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LABORATORY ECONOMICS

Competitive Market Analysis For Laboratory Management Decision Makers

Debt Collection Company Hack May Affect 20+ Million Patients

A web payment page operated by American Medical Collection Agency (AMCA-Elmsford, NY) has been hacked and may have exposed personal data on 20+ million patients from at least three commercial lab companies: Quest Diagnostics, LabCorp and BioReference Labs. AMCA, which also does business under the name Retrieval-Masters Credit Bureau, is a third-party debt collector with a reputation for aggressively pursuing patients for past due bills.

The hack was initially discovered in late February by the web payment security monitoring firm Gemini Advisory (New York City), when they found credit card information from patients linked to AMCA being sold on a darknet marketplace. Gemini believes the AMCA hack may turn out to be the largest medical breach of 2019. *Continued on page 8.*

Startups Racing To Bring AI-Based Pathology Tools To Market

Over the past few years, private equity investors have poured more than $130 million into five startup companies that are developing artificial intelligence (AI) systems that help pathologists analyze digitized pathology slides. In the past three months alone, investors poured $85 million into three of these companies, including $60 million recently raised by PathAI (Boston, MA). In addition, the search engine giant Google has entered the race. No AI-based software tool has received FDA clearance yet, but it's probably only a matter of 1-2 years before they do. *Continued on page 4.*

Alverno Labs Starts Move To 100% Digital Pathology

Alverno Laboratories (Hammond, IN) is the first laboratory in the United States that is transitioning 100% of its pathology slides to digitization. Within 12 months, all ~50 pathologists contracted with Alverno will be making all their pathology case interpretations from computer screens rather than traditional microscopes, according to Alverno CEO Sam Terese. He says the transition is already underway, with an initial four slide scanners already installed and working at Alverno's central lab in northwest Indiana (about 20 miles south of Chicago). He says that reduced courier costs, faster turnaround times, and easier access to sub-specialists mean that digital pathology will help reduce costs at Alverno. *Continued on page 2.*

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Alverno Labs Starts Move To 100% Digital Pathology (*cont'd from p. 1*)

Sam Terese

Terese says that Alverno began seriously considering digital pathology in mid-2017 after the FDA cleared the Philips IntelliSite Pathology Solution as the first digital pathology system to be approved for primary cancer diagnosis in the United States.

Brian Wellborn, Alverno's Manager of Anatomic Pathology, says Alverno evaluated digital pathology systems from four vendors over a 12 month period. It ran 1,000 slides through each company's scanner to compare racking time, scanning time, missed slide pick-ups, et al. Alverno then had nine pathologists review all the images to check for image quality and the user-friendliness of viewing software. Ultimately, Wellborn says FDA clearance tilted the final decision to Intellisite.

Brian Wellborn

Alverno is a joint venture core laboratory owned by Franciscan Alliance and AMITA Presence Health. Alverno, which has 1,600 employees, performs a total of 14 million billable tests per year and serves 30 hospitals and more than 2,500 physician offices (hospital-owned and independent) throughout northern Indiana and Illinois. Alverno's central lab also processes more than 1.1 million histology slides for 142,000 pathology cases each year. Alverno contracts with Pathology Consultants Inc. (Michigan City, IN), which has about 25 pathologists, for professional services, and has contracts with another 20 pathologists who work in the AMITA-Presence system.

As mentioned previously, Alverno's core lab currently has four Philips Ultra Fast Scanners with four more scanners coming in mid-June, and four additional ones coming in early 2020. Wellborn expects the total 12 scanners will ultimately process as many as 4,000 to 6,000 digitized slides per day.

Pathologists located at the core lab plus those at three hospitals—Franciscan Health Lafayette East, Franciscan Health Dyer and Franciscan Health Hammond—are getting specialized medical-grade monitors to review all their pathology cases, except frozen sections for inpatient surgeries. Pathologists at these locations should be 100% digital by August 15. A total of 50 new monitors will be placed at the core lab and 30 hospitals with full transition to digital pathology finished by April 2020, according to Wellborn.

Wellborn says that although the move from the microscope to computer screens will involve a learning curve for pathologists, "they are all onboard with virtually no real resistance."

The benefits from digital pathology are expected to include:

- **Quicker turnaround time:** Slides will be digitized at the core lab and become available for pathologists to review from their monitors almost immediately after scanning. This can shave as much as 24 hours off the time to result reporting for each case.
- **Reduced courier service expense:** Couriers will no longer have to deliver prepared slides from the core lab to each hospital location (up to three hours away) each morning. Digital pathology also eliminates delays that can be caused by the weather, traffic and slides delivered to the wrong hospital.

- **Easier collaboration and second opinions:** Pathologists will be able to share and collaborate on cases with doctors at other locations with monitors, eliminating the need for couriers to transport slides between hospitals.
- **Digitally archived slides:** Alverno processes an average of approximately 4,000 slides per day, that translates to 4-5 terabytes of digitized data daily, or 1-1.5 pedabytes (e.g., one quadrillion bytes of data) a year. Alverno's initial strategy is to hold approximately two months of slides in digital storage (sufficient for 95% of all cases), and keep the glass slides as the permanent source. However, as the price of digital storage continues to fall (15-20% annually), Alverno plans to gradually increase its amount of digital storage to 100%. This will enable much greater versatility with the archived slides, especially from an academic or research/collaborative view.
- **The use of Artificial Intelligence (AI):** Digitized slides are a prerequisite for using AI. And the prospect for AI-based algorithms that increase efficiency was one of the big draws that "sealed the deal" for Alverno's decision to go 100% digital, according to Wellborn. He says that, pending FDA reviews and approvals, Alverno will employ AI tools that will benefit its patients.

Digital pathology for primary cancer diagnosis is currently being used by a handful of Academic Medical Centers in the United States, but nothing near the scope planned at Alverno. Once fully implemented in early 2020, Alverno will have the single largest number of installed Philips scanners in the world. "Philips is banking on us doing this correctly so they can bring this technology to other networks," notes Wellborn.

Leica Gets FDA Clearance For Its Digital Pathology System

The FDA has cleared Leica Biosystems to market its Aperio AT2 DX System for clinical diagnosis in the United States.

FDA clearance was based on Leica's clinical concordance study at five U.S. sites: University of California Davis, Pacific Rim Pathology, Dignity Health, TriCore Reference Laboratories and Intermountain Healthcare. Participating pathologists read approximately 16,000 cases. The study compared reads of pathology slides under a microscope with on-screen digital reads.

Leica entered the digital pathology market through its acquisition of Aperio Technologies in October 2012.

Leica is now the second vendor to have its digital pathology system approved for primary cancer diagnosis—following Philips' clearance in April 2017.

Startups Racing To Bring AI-Based Pathology Tools (*cont'd from p. 1*)
In simplest terms, AI-based pathology systems use image analysis and pattern recognition algorithms to distinguish tumor versus normal tissue from digitized slides. One of the big developmental challenges is that successful AI requires a massive amount of annotated digitized slides to learn from and create accurate and reproducible algorithms.

Furthermore, once these AI products begin hitting the market, they will need to find pathology groups and labs that are actually scanning slides and using digital pathology for clinical diagnostics. The adoption rate of digital pathology in the United States has moved at a snail's pace over the past 10 years.

However, adoption might be on the verge of accelerating (see Alverno Laboratories, page 1) and AI-based decision-support tools that boost pathologist productivity and reduce errors might speed the transition.

Below we provide quick profiles of five pathology AI startups.

Paige.AI (New York City) recently received Breakthrough Device designation by the FDA. The designation is granted for new technologies with the potential to provide more effective diagnosis for life-threatening diseases, where timely availability is in the best interest of patients. Paige.AI's first product is expected to be an AI-based system that helps pathologists diagnose prostate cancer.

Paige.AI has a license agreement with Memorial Sloan Kettering Cancer Center (New York City-MSK), which started to digitize its pathology slides in 2015. The agreement gives Paige.AI exclusive access to these one million digitized slides, and the company is funding digitization of another 4 million of MSKCC's archived slides, with intentions to use the data set to develop its AI-based products. As part of the deal, MSK received a minority stake in Paige.AI.

Paige.AI was co-founded in 2018 by its Chief Scientific Officer, Thomas Fuchs, PhD, who is the Director of Computational Pathology in The Warren Alpert Center for Digital and Computational Pathology at MSK. In addition, co-founder David Klimstra, MD, is Chairman of MSK's Pathology Department.

Paige.AI raised $25 million from a first round of financing led by Breyer Capital in early 2018.

PathAI (Boston, MA) recently raised $60 million through a series B funding led by growth equity firm General Atlantic. This brings its total venture capital raised to about $75 million, following an $11 million series A financing round in late 2017 led by General Catalyst Partners. PathAI is collaborating with Philips (maker of the IntelliSite digital pathology system) on developing a decision support tool, initially aimed at helping pathologists diagnose metastatic breast cancer. PathAI was founded in 2016 by Andrew Beck, MD, PhD, a pathologist with a PhD in Biomedical Informatics from Stanford University.

Deep Lens (Columbus, OH) raised $14 million from a series A financing earlier this year led by Northpond Investors. This raises its total funding to $17.5 million, including an initial seed round of $3.2 million in late 2018.

The company's cloud-based digital pathology service VIPER (Virtual Imaging for Pathology Education and Research) uses technology licensed from Nationwide Children's Hospital (NCH). Deep Lens' CEO Dave Billiter helped develop the technology during his 10 years as Director of Informatics at The Research Institute at NCH.

Deep Lens is offering VIPER and related AI-based decision support tools free of charge to pathology groups that ship them their slides. Deep Lens plans to make money by selling the data it collects to biopharma customers for help with clinical trial recruitment.

Ibex Medical Analytics (Tel Aviv, Israel) recently raised $11 million from a series A round led by Israel-based venture capital fund aMoon Fund. The company has now raised a total of $14 million since being formed in 2016.

Ibex's initial product is the Second Read system for prostate core needle biopsies diagnosis, which has been clinically deployed for more than one year at Maccabi Healthcare Services, a coordinated HMO and health system that serves two million members in Israel (25% of the Israeli market). Ibex has access to millions of pathology slides through its strategic collaboration with Maccabi.

Ibex's Second Read system analyzes prostate cases in parallel with human pathologist review and identifies discrepancies between pathologist diagnosis and its own AI analysis. When a discrepancy is detected, the case is sent back for additional pathologist review.

Nucleai (Tel Aviv, Israel) raised $5 million from a seed round of funding in early 2018 led by Vertex Ventures and Grove Ventures.

Nucleai was founded in 2017 by three vets from an elite Israeli satellite imagery military intelligence unit (IDF Intelligence Corps 9900 unit). The founders, CEO Avi Veidman, CTO Eliron Amir and Lotan Chorev, Vice President of R&D, have applied the technology to computerized analysis of biopsies.

Nucleai's platform assists pathologists by pre-scanning slides to identify areas of potential abnormality thereby allowing pathologists to focus on areas of interest. The company is currently focusing on prostate, breast and colorectal cancers.

Google AI, a division within Google dedicated to AI research, has created an AI algorithm, dubbed LYNA (Lymph Node Assistant), that assists pathologists in evaluating lymph node biopsies. In a study recently published in *The American Journal of Surgical Pathology* (December 2018), six pathologists reviewed 70 digitized slides of lymph nodes for metastatic breast cancer both with and without assistance from LYNA. In the AI-assisted mode an algorithm was used to identify and outline regions with high likelihood of containing tumor. AI-assisted pathologists demonstrated higher accuracy than either the algorithm or the pathologist alone. In particular AI assistance increased the sensitivity of detection of micrometastases (91% vs. 83%). In addition, the average time for a pathologist to review a digitized slide was only one minute, compared with two minutes without the tool.

Company	Headquarters	Founded	Total Funding	Investors
Deep Lens	Columbus, OH	2017	$17.5M	Northpond Ventures, Rev1 Ventures, Sierra Ventures, Tamarind-Hill Partners
Google AI	Mountain View, CA	2017	NA	Google
Ibex Medical Analytics	Israel	2016	$14M	aMoon Fund, Kamet, 83North, Dell Technologies
Nucleai	Israel	2017	$5M	Vertex Ventures, Grove Ventures
Paige.AI	New York, NY	2018	$25M	Breyer Capital
PathAI	Boston, MA	2016	$75M	General Atlantic, General Catalyst, Refactor Capital, Eight Partners, Pillar, Danhua Capital, KdT Ventures

Source: *Laboratory Economics* from companies

LabCorp CEO Dave King To Retire

LabCorp has announced that its CEO Dave King, age 62, will be retiring, effective October 31, 2019. Starting on November 1, King will become Executive Chairman of the Board through at least the end of 2020. He will also act as senior advisor to LabCorp's new CEO, Adam Schechter, age 54, over this same period.

Dave King

King has served as CEO for 13 years, starting in January 1, 2007. He originally joined the Company in September 2001 as Senior Vice President, General Counsel, and Chief Compliance Officer.

During the course of his 18 years with LabCorp, King has accumulated 442,660 shares of LabCorp with a current value of approximately $74 million. Since King has been CEO, the company's earnings per share have increased at an average annual rate of 8.5%, while its share price has increased by 6.9% per year.

Adam Schechter

More recently, King has also been serving as CEO of LabCorp's Diagnostics Division since January 1, 2019. A LabCorp spokesperson says the company "continues to seek a top-notch executive to lead our Diagnostics business and expects to have an announcement in the coming months." In the meantime, King will continue to run LabCorp's Diagnostics business until a new leader is named.

Schechter has served on LabCorp's Board since April 2013, and was an Executive Vice President at Merck & Co. from 2010 to 2018.

Health Network Labs' CEO Resigns Abruptly

Health Network Laboratories (HNL-Allentown, PA) announced on June 4 that Peter Fisher, MD, has resigned as President and CEO. "He resigned due to divergence of opinion with the board regarding policies guiding the company," according to a spokesperson at HNL. Fisher had been HNL's President and CEO since late 2011 when he replaced the retiring David Beckwith, PhD.

Attorney Matthew Sorrentino has been appointed acting CEO effective immediately, the company said in a press release. Sorrentino is an HNL board member and is also Chief Legal Officer and Senior Vice President at Lehigh Valley Health Network, which is the majority owner of HNL.

"Sorrentino's strong background in partnerships, mergers and acquisition makes him the ideal candidate to accelerate HNL's growth and success," according to Kathryn Taylor, HNL's Chairman of the Board. She said the board will soon begin a search for a new permanent CEO.

This turn of events suggests that Lehigh Valley Health Network might be considering a sale of HNL, observes *Laboratory Economics*.

HNL is one of the largest hospital-owned independent labs in the nation. It has about 1,000 employees and serves as a core lab for 12 hospitals and provides outreach testing services in Pennsylvania and New Jersey. Total test volume is approximately 8 million billable tests per year. See the January 2019 issue of *Laboratory Economics* for a full profile of HNL.

Spotlight Interview with Arkana Laboratories' Founder Patrick Walker

Patrick Walker, MD

Arkana Laboratories, founded in 2001 as Nephropathology Associates, is a center for esoteric pathology based in Little Rock, Arkansas. While the lab initially focused on kidney biopsies, it has since expanded into several other areas. *Laboratory Economics* recently spoke with founder Patrick Walker, MD.

Besides nephropathology, what other subspecialties do you provide?
We started with renal biopsies at a time when nobody wanted to do it because it requires light immunofluorescence and electron microscopy. It also requires extreme expertise and most places just don't do enough of them to make it worth putting in all that effort. Our main focus has always been renal biopsies, but we also do other esoteric things that people don't want to do. We do medical renal, we do nerve and muscle, as well as focused molecular diagnostics in the renal area, not in cancer. We also do esoteric serologies—things you can't do in a routine lab. We are able to turn around a renal biopsy in less than 10 hours, which requires a lot of support. We have five electron microscopes, 22 technicians, 107 employees and 19 pathologists.

What areas do you serve?
We serve more than 500 hospitals, pathology groups and nephrologists in 41 states across the country.

Are your volumes and revenues growing? If yes, by how much?
This year we'll do more than 18,000 kidney biopsies—medical renal. The first year we opened we did 900. Typical labs do 250 a year. These are highly subspecialized medical renal biopsies for indications such as glomerular disease syndromes, which include nephrotic syndrome and glomerulonephritis. The second indication is unexplained acute kidney injury. The third is renal transplant. We've been growing about 12% per year. We have a mix of Medicare and private payers. We're contracted with many insurance companies. In some cases, we bill the hospital directly, but we also do patient billing.

Do you use digital pathology? Do you believe digital pathology will become widely used in the near future, or is it just for niche purposes?
We use digital pathology every day for teaching and research. Having slides digitized makes a world of difference. We are not using it for diagnosis. My renal biopsy trays have 15 light microscopy slides and immunofluorescence slides. The time it takes to digitize would be too long when we are trying to turn biopsies around in less than 10 hours. We're not there yet in the renal world, but I think it will happen eventually.

What are your thoughts on the current reimbursement environment for pathology services from commercial insurers like Aetna, Cigna, United and BCBS?
As the big insurance companies get even bigger, it's become more difficult for all of us in pathology. They don't answer to physicians or patients—they answer to shareholders. A number of labs have had to shut down their rural outreach because of reimbursement cuts, but we're doing okay because we are so subspecialized.

Do you plan to expand?
We're always on the lookout for things that other pathologists aren't doing, like neuromuscular, which we added about four years ago. We're looking at eye pathology—there's hardly anyone out there doing it. We want to do things that are often viewed as an inconvenience for others. That's what my passion is—making sure patients get the proper diagnosis.

Tell me about the research and teaching you are doing.
With this large volume and a lot of bright, curious people, we have been able to add a research component into rare diseases. We are involved in discovering pathways for renal disease. We do proteomics, genomics and serology. We publish our in-house research in peer-reviewed journals. We're also doing clinical research, where we're working to add patients into clinical trials. In addition, we teach all over the country through webinars and site visits. People also come to us to learn.

What do you see as your biggest challenges?
Our biggest challenge is reimbursement just like it is for all anatomic pathologists. The payers have no clue what to do with knowledge—and experience-based specialties. We're not a machine shop, but they want to treat us that way. The challenge is to change how we are viewed by payers.

What about your biggest opportunities?
The biggest opportunity is for renal biopsy to become more than the diagnostic tool it's always been and become more of a proteomic, morphologic tool. For example, with lupus, there are five major patterns. In the most aggressive one, there are multiple pathways being up-regulated, down-regulated or not involved. With the availability of new, targeted therapies for these pathways, we can laser-dissect the glomerulus, analyze the pathways and suggest the appropriate drug for treatment. We are just starting to work with drug companies to design clinical trials to use available data. We think that's where the future is.

Debt Collection Company Hack Affects 20+ Million Lab Patients (*cont'd from p. 1*)
Quest Diagnostics says that it was notified by AMCA of the data breach on May 14. AMCA said that an "unauthorized user" had gained access to social security numbers, credit card numbers, bank account information and other sensitive data from up to 11.9 million Quest patients between August 1, 2018 and March 30, 2019. Quest says that patient lab test results are not provided to AMCA and were therefore not affected by the hack. Quest has suspended sending collection requests to AMCA.

LabCorp says the data breach may have affected 7.7 million of its patients referred to AMCA. LabCorp has ceased sending new collection requests to AMCA and stopped the agency from working on any of its pending collection requests.

OPKO Health Inc. says that 422,600 of its patients may have been impacted by the hack through its subsidiary, BioReference Laboratories (Elmwood Park, NJ). BioReference has not sent any new collection requests to AMCA since October 2018, and has requested that it stop working on any pending collections.

In a statement, AMCA said it was notified of a potential data breach by a security compliance firm (i.e., Gemini) that works with credit card companies, which resulted in the collections agency conducting an internal review and then taking down its web payment page. As of early June, Gemini said that it can verify more than 200,000 compromised payment records related to the breach, and that more records are continually being added to dark web marketplaces.

Meanwhile, at least six state attorneys general—in Michigan, New York, Minnesota, North Carolina, Illinois and Connecticut—are now investigating the breach.

Latest Medi-Cal Private-Payer Payment Survey Underway

California's Medi-Cal lab fee schedule has been pegged to private-payer rates since 2015. California's Department of Health Care Services (DHCS) is currently in the midst of its fourth private-payer rate survey, which will be used to set Medi-Cal reimbursement rates for clinical lab and pathology services next year.

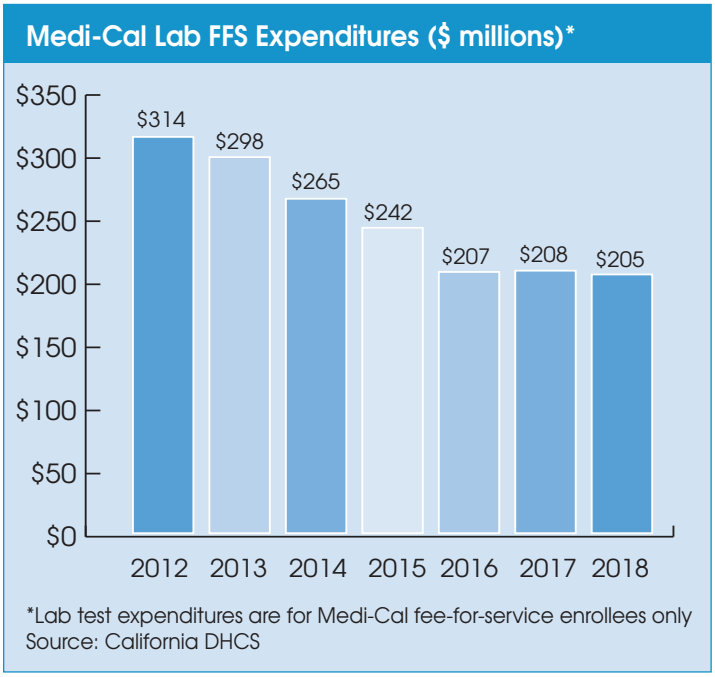
Approximately 300 independent labs, hospitals and pathology groups in California are required to submit their 10 lowest private-payer rates received in calendar year 2018 for approximately 270 high-volume lab and pathology CPT codes. The deadline for reporting the data to DHCS is June 30, 2019. The newly calculated Medi-Cal rates will be announced in June 2020 and will become effective July 1, 2020.

Labs are required to report if they have Medi-Cal paid claims volume of 5,000 or more per year, or Medi-Cal payments of $100,000 or more. Over the past three surveys, an average of about 100 labs per survey actually reported, representing less than 30% of the required labs. DHCS has the authority to suspend providers that are required to report, but fail to do so. However, no lab suspensions have occurred to date.

Medi-Cal's transition to using private-payer lab rates has helped it slash its expenditures on lab testing for its 2.3 million fee-for-service (FFS) members from $265 million in fiscal year 2014 (ended June 30) to $205 million in fiscal year 2018. Medi-Cal lab expenditures have also been tempered by a steady movement toward Medi-Cal managed care plans. Managed care plans are paid on a capitated basis, and they manage member care and negotiate and establish their own rates with their contracted providers. There are currently 10.7 million Medi-Cal members covered by managed care plans.

Medi-Cal currently reimburses clinical lab tests for FFS members at an average of approximately 79% of the Medicare CLFS for 2019. Medi-Cal rates for anatomic pathology services (i.e., CPT 88305) are set at approximately 60% of current Medicare Physician Fee Schedule rates.

The current Medi-Cal private-payer survey is especially interesting because it may provide an early glimpse into future Medicare CLFS rates. It will provide an early indication of the extent to which private health insurance plans in California were influenced by the first PAMA-directed 10% rate cut to the Medicare CLFS that took effect January 1, 2018.



It should also be noted that most Medi-Cal providers, including labs, remain subject to the Assembly Bill 97 (AB 97) 10% payment reduction that was enacted during the California's budget crisis of 2011. Because AB 97 is a payment reduction, not a change to the actual rates, the 10% cut comes off the listed Medi-Cal fee schedule rates. The 10% payment reduction authorized by AB 97 has no sunset date.

Top 20 Medi-Cal Laboratories

The largest Medi-Cal lab provider is The Genetic Disease Screening Program (GDSP) of the California Department of Health, which received $29.5 million of Medi-Cal FFS payments in calendar year 2018, according to the latest available data from DHCS. The Genetic Disease Screening Program provides prenatal and newborn testing services to Medi-Cal recipients.

Quest Diagnostics is second largest, with $29.4 million of Medi-Cal FFS payments. Planned Parenthood, which tests for sexually transmitted diseases, received $24.7 million, followed by LabCorp at $8.8 million.

The largest academic medical centers and hospital outreach labs on the list are Dignity Health, with $3.3 million of payments, followed by Children's Hospital of Los Angeles, $2.5 million, and Loma Linda University, $2.2 million.

In total, the top 20 lab organizations collected $127.9 million of Medi-Cal lab test payments for FFS patients in 2018.

Top 20 Medi-Cal FFS Labs in 2018

Provider	*Reimbursements Paid (FFS Only)*
CA Dept. of Health-Genetic Disease Branch	$29,480,888
Quest Diagnostics	$29,430,089
Planned Parenthood	$24,728,274
LabCorp	$8,797,775
Dignity Health	$3,254,562
Latara Enterprise (dba Foundation Laboratory)	$3,237,767
Whitefield Medical Labs	$3,170,842
Alpha Clinical Lab Inc.	$2,727,436
Biological Laboratory Inc.	$2,685,415
Family Planning Associates	$2,675,343
Medical Diagnostic Laboratory	$2,466,299
Children's Hospital of Los Angeles	$2,453,432
Primex Clinical Labs	$2,202,512
Loma Linda University	$2,180,461
BioCorp Clinical Lab	$1,643,948
Physicians Immunodiagnostic Lab	$1,574,914
Santa Clara Medical Center	$1,340,348
County of San Bernardino	$1,308,036
Laboratory Medicine Consultants	$1,292,523
Regents of the University of CA	$1,259,663
Total for Top 20	$127,910,527
300+ other labs	$77,562,041
Grand Total	$205,472,568

Source: California Dept. of Health Care Services

ASCP Survey Raises Concerns About Lab Employee Shortages

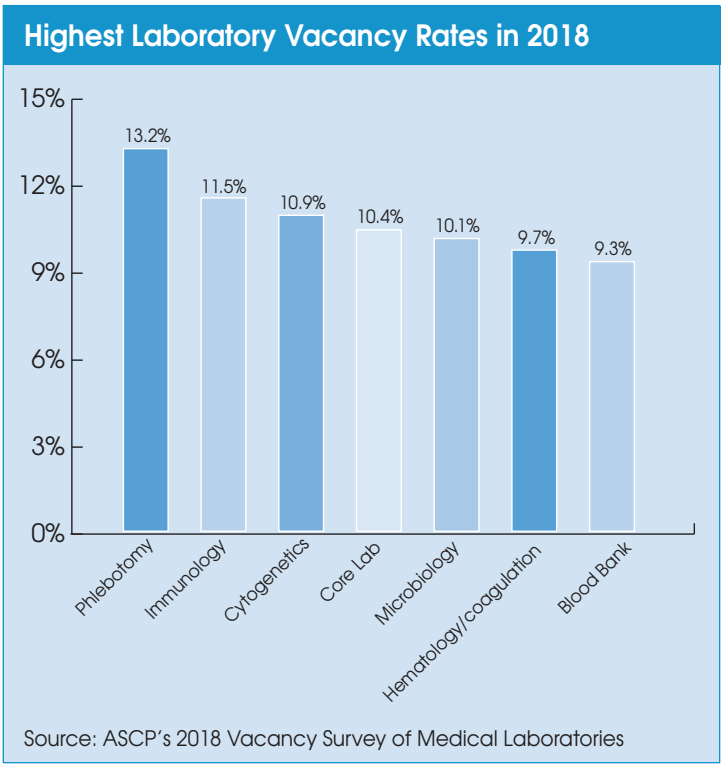
Results from the most recent vacancy survey conducted by the American Society for Clinical Pathology (ASCP) in 2018 show that vacancy rates are considerably higher in most lab departments compared to findings from 2016. The total vacancy rate for anatomic pathology (AP), for example, is 7.5% compared to 4.7% in 2016. For cytology, the 2018 vacancy rate was 7.1% compared to 4.8% in 2016, and immunology has a vacancy rate of 11.5% compared to 6.7% in 2016.

Phlebotomy had the highest vacancy at 13.2% in 2018, up from 8.1% in 2016.

According to the survey, published in the June 2019 issue of the *American Journal of Clinical Pathology*, almost 13% of all AP employees are expected to retire in the next five years. This is actually a decrease from 2016, when almost 16% of all AP employees said they planned to retire in the next five years.

Survey data was based on 1,195 respondents across the United States who currently hold a management-level position or human resources position and are able to discuss the vacancies at their current place of employment. These respondents represent 34,059 employees from across the country.

"The most significant results we found were the increased vacancy rates in 2018 versus 2016 and the decrease in retirement rates in 2018 versus 2016," explains Edna Garcia, MPH, ASCP's Director of Scientific Engagement and Research and author of the report. "We think that those who reported that they will be retiring in past years have now retired, leaving the lab with a need for more incoming lab professionals. We suggest a vigorous recruitment campaign should be put in place now to address the shortage in the future."



The Long-Anticipated Pathologist Shortage May Be Here

Separately, a study published online on May 31 in *JAMA Network Open* showed that between 2007 and 2017, the number of active pathologists in the United States decreased from 15,568 to 12,839 (-17.5%). Over the same 10-year period, the estimated number of new cancer cases in the United States increased from 1 .445 million to 1 .689 million (+16.9%). The study (*Trends in the U.S. and Canadian Pathologist Workforces from 2007 to 2017*) suggests that while the current U.S. pathologist workforce is insufficient, there are new technologies on the horizon, including artificial intelligence, which may decrease the need for pathologists. The study is available at: (https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2734800).

Lab Stocks Up 34% Year To Date

Eighteen lab stocks have risen by an unweighted average of 34% year to date through June 12. In comparison, the S&P 500 Index is up 15% so far this year. The top-performing lab stock thus far in 2019 is Guardant Health, which has jumped 133%, followed by Veracyte, up 115%, and NeoGenomics, up 81%. Shares of LabCorp are up 32%, while Quest Diagnostics is up 19%.

Company (ticker)	Stock Price 6/12/19	Stock Price 12/31/18	2019 Price Change	Enterprise Value ($ millions)	Enterp Value/ EBITDA	Enterp Value/ Annual Revenue
LabCorp (LH)	$166.47	$126.36	32%	$22,900	12.0	2.0
Quest Diagnostics (DGX)	99.50	83.27	19%	17,810	11.9	2.4
Sonic Healthcare (SHL.AX)	27.43	22.11	24%	14,100	15.2	2.4
Exact Sciences (EXAS)	112.28	63.10	78%	13,760	NA	26.2
Guardant Health (GH)	87.62	37.59	133%	7,490	NA	67.8
NeoGenomics (NEO)	22.86	12.61	81%	2,270	55.7	7.3
Myriad Genetics (MYGN)	24.44	29.07	-16%	1,850	15.7	2.2
Genomic Health (GHDX)	52.39	64.41	-19%	1,750	37.6	4.3
Natera (NTRA)	24.59	13.96	76%	1,740	NA	6.7
Invitae (NVTA)	19.08	11.06	73%	1,570	NA	9.8
CareDx (CDNA)	38.12	25.14	52%	1,450	NA	16.4
Opko Health (OPK)	1.92	3.01	-36%	1,300	NA	1.4
Veracyte (VCYT)	27.01	12.58	115%	1,050	NA	10.4
Enzo Biochem (ENZ)	4.31	2.78	55%	188	42.2	2.2
Psychemedics (PMD)	9.85	15.87	-38%	50	5.5	1.2
Cancer Genetics Inc. (CGIX)	0.18	0.24	-23%	26	NA	1.0
Interpace Diagnostics (IDXG)	0.70	0.80	-13%	20	NA	0.9
Biocept (BIOC)	0.98	0.86	14%	7	NA	2.0
Unweighted Averages			**34%**	**$89,331**	**24.5**	**9.2**

Source: *Laboratory Economics* and Capital IQ