

# New prediction and discovery tools – from Healthcare to InsurTech –

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## Big data is here to stay – in some form or other

First it was statistics, then data mining, then real-time analytics, then Big Data and Machine Learning and IA. Oh yes, Big Data is already yielding the headlines to Small Data and Thick Data, in case you missed them. What will be the next slogan?

Names and technologies change, but the value of data keeps increasing. Can you imagine an organization that does not store every bit of data it sees – just in case it might be useful later?

Different sectors have embraced data analysis technologies at different speeds. Fintech, marketing, telcos are way ahead of most others. At Amalfi Analytics we have addressed healthcare management, designing new algorithms and data analysis technologies tailored to their cost-benefit tradeoffs. Although this is a risk-averse and slow-moving sector, people change their minds quickly when they see more efficient analysis processes, and as a consequence improvements in outcomes and costs.

## Healthcare, predictive models, risk analysis

For example, we are using predictive models to help manage hospital emergency departments. We predict in real time number of arrivals, number of beds that will be required, and congestion at each of the subsystems (boxes, clinical analysis, imagery, specialists....). Also we can link these predictions to resource needs, and in particular critical staff, such as nurses. This way, emergency department managers can start provisioning before a peak of activity – and chaos – occurs.

We can also flag specific risks for specific patients (complications, sepsis, returning within 48 hours for unsolved issues....). True, it is hard to achieve high accuracy rates patient-by-patient, because that requires integrating several sources of clinical information, which is complex, expensive, and hard to scale. But we repeatedly observe that lower resolution data, easy to access and integrate, provides predictive power that is enough to act cost-effectively on patient collectives. And this is the main managerial concern. Furthermore, as they are standardized data, we can do benchmarking among institutions, and therefore improve collaboratively.

## Patient trajectories, prevention and cost analysis

In a different direction, we have developed algorithms to analyze the temporal evolution of entire populations.

Complex, chronic diseases are difficult to manage and to plan for because they exhibit large variability. This is why indicator-based systems are not up to the task: They are too unidimensional and do not work well in the face of complex interactions among factors and large variability within one disease.

Similarly, most BI-like tools are too notarial (“how many diabetics did I have last year?”) rather than predictive (“how will my diabetics look like in 1, 2, ... 5 years?”). At most, they incorporate simple trend mechanisms that extrapolate linearly from the present to the future. Standards such as the DRG (“Diagnostic Related Groups”) place patients in groups of similar costs for the system, but they are too coarse to predict future evolution of a population.

Our proprietary algorithms split a population of patients in homogeneous “states”. Each state is characterized by the co-occurrence of other symptoms, by its typical cost and resource usage, and by a similar future evolution. Then they discover “trajectories”, the typical futures that patients in each state tend to follow. And then they can project the current population to any given time in the future, by “fast-forwarding” the evolution of each patient from its current state.

## Applications to the needs of insurance?

Society as a whole is becoming more complex and varied. The same complexity and variability that complicates planning and prevention in healthcare also complicates enormously the actuarial computations that insurance companies must optimize.

Although we developed our methods for the healthcare sector, we envision applying them to insurances. In general, they could yield more visibility and anticipation of future costs, mitigating the uncertainty in P&L statements for the following months.

For example, predictive methods for managing absenteeism are 100% applicable to other sectors, both preventive and corrective actions. We can take the point of the view of the employer and that of the mutualities – who pay for a large fraction of the costs of absenteeism, for example helping predict the duration of absences once they have occurred.

The algorithms for discovering patient trajectories should be helpful in:

- Discovering collectives that have higher-than-normal risks and costs. These collectives are sometimes hidden in the data as they are characterized not by a single factor (say, age) but by multiple ones.
- Precisely adjusting insurance premiums to patient profiles. The better you can predict the evolution of your insured mass, and how groups within it will evolve differently, the better you will be able adjust the premiums, with low risk.

- Computing the amount of reserves and provisioning for the future. If you can more precisely predict the expense that your population will generate in the following years, you can adjust your reserves better. Savings can be enormous.

At Amalfi Analytics we look forward to opportunities to transport this new generation of analysis algorithms to the insurance world.

**Tags:** Big Data, Machine Learning, analytics, from HealthcareTech to InsurTech

# Clinical Management with Amalfi Analytics

## Why Amalfi Analytics?

Managers of healthcare institutions devote more and more of their time to analyzing information to manage. This task is carried out with tools such as scorecards with Business Intelligence (BI), but the indicators are partial and provide only inadequate retrospective information for planning. In addition, they are one-dimensional and do not allow to see the multiple relationships that define chronic and complex disease.

## What do we do?

Amalfi offers tools for clinical management decision making. With powerful Machine Learning algorithms, our products generate prospective analyses to predict and anticipate events.

Our modules can be combined according to the needs of analysis, both at territorial and healthcare center levels. The different modules allow:

- Discovery of patterns of patient health problems.
- Analysis of population mobility in a territory and use of resources.
- Analysis of temporal evolution of patients in the form of trajectories.
- Reduction of waiting times in emergencies.
- Hospitalization and readmission risks.
- Absenteeism prediction.

## Features

- Technology developed from actual requirements of clinical managers.
- Platforms focused on the unsolved problems of clinical management, and oriented to cost-benefit analysis.
- Incorporate the latest techniques in Machine Learning and Big Data.
- Analysis adapted to the organization's data: Real-world data.
- Discover complex associations that classical statistics and BI do not allow analyzing.
- Scalable to large volumes of data.
- Speed of execution and interactivity.
- Open platform: Customizable to the needs of each organization.
- Minimum Database requirement – use data already available routinely for the scorecard.
- Very intuitive to use.
- Minimum intrusiveness in existing IT systems.

# Clinical Management with Amalfi Analytics

## Benefits

Our tools offer the overall vision, which allows you to evaluate alternatives, and therefore are ideal for clinical management decision making:

- Faster to obtain conclusions: the manager herself explores and visualizes the data and her intuitions. Facilitates collaboration and sharing of discoveries.
- Discover unwanted variability in therapeutic patterns. Improved protocolization.
- Rationalize polypharmacy.
- Reduce waiting times and risks in emergencies.
- Minimize readmissions.
- Prevent costs due to absenteeism, and perform better staff provisioning.
- At the territory level, facilitate the distribution of resources and the development of health plans, as well as supporting the community approach.

Some figures: 10% reduction in chronic disease care expenditures, 30% of patient referral timeouts, 10% in readmission rate, and up to 20% on unnecessary medication. Very noteworthy reduction of 80% of technical analyst time. Return on investment in less than 1 year.

## How does it work?

Amalfi uses proprietary Big Data tools and methodologies, developed in a leading research group of the UPC, Barcelona.

Our products help in specific areas. They are independent, but combinable:

- ANIS: Analysis of patterns of health problems in complex patients.
- ALOE: Territorial management; mobility and resource use.
- APIS: Optimization of flows and reduction of risks in emergencies.
- ROSE: Hospital readmission prediction.
- ARUM: Prediction and management of absenteeism.
- MINT: A marketplace for hospital beds.

Depending on your needs, we jointly define the modules that your organization will need, analyze the available data sources and how they will be used, and activate the service in the cloud. Alternatively, you can deploy the solution locally or in your private cloud.

# Clinical Management with Amalfi Analytics

The standard implantation protocol includes:

- Initial session with the system team, to support data extraction.
- Basic support of the team for installation/activation.
- Half-day training of users.
- Change management (optional, according to impact).
- Corrective maintenance and technical assistance.
- Evolutionary maintenance (according to contract).

Some of our projects:



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