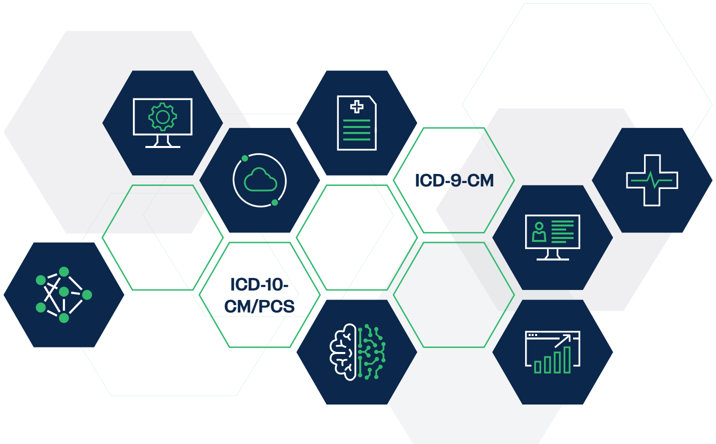
The Evolution of Coding: Understanding How Technology is Assisting Us

Contents

Coding and coding technologies have undergone a dramatic – and rapid – evolution. What began as a manual, paper-based process involving massive ICD-9-CM diagnostic and procedural code manuals, typewriters, and file folders has in the span of a few short decades transformed into a highly specialized digital cloud-based process bolstered by predictive analytics, artificial intelligence (AI), and natural language processing (NLP).



In the early days of the profession, medical coders were primarily in hospitals. Once the patient was discharged, they would work with the facility's chargemaster and the patient chart containing upwards of 80-100 pages of handwritten notes to cull codable details of the patient encounter by referencing coding manuals. These were then entered manually into the facility's database or billing system as an electronic code.[1]

It was a paper-based, error-prone, inefficient system with few real alternatives as personal computers (PCs) were financially out of reach for all but the largest healthcare facilities. All that changed with the technology boom of the 1980s, followed by the years-long transition to ICD-10-CM/PCS, both of which forever altered how and how much patient information was collected and managed. Handwritten documentation, typewriters, dot matrix printers, and fax machines gave way to digital records, clearinghouses, and portals for immediate and secure information exchange between providers, payers, and patients.[2]

The Evolution of Coding – A Timeline

Yesterday

1960s
- Electronic health record (EHR) systems first appear.

1970s
- Regenstreif Institute develops the first electronic medical record (EMR) in 1972.
- Hospitals and physician practices began using "minicomputers" for billing and other financial applications.

1980s-1990s
- In 1992, the Institute of Medicine sets the goal of all physicians using computers in their practice by 2000[I].
- PCs, local area networks (LANs), and Internet access becomes more affordable, increasing their uptake in healthcare.
- With the PC comes the "mouse interface" and the convenience of drop-down menus.
- Encoder software enters the healthcare mainstream, accelerating searches, increasing accuracy, and streamlining the overall coding process. systems first appear.

Mid-1990s
- Integration of computers into the clinical process begins, bringing with it automation of tasks such as order entry, results reporting, and some nursing applications.

1.

The Rise of Coding Technology

The first major impact of the tech boom of the 1980s was the emergence of more affordable, powerful, and compact hardware. PCs, local area networks (LANs), and the Internet became more prevalent, providing faster and easier access to medical information. The PC also introduced the "mouse interface" with user-friendly (for the times) pull-down menus, pop-up lists, buttons, multi-page forms, and scrolling fields. Help screens, control functions, audit trails, and exporting data to statistical packages for analyses were also part of the new normal.[3]

The next evolution could be considered the rise of encoder technologies. These accelerated searches, increased coding accuracy, and streamlined the overall process by using a terminology tree that starts at the main levels and branches out with each selection until, ultimately, the most specific set of codes is identified. Some encoders at the time included a computer-assisted coding (CAC) element that suggested codes associated with diagnoses that may otherwise have been overlooked in the documentation – further accelerating the process and boosting accuracy.[4]

By 2015, electronic health record (EHR) systems had made their way more deeply into the mainstream. Physicians began documenting electronically, and networks of microcomputers were used to write inpatient orders that were linked to the EHR. Patient data management systems enabled automated management of patient records, which could be connected to bedside monitoring devices to record and interpret patient data in the EHR. Departments including pharmacy, laboratory, surgery, radiology, respiratory therapy, and infectious diseases were interfaced with records systems, although manual authentication remained a requirement.[5] Cloud-based systems were also growing in popularity.

1999[II]

- The Leapfrog declaration requiring physicians to begin to use computers for order entry or see their hospitals "blackballed".
- Practice management vendors begin developing EMR systems to automate the physician's clipboard and provided a medical history of patient treatment within the physician's office.

Early 2000s

- Computer-assisted coding (CAC) solutions start to take hold, growing in popularity for their ability to suggest codes associated with diagnoses that may otherwise have been overlooked in the documentation and further accelerate the overall coding process.

2004

- The Office of the National Coordinator of Health Information Technology is created and the call for a nationwide implementation of EHRs by 2014 is issued.

2009

- The American Recovery and Reinvestment Act (ARRA) 2009 was signed into law, and with it came the HITECH Act and Meaningful Use regulations.

These advances brought with them new tools that bolted onto EHRs and allowed coders to work directly in the patient's electronic record, aggregating data and quickly looking up chart information to populate billing and procedure codes. While EHRs and associated tools made the coding process light-years faster than its manual predecessor, it was not without challenges. Coders were working with third-party modules on legacy EHRs, requiring them to switch between multiple systems to collect the required information and compare it to the chargemaster, reference code books, and other information sources to arrive at the appropriate clinical codes for the case.

In other words, despite going digital, coding remained a labor-intensive post-discharge process that often resulted in suboptimal reimbursement.

2015

- EHR systems were more deeply mainstream, driving adoption of electronic documentation and networking for inpatient orders.
- Patient data management systems enabled automated management of patient records and could be connected to bedside monitoring devices to feed data directly into the EHR.
- Interfaces were established with departments including pharmacy, laboratory, surgery, radiology, respiratory therapy, and infectious diseases.
- The popularity of cloud-based systems accelerated.

Today

2010-2020s

- CAC is enhanced with natural language processing (NLP), allowing the technology to electronically review notes within the EHR and apply system logic and standard coding rules to propose and group DRG codes based on the presence of diagnostic words and/or phrases.
- Clinical Documentation Integrity (CDI) tools are being used to improve provider documentation and ensure it supported ICD-10's higher specificity levels.

2.
Coding Technology Today

The tipping point that brought us to the coding technologies of today was the transition to ICD-10-CM/PCS, a nearly decade-long process that came to fruition in October 2015 and brought with it a vastly increased number of codes – from about 14,000 to more than 70,000 – and a completely new classification system[6], both of which threatened coder productivity. Technologically, the transition required system upgrades and enhancements to ensure they were compliant with the code set and capable of supporting both classification systems as, at the time, some private payers (e.g., worker's compensation plans) were not required to transition to ICD-10.[7]

ICD-10 also exposed weaknesses in documentation processes – a critical issue as clinical documentation is considered by many to be the cornerstone of medical information and the foundation of patient care as the permanent record of a patient's history, diagnoses, tests, and treatments. In addition, accurate clinical documentation and subsequent coding can help ensure appropriate reimbursement and reporting of quality metrics under value-based purchasing methodologies.[8]

Eliminating documentation issues and complying with the mandated ICD-10 transition led provider organizations to demand tools that would make the coding process easier and more efficient while also ensuring compliant documentation capable of supporting ICD-10's higher specificity levels. The answer was markedly enhanced CAC software and the addition of Clinical Documentation Integrity (CDI) tools designed to improve provider documentation for enhanced patient outcomes and data quality, and more accurate reimbursement.[9]

- Cloud-based CAC and audit tools are integrated into a single platform, allowing coders, providers, CDI staff, and auditors to collaborate across a shared workflow.
- NLP and artificial intelligence (AI) were applied to CAC and CDI to automate chart analysis.
- Predictive analytics now provides organizations with deeper insights into performance gaps and coding documentation trends impacting reimbursements.

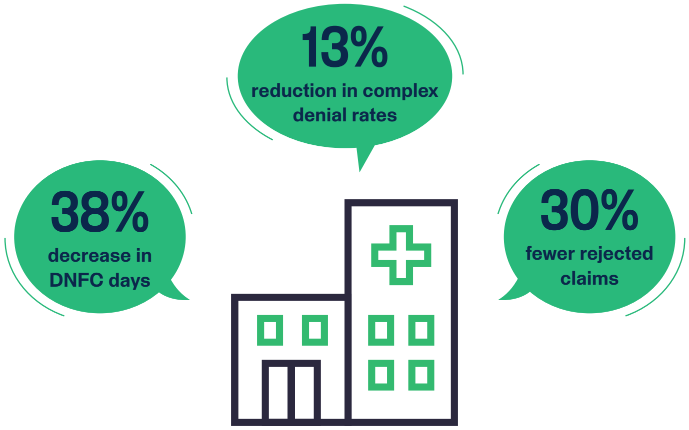
Tomorrow

2020s and Beyond

- Coding alert technology is emerging that works in the background of CAC, scanning documentation against a database of procedures and terminologies, alerting coders to possible opportunities, and pointing back to where in the record it found the information.
- Autonomous coding is nearing fruition, bringing with it the promise of a fully automated solution capable of "understanding" unstructured clinical notes that rapidly and accurately codes charts without any human intervention.

This was the case for a 470-bed academic medical center in New York, which sought out a CAC solution to offset anticipated productivity losses due to the change-over to ICD-10, which was expected to negatively impact discharged not final billed (DNFB) and hospital cash flow. Instead, with the addition of CAC, coder productivity increased by 33 percent and there was no measurable impact on DNFB or Case Mix Index (CMI). By comparison, similar facilities at the time were experiencing coder productivity losses of between 10 percent and 50 percent.

Further, the medical center's discharged not final coded (DNFC) decreased by 38 percent, enhancing cash flow by more than $2.2 million. Complex denial rates also decreased by ~13 percent and rejected claims were down by ~30 percent.[10]



Today's CAC solutions are typically enhanced with NLP capabilities, which allows the technology to electronically review notes within the EHR and apply system logic and standard coding rules to propose and group diagnostic related group (DRG) codes based on the presence of diagnostic words and/or phrases. Coders are then able to accept or decline proposed codes. It is a level of automation that makes it possible to achieve higher coder productivity without an increase in staffing levels.

- Clinical Language Understanding (CLU) is beginning to be integrated with CAC and other technologies, bringing with it the ability to analyze free text within clinical documentation and extract appropriate data for use in a variety of healthcare applications, including coding.
- Having made their mark in other industries, Robotic Process Automation (RPA), also known as Bots, are moving into healthcare and leveraging AI to automate mundane, rules-based processes such as ensuring bundled procedures include all the required codes and modifiers.

[i] https://www.beckershospitalreview.com/healthcare-information-technology/a-history-of-ehrs-10-things-to-know.html?oly_enc_id=3469D1003334B7W

[ii] https://mthink.com/health-care-technology-history-clinical-care-innovation/#:~:text=but%20it%20wasn't%20until,widely%20used%20in%20health%20care.&text=primarily%20involved%20hospital%20billing%2C%20financial%20applications%2C%20and%20physician%20billing

The benefits of NLP-enabled CAC have been proven across healthcare organizations of all sizes and types. For example, a 99-bed acute care facility in Central New York turned to NLP-driven CAC to improve processes and resolve multiple coding workflow and code assignment challenges. The result was a 50 percent decrease in DNFC days and a CMI increase of nearly 5 percent, representing nearly $593,000 in optimized reimbursement. Also realized was a 50 percent improvement in coder efficiency and a vastly improved revenue cycle process with an annual bottom-line impact of approximately $680,000.

The facility's CFO points to several features of the new solution that generated benefits, the most impactful of which were its customizable and easy-to-configure workflows and worklists that improved coders and DRG analyst efficiencies, and auto code suggestions and alerts that helped optimize reimbursements opportunities. The NLP-driven CAC solution also ensured all queries made by coders and CDI specialists were accessible to all users linked to a case, which eliminated query duplication and the need to access multiple systems.[11]

CDI software has grown in importance under value-based care models, which call for greater reliance on risk-adjusted coding and publicly reported quality data. These tools now prompt providers to improve specificity within their documentation to support coder accuracy and appropriate reimbursement under ICD-10. They also suggest query opportunities based on "triggers" that are identified during an automated scan of the record (e.g., documentation, vital signs, lab results, radiology findings, or medications).[12] This allows CDI professionals to review the documentation before and after discharge to identify additional reimbursement prospects and problem areas that can be corrected before claims are submitted.[13]

A growing number of providers and coding outsource vendors are leveraging the cloud to integrate CAC, CDI, and auditing tools into a single cohesive platform. Doing so allows coders, providers, CDI staff, and auditors to collaborate across a shared workflow that follows the patient throughout their encounter. Importantly, integrated cloud-based CAC and auditing platforms enable provider organizations to hone coding and charge capture processes to reduce denials, accelerate payments, and capture correct revenue.

The addition of NLP and AI technologies to the mix enhances these benefits by taking some of the workload and decision-making burden off coders and CDI professionals by automating the analysis of chart contents and prioritizing for CDI specialists those with the highest likelihood of requiring clinician queries. When these tools are embedded into encoder and CAC software to suggest the most likely codes based on clinical indicators, it allows coders to focus on validating or adjusting recommendations based on their review of appropriate chart elements.

The resulting coder-CDI collaboration also generates a higher degree of quality, accuracy and, subsequently, reimbursement. Coder and CDI staffs become more efficient and able to focus more on complex cases while the software manages the routine cases and more easily automated tasks.

Advances in AI- and NLP-enabled coding technologies also allow healthcare organizations to address improper documentation and coding that currently cost the U.S. healthcare system about $54 billion annually.[14] For example, adopting a single path coding model that merges professional and facility coding into a single workflow can significantly boost productivity while increasing clean claims and reducing denials.[15]

Technology is crucial to the success of single-path coding because of the cost involved and the time and effort required to successfully transition from one system to another. The best solutions will bring together NLP and AI capabilities, as well as the ability to process data regardless of the originating format to accommodate disparate systems. In other words, a unified coding platform is key. Also important are robust reporting capabilities, user-friendly dashboards, and the ability to provide feedback to coding professionals and build facility-specific edits.[16]

3.

The Power of Analytics

One offshoot of the broad adoption of EHRs, clinical information systems, and connected devices, as well as the increased documentation specificity required under ICD-10-CM/PCS, was the massive volume of healthcare data collected by the typical healthcare institution. The healthcare industry already generates approximately 30 percent of the world's data volume[17], and International Data Corporation (IDC) predicts that healthcare data will experience a compound annual growth rate (CAGR) of 36 percent through 2025.[18] Globally, the World Economic Forum predicts that 463 exabytes of all types of data will be created each day by 2025,[19] with healthcare contributing ~139 exabytes to that total.

For clinicians, the goal with all this data is a 360° view of the patient – a complete picture of all medical, social, and environmental information associated with the individual to enable precision treatment and optimal outcomes.[20] For administrators, this deep well of information can be tapped to predict everything from utilization to length of stay, driving more accurate discharge planning and resource allocation.

For coders, data analytics can be used to improve productivity, accuracy, and revenue cycle outcomes. For example, the coding team can tell if optimal productivity has been achieved by monitoring everything from begin/end times, average number of charts coded per hour, percentage of charts exceeding standard minutes to code, case assignments, how many systems are accessed per case, frequency of and turnaround times for physician queries, and the volume of coding and non-coding tasks assigned to each coder.

Analytics can also be a powerful tool in reducing claim denials due to coding and documentation miscues, which are behind an average annual loss of $5 million for hospitals and write-offs of up to 5% of a physician practice's net patient revenue.[21] Identifying denial trends is critical as rates are on the rise, having already increased more than 20 percent over the past five years to ~10 percent for hospitals[22] and ~20 percent for practices. Adding to the problem is the cost to rework or appeal denials, which averages $25 per claim for practices and $181 per claim for hospitals.[23]

10%

Increased rates over the past five years for hospital

20%

Increased rates over the past five years for practices

These were the goals of a 212-bed acute care hospital in Ithaca, New York when it integrated cloud-based AI-driven computer-assisted CDI software with its EHR and encoder systems. Specifically, the facility wanted to increase several key performance indicators for the mid-revenue cycle, including CMI, CDI impact on reimbursement, and physician collaboration. Not only did automation redefine the CDI workflow into a streamlined, single process that drove across-the-board improvements to overall mid-revenue cycle system effectiveness, but the cloud infrastructure resulted in a $130,000 savings.[24]

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Applying predictive analytics – a sophisticated analytical technique that goes beyond using data to understand past performance – can help healthcare organizations reduce costs and increase revenues by providing insights into performance gaps and coding/documentation trends that are driving down reimbursements and driving up denials. Predictive analytics leverages historical data, AI algorithms, machine learning (ML) and NLP to identify denial trends and documentation and coding miscues that lead to over- and under-coding, the latter of which is akin to leaving money on the table.

In addition to optimizing the revenue cycle, data analysis and predictive analytics can facilitate more timely interventions by generating alerts and reminders and matching patient needs with available services – reducing 30-day readmission rates and supporting reimbursement under value-based care models. It helps minimize third-party audit risks by validating claims before they leave the facility, accelerates the revenue cycle, and reveals waste and fraud.[25]

4.

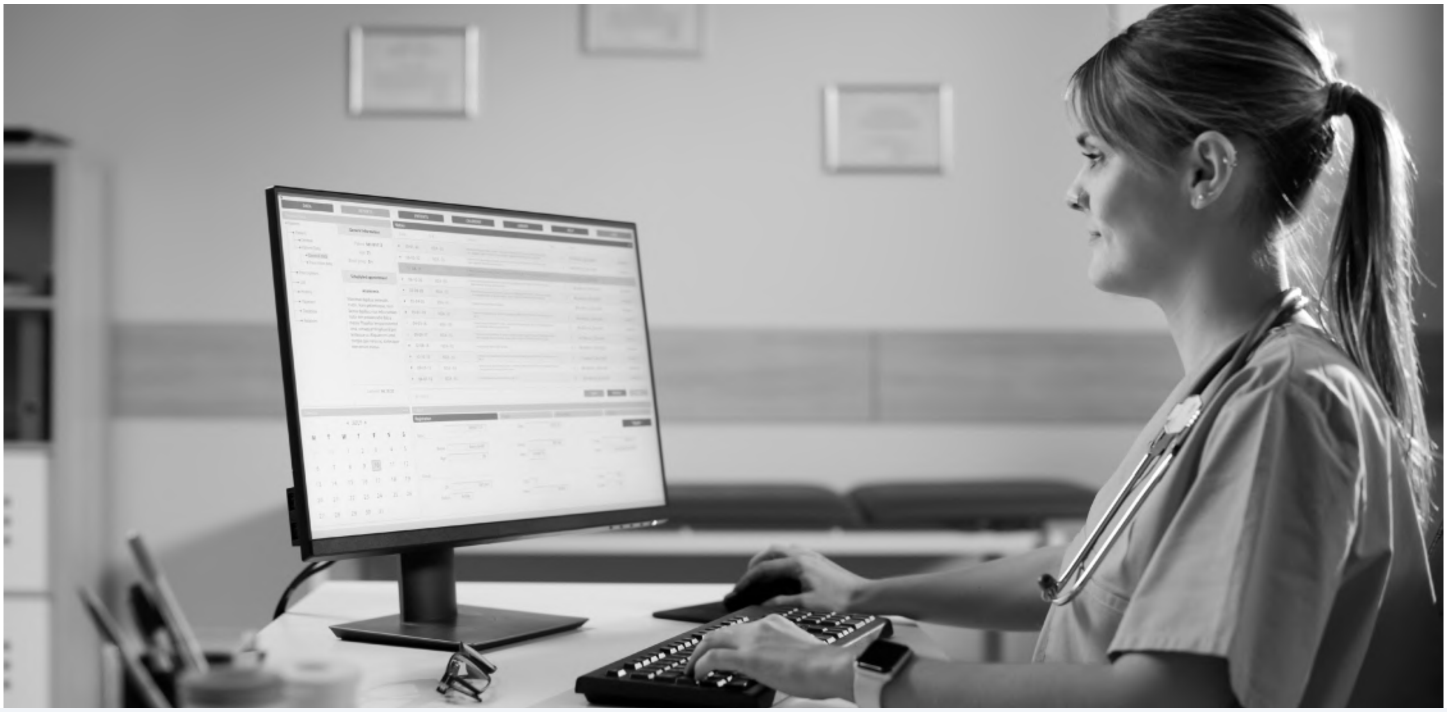
Emerging Technology Trends

Adoption of predictive analytics and the potential already demonstrated by continued advances in AI, ML and NLP have set the stage for emerging technologies that are poised to transform coding into a fully autonomous process in which the coders of today are tomorrow's validators or auditors.

For example, a handful of organizations are experimenting with "coding alert" technology that works in the background of CAC software, scanning documentation against a database of procedures and terminologies, alerting coders to possible opportunities, and pointing back to where in the record it found the information. By providing coders with this kind of predictive insight, revenue losses due to missed procedure coding can be reduced. When coupled with AI/ML to boost its accuracy over time, this enhanced CAC technology accelerates the overall process and will advance coding automation by expanding its potential beyond routine cases.

In fact, as the accuracy of automated coding technology expands, it brings the process closer to full autonomy. Pushing CAC across the last mile to true autonomous coding – a fully automated solution that rapidly and accurately codes charts without any human intervention – requires technology capable of "understanding" unstructured clinical notes. This is where coupling Clinical Language Understanding (CLU) with AI/ML and NLP comes into play.

CLU analyzes the free text within clinical documentation and extracts appropriate data for use in a variety of healthcare applications, including coding. It draws upon clinical knowledge and computational linguistics to create a digital narrative of the physician's documentation. It then applies this understanding to determine what within the documentation is relevant and which codes are most appropriate to assign to the case.[26]



Importantly, autonomous coding technology also understands what it does not know and flags those charts for human review. As such, it promises to significantly accelerate the end-to-end coding process, completing charts in seconds and the full process in minutes, while pushing accuracy levels to near perfect and generating astronomical productivity gains – a 700 percent increase in one pilot program.[27]

Autonomous coding also promises to enhance and accelerate the overall revenue cycle by eliminating missing reimbursement opportunities, backlogs, delays, and claims errors that plague human-centered coding processes. At the same time, it elevates coders by transitioning them into the role of auditor – where they will be supported by yet another emerging technology, bots.

Bots, or Robotic Process Automation (RPA), are AI-powered "digital critters" that are used for repetitive and manual tasks like claims reviews. They have already achieved popularity outside of healthcare and are now making their way into provider organizations to streamline enterprise operations. Bots allow mundane, rules-based processes to be automated, freeing humans to focus on higher-value, mission-critical efforts.[28]

In coding, bots stand in for human auditors on cases requiring only cursory checks, such as ensuring bundled procedures include all the required codes and modifiers. This frees auditors to focus on the more complex cases requiring deeper quality assurance before being released as claims. Adding bots to the coding process at any level of automation can further reduce the risk of denials and, subsequently, lost reimbursements.

5.

Conclusion

Looking back across 50 years of coding technologies reveals a pattern to the catalysts for change. The lion's share of technology advances emerged from an urgent need to accelerate the coding process and improve accuracy, boosting productivity despite ongoing coder shortages and enhancing the revenue cycle by reducing denials and audit risk.

As important as the evolution of coding technology has been to the revenue cycle, failing to appreciate its impact on patient outcomes would be a grave oversight. Over time, the application of CDI, AI/ML, NLP, and CLU have improved clinical documentation, which drives diagnosis and treatment and improves patient outcomes. They allow healthcare organizations to stay abreast of rapidly evolving code classifications, regulatory mandates, and advances in medicine.

As these vital technologies merge into their future state, they will continue driving improvements to the financial stability of provider organizations and forming a solid foundation for success under current and future value-based models of care.

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