

# Sg2 Neurosciences Landscape Update

## 2024 NERVES Annual Meeting

**Katherine Zentner**  
Senior Director, Sg2

May 3, 2024

# Agenda

## Neurosciences Update

### Digital Health Landscape

# National Trends Reflect Continued Evolution in Neurosciences, Heightened Pressures

**Rising Acuity** across sites as patients become increasingly complex; **site-of-care shifts continue**



**Diagnostic advances** extend access, supporting efficient resource use across sites; treatment evolution impacts demand



**Payment evolution** supports case for continuum-wide approach (eg, HOPD procedures requiring prior authorization; bundled/virtual pain management; proposed spinal fusion mandatory bundled payment)



**Procedural approaches** become increasingly targeted, decreasingly invasive; expand pool of candidates



**New pharmacologic options** create opportunities in some cases, threaten traditional volumes in others (eg, dementia, MS)



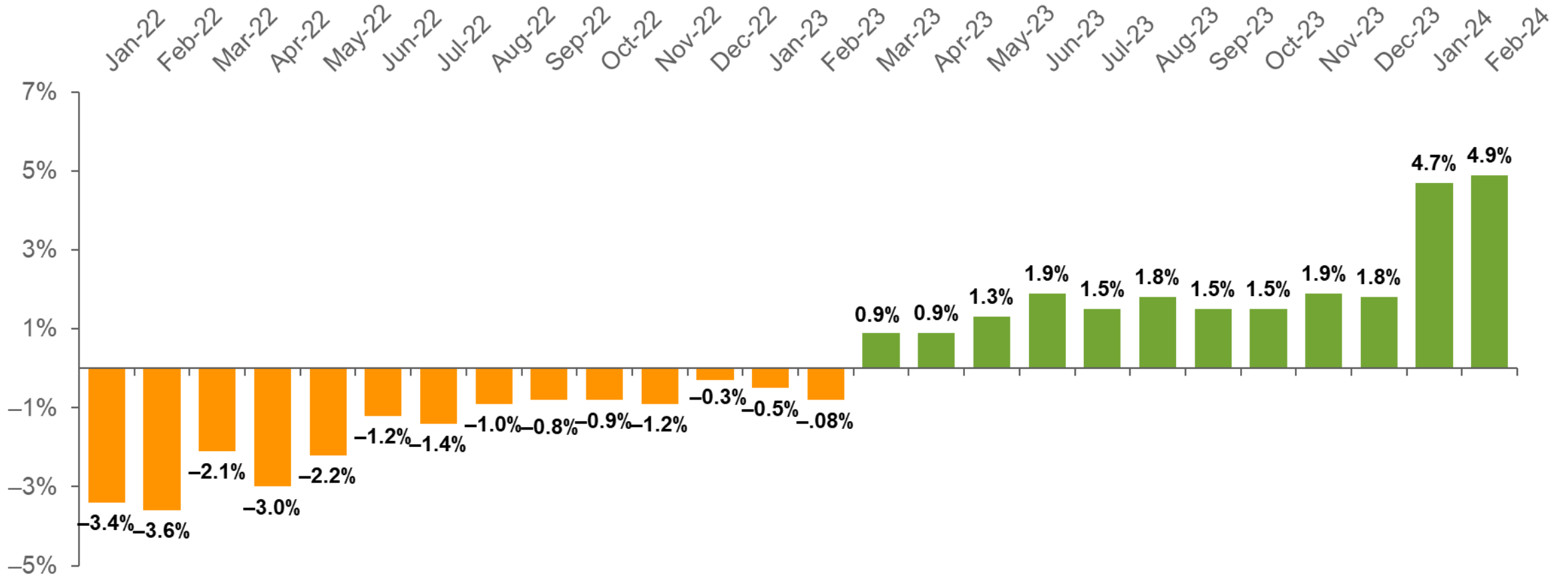
**Workforce challenges** and burnout exacerbated; further complicated by **rising costs**



Rising pressure to **demonstrate value**, bolster **operational effectiveness** across the System of CARE

# Hospital Financial Picture Reflects a Strong Start

## Kaufman Hall Operating Margin Index YTD by Month



**Note:** The Kaufman Hall Hospital Operating Margin and Operating EBITDA Margin Indices are comprised of the national median of the Kaufman Hall data set adjusted for allocations to hospitals from corporate, physician and other entities. Includes CARES Act. **Source:** Kaufman Hall. Kaufman Hall Hospital Operating Margin and Operating EBITDA Margin Indices. March 2024.

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# Innovation in Neurosciences Takes Many Forms

## SELECTED EXAMPLES

DIAGNOSTICS, MONITORING, IMAGING	TREATMENT	CARE DELIVERY, TRAINING
<ul style="list-style-type: none"><li>• Biomarkers</li><li>• <b>Evolving role of genetic testing</b></li><li>• Portables</li><li>• Computational imaging techniques</li><li>• Remote monitoring/wearables</li></ul>	<ul style="list-style-type: none"><li>• Spinal cord stimulation for diabetic neuropathy</li><li>• <b>Ultrasound as therapeutic, eg:</b><ul style="list-style-type: none"><li>– Essential tremor, neuropathic pain, OCD</li><li>– BBB disruption (eg, brain tumor)</li></ul></li><li>• Intraoperative advanced imaging</li><li>• Robotics and navigation</li></ul>	<ul style="list-style-type: none"><li>• Nontraditional partnerships</li><li>• Evolving workforce and training needs</li><li>• Alternative payment models</li></ul>

ARTIFICIAL INTELLIGENCE

VIRTUAL AND AUGMENTED REALITY



## ADOPTION BENEFITS

- Workforce and workflow
- Patient selection and treatment optimization
- Referral channels; access
- Research
- Medical education



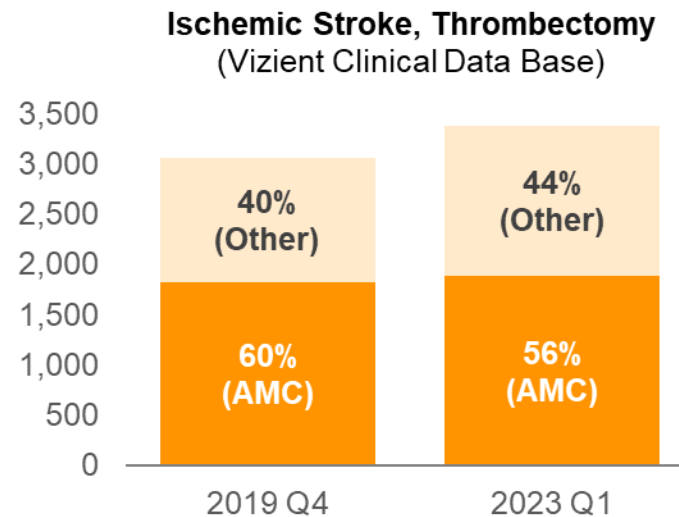
# Evolving Stroke Market Fuels the Need for Effective Systemness

The skyrocketing incidence of behavioral health **comorbidities increases cost and complexity.**

**47%** Stroke patients with comorbid BH diagnosis:

- + 2.2 days ALOS
- + \$3,020 direct cost

Ongoing service distribution efforts and “**tertiary tussle**” as **thrombectomy adoption continues**



Between Q4 2019 and Q1 2023, non-AMCs saw **7x to 8x** more thrombectomy growth than the AMC cohort.

## ADDITIONAL TRENDS

- Growing recognition of **SDOH**; elevated need to close gaps
- **Neurointerventional advances**
  - Evolving approaches, emerging devices, robotic applications
- **Recent research findings**
  - Expanding eligibility for thrombectomy in large strokes
  - Benefits of tenecteplase
  - Novel neuroprotectant medication
  - **Potential role of MIS in ICH**

**Note:** Time frame of BH analysis is Q1 2019–Q4 2022. Stroke includes ischemic and hemorrhagic stroke (SDH, ICH, SAH). AMC = academic medical center; BH = behavioral health; ICH = intracerebral hemorrhage; MIS = minimally invasive surgery; SDOH = social determinants of health. **Sources:** Data from the Vizient Clinical Data Base used by permission of Vizient, Inc. All rights reserved; Sg2 Analysis 2023.

# Volume-Quality Relationship for Complex Stroke Cases Warrants Cautious Approach to Stroke Distribution

## Intracranial Vascular Procedures for Primary Diagnosis of Hemorrhage With MCC (MS-DRG 20), CY 2021

MS-DRG 20 Average Annual Volume Range	# of Hospitals in Cohort	% Admitted via ED	Complication %	Observed Mortality %	Mortality Index	Median DRG Triplet Volume (MS-DRG 20–22)
<10	54	79.05%	28.06%	22.53%	1.97	8
10–24	64	65.16%	23.98%	16.71%	1.34	23
25–49	56	61.04%	21.72%	14.24%	1.10	49
50+	20	55.02%	19.90%	11.49%	1.00	83

### As volumes increase:

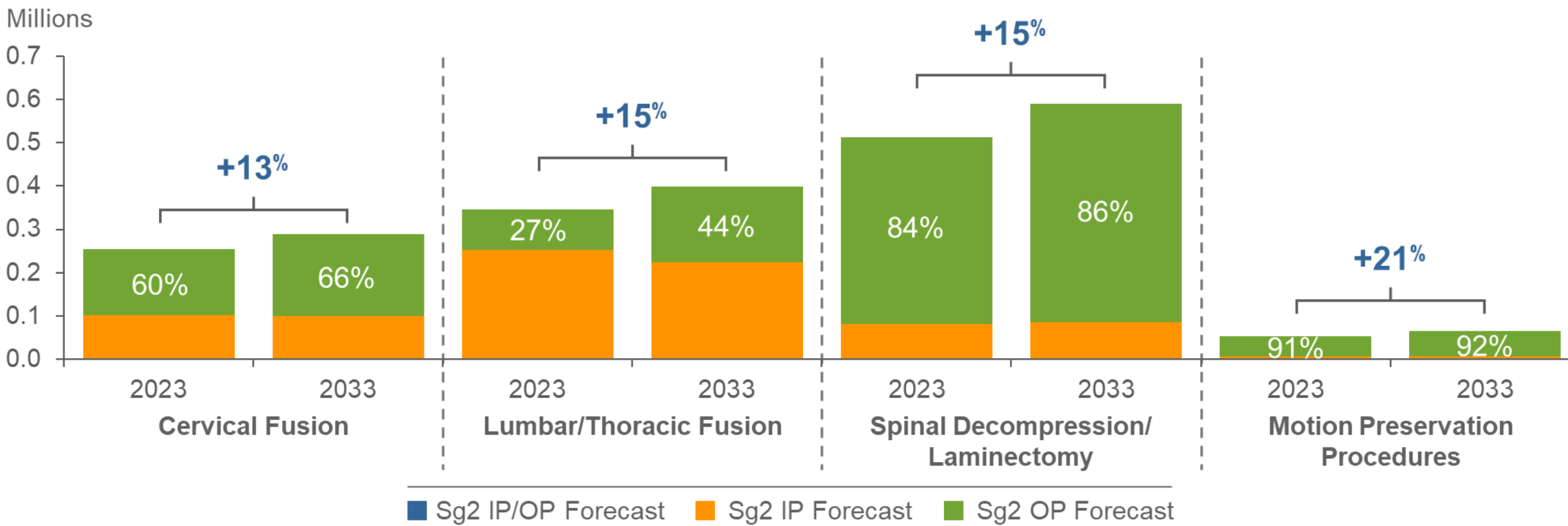
- Percent admitted via ED declines, hinting that these may be larger referral centers or “hubs”
- Mortality, complications markedly decline; Mortality index (observed vs expected mortality) approaches 1.00

**Note:** Analyses include adults only; transfers out to a different hospital have been excluded due to inability to track outcomes. MS-DRG 20-22 analysis limited to CY 2021. ED cases are defined as presence of UB92 revenue codes 450–459. Complications include complication diagnoses not present upon admission. CY= calendar year; MCC = major complication or comorbidity. **Source:** Data from Vizient Clinical Data Base used with permission of Vizient, Inc. All rights reserved.



# Spine Growth Occurs Amid Maturing OP Shift

## Spine Growth and OP Shift US Market, 2023 vs 2033



**Notes:** Analysis excludes 0–17 age group and includes the spine service line. **Sources:** Impact of Change®, 2023; HCUP National Inpatient Sample (NIS). Healthcare Cost and Utilization Project (HCUP) 2019. Agency for Healthcare Research and Quality, Rockville, MD; Proprietary Sg2 All-Payer Claims Data Set, 2021; The following 2021 CMS Limited Data Sets (LDS): Carrier, Denominator, Home Health Agency, Hospice, Outpatient, Skilled Nursing Facility; Claritas Pop-Facts®, 2023; Sg2 Analysis, 2023.

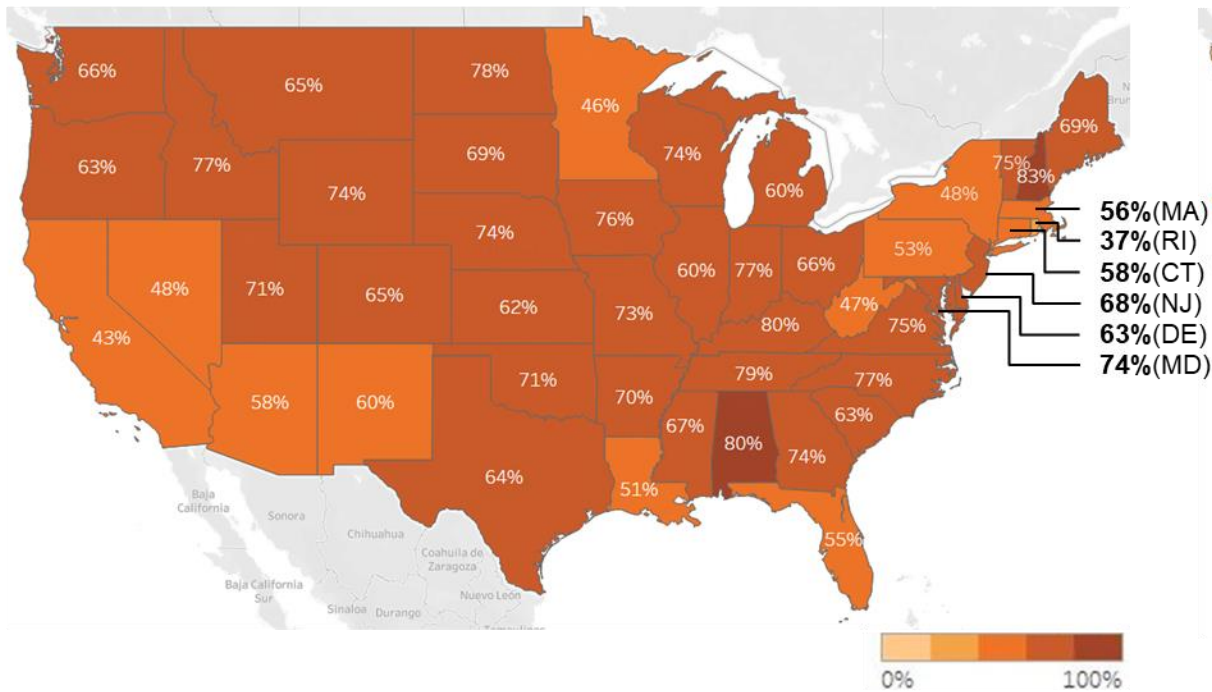


# For Spine Surgery, Shift Potential Varies by Procedure and Market

## Cervical Fusion Commercial Snapshot: Some Markets Approach OP Shift Ceiling While ASC Shift Remains Limited and Varies Across Markets

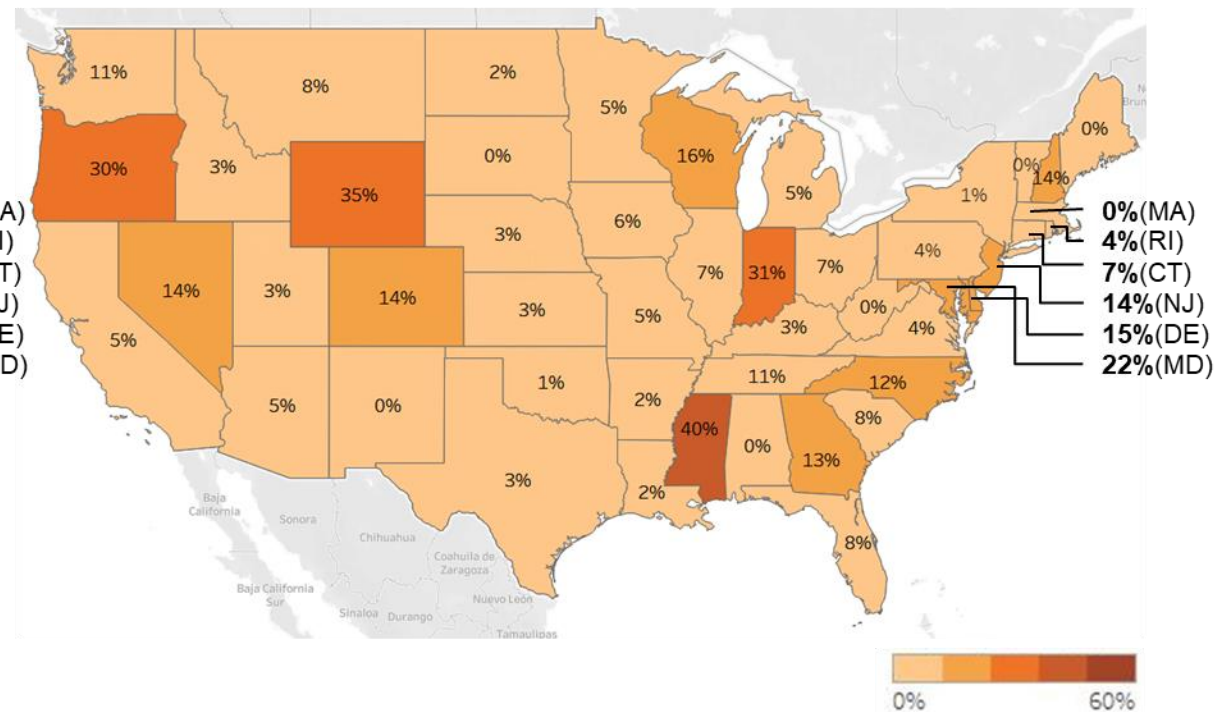
### Cervical Fusion %OP

Commercial Claims, 2022 Q1–Q3



### Cervical Fusion %ASC

Commercial Claims, 2022 Q1–Q3



**Note:** Analysis excludes 0–17 age group and includes commercial claims only. Cervical Fusion includes cervical spinal fusion and Degenerative Spine and Disc Injury CARE Family only. %OP includes hospital outpatient department and ambulatory surgery centers. %ASC includes ambulatory surgery centers only. ASC = ambulatory surgery center. **Sources:** Proprietary Sg2 All-Payer Claims Data Set; IQVIA; Sg2 Analysis, 2023.

# Pain Management: Burgeoning Need and Access Constraints

## Warrant Multifaceted, Continuum-wide Approach



- Growing need, heightened complexity
- Continued treatment advances (eg, neurostimulation)
- 2022 Update to CDC guidance on opioid prescribing aims to increase flexibility in managing patients with chronic pain.
- Payer influence on site-of-care and treatment selection continues
  - CMS’s 2023 addition of facet joint interventions to HOPD prior authorization list
  - New pain management codes for 2023 span bundled monthly services for chronic pain, telehealth services for established visits

### KEY CONSIDERATIONS:

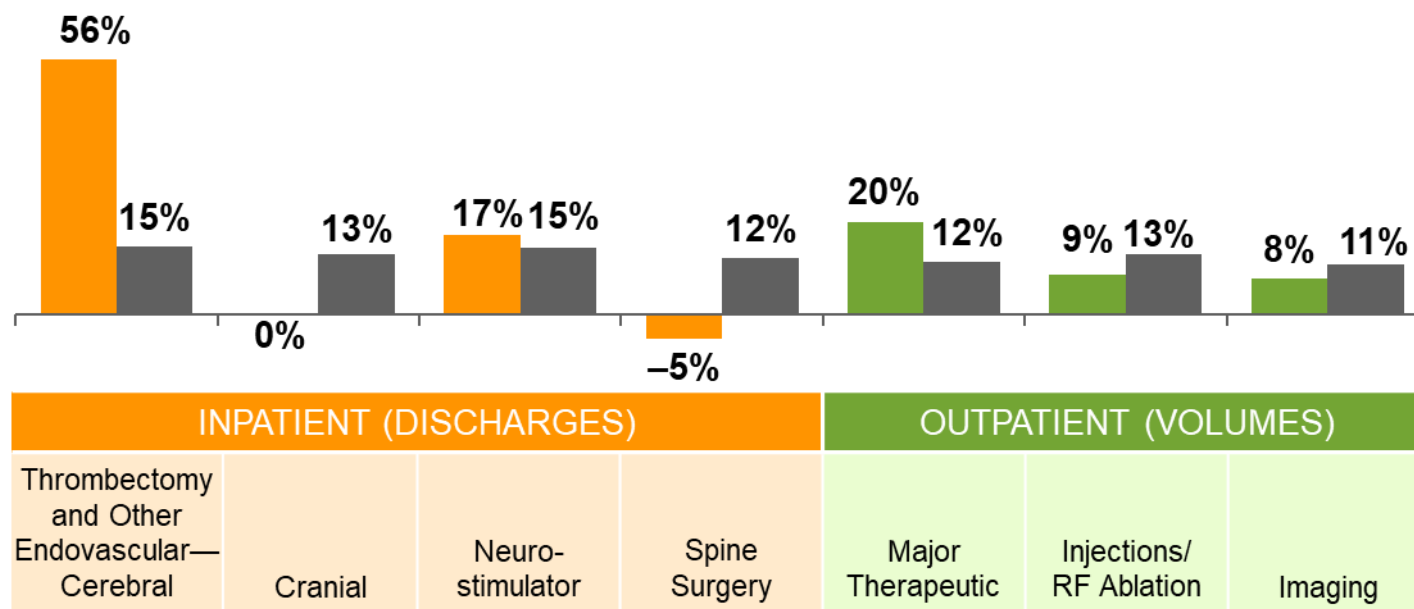
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- Supporting **primary care**
- Facilitating **access and triage**
- Expectation setting and facilitating **patient engagement**
- **Opioid stewardship** and abuse prevention
- Navigating access hurdles (eg, **prior authorization**)
- **“Connecting the dots”** across interdisciplinary teams, care continuum

# Capturing Growth In Neurosciences Will Increasingly Require System Approach, Operational Effectiveness

## Neurosciences and Spine Forecast

Select Procedures, US Market, 2023–2033



For health systems and physicians, **some innovations will be “baked in”**—others will require programmatic or care delivery change.

### Example: AI as a Supporting Technology

- Expediting diagnosis and informing treatment decisions
- Facilitating collaborative approach across multiple sites
- Supporting research and clinical trial enrollment

**Note:** Analysis excludes ages 0-17, includes neurosciences service line and the Brain/CNS Cancer CARE Family. Imaging includes advanced and standard imaging. **Sources:** Impact of Change®, 2023; HCUP National Inpatient Sample (NIS). Healthcare Cost and Utilization Project (HCUP) 2019. Agency for Healthcare Research and Quality, Rockville, MD; Proprietary Sg2 All-Payer Claims Data Set, 2021; The following 2021 CMS Limited Data Sets (LDS): Carrier, Denominator, Home Health Agency, Hospice, Outpatient, Skilled Nursing Facility; Claritas Pop-Facts®, 2023; Sg2 Analysis, 2023.

# Agenda

Neurosciences Update

**Digital Health Landscape**

# Many Technologies Are Defining the Digital Frontier in Health Care



## TELEHEALTH

- Video visits
- RPM



## INTERNET OF THINGS

- Ambient sensors
- Wearables



## MOBILITY

- Digital therapeutics
- Portable diagnostics



## VR AND AR

- Rehabilitation
- Pain management

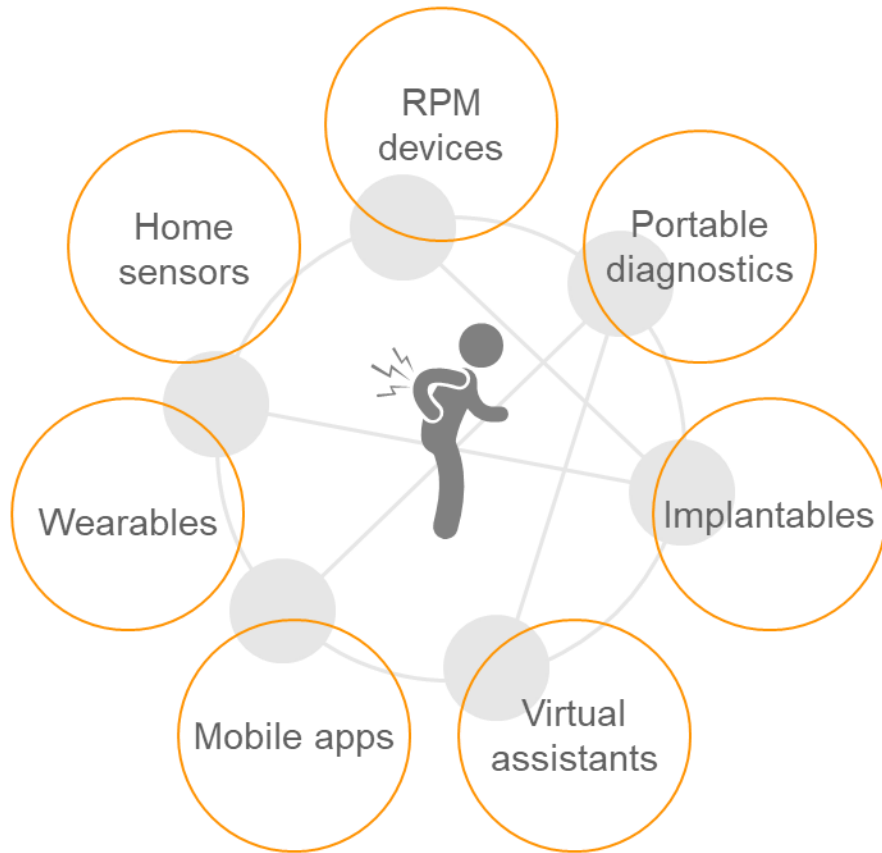


## AI

- Machine/deep learning
- Generative AI

# Internet of Things: Enabling Ambient Intelligence and Personalized Care

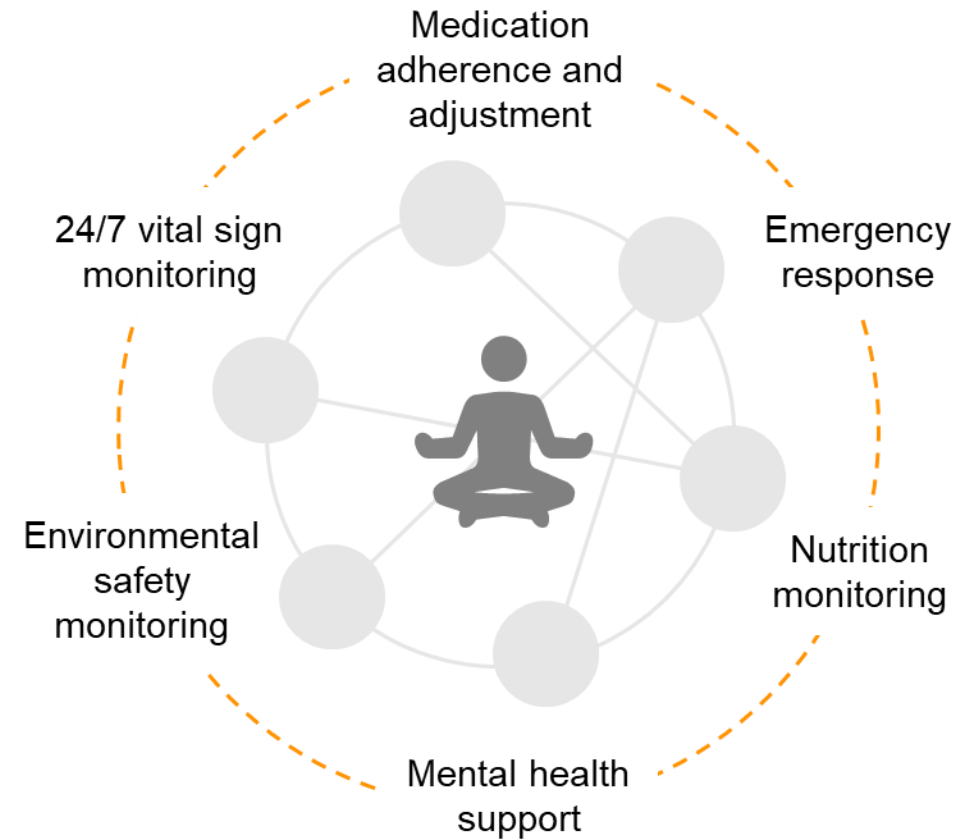
## Smart Devices, Sensors and Wearables Lead to Data-driven Health Interventions



Analytics engine +  
data integration



Data trending,  
coaching and  
feedback



# Mobility: Digital Rehabilitation on the Go



POST-OP  
DISCHARGE

PREVENT



Detect Early Deviation  
From Recovery Expectations  
*(Intervention Here Can Be Most Effective)*



Monitor Activity,  
Range of Motion,  
Vital Statistics



RECOVERY

Receive Reminders

Connect on  
Demand for  
Therapy Instruction  
and Real-Time  
Feedback

COMPARE

Set Personal Goals  
and Recovery  
Expectations



## Duke Clinical Research Institute Trial

Compared to traditional PT,  
virtual PT reduces:

- Total readmissions by 60%.
- Total outpatient PT visits by 86%.
- Total home health visits by 95%.
- Total urgent care or ED visits by 30%.
- Total SNF stays by 60%.

# AI: Transforming Neuro Disease Detection, Treatment and Research

## Event Detection and Triage

- Analyzing CT images to speed up diagnosis and treatment of conditions that require rapid response, such as acute stroke

## Early Detection and Disease Progression

- Identifying early biomarkers of neurological diseases (eg, Alzheimer's, ALS); predicting progression
- "Emotion AI" analyzing facial expressions, speech patterns, and physical movement to uncover early warning signs for neurological conditions

## Dataset Enhancement

- Generative AI could produce synthetic EEG or fMRI data to augment limited datasets used to train algorithms in detecting neurological disorders

## Neural Prosthetics and Brain-Computer Interfaces (BCI)

- AI will increasingly play a role in the development of neural prosthetics and BCIs, which can help restore or augment human cognitive or sensory-motor functions
- AI-enabled devices can interpret neural signals and translate them into actions (e.g., controlling a cursor on a screen) or sensory feedback

## Outcomes Prediction and Individualizing Treatment

- Spine Care: Increasing role of AI/machine learning in improving accuracy in complex procedures, assisting in surgical planning, outcomes prediction, and design of patient-specific implants
- Researchers in Australia are testing an AI model to predict treatment response in epilepsy patients

**Sources:** Yeung JA, et al., "[Artificial intelligence \(AI\) for neurologists: do digital neurones dream of electric sheep?](#)" *Practical Neurology* 2023;23:476-488; Niiler E, "[How AI and Facial Recognition Could Spot Stroke and Other Diseases,](#)" *The Wall Street Journal*, April 2023; Hajjar I, et al., "[Development of digital voice biomarkers and associations with cognition, cerebrospinal biomarkers, and neural representation in early Alzheimer's disease,](#)" *Alzheimers Dement (Amst)*. 2023 Feb 5;15(1):e12393; Marks R, Kurtzman L, "[How Artificial Intelligence Gave a Paralyzed Woman Her Voice Back,](#)" UCSF, August 2023; Sevilis T, et al., "[Abstract WP81: Validation Of Artificial Intelligence To Limit Delays In Acute Stroke Treatment And Endovascular Therapy \(VALIDATE\),](#)" *Stroke*. 2023;54:AWP81; Hakeem H et al. Development and validation of a deep learning model for predicting treatment response in patients with newly diagnosed epilepsy. *JAMA Neurol*. 2022;79(10):986-996





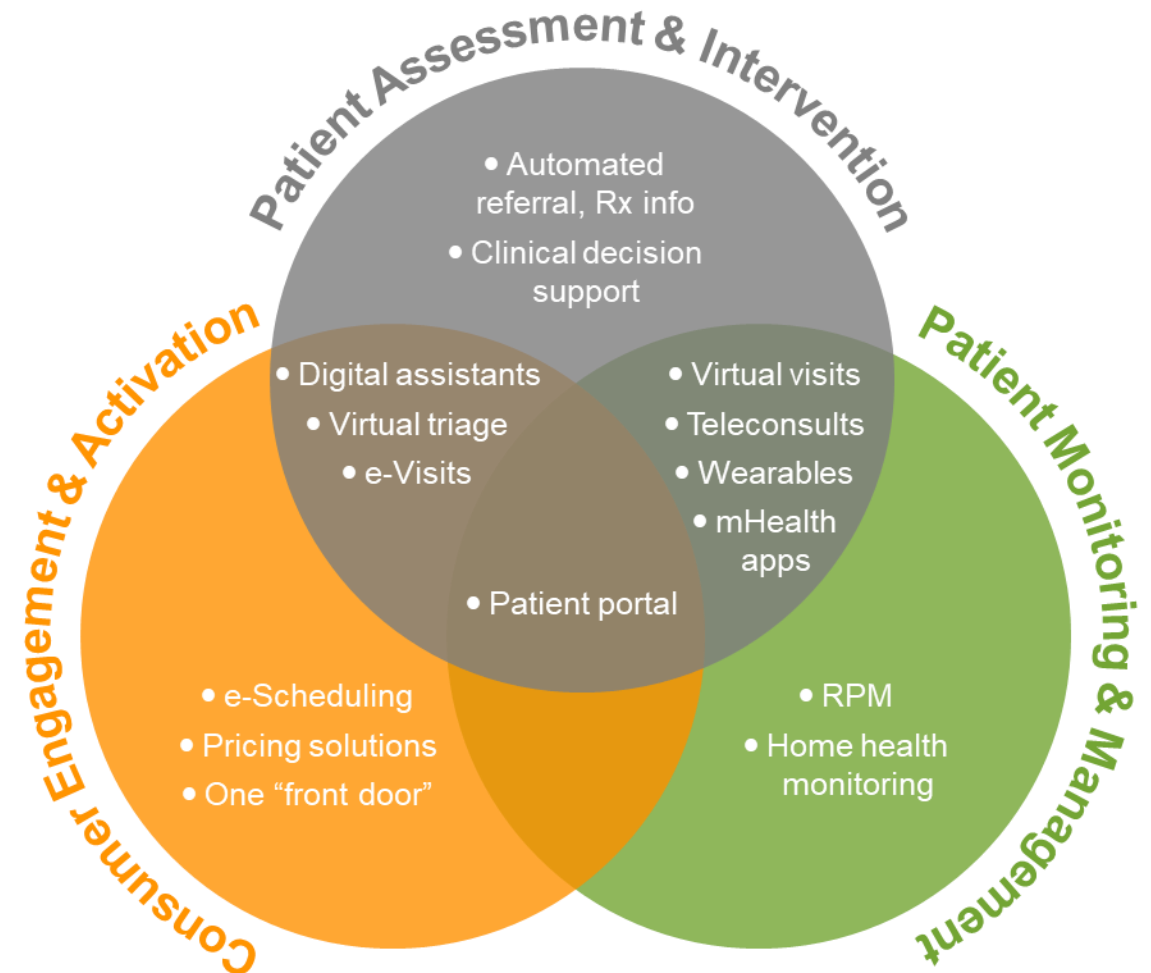
Which digital innovation do you think holds the greatest potential?

- A. Telehealth
- B. Internet of Things
- C. Mobility
- D. VR/AR
- E. AI

# Digital Investments Enable Health Care Strategy

## STRATEGIC IMPERATIVES

- Improve access to care.
  - Increase transparency for patients.
  - Grow share of care.
- 
- Streamline care delivery.
  - Expand access channels.
  - Drive cost reduction, efficiency and increased provider capacity.
- 
- Support ongoing condition management.
  - Optimize postdischarge outcomes.
  - Manage overall cost of care.



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