American Academy of Actuaries

Issue Brief

AI Use Cases in Insurance and Pension

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Key Points

- Human oversight remains essential—despite AI's expanding capabilities, human review remains critical for complex, high-stakes decisions to ensure quality, fairness, and accountability throughout insurance operations.
- Health insurance sees the broadest AI impact—members, providers, and payers all benefit, with AI improving care navigation, claims processing, fraud detection, and population health management across the ecosystem.
- The landscape is rapidly evolving—these use cases represent a snapshot of a fast-moving field, with regulatory, privacy, and accuracy considerations continuing to shape how AI is adopted industry-wide.
- Generative AI is redefining what's possible in insurance—while traditional AI has long supported core functions, newer generative AI capabilities are unlocking novel applications across underwriting, claims, pricing, and beyond.

Background & Scope

Artificial intelligence (AI) and artificial intelligence systems (AIS) are not new to insurance. AI has arguably been commonplace for decades, with multivariate analysis using generalized linear models (GLMs) becoming the foundation of many rating plans in the 1990s. Industry and regulatory best practices have evolved to manage these types of AI. Regulatory concerns regarding newer methodologies may be different from those for these historical methodologies.

The recent explosion of generative AI (GenAI) capabilities has shifted the colloquial meaning of "AI" to become nearly synonymous with GenAI. As such, while there are many traditional uses of AI and AIS already in place within insurance companies, supporting decision making in the most fundamental business operations within the insurance and pension industries, this paper largely focuses on more novel uses which have emerged in recent years.

This paper discusses several AI uses across the financial industry including life, health, property and casualty insurance as well as pensions. The use cases provided include many of the use cases known by the authors to be under consideration or used by insurance companies. The list is not exhaustive, and the field is rapidly evolving; the authors acknowledge that other use cases exist at the time of this publication.

Furthermore, there are several applications of AI that will be used within enterprises regardless of industry as a course of doing business (e.g., the deployment of AI-enabled software to mitigate cybersecurity risks or the use of company document search tooling). These uses are considered out of scope for this paper as they are not unique to financial operations.

American Academy of Actuaries
1850 M Street NW, Suite 300
Washington, DC 20036
202-223-8196 | www.actuary.org

Geralyn Trujillo
Senior Director, Public Policy

Use Case Categories

The use cases involve the following operational areas of the insurance industry:

- Claims
- Underwriting
- Pricing/Rate Making
- Reserving
- Marketing
- Finance
- Actuarial Modeling
- Risk and Compliance
- Loss Prevention/Fraud Detection
- Policy Administration
- Customer Service
- Information Technology

Paper Structure

The paper has two sections. The first discusses the use cases of AI in life insurance, property and casualty (P&C) insurance (both personal and commercial), and pensions. These lines of business were covered together due to significant overlap.

The second section covers health insurance. While there is overlap with the other lines, health insurance has unique considerations which warrant a separate section. For example, the impact of AI can be felt across three different perspectives: members, providers, and payer.

The members who were authors of the AI, Data Science, and Analytics Committee are:
Dorothy Andrews, Ph.D., MAAA, ASA, CSPA; Mo Ashab, MAAA, ACAS, ASA; Tom Bakos, MAAA, FSA;
Stephanie Bolstridge, MAAA, FCAS; David Driscol, I MAAA, EA, FCA, FSA; Hsing-Hui (Kay) Fu, MAAA, ASA;
Jed Linfield, MAAA, FSA; Tyson Mohr, MAAA. FSA; David A. Quinn, MAAA,FSA;
Spencer Sadkin (Chairperson), MAAA, FCAS; David Schraub, MAAA, FSA; and Paula Schwinn, MAAA, FSA.

AI Use Cases in Life Insurance, P&C Insurance, and Pensions

Claims

AI can be utilized in many ways to improve claims operations, including the triaging of life and P&C claims, optimizing responses after catastrophe events, detecting opportunities for subrogation, and automating small claim settlements.

Claims Triage

AI can prioritize incoming claims in a claim triaging process by analyzing first notice of loss/injury data, photos, and reports to classify claims by expected severity and complexity, as well as fraud risk. Natural language processing (NLP) can be used to flag emotionally urgent cases or potential fraud by analyzing language patterns such as tone and hesitation. Based on this, simple claims get routed for fast settlement, complex claims get sent to adjusters, and potentially fraudulent claims are routed for investigation. When properly calibrated, this speeds up claims processing, improves customer satisfaction, and optimizes the allocation of claims resources. However, if claims are misclassified, it can result in delaying a payout or overloading senior adjusters.

Claims triage includes the calibration of human review based on materiality. Small or straightforward claims can be paid automatically. Larger claims, newer policies, and other instances that could trigger underwriting or fraud investigation can be routed to humans for review.

P&C Catastrophe Event Response Optimization

AI can be used to predict the impact of natural catastrophes, allowing for proactive claim personnel allocation. By combining satellite imagery, weather forecasts, and policy geodata, AI can estimate which policyholders may be most affected by an event such as a hurricane or wildfire. Post-event, AI can use aerial images to assess damage and further optimize claim personnel allocation. This information can be used to trigger outreach, send support information, or initiate proactive claims checks. This process supports customer trust and continuity of service, while also accelerating recovery. However, misfires may cause confusion or distress if consumers are wrongly impacted.

Detecting P&C Subrogation Opportunities

AI can be used to identify potential third-party liability in P&C claims by reviewing claim details and external data to identify when a third party may be liable, triggering recovery processing. When effective, this application of AI can increase subrogation recoveries and improve profitability by reducing combined ratios. Appropriate human oversight remains important to ensure that recovery efforts are pursued judiciously and do not unduly strain relationships with customers or business partners.

Underwriting

AI can be used to support underwriting activities, including risk selection, property inspections in P&C insurance, medical file summarization in life insurance, co-piloting for underwriters, predicting policy lapses, retention, and other policyholder behavior across life and P&C lines, and verifying property features and commercial underwriting through aerial imagery.

Risk Classification Models

Actuaries can use AI to develop, refine, and apply risk classification models that continuously learn from new loss data, external trends (e.g., weather patterns, traffic changes, infectious disease spread, or vaccine hesitancy), and emerging risk factors. Companies may update their underwriting practices based on these models when they identify sufficient value from the new classification. This application of AI can support competitive pricing while managing profitability. However, risk classification systems which change rapidly can trigger heightened regulatory interest or confuse brokers and policyholders.

AI can assist in the review of insurance applications by analyzing the information provided and making an initial decision to approve coverage, assign rating tiers, or request additional information. This is known under numerous names such as Automated Underwriting, Accelerated Underwriting, Fluidless Underwriting, and Simplified Underwriting.

Support for Underwriters

AI can be utilized as a decision support tool for underwriters. Large language model (LLM)- powered interfaces can help answer underwriting questions, summarize risk reports, automate submission intake, and suggest endorsements based on similar cases. AI can also review policies to provide underwriters with insights related to underwriting action like adjusting deductibles or limits, sending policyholder notices, or nonrenewing policies. For example, when a policy renews after a claim, AI can review claim notes to flag policies where coverage changes could be considered to help re-calibrate exposure. This improves underwriter productivity and promotes greater consistency; however, appropriate safeguards are needed to ensure that AI-enabled insights are balanced with relevant human expertise and judgment in underwriting activities.

Property Feature Verification

AI can be used to analyze images to verify whether certain features of insured properties are present that may affect risk exposure and insured value (e.g., solar panels, trampolines, decks, pools). Images may be provided by policyholders or inspectors or obtained from third-party aerial imagery vendors. AI can also be used to pre-populate property insurance quotes or application inputs, such as square footage or roof condition. Additionally, AI can also evaluate exposure to certain perils (e.g., wind, hail) based on climate data and building characteristics. In wildfire-prone regions, AI can identify the presence of wildfire mitigation strategies for underwriting purposes and recommend mitigation opportunities to policyholders. Images can then be used to monitor changes in property over time, which can prompt coverage reviews or adjustments. These applications can reduce inspection costs and accelerate underwriting decisions; however, incomplete or misleading images may adversely affect the quality of assessments.

Property feature verification using AI can be particularly useful in commercial underwriting. It can analyze images to identify unique features requiring further investigation, such as hazardous activity (e.g., waste disposal), the condition of parking lots, roof-mounted HVAC systems, or the presence of outdoor inventory. AI can support the assessments of outdoor lighting and security features. It can also estimate certain considerations that may impact premium, such as size of vehicle fleets or occupancy of apartment buildings.

Automated Policy Document Generation

NLP can be used to support the drafting of tailored policies. NLP may be applied to customize coverage documents based on client profiles, location-specific regulations, and selected endorsements. This can help reduce manual errors and shorten onboarding time. However, this use of AI requires rigorous compliance and quality control checks to mitigate the risk of language errors, inconsistencies, or omissions.

Pricing

AI can be used to improve the ratemaking process, in telematics data analysis, multi-peril modeling, renewal pricing, health behavior discount, and the analysis of in force business.

P&C Rate Indications

For P&C insurance, rate indication calculations can be made more efficient through the use of AI tools. Routine selections can be made by simple modeling techniques, while more complex or impactful selections can be flagged for human review. Model selections can be back-tested over time to support ongoing model refinement. The degree of human involvement can be adjusted to balance expenses and accuracy.

Pricing actuaries also bring nonquantitative considerations to bear on ratemaking. Considerations such as competitive analysis, weather trends, litigation trends, and the underwriting cycle can be summarized with the assistance of AI. AI can review publicly available competitor filings to identify trends and comparative insights. AI can then provide insights into the insurance market which can inform strategy such as the timing and magnitude of rate changes, while remaining subject to actuarial judgment and regulatory requirements.

In-Force Pricing

AI can be used to assist with the pricing of renewal books. AI can help balance the risk changes and competitive positioning to inform how renewal premiums are set. This protects retention while maintaining margins, while recognizing that changes that are too aggressive risk driving away profitable clients. In life insurance, in-force policies are analyzed regularly to determine if adjustments are needed to the crediting rate, cost of insurance, dividends, and other features. This analysis can also be used to inform product development conversations, reinsurance rate negotiations, and financial reporting calculation (especially under GAAP and IFRS accounting frameworks). AI may inform these decisions, as well as competitive and strategic positioning.

For example, AI can be used to analyze experience of in-force products to provide insights on policy behaviors like lapse rates, rider election, and benefit usage across various policy characteristics (e.g., age, gender, face amount, duration, level vs. post-level term).

Telematics Data Analysis

AI can be used to set usage-based rates in auto insurance. AI analyzes driving behavior from mobile apps or On-Board Diagnostic (OBD) devices, adjusting premiums for considerations like braking, speed, and time-of-day risks. This encourages safer driving and aligns price with individual risk. However, there may be potential privacy concerns and regulatory limitations on how data are used.

In life insurance, AI can be used to quickly and accurately analyze a policyholder's vitals for more personalized pricing subject to regulatory restrictions. For example, some insurers have programs that leverage wearable health trackers in exchange for discounted premiums.

Policyholder Behavior Assumptions

AI can be used to predict policyholder behavior (e.g., lapse, partial withdrawal, ratchet, annuitize) based on market conditions and other factors. These insights can be used for activities like expense allocation, product design, and asset modeling. They can be used to provide more accurate and granular mortality assumptions (e.g., by ZIP code) to more accurately model embedded longevity risk for annuities and mortality risk for life insurance.

Other Applications

Filing and Documentation Support

AI can assist with filing support by drafting responses to narrative filing exhibits, such as model questionnaires. AI can summarize past filings with a state to determine if the filing material can be adjusted to better meet regulatory needs, which speeds up the approval process. After the filing, AI can also be trained on past objections from regulators to produce draft responses to new objections. Human oversight is necessary to ensure that the responses are factual and relevant to the specifics of the filing.

AI can help actuaries keep documentation of their models current. LLMs can compose documentation and reporting for a variety of stakeholders, such as model users, executive audiences, and policyholders. Precept 4 and ASOP 41 issues related to appropriate phrasing for specific recipients can often be dealt with by appropriately framing the prompt.

Automated Regulatory Filings

AI can prepare NAIC and state regulatory submissions by extracting data from policy, claims, and financial systems to populate state insurance department reports (e.g., actuarial opinions and memoranda). This has the advantage of reducing compliance workloads and minimizing errors but changing state rules and regulations require continuous tuning.

Reserving Support

AI can summarize information relevant to reserving selections. For example, it can spot trends across similar lines, regions, and claim developments. This output should be used as one of many sources that actuaries use when making reserving decisions.

Portfolio Insights for Brokers

AI can assist with matching brokers to products based on past performance. AI can also be used to generate insights into a broker's book of business (i.e., loss trends, pricing opportunities, cross-selling ideas, underinsured policyholders) based on submitted policies. Policyholders identified to be at high risk of lapsing can be contacted with retention offers. Leads can be produced based on public information about major life events (e.g., birth of a child, marriage, funerals). The benefits are that this deepens broker relationships and increases premium written. A disadvantage of this is that incorrect data can embarrass or mislead key partners.

Predictive Maintenance Recommendations

In P&C insurance, AI can be utilized to identify potential risks related to equipment before it becomes an issue. For commercial property or fleet insurance, sensors combined with ML can detect patterns and identify potential failures, recommending preventive repairs. This has the benefit of reducing claim frequency and adding value to insureds. However, over-alerting can strain insured relationships or cause unnecessary spending.

Stochastic Modeling Efficiency

Stochastic models, especially those used in life insurance, are notoriously complex due to the large number of calculations required, the platforms the models are run on, and the need to improve efficiency. AI can help actuaries identify which scenarios are most important to focus on so that more resources can be devoted to them. With the help of AI, actuaries can quickly understand the process flow and develop their actuarial expectations without running scenarios that are immaterial to the result.

Pension Actuarial Work

In pension actuarial work, AI can add efficiencies to vetting data submitted for annual actuarial valuations, hence adding sophistication to a process that has already been mechanized using traditional computing technology. Privacy issues remain an important consideration in performing data work using AI. Use of deidentified data and/or a local installation of an LLM may address privacy issues, but caution in this regard is strongly advised. For example, a local installation of an LLM may not provide as much internal confidentiality within an organization as its policies require. AI tools can offer efficiencies in experience studies (which involve review of multiple years of plan experience), but special precautions are advised vis-à-vis the accuracy of the results presented and the treatment of time periods for which experience data may not be available. In the evaluation of economic assumptions, AI may be used to routinely incorporate economic data that is relevant but not an element of the subject plan's experience.

AI tools may be used to read, extract, and evaluate the participant information needed to perform benefit calculation. Plan rules for calculation of benefits have, in many cases, already been automated using existing technologies, but AI can be useful in calculating benefits payable under plans that have small numbers of participants. Additionally, AI can be used to provide follow-up communications to participants and/or plan sponsors where data are missing or appear to be inaccurate. Calculation of pension benefits that do not involve adjustments for actuarial equivalence can usually be made accurately if the prompt contains sufficient detail as to calculation protocols (rounding, averaging rules, etc.). Those that involve actuarial equivalence must be closely scrutinized before they are used.

As in the case of benefit calculations, AI tools can be used to compile plan information to be used in reports to plan trustees and regulatory agencies. It can also be used in the provision of participant service, particularly in defined contribution plans. A major issue for defined contribution plans and their administrators is to ensure that "advice" given to plan participants by AI-powered customer service resources is accurate and does not create liability exposures for plan sponsors.

AI Use Cases in Health Insurance

AI for Members: Empowering Individuals in Their Health Journey

For health insurance members, AI provides practical tools to simplify interactions, improve health outcomes, and save money. By putting personalized insights directly into the hands of patients, AI can transform passive insurance holders into active health managers.

Care Navigation & Support

AI-driven symptom checkers and virtual assistants can help individuals decide whether to seek telehealth, urgent care, emergency services, or self-care. Insurers can leverage chatbots to offer immediate answers about coverage, deductibles, and claim status at any time. AI also powers provider search and matching functions, offering targeted recommendations based on a member's medical needs, preferences, and location.

Personalized Health Management

By analyzing lifestyle, claims data, and wearable outputs, AI can provide wellness recommendations, preventive care reminders, and predictive insights for chronic disease risks. AI can also be leveraged to support medication adherence, lab tests, and follow-ups through reminders.

Future Benefits for Members

Emerging AI tools can deliver proactive alerts for preventive care, make coverage recommendations during open enrollment, and integrate mental health support through AI-guided screening tools.

Cost Transparency & Savings

AI tools can support transparency by generating personalized cost estimates for procedures and medications. For example, an AI tool could suggest a lower-cost, generic drug or flag fraudulent or duplicate services to protect members from unnecessary bills.

Explanation of Benefits (EOB) Plain Language Summary

Generative AI can rewrite EOBs into clearer explanations of coverage, billing, and next steps.

AI for Providers: Enhancing Care Delivery and Efficiency

Healthcare providers face the dual challenge of delivering quality care while managing administrative complexity. AI may help reduce paperwork, optimize workflows, and strengthen patient engagement opportunities.

Care Management & Population Health

AI can also help identify patients at risk for chronic conditions and provide reminders for care adherence. Hospital readmission prediction may allow early intervention to improve outcomes.

Claim Submission

Document automation, provider directory accuracy, and workforce optimization through AI use can streamline operations, allowing providers to focus on care.

a) Automated Data Extraction—AI pulls relevant clinical information from electronic medical records (e.g., labs, notes, history) to auto-populate prior authorization requests.

b) Smart Eligibility & Rule Checking—AI compares patient data to payer rules/ coverage criteria to predict likelihood of approval.

c) Submission Support—AI flags missing documentation before submission, reducing claim denials.

AI for Payers: Driving Smarter Decisions and Cost Control

Health insurance payers face pressure to manage risk, reduce costs, and maintain regulatory compliance. AI may offer opportunities to enhance decision-making and operational efficiency while improving partnerships with members and providers.

Risk Stratification & Underwriting

AI forecasts high-cost claims and chronic disease prevalence. Dynamic underwriting automates low-risk cases, while social determinants of health integration improves risk prediction accuracy.

Claims Management & Cost Containment

Automated adjudication speeds claim processing, while fraud detection prevents waste and abuse. Predictive routing ensures efficient claim handling.

Care & Disease Management

AI highlights high-risk members, drives preventive screenings, and predicts hospital readmissions to reduce costs and improve care coordination. It may also identify which members have care gaps and suggest outreach strategies. AI tools can also help identify potentially missed diagnoses that, if recorded, could help members receive appropriate care.

Provider Network Management

AI can be used to score provider performance, ensure directory accuracy, and help members find high-value care options through cost and quality transparency tools.

New Data Sources

AI can convert electronic medical records notes into machine-readable tables with rows for members and columns for diagnoses, medications, labs, events, and other relevant information. This structured data may improve risk and quality estimates when combined with other claims data. AI can also create statistically representative, synthetic, health data for model development without exposing protected information.

Fraud, Waste, and Abuse (FWA) Detection

AI can identify anomalous billing patterns and generate case summaries for investigators. For example, the federal oversight agency of Medicare and Medicaid, the Centers for Medicare & Medicaid Services, announced an August 2025 challenge to develop AI for fraud detection in Medicare claims.

Conclusions

AI is being used in the insurance industry in functional areas of life and P&C insurance such as claims, underwriting, marketing, pricing, reserving, and other areas. The pensions industry is also feeling the impact of AI usage but to a limited extent when compared to insurance.

In health insurance, AI is becoming the connective tissue of the health insurance ecosystem. For members, AI delivers clarity, affordability, and proactive health management. For providers, AI reduces administrative burdens and supports better care. For payers, AI drives cost control, compliance, and smarter decision-making. Together, these advancements create a health care system that is more efficient, transparent, and centered on patients. The changes described in this paper will most probably affect health care costs. It is up to the health plan actuary to estimate the effects of the new processes with AI on health cost, utilization, and trend.

The American Academy of Actuaries is a 20,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. For more than 60 years, the Academy has assisted public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

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