# Understanding the Future of Research Computing at PSOM

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Earlier this year, we asked research faculty across the Perelman School of Medicine to share how they use computing resources and where they face challenges. The response was clear: as research increasingly relies on computing, our infrastructure is being stretched in new ways, signaling that it's time to invest in the next phase of growth. This survey not only highlights the gaps in our landscape today but also points to the opportunities we have to strengthen research computing for the future.

What We Heard

Faculty responses revealed several recurring challenges:

- **Cost and affordability** — Graphics Processing Units (GPUs), high-performance computing (HPC), and data storage remain expensive, especially for smaller or newer labs.
- **GPU and HPC availability** — memory limits, outdated systems, and job quotas make it hard to run the analyses faculty need.
- **Data integration** — difficulty linking clinical data with research datasets, creating barriers to innovation.
- **Storage and data management** — need for scalable, affordable storage with reliable backup and archiving.
- **Support and communication gaps** — uncertainty about where to go for help and difficulty onboarding new lab members.
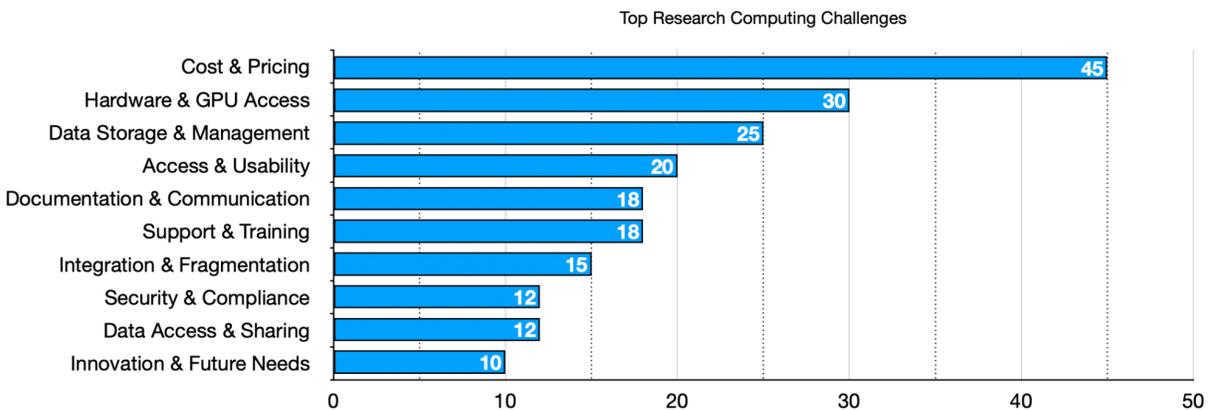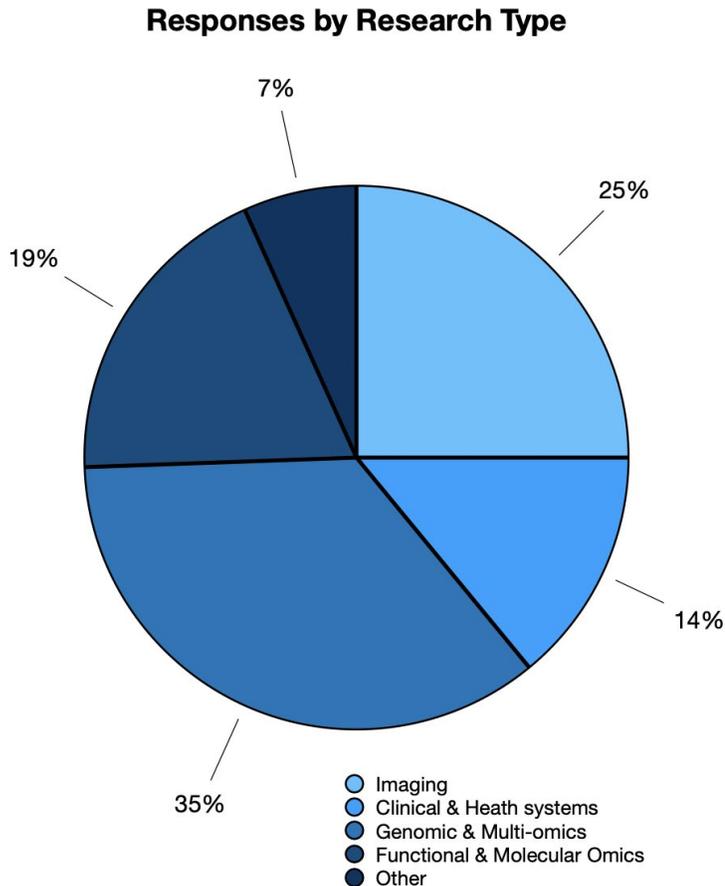

Research Computing challenges by category as reported by PSOM survey participants.

Breakdown of Research Data Types

When asked about the kinds of data they work with, faculty responses clustered into **four major categories**:

- **Clinical data:** Derived from EHR systems, patient records, and health registries; often requires HIPAA-compliant environments.
- **Imaging data:** Radiology, microscopy, and pathology images that demand large storage and GPU resources for analysis.
- **Omics data:** Genomic, transcriptomic, and proteomic datasets that drive computationally intensive workflows.
- **Other research datasets:** Including behavioral, epidemiological, and public datasets that support cross-disciplinary studies.

This breakdown highlights how diverse research at PSOM has become — spanning structured and unstructured data, each with distinct compliance, storage, and compute needs.

Responses by Research Type

Legend:
- Imaging
- Clinical & Heath systems
- Genomic & Multi-omics
- Functional & Molecular Omics
- Other

Distribution of research data types (clinical, imaging, and omics datasets) that dominate PSOM's computing landscape.

Use of Computing Solutions: HPC vs. Cloud vs. Desktop

Faculty reported using a mix of computing platforms depending on project size and complexity:

- **High-Performance Computing (HPC):** The primary choice for large-scale analyses, simulations, and multiomics processing. Researchers value its power and integration with local storage but noted constraints on GPU access and queue times.
- **Cloud Computing:** Increasingly adopted for flexible scaling and AI workloads, though cost predictability and compliance remain concerns. Faculty expressed interest in secure, institution-supported cloud options.
- **Desktop or Local Servers:** Still common for smaller datasets, exploratory work, and teaching. However, limited compute power and lack of centralized support make these less viable for long-term scaling and modern cybersecurity requirements.

Together, these findings show that most researchers rely on **hybrid workflows** — combining on-premise HPC for heavy compute and cloud platforms for flexibility and collaboration.
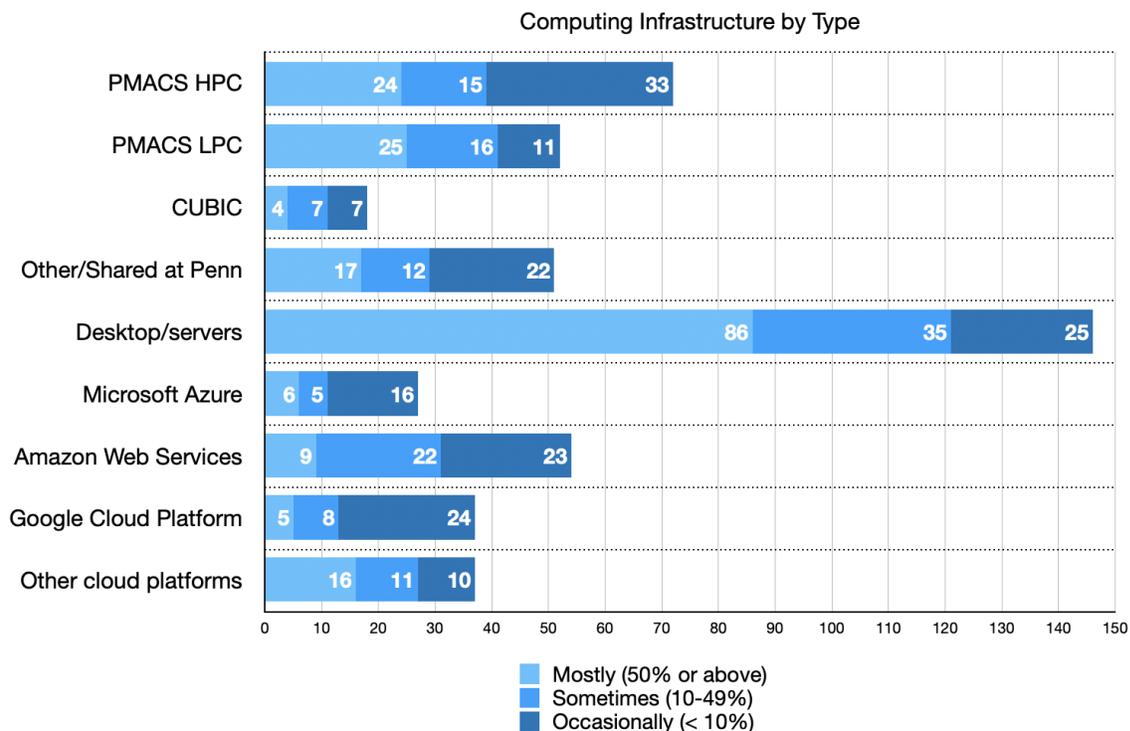
Computing environment usage — using desktop computers and/or servers remain the dominant processes for managing data, but cloud adoption is growing, especially for AI and data-sharing projects.

What Faculty Need Going Forward

When asked about new technologies and capabilities, faculty responses clustered around three big priorities:

- **AI tools and large language models (LLMs):** Researchers are eager to use AI — from natural language processing for clinical notes to deep learning for imaging. Many stressed the need for secure, on-premise access given compliance requirements.
- **Better data sharing infrastructure:** Current restrictions on platforms like Dropbox or Google Drive make collaboration difficult. Respondents want easier, more flexible ways to share data across institutions.
- **HIPAA-compliant and flexible compute environments:** Faculty expressed frustration with ticketing systems and delays when trying new tools. Secure cloud platforms and user-friendly HPC setups could open new possibilities.

Looking Ahead: The Next 3–5 Years

One message came through loud and clear: demand is only going to grow.

- Many labs expect their computing and storage needs to at least double — some described their growth as "exponential."
- GPU-intensive workloads, especially for AI and machine learning, are expected to grow substantially.
- Storage demands are set to skyrocket, with labs already managing hundreds of terabytes and planning for petabyte-scale data.
- Researchers anticipate increased reliance on cloud–HPC hybrid models, deeper integration with EHR data, and new data modalities like spatial omics and multiomics.

Taken together, these findings highlight both the urgency of current challenges and the opportunity to chart a clearer path forward for research computing at PSOM.

In response to these survey findings, PMACS has begun evaluating and refreshing its approach to research computing at PSOM. These efforts are focused on strengthening the computing ecosystem while addressing the scalability, accessibility, and compliance needs identified by the research community.

- With the launch of **PARCC**, PMACS is re-evaluating its cluster computing strategy to better align CPU and GPU capabilities with PSOM research needs.
- PMACS is advancing compliant solutions to support evolving NIH requirements, including NIST 800-171.
- In partnership with ISC, PMACS is offering HIPAA- and NIST-compliant cloud computing options for research that benefits from cloud-based workflows.

- Investments in new storage technologies are improving performance, resiliency, and scalability.

PMACS Response to the Survey Findings

In response to the needs and priorities identified through this survey, the Perelman School of Medicine Academic Computing Services (PMACS) provided the following overview of current and planned efforts to strengthen the research computing ecosystem at PSOM.

PMACS continues to evaluate our approach to refresh & strengthen our research computing ecosystem in response to the survey findings. We are developing a multi-year strategy focused on scalability, accessibility, and security. Immediate priorities include:

- ***Refreshing our cluster computing strategy:*** *With the launch of PARCC, which brings significant CPU and GPU computing to the University of Pennsylvania, PMACS is evaluating the structure and capabilities required by PSOM and architecting a new strategy to better meet the needs of faculty and staff going forward.*

- ***Support compliant research:*** *PMACS is actively working to provide compliant solutions to support new NIH research requirements, such as the adoption of NIST 800-171 when receiving data from designated NIH repositories.*

- ***Building compliant cloud compute options:*** *PMACS has partnered with ISC to offer a HIPAA and NIST 800-171 compliant AWS environment for those research initiatives that will benefit from the cloud.*

- ***Enhancing data storage and management:*** *PSOM has invested in new storage technologies that will improve performance while enabling efficiency, resiliency and scalability of enterprise solutions.*

Together, these efforts represent the foundation for the next generation of research computing at PSOM. By aligning infrastructure investments with evolving scientific and compliance needs, PMACS aims to provide researchers with the flexibility, performance, and security required to accelerate discovery. We remain committed to ongoing collaboration with faculty and partners across Penn to ensure that our computing environment continues to grow in step with the expanding ambitions of the PSOM research community.

Conclusion

The survey results make one thing clear: the PSOM research community is ambitious, innovative, and ready to move faster — but continued investment in computing infrastructure is essential to keep pace. The gaps identified provide a clear roadmap, from expanding GPU and HPC capacity to improving storage, secure AI access, and compliant computing environments.

In response, PMACS is advancing a multi-year strategy focused on scalability, accessibility, and security, including a refreshed cluster computing approach with the launch of **PARCC**, new compliant cloud options, and investments in next-generation storage. Together, these efforts lay

the foundation for a more flexible and secure research computing ecosystem. This survey is only the beginning, and continued collaboration between researchers and computing partners will be key to ensuring PSOM's infrastructure evolves alongside its scientific ambitions.