



xPatterns
Computer-Assisted Coding

THE FUTURE OF CODING IS NOW

xPatterns Computer-Assisted Coding: The Future of Coding is Now

Features and Benefits:

- Automatically generates medical codes directly from clinical encounter notes
- Maps clinical codes to appropriate billing code
- Detects under-coding, over-coding, and miscoding
- Batch audit of historical records
- Delivers higher coding accuracy and improved billing
- Improves coder efficiency and productivity
- Reduces A/R outstanding days
- Lowers denials and reduces claims reworking
- Configurable workflows for administrators, coders and doctors
- Learns your coding best practices through feedback
- Optimizes from user interaction
- Intelligent analytics
- HL7 compatible
- Cloud-based – Easy to deploy and operate

Atigeo has been on the leading edge of delivering innovative intelligence technology for the last seven years. Our latest product, xPatterns Computer-Assisted Coding (C.A.C.), is the result of an in-depth collaboration between medical professionals and Atigeo's scientists and engineers. xPatterns C.A.C. breaks the mold of traditional coding methodologies to bring exceptional intelligence to computer-assisted coding. This paper explains the differentiated benefits of the product, outlines the intelligence components that make up xPatterns C.A.C., and delineates the reasons why it is the future of coding.

Clinical Encounter Notes—be they physician notes, lab results or discharge records—contain a vast amount of relevant information. In a real sense, these encounter notes are the main repository of data intelligence for hospitals and other healthcare organizations. Quite often, some of the information laden in encounter notes goes undetected, resulting in under-coding and lower claims. xPatterns C.A.C. is the ideal tool for analyzing medical records, discovering all the relevant information within them, and correspondingly, generating accurate codes. For the average engagement, Atigeo anticipates that xPatterns C.A.C. will deliver double-digit percentile improvements in terms of coding accuracy and revenue capture as compared to legacy solutions.

Using state-of-the-art natural language processing (NLP) and proprietary smart pattern matching technologies, xPatterns C.A.C. automatically generates clinical codes directly from encounter notes, and furthermore, infers these to the correct billing codes. Using Atigeo's advanced computer-assisted coding software, hospitals and health organizations benefit from higher coding accuracy, improved billing, faster coding turnaround time, reduced A/R (Accounts Receivable) outstanding days, lower denials and reduced claims reworking. Hospitals and physicians' offices using xPatterns C.A.C. enjoy higher revenues, more cash-on-hand, and lower coding costs per patient.

xPatterns C.A.C. is feature-rich. It includes workflows accommodating the roles played by administrators, coders and doctors in coding. In its audit mode, xPatterns C.A.C. detects under-coding, over-coding, and miscoding, highlighting potential opportunities where higher billing is justified. Financial managers can view real-time dashboards showing coding productivity, organizational trends and other analytics. With xPatterns C.A.C., coders are able to quickly examine the system's recommendations, and then confirm or adjust the codes as needed, thus becoming much more efficient. In place of laborious perusal of encounter notes and looking up codes, with xPatterns C.A.C., the coder's primary tasks become review and validation.

xPatterns C.A.C. uses a combination of innovative inferencing and machine learning algorithms. It incorporates user feedback to learn your coding best practices as it processes your records. Thanks to its sophisticated adaptive technology, xPatterns C.A.C. optimizes from user interaction.

Suite of Products:

- Variants of xPatterns C.A.C. (cloud-based, interactive application for coders):
 - For Hospital Inpatient
 - For Hospital Outpatient
 - For Physician's Office
- xPatterns C.A.C. for Audit
- xPatterns Web Services:
 - For Medical Concept Extraction
 - For Medical Coding Inference

Code Categories (& code sets) supported in xPatterns C.A.C.

- Clinical Codes (ICD-9, ICD-10, CPT and HCPCS)
- Grouping Codes (DRG, APC, E&M)
- Compliance Codes (NCCI edits, OCE, MCE, MUE)
- Reimbursement Codes (RVU)

The xPatterns C.A.C. Product Suite

Atigeo offers a suite of products for computer-assisted coding. There are two main functionalities at the core of all xPatterns C.A.C. product variants:

- Medical Concept Extraction: Analyzes encounter notes using natural language processing and pattern matching technologies, to identify the actionable medical terms or concepts.
- Medical Coding Inference: Generates the appropriate codes. Depending on the encounter type (i.e., Hospital Inpatient, Hospital Outpatient, Physician's Office), different code sets are applicable (for example, ICD-9 Procedure codes are used for Hospital Inpatient, but not in the other cases). The code categories supported in xPatterns C.A.C. are the following:
 - Clinical Codes (ICD-9 Diagnosis, ICD-9 Procedure, ICD-10 Diagnosis, ICD-10 Procedure, CPT, HCPCS)
 - Grouping Codes (DRG, APC, E&M)
 - Compliance Codes (NCCI edits, OCE, MCE, MUE)
 - Reimbursement Codes (RVU)

The cloud-based, interactive C.A.C. web application that can be used by coders to process encounter notes and generate codes comes in 3 variants, which correspond to the 3 main encounter type scenarios. Accordingly, the 3 user-interactive variants of xPatterns C.A.C. are:

- **xPatterns C.A.C. for Hospital Inpatient**
- **xPatterns C.A.C. for Hospital Outpatient**
- **xPatterns C.A.C. for Physician's Office**

Medical concept extraction is essentially the same for all these variants. However, each of them uses the medical coding inferencer differently to surface the appropriate set of codes for each encounter scenario.

Other products offered by Atigeo as part of the product suite are the auditing application and the web services:

- **xPatterns C.A.C. for Audit**
- **xPatterns Web Services for Medical Concept Extraction**
- **xPatterns Web Services for Medical Coding Inference**

These are described in the sections below.

Audit Application:

- Examine historical records
- Discover uncaptured revenue
- Free-to-run, revenue-sharing pricing model

xPatterns Medical Web Services:

- For Concept Extraction, and Coding Inference
- Can be integrated into EMR and Billing Systems
- Seamless integration of advanced C.A.C. functionalities with existing HIT workflow
- Cloud-based, no new hardware or deployment changes needed

xPatterns C.A.C. for Audit: Analyzing Historical Records

xPatterns C.A.C. for Audit is designed to analyze historical records for a hospital or health organization. Millions of prior coded records are examined in batch, with records suspected of being under-coded, over-coded or incorrectly-coded getting flagged, with associated analytics being provided in a variety of categories. With the auditing functionality, a hospital administrator can look deeper into coding accuracy and organizational trends, learn where records can be coded at higher DRG values, and review revenue optimality. xPatterns C.A.C. for Audit provides business intelligence reports illustrating coding errors and anomalies based on a variety of categories: by type of procedure; type of patient status; by insurance provider; by coder; by specialty, and other custom categories.

xPatterns C.A.C. for Audit engagements typically require some level of customization. Atigeo has a free-to-run, uncaptured-revenue-sharing business model for the Audit product. Please contact your Atigeo representative for additional information.

xPatterns Medical Web Services: Integration with your EMR and Billing Systems

xPatterns Web Services provide for the integration of xPatterns C.A.C. core functionalities within your existing EMR and Billing systems. As noted above, Atigeo provides two such products: xPatterns Web Services for Medical Concept Extraction, and xPatterns Web Services for Medical Coding Inference. xPatterns Web Services enable hospitals to seamlessly integrate these functionalities into their overall HIT architecture.

Atigeo has established partnerships with a number of healthcare software providers, and will work with your IT team and your HIT partners on integration projects. Please contact your Atigeo representative for additional information.

Significant Productivity Improvements

The 3 variants of the interactive xPatterns C.A.C. product (for Hospital Inpatient, for Hospital Outpatient and for Physician's Office) share the same UI and workflows. Each provides an integrated, collaborative work environment for coders, administrators, doctors and all roles involved in the coding process. The integrated workflow automation features combined with the intelligent coding functions deliver a high-productivity environment for coders.

The UI was designed specifically with coders' input and participation so it would present the optimal workflow. It is intuitive and easy-to-follow, and minimizes the amount of data entry, screen switching and "busy work" for coders. Notes and codes are shown in adjacent panels to facilitate the review process, and visual and color cues are used to make the screen elements easy to remember and process.

Workflow Improvements:

- Coder-friendly: Designed by coders for coders
- Workflows orchestration for collaborations between doctors, administrators, and coders
- Notes and Codes shown side-by-side; No need for tedious screen switching
- Visual and color cues for easy comprehension and processing

Advanced Analytics:

- Dashboards and Reports
- Insight into revenue forecasts
- Analysis of use of Diagnostic, Procedural and E&M Codes
- Departmental and coder trends

Unlike legacy coding tools that are add-ons to existing applications, xPatterns C.A.C. is a fully-integrated product. Because of this integration, the coder does not need to leave their coding session and switch their work context to another tool or application. Most functions needed by coders are available within a click, and most frequently are pre-arranged for them.

The novel workflow design allows collaboration among coders, reviewers, managers and financial staff. Workflows are designed to be flexible, highly configurable, and adaptive to the users' roles. With many roles supported, such as Coder, Super-coder, and Administrator, the application tailors the user interface to ideally fit each user's profile and workflow process.

xPatterns C.A.C. reduces redundant steps for coders, typically experienced when switching between applications. Faster coding means faster time-to-bill, and earlier cash collection. The impact of xPatterns C.A.C. on reducing your A/R days will be substantial.

Beyond Business Intelligence

xPatterns C.A.C. provides advanced analytics and flexible dashboards that provide deep insight into your coding processes. The dashboard offers a simulated forecast of revenues, and enables you to determine the class of reimbursements you are entitled to. Thus, your organization will become better equipped and more effective in negotiating with payors.

Detailed and summary statistics of coding activity, and analytics on the different code sets utilized by coders will improve the overall coding process for each organization.

Combining Semantics and Analytics

A key advantage of xPatterns C.A.C. resides in its unique combination of semantics and analytics. Legacy systems typically offer either language processing and semantics, or data analytics. Atigeo has combined these technologies into one application that drastically improves healthcare management for physicians, coders and administrators. Unlike other coding systems that require doctors to dictate in a certain template or structure, xPatterns C.A.C. provides complete freedom to doctors, since it can process encounter note text regardless of the format, narrative style and sequence used in dictating notes. With xPatterns C.A.C., doctors can concentrate on providing care rather than dealing with software constraints.

Benefits of Advanced Analysis of Encounter Notes

The xPatterns Medical Web Services provide the needed intelligence for a two-stage coding process. The first stage is medical concept extraction, during which the encounter note is ingested (i.e., read), and the appropriate medical terminologies—such as diagnoses, precautions, medical history, allergies and procedures—are extracted and arranged in a record of the patient encounter. This is done using Atigeo's proprietary natural language

Encounter Notes Analysis:

- Medical records enter via the ingestion pipeline
- Analyzed via a combination of state-of-the-art and proprietary natural language processing techniques
- Cross-referenced with canonical, frequently-updated medical terminology libraries and ontologies
- Real-time analysis performed in the cloud
- Detection of actionable terms and concepts in encounter notes
- Integrated with downstream services for code generation and application of code rules

Coding Accuracy:

- Baseline system provides highest levels of code generation accuracy compared to legacy systems
- Coders provided with easy-to-use interface for review, validation and modification of generated codes
- Adaptive system provides for learning through feedback, enabling per-institution as well as crowd-sourced accuracy improvements

processing software that offers advanced medical terminology detection. Unlike other solutions that only work with structured medical documentation, the Atigeo solution excels at understanding any unstructured document.

The concept extraction service is equipped with a powerful terminology engine that recognizes over 2.7 million medical terms and maps these to diagnosis and procedure codes. The terminology engine incorporates data from over 600 hundred medical ontologies and taxonomies drawn from various highly-recognized medical libraries. The software automates time-consuming manual document review thereby freeing coders to focus on coding review for quality and compliance. This results in a streamlined coding workflow, improved productivity, higher revenues and more timely reimbursement.

In the second stage, i.e., coding inference, the extracted concepts are analyzed to determine the most appropriate clinical and billing-related codes and scores. The result is an automated coding system that helps coders submit accurately-coded, compliant, and audit-ready claims. Ultimately, this translates into earlier and higher-yield capture of revenue. xPatterns C.A.C. also helps mitigate the risk of non-compliance with federal guidelines, providing an additional level of review for quality and accuracy.

Ensuring Coding Quality and Accuracy

A key feature of xPatterns C.A.C. is automatic code recommendations based on prior medical notes and charts. The recommended codes are based on ICD-9, ICD-10, CPT and HCPCS guidelines, plus other important government, provider/payor rules including NCCI edits, as well as OCE, MCE and MUE.

Accurate coding recommendations help coders become more productive and consistent in their coding. Consistency is key to improving quality and accuracy of coding. The system can learn from experienced coders by extracting codes from prior encounter note records and making recommendations when similar diagnoses and CPT patterns are detected.

In a typical xPatterns C.A.C. coding session, coders are prompted with recommended codes based on the underlying algorithms. The applicable code sets and grouper rules are selected based on the date of the encounter.

The system provides justification terms for the recommended codes in a single screen without requiring the coders to leave their coding session. The code justification feature acts as training and reminders to coders so they can associate the proper rationale with the recommended codes.

A Coding System that Learns

Because the logic kernel of xPatterns C.A.C. is an adaptive intelligent system, it can learn both from coders, from and recently-acquired



Auto-Adaptive System:

- Based on the xPatterns Adaptive Platform
- Learns your coding best practices through feedback
- Improves with user interaction

encounter notes and codes. As a result, the coding system becomes more accurate over time. These improvements in coding are then available to coders immediately.

Thanks to the intelligent learning features of xPatterns C.A.C., when coders make corrections, the system learns the patterns, and applies the newly-acquired learning to the internal knowledge base. A workflow requiring reviewer validation of any code modification ensures that only dually-checked corrections are applied to learning.

Atigeo periodically updates the code sets as they are released by CMS and other regulatory entities. This update happens seamlessly.. Atigeo recognizes that each care organization is unique and often has specific coding policies and standards. xPatterns C.A.C. offers the flexibility for organizations to add and configure their own unique set of coding and grouper rules. These combined features—the ability to support custom rules, use of prior year coding guidelines when applicable, and hospital-specific coding scenarios—offer a rich set of update capabilities to your coding process.

Best Practices for HIPAA Compliance

Atigeo has implemented several features into xPatterns C.A.C. that are regarded as best practices for HIPAA compliance. Aside from tracking user access, and logging detailed transactions for each record, the application consistently encrypts Personal Health Information (PHI) while the data is at rest or while the data is in transit. Detailed access logging provides other benefits for analytics by providing metrics for productivity, time-to-code, and time spent on rework.

The automated coding solution was designed from the grounds up with security and privacy policies in mind. User access is controlled through multi-stage security checks including authentication and domain access controls. Strong user account names and passwords are enforced, and usage is tracked so that suspicious activity can be detected and flagged.

Realizing the Cloud Advantage

xPatterns C.A.C. is offered as a cloud solution, and can be installed and configured in less than two weeks. The cloud implementation advantages include lower upfront capital expense, and lower cost of ownership. IT support requirements are minimal, both at launch and while in operation. This is a significant improvement over legacy, on-premise installations which typically require significant IT involvement and expenditure.

Another advantage of xPatterns C.A.C. is that software updates happen in the cloud, with no impact to end users. Updates happen regularly (including code set updates) and do not disrupt operation, nor require any IT support.

Additional Features and Benefits:

- Includes best practices for HIPAA compliance
- Cloud-based solution: easy to install, operate and update with minimal IT support
- 3 Integration options with EMR Systems:
 - Via your existing or xPatterns C.A.C.'s HL7 interfaces
 - Web services integration
 - Batch submission of flat files
- Text, Word, PDF formats supported

Three possible EMR system integration options are available: First, you can provide an HL7 copy of an existing interface from your interface engine, or use Atigeo's HL7 standard specification to create a new interface. Secondly, Atigeo supports and can enable a web services integration interface. The third option is for IT to regularly extract a batch file from the EMR system and process this through xPatterns C.A.C.

Rich Document Type Support

Medical documents of various types are supported including any text, Word or PDF documents. In all these scenarios, while coders are not given the option to annotate the original documents, they can refer to the documents easily, and add their comments as needed. A wide variety of clinical notes and note types are supported, including admit notes, surgical notes, diagnostic notes, and discharge notes.

A Remarkable Improvement to the Bottom Line

Improving documentation quality using xPatterns C.A.C., combined with higher quality and accuracy in coding, plus faster coding workflows have a profound effect on improving the health of your patients as well as net gains. Higher accuracy through the entire documentation and coding process translates into higher coder productivity, higher reimbursements and reduced A/R days. The net effect of these benefits can impact your bottom line by double-digit percentile improvements.

The screenshot displays the xPatterns C.A.C. interface. At the top, the header includes the xPatterns logo, 'Sample003 Assigned', and a search bar labeled 'Search Notes'. Below the header, there are buttons for 'Reject', 'Complete', and 'Close'. The main interface is divided into two panels. The left panel, titled 'Notes', shows a 'Cardiology Consultation' note for a patient named [Patient] with a date of service (DOS) of 11/04. The note text describes a 44-year-old female with symptoms of tachycardia, weight gain, and blood pressure increases. The right panel, titled 'Codes', shows a list of ICD9 and ICD10 diagnostic codes, including 'Disorder of thyroid, unspecified', 'Arthropathy, unspecified', 'Overweight', 'Hyperlipidemia, unspecified', 'Tachycardia, unspecified', 'Other hyperlipidemia', 'Essential (primary) hypertension', 'Chest pain, unspecified', and 'Irritable bowel syndrome without diarrhea'. Below the codes, there are sections for 'CPT', 'HCPCS', and 'APC Grouper', each with a count of 1, 0, and 0 respectively. At the bottom of the interface, there are links for 'known issues', 'release notes', and 'support', along with the xPatterns logo and tagline 'connect. discover. act.'

The xPatterns Difference

xPatterns C.A.C. is built atop xPatterns. xPatterns is an application framework for building enterprise-grade, intelligent Big Data applications. The text processing and intelligence components of xPatterns are fully leveraged in xPatterns C.A.C. to achieve state-of-the-art analysis and accuracy.

xPatterns – what's included out of the box

Distributed Processing:

- Scalable, reliable processing
- Scalable, reliable storage
- NoSQL (key/value) storage
- Pig & Hive queries
- Workflows & Scheduling
- High availability
- Backups
- Auto-scaling
- Search, filtering, faceting
- Real-time dataset updates
- Shared schema mgmt.

Advanced Analytics:

- Natural language toolkit
- Supervised learning
- Unsupervised learning
- Concept extraction
- Ontologies
- Plotting & Visualization
- Information Retrieval
- Data Mining
- Scientific computing
- Predictive analytics
- Inference

Framework Features:

- Create & deploy apps
- Scheduled workflows
- Data ingestion, push or pull
- Normalize, filter and de-dup incoming data
- Plug & play analytical tools
- Continuous measurement
- Automated feedback loop
- Data lifecycle management
- Logging & monitoring
- Personalization

The xPatterns architecture consists of an infrastructure layer, horizontal and domain-specific intelligence layers, and development and administrative environment layers. The framework is designed to achieve flexibility to choose the right intelligence components to solve specific Big Data problems using a simple high-level programming language. xPatterns takes care of the management of the runtime environment so that solutions can be readily created to take advantage of Big Data opportunities.