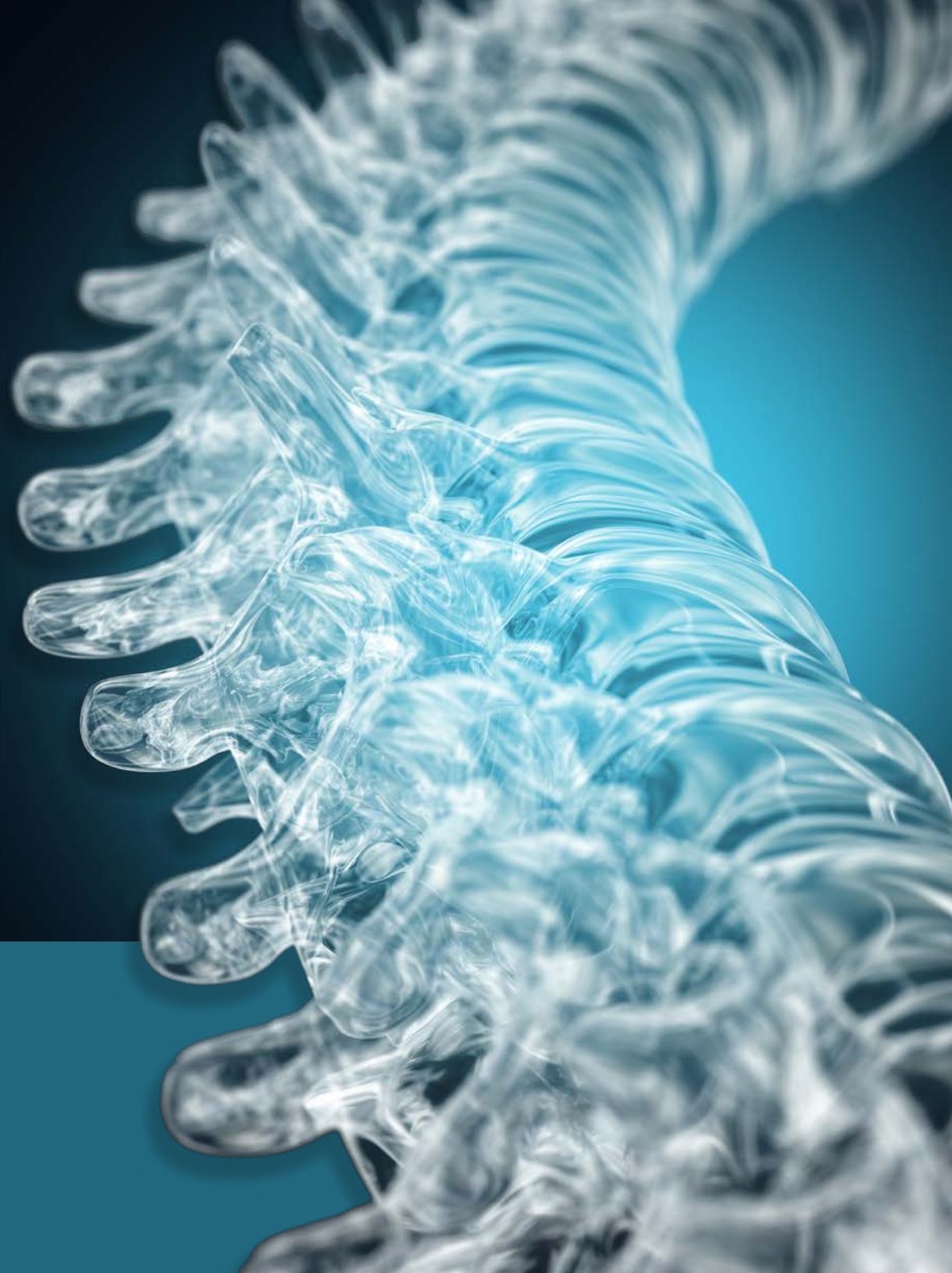
SPINE MARKET

DATA AND INFOGRAPHICS



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SPINE MARKET

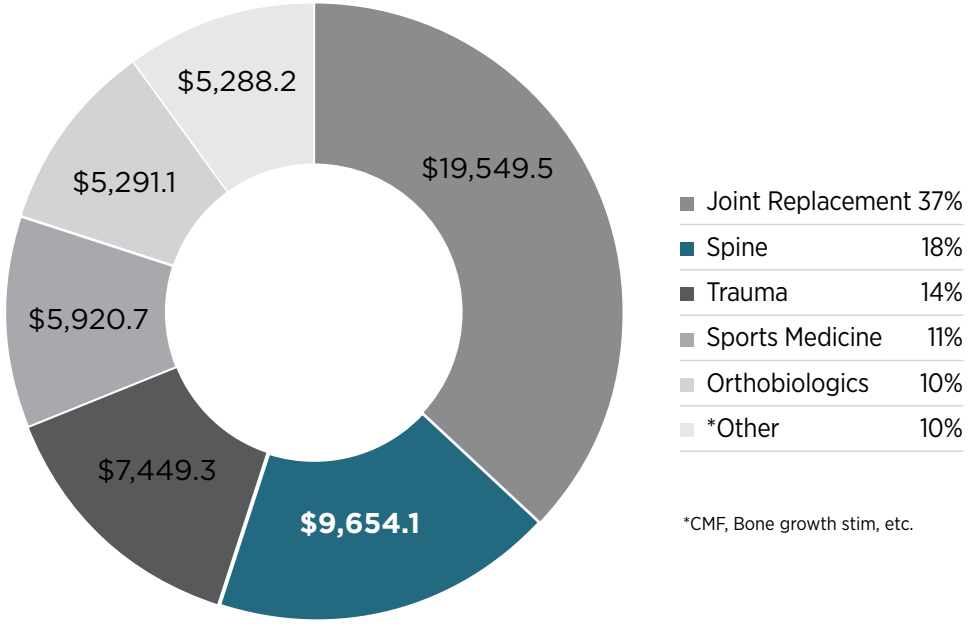
2019 Revenue:
$9.6 billion, + 3.5% vs. 2018

The spine market accounted for 18.2% of the $53 billion orthopedic market in 2019, making it the second largest subsegment after joint replacement.

Spine sales have hovered in the 2% to 3% range in recent years. The segment first crossed the $9 billion threshold in 2017. Sales grew +3.5% in 2019 to reach $9.6 billion.

Our spine market numbers include revenue for implants, instruments and surgical assistance systems, e.g., robotics and navigation, to treat a variety of issues, including disc disease, herniated discs, scoliosis and vertebral fractures.

Spine Market Share ($Millions)



*CMF, Bone growth stim, etc.

Spine Sales – 2017 to 2019 ($Millions)

	2017	2018	2019
Sales	$9,080.9	$9,324.7	$9,654.1
$ Chg		$243.8	$329.4
% Chg		2.7%	3.5%

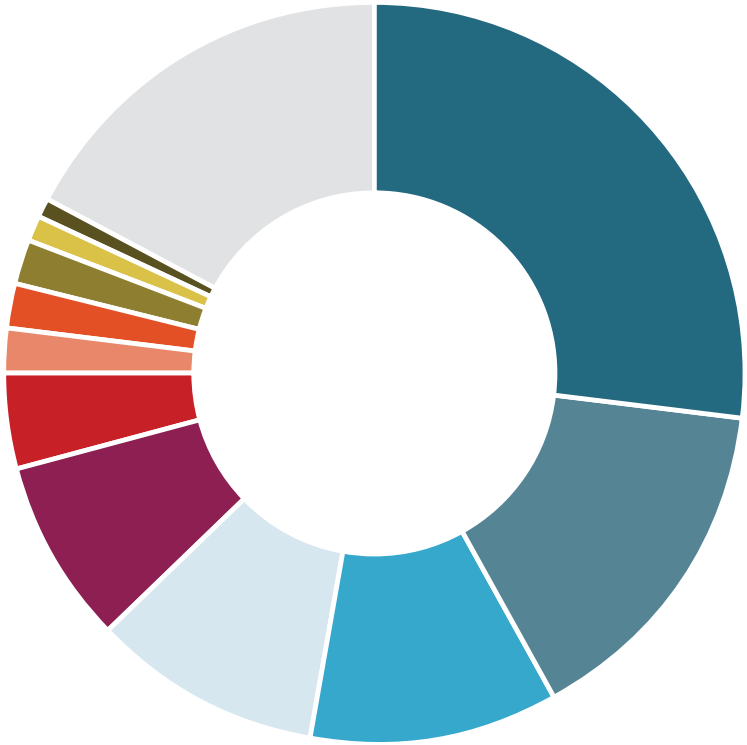
SPINE PLAYERS

The spine market is dominated by Medtronic, with sales of $2.6 billion or 27% market share (excludes biologics). DePuy Synthes, Stryker and NuVasive all have sales over $1 billion and achieved 10% or more market share in 2019.

The next tier of players each have between 8% and 1% market share. The majority of these players, like Globus Medical, ulrich medical and Spinal Elements, are spine-focused companies that have experienced greater sales growth than their larger competitors.

All told, hundreds of companies play in the spine space and have revenue under $100 million.

Spine Market Share – Top 11 Players and All Others



Medtronic	27%	Aesculap	2%
DePuy Synthes	15%	ulrich medical	2%
Stryker	11%	Spinal Elements	2%
NuVasive	10%	Surgalign*	1%
Global Medical	8%	ATEC Spine	1%
Zimmer Biomet	4%	All Others	17%

*Formerly RTI Surgical

TOP SPINE PLAYERS BY MARKET SEGMENT

The four largest players are split between predominately spine-focused and diverse orthopedic companies. Medtronic and NuVasive each derive about 85% of their revenue from spine, while DePuy Synthes and Stryker draw about 15% of their revenue from the segment.

4 Largest Spine Companies' Revenue by Market Share

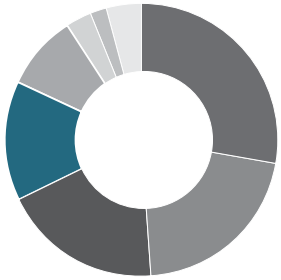
Medtronic

Spine	83%
Orthobiologics	17%

DePuy Synthes

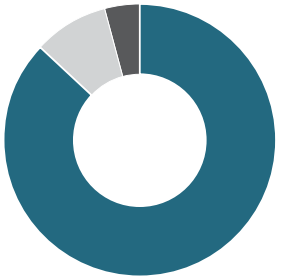
Trauma	29%
Knee Replacement	17%
Hip Replacement	17%
Spine	16%
Sports Medicine	8%
Extremeties Joint Rplcmt	5%
Orthobiologics	4%
Other	4%

Stryker



Knee Replacement	28%
Hip Replacement	21%
Trauma	19%
Spine	14%
Sports Medicine	9%
Orthobiologics	3%
Extremeties Joint Rplcmt	2%
Other	4%

NuVasive



Spine	87%
Orthobiologics	9%
Trauma	4%

TOP 11 COMPANIES BY SUBSEGMENT

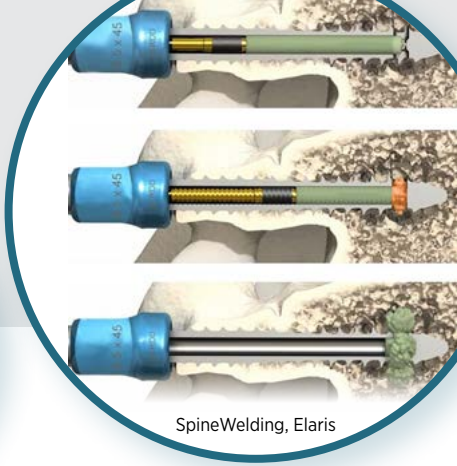
The list below illustrates the subsegments in which the 11 largest spine companies play. All 11 have a presence in the cervical, deformity/degenerative and interbody spaces. The portfolios of DePuy Synthes, Globus Medical, Medtronic, Stryker and Zimmer Biomet span each segment.

Company	Country	Cervical	Deformity/ Degenerative	Interbody	Trauma/ Tumor	Vertebral Body Replacement	Artificial Disc	Dynamic Stabilization	Vertebroplasty/ Kyphoplasty
AESCULAP	Germany	x	x	x	x	x	x		
atec Spine Approach Technologies	United States	x	x	x					x
DePuy Synthes	United States	x	x	x	x	x	x	x	x
GLOBUS MEDICAL	United States	x	x	x	x	x	x	x	x
Medtronic	United States	x	x	x	x	x	x	x	x
NUVASIVE	United States	x	x	x	x	x	x	x	
SPINAL elements	United States	x	x	x	x	x			x
stryker	United States	x	x	x	x	x	x	x	x
Surgalign SPINE TECHNOLOGIES	United States	x	x	x				x	
ulrich medical	Germany	x	x	x				x	
ZIMMER BIOMET	United States	x	x	x	x	x	x	x	x

10 NEW SPINE COMPANIES ON OUR RADAR

Spine continues to be a popular market for startups and smaller companies. In 2019, we counted 10 companies with their first FDA 510(k) in the space.

Augmedics, xvision



SpineWelding, Elaris

1. **Additive Implants,** Cervical Spacer

- For use with supplemental fixation and autogenous and/or allogeneic bone graft; the hyperlordotic implants must be used with an anterior cervical plate
- Engineered to support stability at the bone/implant interface throughout healing
- Additively manufactured with a roughened porous surface and features on superior, inferior and lateral aspects to engage bone with vertebral endplates

2. **Addivation Medical,** Cervical Interbody

- To be used with autogenous bone graft and/or allogenic bone graft and implanted via an open, anterior approach
- To be used with supplemental spinal fixation systems that have been cleared for use in the cervical spine
- Company is focused on development and commercialization of 3D-printed off-the-shelf and patient-specific devices to treat degenerative, trauma and deformity spinal conditions

3. **Augmedics,** xvision Spine System

- System uses sensors and collects surgical information that can be connected to a big data system to analyze and process data
- Allows surgeons to see the patient's anatomy through skin and tissue and to navigate instruments and implants while looking directly at the patient, rather than a screen
- Open platform technology from a 3D imaging and implant perspective, with a small O.R. footprint

4. **Biofusion Medical,** SI-Restore Sacroiliac Joint Fixation System

- Cannulated titanium screw and washer affixed to screw head for full cortex engagement
- Uses guide pins for accurate prep and placement of the implant
- Features a pivoting load distribution cap engineered for 360 degree contact with the ilium

5. **BONWRx,** VK100 Percutaneous Vertebral Augmentation

- Indicated for fixation of pathological fractures of the vertebral body using vertebroplasty or kyphoplasty
- Pre-filled cartridge containing the two material components and a dispensing system which blends them for injection into the injured vertebrae; material cures *in situ* to form a non-resorbable polymer

6. **CMF Medicon Surgical,** MediExpand TL Expandable VBR System

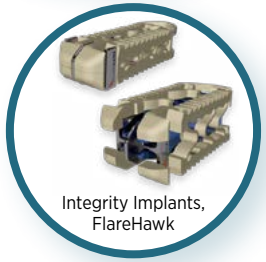
- Developed for reconstruction of the thoracic and lumbar spine after single or multilevel corpectomies as a result of tumors
- Company is the U.S. subsidiary of Germany-based Medicon eG

7. **Elevation Spine,** Saber-C Cervical Interbody

- Spacer is available in allograft, titanium-coated PEEK and titanium options
- Pre-loaded spike fixation reduces surgical steps
- Straight-in spike delivery

8. **Integrity Implants,** FlareHawk Interbody

- For use with autogenous bone graft and/or allogeneic bone graft composed of cancellous and/or corticocancellous bone, and with supplemental fixation instrumentation that has been cleared for use in the lumbar spine
- Reportedly the first interbodies that simultaneously expand in height, width and lordosis
- In late 2017, company entered into an agreement to license SITES Medical's OsteoSync Ti highly-porous titanium scaffold technology for use in FlareHawk devices



Integrity Implants, FlareHawk

9. **restor3d,** ADI Cervical Interbody

- Indicated to treat degenerative disc disease via an anterior approach using autogenous bone and supplemental fixation
- Comprises a single, continuous piece of titanium alloy fabricated via additive manufacturing
- Has a porous structure throughout the implant body, a circular window for the packing of graft material, a threaded hole for insertion, teeth on the surfaces of the perimeters to aid expulsion resistance and side windows on the walls of the implant
- Company entered into an exclusive development and licensing agreement with SeaSpine

10. **SpineWelding,** Elaris Pedicle Screw

- First FDA 510(k) clearance applying proprietary BoneWelding technology that is designed to support load-bearing implants
- Process uses ultrasonic energy to liquefy pre-defined polymeric components of the Elaris Pin, extruding them through the screw's fenestrations and forming a bond between implant and bone
- Liquid polymer solidifies upon contact, forming a confined, solid ring around the screw tip; the bioresorbable polymer is gradually metabolized into H2O and carbon dioxide

SPINE MARKET M&A

The last major spine acquisition came in late 2018 when Stryker purchased K2M for $1.4 billion. However, activity hasn't been stagnant within the last two years. Companies have found opportunities to purchase novel products, platform technologies and distributors or contract manufacturers.

A timeline of spine acquisitions is represented to the right.

2019

1Q

- RTI Surgical acquires Paradigm Spine
- Kyocera acquires Renovis Surgical Technologies

2Q

- WishBone Medical acquires CSpine
- Boston Scientific acquires Vertiflex

3Q

- Medtronic acquires Titan Spine
- Osseus Fusion acquires SIJ Surgical

2020

1Q

- Spineart acquires assets of Eden Spine Europe

2Q

- Spineart acquires Meditech Spine
- Pantheon Surgical acquires Incite Innovations
- Pantheon Surgical acquires Blue Topaz/CompresSIve sacroiliac screw system

3Q

- Safe Orthopaedic acquires LCI Medical, contract manufacturer
- WishBone Medical acquires assets of Back 2 Basics and Orbbo Surgical
- Wenzel Spine acquires Statera Spine

PENDING

- Medtronic to acquire Medicrea for $160 million

INTERBODY FUSION TRENDS

Interbody fusion devices are the second largest segment of spine products behind plates and screws. These devices assist in fusion and are made of bone, metal and plastics. Three trends in recent years have been the growth of the expandable and corpectomy markets in lumbar fusion and the use of metals over PEEK in all interbodies.

Types of Interbody Fusion Devices (IBFs)

Allograft Bone

IBF

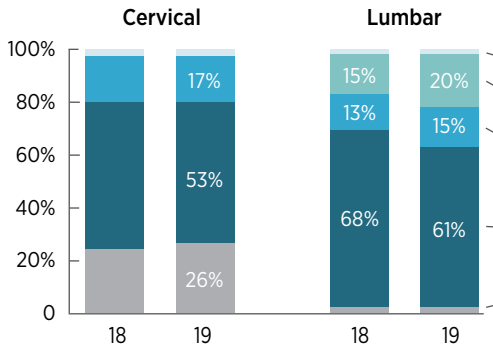
IBF Expandable *(IBF-EX)*

IBF w/Integrated Screws *(IBF-IS)*

Corpectomy *(XCorp)*

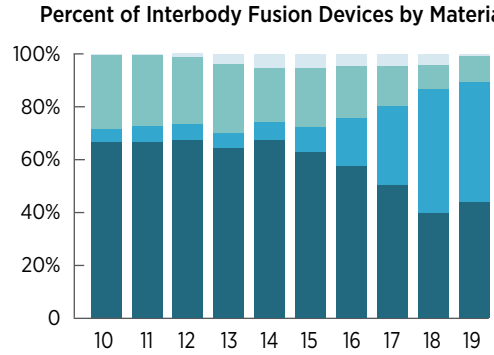
Images Courtesy of Manufacturers.
Top to bottom: MTF Biologics, Life Spine, Nexxt Spine, Atlas Spine, Zavation Data

Use Trends of Interbody Fusion Devices: 2018 vs. 2019



	2019 ASP/Case Cervical	Lumbar
XCorp	NA	NA
IBF-EX	NA	$4,473
IBF-IS	$2,394	$5,578
IBF	$1,017	$3,119
Bone	$899	$2,106

Material of Interbody Fusion Devices: 2010-2019



"Other" includes ceramic and carbon fiber

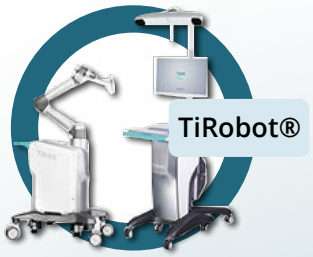
Metals include titanium, titanium-coated, and trabecular metal

Content Source: Orthopedic Network News, a Curvo Labs publication

ROBOTS IN SPINE

The use of robots has become a dominate topic in spine surgery as hospitals and spine companies seek to bring accuracy, precision and efficiency to procedures.

Currently, five robots are utilized in spine. These systems are noted to the right. Stryker (Mako) and NuVasive (Pulse) both have robots in development, but these are more than a year away from commercialization.



TINAVI
Spine, Trauma
Launched 2016

Brainlab
Spine
Launched 2015

Zimmer Biomet
Spine
Launched 2014 by Medtech

Globus Medical
Spine
Launched 2017

Medtronic
Spine
Launched 2019

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