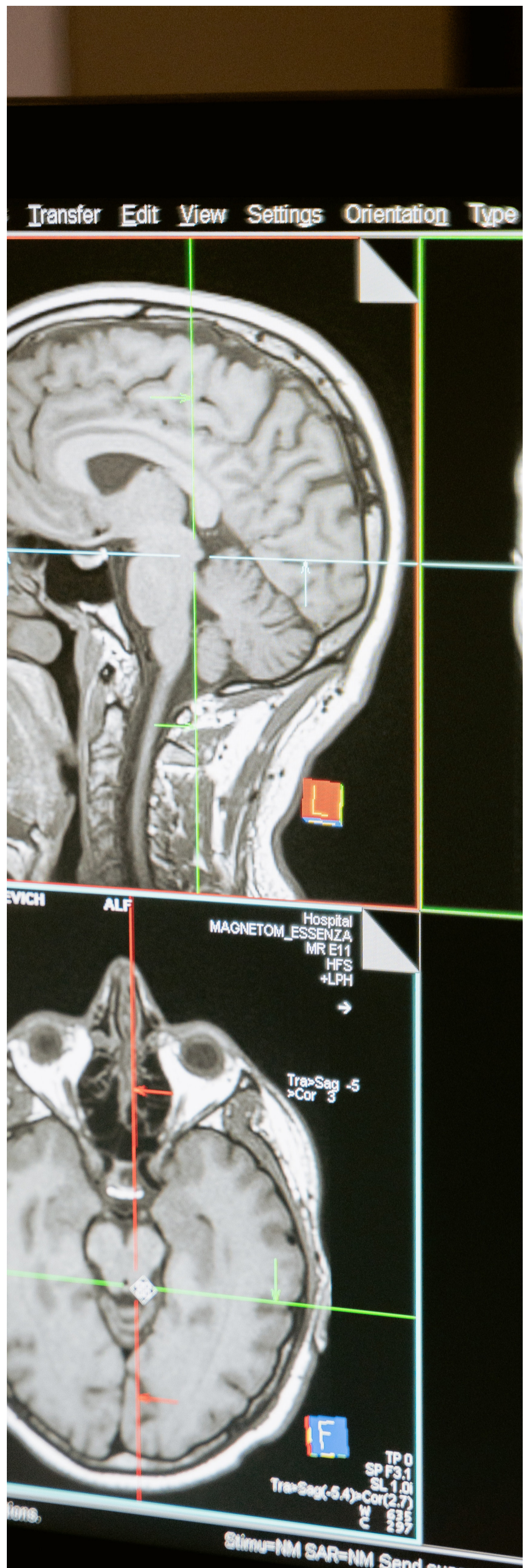
Opportunities and concerns around leveraging aggregate data

When asked about the most compelling reasons for increasing access to real-time, aggregated patient data, two thirds of respondents cited improving the quality of care, underlining that patient outcomes are top of mind in the healthcare space. Managing population health and reducing the cost of care were seen as additional drivers. Notably, the most common responses remained rather vague, indicating that providers may not have a good sense for the opportunities that come with access to aggregated data and how to use such data most effectively. With that in mind, companies offering data services are well-advised to tailor their services to specific use cases and be able to give concrete examples of how their relevant audience can leverage the data for best outcomes. Even if well-established learnings from other industries are proposed, the value proposition for the healthcare space needs to be understood and explained.

On the flip side, the concerns that respondents see with increased access to aggregated patient data cover a broad spectrum: difficulty maintaining patient privacy (15 mentions), difficulty adequately interpreting data and the risk of being too reactive to real-time data (17 mentions), and alarm fatigue from poorly implemented alerts (13 mentions) are the most common concerns.

Key concerns about increasing access to patient data

Patient privacy is top of mind for professionals in the healthcare industry who have access to highly intimate information about their patients. Notably, 86% of respondents who work in IT selected this as a main concern, indicating that buy-in from this group on the



security credentials of any digital solution will be crucial for establishing and integrating these tools. Any tool providing aggregate information should address how information is deidentified and aggregated, and how anonymization is handled for potentially small subgroups within the data, to increase provider as well as patient trust in such tools.

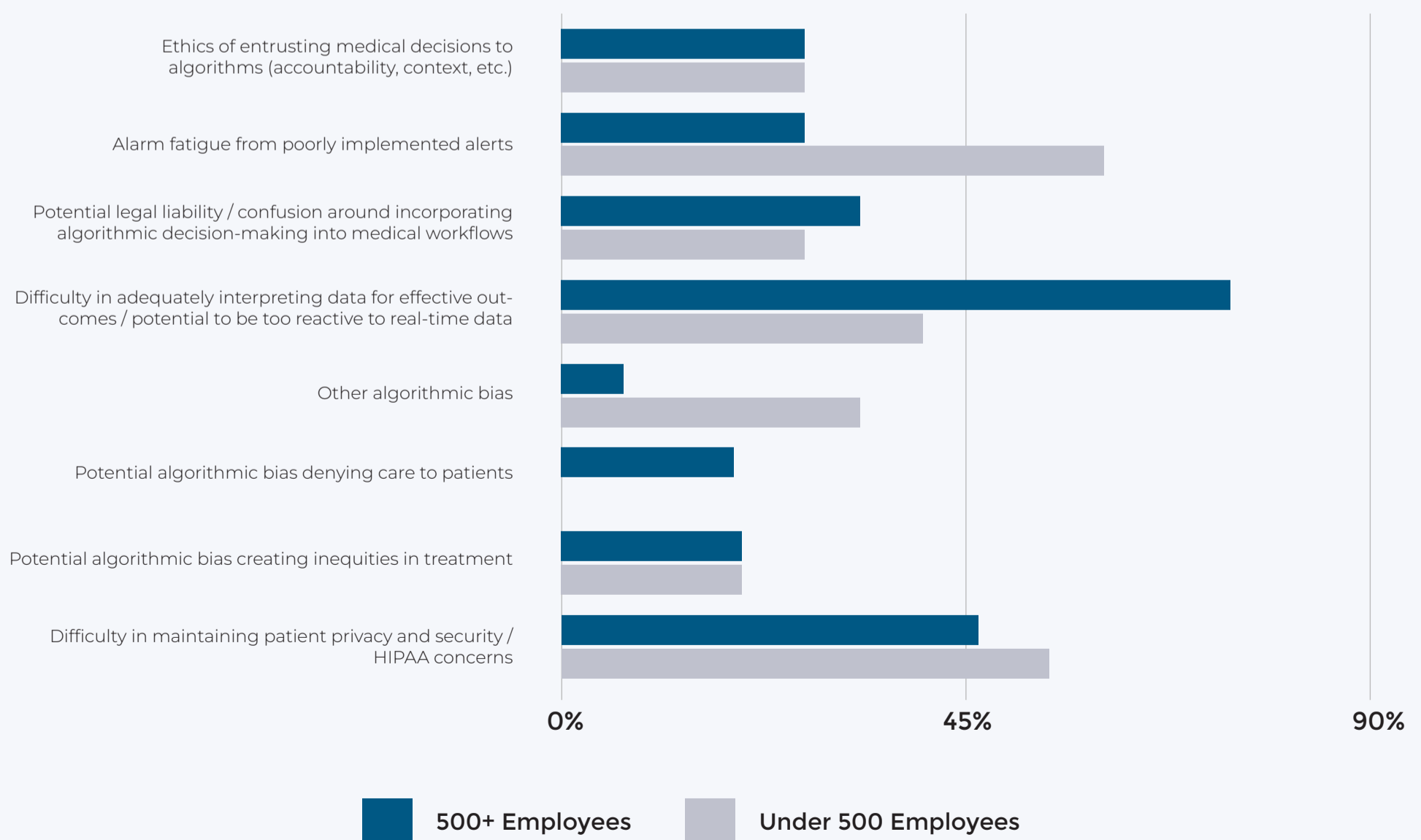
The second biggest concern relates to the vagueness regarding reasons to use such data: providers are not certain how they could leverage the information they are given access to and how to interpret it properly. As we see in Figure 4, this is the top concern for large organizations, with 85% of respondents from organizations with over 500 employees selecting this option, while it is the third biggest concern for smaller organizations. This could be a result of larger companies seeing more risk in managing their huge databases to generate usable insights. Any organization offering data to healthcare organizations should highlight relevant use cases and showcase how to interpret results to achieve a direct positive outcome, as well as make clear the limitations of the data at hand. Access to data alone is not perceived as, and is not in fact, the solution to improving care and patient outcomes, and offering data without context will likely leave potential users wary of liability for inadvertently misinterpreting or misusing information. Data providers

should aim to foster use of data in targeted ways to support decision making to build appreciation and trust in the opportunities that come with access to data at scale.

The third biggest concern is around how tools using such data may be implemented and integrated with day-to-day work. Any tool supporting clinical decision making must be calibrated to the user's need. A prime example of this is the concern expressed by half the respondents about alarm fatigue through poorly implemented alerts. The threshold for triggering an alarm about a particular patient and medical situation needs to be calibrated appropriately, and these thresholds need to be defined in consultation with the care providers in a customizable manner. A very low threshold can result in facile alarms that burden the healthcare system. The lower utility of these alerts would eventually lead to these alarms being perceived as useless. This alarm fatigue becomes more critical in the private practice scenario where ignoring a reasonable alarm can result in litigation and losses-reputational and monetary. Alarm fatigue is 38% more likely to be listed as a concern for smaller companies compared to larger ones.

Figure 4 highlights the biggest concerns with increasing access to data based on hospital size.

Figure 4: 3 biggest concerns with increasing access to real-time, aggregated patient data



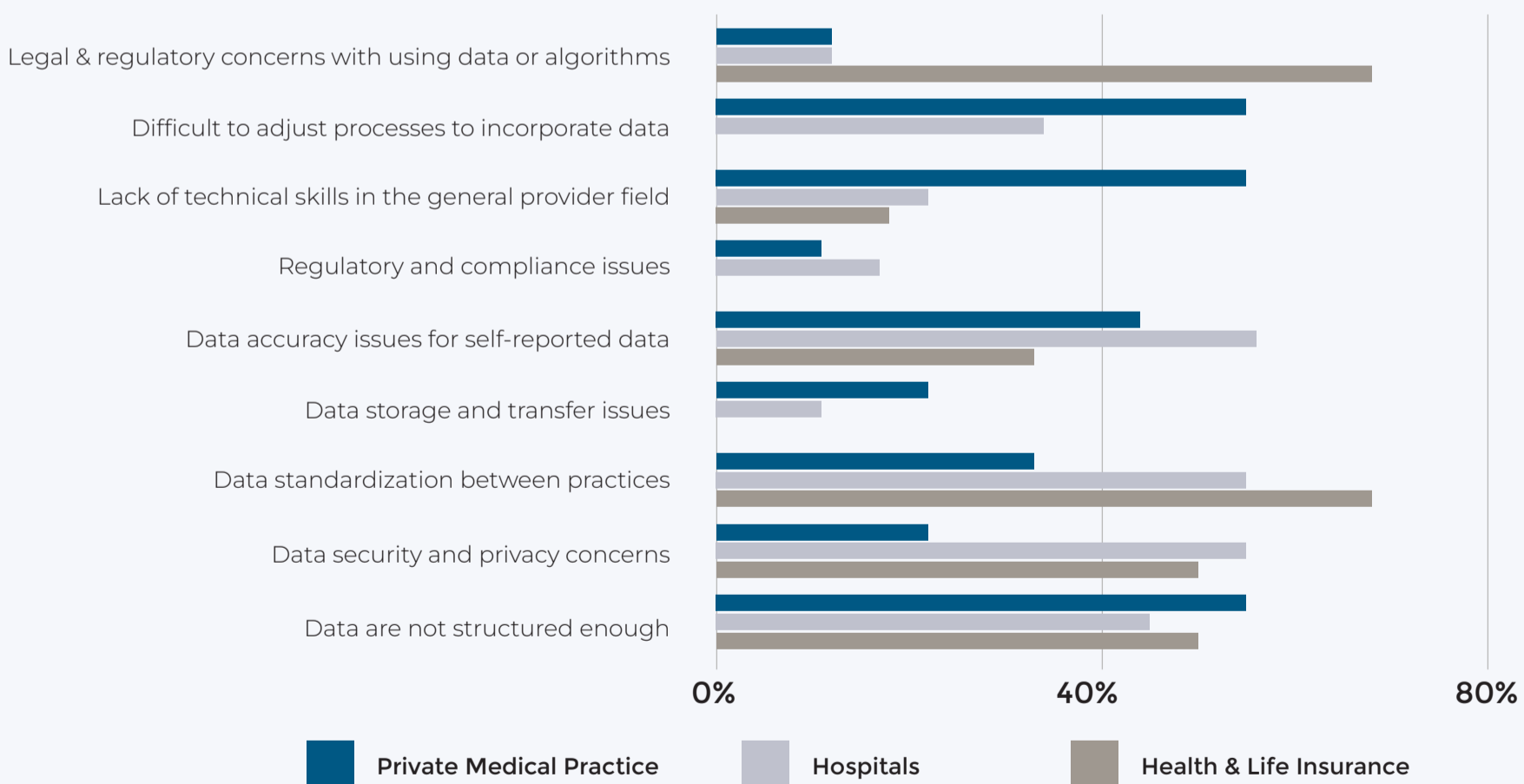
Biggest challenges in leveraging healthcare data

When asked about the biggest challenges to effectively leveraging data, data structure, privacy (12 nominations each), and standardization (13 nominations) as well as accuracy issues for self-reported data (13 nominations) are the main pain points identified by all respondents. Data accuracy issues are further named by 72% of respondents that state they adopted digital health tools in the past year, pointing to negative experience working with healthcare data. All these concerns are focused on data quality and portability and highlight an issue the healthcare industry has faced for a long time: often manual entry of unstructured data into systems that may be different from organization to organization results in large amounts of data that are very hard to effectively aggregate or leverage. A tool that is flexible to work with many EHR systems and allows for cleaning and handling of unstructured data will have a greater buy-in from a large swathe of users.

Perspectives on challenges vary by industry player

When taking a more nuanced view of which issues different subsets of the respondent group consider most important, an interesting industry split becomes apparent, shown in Figure 5: two thirds of respondents working in the insurance industry consider legal and regulatory concerns with using data or algorithms a top challenge, compared to 11% of respondents at hospitals or private practices. Employees at hospitals and private practices name difficulty to adjust processes to incorporate data as an important consideration, while no representative of the insurance industry selects this option. This may be because the insurance industry is used to working with data at a large scale and incorporating new data and tools and is more attuned to downstream implications of such data usage, whereas hospitals and private practices have more standardized procedures. Compared to other respondents, those from the insurance industry are also notably less satisfied with their current level of access to patient data. Overall, the insurance industry appears more open to adopting new data sources and tooling compared to other sectors in the healthcare field.

Figure 5: Top 3 challenges in effectively leveraging data to improve healthcare



Interestingly, the difficulty of adjusting processes to incorporate data is highlighted by significantly more respondents working at organizations with fewer than 500 employees compared to respondents at larger organizations. This appears counterintuitive, since

administrative changes are perceived as more difficult at larger organizations, but may be a proxy for lack of dedicated resources at smaller organizations, if no personnel are available to implement and support a new system.



Conclusion

The adoption of digital tools in healthcare has been fuelled by the emergence and spread of new technologies and was greatly accelerated by the COVID-19 pandemic. The past two years have seen the industry adjust to shifts in requirements for care and introduce new systems to support this changing landscape. While telehealth and administrative software have seen the largest growth in adoption, other technologies are experiencing promising growth across the healthcare spectrum, including clinical and diagnostic tools and population health monitoring. This trend will only continue, and digital solutions will become more and more prevalent across the industry. However, many challenges exist that are specific to the healthcare space and need to be addressed by developers to foster adoption of new tools.

Healthcare providers have been relying on different software products to manage electronic health records for a long time, and a major concern for any new tool is integration with existing systems to ensure efficient and secure flow of information. Patient privacy is another important factor that healthcare professionals are especially attuned to, given the highly sensitive data they are exposed to every day. Gaining the trust of providers as well as patients is crucial to adoption of any tool or service in this space, and transparency around how data is processed and used is key. Health data is also highly unstructured – reporting standards vary from provider to provider as well as from organization to organization. There is a great opportunity for tools that are flexible enough to interface with different systems and ingest data of different types and quality and faithfully and securely prepare it for downstream use.

Buy-in to adoption of new technologies will also depend on many different players, including administrative and IT personnel as well as clinical personnel. The unique concerns of all these actors need to be considered and addressed during development and marketing of any products.

Finally, any clinical tool should not aim to replace a provider's expert opinion, but rather enhance and support the provider's work, exposing additional information for decision making and streamlining workflows. To ensure that such tools can deliver on this promise, development should happen in close collaboration with potential end users, frequently soliciting inputs for improvement. Tools that are perceived as effective helpers in a clinical setting have the best chance at lasting adoption, while tools that appear to undermine a provider's authority will face resistance.

Digital health tools have seen a steep rise in recent years, and notwithstanding unique challenges in this field, professionals in the healthcare space are excited for the opportunities opened up by these systems. It is up to digital health developers to seize the opportunity and work with healthcare professionals to bring to market the next generation of tools easing provider tasks and improving patient outcomes.

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