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Performance Measurement and Management within the Tuscany Health Ecosystem

People, Processes, and Policies

Nicola Bellé, Paola Cantarelli, Veronica Cruciani, Stefano Gandolfi, Alessandro Gazzetti, Francesca Meda, Luca Pirrotta, and Milena Vainieri

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Executive Summary

This white paper is titled “Performance Measurement and Management within the Tuscany Health Ecosystem. People, Processes, and Policies” and is developed under the Tuscany Health Ecosystem project. It presents a comprehensive overview of the region’s healthcare reforms and the supporting decision-making toolbox designed to improve policy-making, management, and service delivery across Tuscany. In recent years, the regional government has undertaken a series of ambitious initiatives to modernize its healthcare system, seeking to create a more efficient, equitable, and resilient model of care. These efforts should always be supported by a comprehensive toolbox of decision-making instruments that integrate behavioral insights, digital technologies, and evidence-based management practices.

The toolbox developed within the Tuscany Health Ecosystem plays a pivotal role in supporting policy-making and managerial decisions. In this perspective, behaviorally informed electronic health records provide an instructive example: they serve not only as repositories of clinical data but also as instruments that shape professional behavior, enhance decision-making, and align workflows across care settings. Usability, integration with real-world routines, and continuous training ensure that these systems enhance safety, consistency, and organizational learning. Predictive alerts, smart defaults, and context-aware recommendations further support evidence-based practice, helping professionals make decisions that are both timely and accurate.

Complementing these technological tools, the Employee Viewpoint Survey captures the experiences, preferences, and behavioral patterns of healthcare professionals. By integrating experimental simulations of decision-making, the survey provides a nuanced understanding of how staff weigh competing demands, interact with organizational processes, and respond to interventions. This approach informs targeted strategies to optimize workflows, strengthen collaboration across institutions, and guide organizational change in a manner that is both participatory and contextually grounded.

Workforce planning is further enhanced through staffing needs algorithms and task-shifting strategies, which estimate personnel requirements based on service demand, structural indicators, and long-term trends. When combined with qualitative assessments and experimental insights, these tools allow managers to reallocate roles, anticipate future workforce requirements, and implement interventions that are evidence-based yet sensitive to the realities of clinical practice.

In parallel, an artificial intelligence-driven Clinical Decision Support System integrated into emergency care platforms supports clinicians in admission and discharge decisions, improving patient flow, reducing waiting times, and optimizing hospital resource allocation. Its transparent design ensures that staff understand and trust its recommendations, while its flexibility allows adaptation to diverse emergency network workflows. As a result, the system strengthens coordination, accelerates discharge planning, and enhances systemic efficiency across the healthcare continuum.

These tools will operate within the broader context of Tuscany’s comprehensive healthcare reform, which aims to improve efficiency, reduce territorial disparities, and ensure long-term sustainability. The reform initiatives cover a wide spectrum, including modernization of medical transport and emergency systems, reorganization of continuity of care, socio-health integration, digitalization, expansion of telemedicine, and optimization of pharmaceutical and energy resources.

Central to translating these strategies into measurable results are advanced systems for performance monitoring, planning, and management. Tuscany leverages three complementary performance management systems: the National Outcomes Program, the New Guarantee System, and the Dartboard Performance Evaluation System. These platforms provide multi-level insights into hospital, territorial, and regional performance, enabling evidence-based governance while aligning financial and operational objectives. By combining behavioral, technological, and performance management tools, this white paper seeks to foster a healthcare system that is preventive, predictive, personalized, participatory, and resilient, ultimately improving equity and the quality of services across the region.

The concluding section of this white paper situates the above lines of applied research within the Tuscany Health Ecosystem in the broader context of behavioral public administration and management in our Country. This section examines behavioral and cognitive insights in Italian public management, exploring how these perspectives inform decision-making processes. It addresses understanding rationality and its limits, as well as the influence of bias, noise, and the architecture of decision-making on managerial outcomes. The analysis highlights behavioral insights in the Italian public sector and the role of experimentation and evidence-based management in improving effectiveness. Tracing the shift from behavioral to cognitive public management, the section concludes with policy lessons and the road ahead, offering guidance for more informed, adaptive, and efficient management of people, processes, and policies.

Toolbox to Support Policy-Making and Healthcare Management

This section outlines a set of practical tools developed to assist healthcare policy-makers and top managers in improving service delivery within the Tuscany Health Ecosystem. These tools are designed to enhance individual and organizational decision-making by strengthening the evidence base and fostering more adaptive, responsive, and sustainable governance. Although distinct in their technological and methodological components, they share a common goal: enabling more participatory and informed policy choices. From digital health records informed by behavioral insights to simulations that explore staff decision-making, to algorithms for identifying staffing gaps and redesigning roles, each tool is conceived as a dynamic asset meant to evolve alongside system needs and professional practices (Figure 1).

Around the world, specialized units have been created to address complex societal and organizational challenges through a scientific lens, using structured tools and evidence-based methodologies that share the same rationale and purpose as our toolbox. These units include the People Lab, the Better Government Lab in the United States, the University of Pennsylvania Nudge Unit, and the European Commission’s Competence Centre on Behavioural Insights. They are dedicated to understanding human behavior in real-world contexts and designing interventions that guide choices toward improved outcomes while preserving individual freedom. They operate at the intersection of behavioral science, data analytics, and policy experimentation, applying rigorous methods such as randomized controlled trials, field experiments, semi-structured interviews and behavioral simulations to test and refine solutions.

The People Lab, the Better Government Lab, and the Penn Medicine Nudge Unit focus on embedding behavioral insights into the design of public services and organizational processes, ensuring that interventions are both effective and contextually grounded. The University of Pennsylvania Nudge Unit specifically applies behavioral science to improve patient care, safety, and operational efficiency within the healthcare system, using evidence-based interventions to influence clinician and patient decision-making. Its relevance for our context lies in demonstrating how behavioral insights can be directly integrated into clinical and organizational workflows, providing a practical model for leveraging nudges to enhance healthcare delivery and workforce performance. Similarly, the European Com-

Figure 1. *Toolbox to support policy making and healthcare management (source: Authors’ elaboration).*

mission's Competence Centre on Behavioural Insights integrates behavioral research into policy development at the European level, providing evidence-based recommendations that inform strategic decisions. Across these institutions, a common principle emerges: the systematic application of scientific methods to identify key levers for change, measure the impact of interventions, and iteratively improve them based on empirical evidence.

By aligning with these international experiences, our toolbox leverages the same scientific approach – combining quantitative and qualitative analysis, behavioral insights, and digital tools – to support evidence-informed decision-making. This approach ensures that interventions are not only operationally feasible but also tailored to the specific dynamics of the workforce and organizational culture. In this way, such multi-professional expert units worldwide provide a model for how a scientifically grounded, carefully structured toolkit can enhance organizational performance, policy effectiveness, and the quality of healthcare services while fostering transparency, accountability, and sustainable improvement.

Behaviorally-Informed Digital Health Records across Settings

Electronic Health Records (EHRs) are far more than mere repositories of patient information – they function as complex behavioral infrastructures that actively shape clinical routines, influence professional behavior, and ultimately affect strategic healthcare outcomes across multiple organizational and territorial levels. As demonstrated in an umbrella review (Belle, Cantarelli, Cruciani, et al., in progress) and reinforced by mixed-methods studies (Belle, Cantarelli, Gazzetti, et al., in progress), EHRs should be regarded as living, adaptive systems that require continuous refinement, careful alignment, and constant calibration at the technological, human, and institutional dimensions in order to remain effective, safe, and relevant over time. Their potential can only be fully realized when they are integrated thoughtfully into broader organizational and governance strategies.

In their umbrella review, Belle, Cantarelli, Cruciani, et al. (in progress) analyzed 522 literature reviews and meta-analyses, published in English in the past five years, that examined factors influencing the efficiency and effectiveness of EHRs in supporting professional decision-making. Studies were included if they explored factors relevant to decision-making through, in, or with EHRs, resulting in a final sample of 199 studies. For each study, bibliographic information was extracted from Scopus, and additional data were gathered using a structured template. Each review was recorded as a single entry in a tabular dataset containing general descriptors – such as review type, number of primary studies, and adherence to reporting guidelines – and an evolving set of EHR-related factors identified iteratively throughout the analysis. The impact of each factor was coded as positive, negative, or mixed/inconclusive, with recommendations also noted. After data extraction, all factors were examined collectively and hierarchically organized into three overarching domains – technological, human, and institutional. Related elements were grouped into aggregated categories with subcomponents where appropriate, resulting in a structured framework for understanding the key determinants of EHR effectiveness in clinical decision-making.

Results show that the technological domain is the most extensively discussed across the reviewed literature, with 108 papers addressing topics such as data management, artificial intelligence, usability, ICT barriers, and software design. Within this group, data-related aspects and artificial intelligence applications were the most frequently examined, reflecting growing interest in how information quality and algorithmic tools enhance clinical decision-making. The human domain was represented in 85 papers and focused on factors related to individual and collective interactions with EHRs. Common themes include user familiarity with systems, behavioral nudges, and patterns of use, with additional attention to collaboration, ethical considerations, and mandated actions. Finally, the institutional domain, discussed in 79 papers, encompass factors shaping EHR implementation and sustainability within healthcare organizations. Key topics included the adoption process, access management, workflow optimization, privacy, and adherence to guidelines, alongside considerations of system customization and evaluation practices. Overall, the distribution of studies highlights the multifaceted nature of EHR effectiveness, with technological, human, and institutional factors each contributing essential but distinct perspectives to understanding decision-support mechanisms in healthcare.

Based on this review, Belle, Cantarelli, Cruciani, et al. (in progress) developed behaviorally informed guidelines for the implementation of EHRs. Usability is central to EHRs effectiveness. Healthcare professionals often operate under intense cognitive load, multitasking, and significant time pressures, which makes it imperative that EHRs are designed for both clarity and operational efficiency. Every screen, data entry field, and interface component should serve a clear, functional purpose, reducing informational noise, guiding user attention intelligently, and supporting clinicians in making evidence-based, consistent decisions. Visual hierarchy, intuitive navigation, and coherent information presentation are not merely interface or aesthetic considerations – they are core features directly tied to patient safety, workflow efficiency, and overall system performance. Moreover, EHR design is never neutral: the way information is structured, highlighted, or concealed can subtly but meaningfully nudge behavior, with direct implications for decision-making, clinical outcomes, and compliance with protocols.

Equally critical is the embedding of EHRs into real-world workflows and existing clinical guidelines (Gandolfi et al., 2025). Systems must be closely aligned with the actual delivery of care across a diverse range of settings – from high-acuity hospital units to home-based and community care – ensuring that technology enhances rather than disrupts team coordination and patient-centered workflows. Embedding must be co-designed in close collaboration with healthcare professionals to reflect real roles, contextual needs, and routine practices. Navigation and interaction design should facilitate multitasking, interdisciplinary collaboration, and the integration of communication tools, shared care plans, and task delegation mechanisms in a seamless and intuitive manner.

Training and ongoing professional development are fundamental for effective EHR utilization. Initial onboarding must be complemented with scenario-based learning, peer mentoring, iterative feedback loops, and continuous skill reinforcement to help clinicians manage complexity, uncertainty, and variability inherent in healthcare delivery. Systems must also provide sufficient flexibility for adaptation to local organizational contexts, while maintaining robust standards for interoperability, data integrity, and quality assurance. Without meaningful training, contextual customization, and continuous support, even highly sophisticated systems risk underuse, circumvention, or inefficient adoption.

Once these foundational elements are established, EHRs can be strategically leveraged as behavioral tools to actively influence professional practice. Thoughtfully designed nudges – including timely alerts, intelligent defaults, and predictive analytics – can support safer, more consistent, and evidence-aligned decision-making. However, these interventions must always be rigorously evidence-based and carefully tailored to local workflows and cultural context: poorly designed nudges may backfire, resulting in alert fatigue, cognitive overload, or resistance among staff. Behavioral features should therefore be tested systematically, for example through randomized trials or quasi-experimental designs, to ensure both clinical and behavioral efficacy.

EHRs also carry substantial strategic weight. Their architecture and content reflect organizational and governance priorities, with design decisions shaping what information is recorded, prioritized, and acted upon. As instruments of organizational control and strategic alignment, they must be closely coordinated with institutional missions, operational objectives, and long-term improvement goals. Effective governance requires oversight by multidisciplinary teams – including nudge units, evidence antennae, or digital health strategy boards (Cantarelli, 2023) – to maintain scientific rigor, ensure ethical standards, monitor impact, and balance innovation with practical operational needs.

Finally, the EHR strategy must emphasize adaptation over novelty. Many digital health systems fail not because of technological obsolescence, but because they are misaligned with actual clinical workflows, organizational culture, or local realities. Rather than rushing to adopt the newest technologies, healthcare organizations may achieve superior results by refining existing systems, incrementally improving usability, and tailoring solutions to the specific contexts and needs of users. In digital health, adopting a smart second-mover approach – focusing on strategic adaptation, evidence-informed design, and careful implementation – can confer substantial advantages, supporting sustainable improvements in patient care, professional performance, and overall system resilience.

Parallel mixed-methods work of an empirical nature by Belle, Cantarelli, Gazzetti, et al. (in progress) nicely aligns with the stream of literature focused on the digitalization of public services (Mergel et al. 2025). The digitalization of public services marks a fundamental transformation in how governments design and deliver public value, moving beyond the mere automation of administrative processes. As outlined by Mergel and colleagues (2019), digitalization entails a reconfiguration of institutional norms, decision-making, and organizational capabilities, emphasizing agility, user-centeredness, and data-informed governance. Expanding this perspective, Mergel et al. (2025)

highlight the importance of stakeholder engagement throughout all phases of public service co-production – from co-commissioning to co-assessment – and identify implementation as a critical stage previously overlooked.

To investigate these dynamics in EHRs in healthcare, Belle, Cantarelli, Gazzetti, et al. (in progress) conducted three online experiments involving 2,257 professionals from public healthcare organizations. Participants evaluated pairs EHRs or healthcare scenarios to identify preferred features. The first experiment, with 207 respondents, showed that professionals preferred EHRs that were easy to use, completed via dropdown menus, faster to fill in, and equipped with patient scales and trend displays. The second experiment, involving 204 professionals, partially confirmed these findings, emphasizing ease of use, patient scales, and trend availability as the most valued factors. The third experiment, with 1,846 respondents, investigated the relative impact of a set of factors on perceived quality of care. Integration among organizational units within the healthcare organization emerged as by far the most influential factor, accounting for roughly 31% of the total effect on quality of care. Next in importance was strong rather than weak integration among multiprofessional teams, which contributes about 16%, followed by action-oriented rather than problem-based alerts in the EHR, accounting for around 15%, and full rather than partial digitalization of health records, which represents approximately 13%. Having an EHR tailored to specific settings rather than standardized across all settings contributed about 9% of the total. The remaining factors each had a relative weight of about 5% on perceived quality of care: the nature of data entry fields (free-form versus preset by default), the degree of workspace flexibility (low, with assigned spaces, versus high, with shared spaces), and the number of alerts in the EHR (few versus many). Overall, it is noteworthy that the combined relative weight of organizational integration factors (around 48%) and EHR architecture factors (around 47%) appears nearly equivalent in shaping the perceived quality of care provided by healthcare organizations. Focus groups and semi-structured interviews with professionals on the features that make EHRs effective provide additional evidence and deepen our understanding of how behavioral-informed digital tools can enhance healthcare management.

Employee Viewpoint Survey with Experimental Simulations of Decision-Making Processes

The employee viewpoint survey is a routinary tool used to assess healthcare professionals' experiences and perceptions regarding working conditions, management quality, communication, training opportunities, and administrative processes. Administered every two to three years in collaboration with regional governments and their healthcare institutions and the Management and Healthcare Laboratory of Scuola Superiore Sant'Anna, the survey combines observational data (Pirrotta et al., 2025) with experimental components (Belle and Cantarelli, 2024a; Belle and Cantarelli, 2024b; Belle, Cantarelli, Cruciani, and Gandolfi, in progress). This combination enables both a broad evaluation of organizational climate and a focused exploration of behavioral dynamics through simulation. The survey supports decision-making in several ways. It gives structured voice to professionals, offering leaders a regular health check of their workforce; it highlights areas that require deeper investigation through interviews or focus groups; and it informs actionable changes by identifying issues that can be addressed with targeted short- and medium-term interventions.

For example, Pirrotta et al. (2025) investigates the critical association of communication and job satisfaction in the success of public organizations, focusing on how training activities and meetings associate with the perceived quality of communication and how this, in turn, relates to employee satisfaction. Drawing on organizational climate surveys conducted between 2019 and 2020 across six Italian Regional Healthcare Systems, the research encompasses data from 58,888 employees and employs linear regression models to analyze the relationships. Findings indicate that high-quality internal communication is positively associated with employee satisfaction, with frequent meetings and targeted communication training emerging as key for an effective communication. For healthcare organizations, these results offer practical guidance, suggesting that structured training programs and regular internal meetings can significantly enhance communication and, consequently, job satisfaction. The study's originality stems from its use of a large, robust dataset, which strengthens the reliability of the findings and broadens their applicability, while also contributing to the understanding of how internal communication processes is related to job satisfaction within public healthcare settings.

On the experimental side, Belle and Cantarelli (2024a), integrating insights from nudge theory with research on prosocial behavior, investigate how carefully crafted messages highlighting the positive social impact of influenza vaccination can influence vaccination intentions among professionals working in public healthcare settings. Specifically, the authors explore whether emphasizing the benefits of vaccination for others – such as family members, friends, and particularly patients – can serve as an effective behavioral nudge to increase both the likelihood of individuals getting vaccinated themselves and their willingness to actively promote vaccination within the workplace. To test this, they conduct an online randomized controlled trial involving a substantial sample of 13,785 healthcare professionals across Italy. The findings reveal that when participants receive a brief message encouraging them to consider the broader positive effects of vaccination on others, their intentions to get vaccinated and to advocate for vaccination in their professional environment significantly increase. By contrast, messages that highlight only the personal benefits of vaccination do not significantly affect individuals' own vaccination intentions and only produce a modest effect on their motivation to promote vaccination among colleagues. Importantly, the effectiveness of these prosocial nudges was not uniform across all occupational roles, suggesting that job type moderates how individuals respond to social versus personal framing. Overall, this study extends both theory and practice in the field of behavioral public administration by demonstrating that targeted nudges can effectively foster prosocial behaviors in workplace contexts, offering a practical and scalable approach to improving public health outcomes through subtle behavioral interventions.

Belle and Cantarelli (2024b), then, conducted four online experiments involving a total of 16,461 public professionals to investigate the causal effects of different reciprocity styles in the workplace on colleagues' expected job satisfaction and motivation. Their results show that the giving reciprocity style – characterized by helping others when the benefits outweigh personal costs – is the supervisory approach that maximizes subordinates' expected satisfaction (Study 1). Moreover, they found that employee motivation is anticipated to be highest when supervisors or colleagues adopt a giving reciprocity style. Interestingly, the motivational boost from a giving peer appears to be stronger than that of a giving supervisor (Study 2). Additionally, Belle and Cantarelli (2024) demonstrate that the expected motivation of existing team members increases when a giver joins their unit, whereas the arrival of a taker – someone who helps only when personal benefits are greater than costs – reduces colleagues' motivation compared to when a taker leaves the team (Study 3). From a practical perspective, Belle and Cantarelli (2024) highlight that the reciprocity style of public employees, whether in supervisory or peer roles, exerts a causal influence on coworkers' expected satisfaction and motivation, independent of leadership style or communication focus. They emphasize that giving is the style most likely to enhance both satisfaction and motivation among subordinates and peers. In terms of human resource management, public organizations are encouraged to consider reciprocity styles as a distinct factor alongside leadership approaches and communication strategies.

As demonstrated by the last two studies mentioned, a particularly innovative feature of the employee viewpoint survey is the integration of choice models to analyze complex decision-making (Belle and Belardinelli, 2024). These models present staff with hypothetical scenarios – such as choosing between positions with different team dynamics, interaction styles (Belle and Cantarelli, 2024b), or digital tools (Belle, Cantarelli, Gazzetti, et al., in progress) – to reveal how professionals weigh competing factors. Beyond simply capturing preferences, choice models uncover decision rules, behavioral tendencies, and cognitive biases that influence daily professional choices. This insight allows management to design interventions that are more attractive, sustainable, and tailored to the specific context of the workforce.

Choice models also enable scenario testing and predictive analysis, allowing managers to explore the potential impact of different policies, staffing arrangements, or incentive structures before large scale implementation. This capability is especially valuable in complex, resource-constrained environments, as it supports proactive planning, minimizes unintended consequences, and aligns interventions with both staff needs and organizational goals. Most importantly, this approach strengthens collaboration among public institutions responsible for promoting health and preventing harm, with environmental protection agencies serving as key partners in advancing these objectives. Experiments by Belle, Cantarelli, and Cruciani (2025) demonstrate how cognitive biases shape policy decisions in discouraging environmental norm violations and encouraging adherence, showing that while financial incentives, penalties, and social pressures can deter undesirable behaviors, they are less effective at fostering sustained compliance. Complementary strategies, such as im-

proved oversight and reduced administrative burdens, are often necessary to serve both ends. Specifically, their study adopts a behavioral management lens and employs experimental methods to investigate how public employees within an environmental protection agency form judgments about organizational conduct. In the first study, conjoint experiments were conducted to assess employee evaluations of companies either breaching (1a) or adhering to (1b) environmental regulations. Results show that the perceived probability of detecting violations and the administrative burdens associated with enforcement consistently shape employees' assessments. However, the significance of economic gains versus losses changes depending on whether the scenario is framed in a negative or positive light, and social norms influence perceptions of violations but have little effect on views of compliant behavior. Study 2a further reveals that employees exhibit risk-averse behavior when dealing with potential gains yet tend to be risk-seeking in situations involving losses. Study 2b identifies a pronounced zero-risk bias, with many employees showing an irrational preference for eliminating risk in one domain rather than achieving a greater overall reduction across multiple areas. The findings carry both theoretical and practical implications. While monetary incentives, penalties, and social pressures are effective tools for discouraging regulatory breaches, they are less effective at promoting proactive compliance. To address both goals, environmental agencies and their managers may benefit from emphasizing targeted oversight and streamlining administrative processes to encourage adherence to regulations while maintaining efficiency.

In parallel, additional work is uncovering the root causes of implicit stereotypes (Belle and Scopis, under review). Implicit stereotypes are widely recognized as a potential source of discrimination, yet understanding the specific triggers and contributing factors remains fragmented. Although numerous studies have explored how implicit stereotypes are activated and investigated the various cognitive, social, and contextual factors that influence them, there has yet to be a comprehensive synthesis that integrates these findings. This gap constrains the development of targeted interventions and hampers the formulation of robust, evidence-based policy recommendations aimed at mitigating bias in decision-making and organizational practices. To address this gap, Belle and Scopis (under review) conducted a systematic search of peer-reviewed studies using experimental or clinical case–control designs. About 83 met the inclusion criteria, yielding a total of 143 reports and 157 experimental manipulations. Across these studies, they identified 89 distinct factors, with 91% demonstrating a reliable effect on implicit stereotype measures, while 6% produced mixed outcomes depending on the specific experimental conditions. To organize these findings, they grouped the factors by conceptual similarity, resulting in seven categories that were further structured into three overarching areas: External, Internal, and Procedural factors. External factors included environmental conditions, contextual information, and target characteristics; Internal factors encompassed conscious strategies, psychological states, and neurological influences; and Procedural factors referred to task characteristics. The review demonstrates that implicit stereotypes are highly malleable and strongly context-dependent, highlighting the importance of considering situational influences in both research and practice. These results provide valuable guidance for policy-makers and practitioners, suggesting that effective societal strategies to reduce unintentional discrimination should account for the wide range of factors capable of shaping implicit biases.

The research methodologies described above one by one becomes even more powerful when integrated into mixed-method designs that combine quantitative and qualitative approaches (Belle, Cantarelli, Gazzetti, et al., in progress; Belle and Cantarelli, under review). For instance, Belle and Cantarelli (in progress) explain that nudging interventions have the potential to improve expert decision-making in public management by promoting more efficient use of scarce resources and ensuring greater equity in treatment. In their study, they employed a sequential explanatory mixed-methods design. In the first phase, they conducted experiments with 2,763 healthcare professionals making prescribing decisions to examine whether they are susceptible to systematic errors (bias) and exhibit variability in choices when presented with the same case (level noise), depending on how choices are structured. The results show that physicians' decisions can be steered in the desired direction through the use of guidelines, cost information, command-and-control mechanisms, reduction targets, and social comparisons. Importantly, their findings demonstrate that nudges can reduce or redirect variability between individuals' decisions, and they compared different measures of noise, including equality in distribution and standard deviation. In the second phase, they conducted 16 semi-structured interviews with healthcare managers to explore how educative and architectural nudges are applied in real-world health systems and to investigate the underlying causes of level noise. This phase advances the application of decision sciences within behavioral public management. The experimental phase indicates that educative nudges help healthcare professionals make decisions more consistent with rational-choice models. Regarding level noise, all experimental conditions – except for the guideline condition – showed significant unwarranted variability between subjects. A key methodological insight is that how noise is measured strongly influences findings: using variance, level noise was detected only in two experiments, whereas assessing equality of quartile distributions across experimental arms revealed significant level noise in all experiments. The qualitative phase complements these findings by highlighting how educative nudges enhance decision-making through knowledge, while architectural nudges guide behavior by shaping the decision environment. The authors also identify a concise set of root causes of level noise. At the individual level, variability arises from differences in bounded rationality, professional background, and expertise, while at the contextual level, discrepancies are linked to variations in guidelines and organizational environments. Overall, this work demonstrates that nudging can both improve decision quality and reduce variability, offering actionable insights for public health management. This integration provides both the depth needed for strategic planning and the breadth required for scaling organizational improvements.

In conclusion, by linking behavioral insights, choice modeling, and traditional survey data, organizations can implement interventions that are not only evidence-based but also behaviorally informed, enhancing the likelihood of meaningful, sustainable change across healthcare settings.

Staffing Needs Algorithms and Task Shifting Strategies

Workforce planning is a central concern in healthcare management, demanding precise, evidence-based tools to ensure that human resources are effectively aligned with service needs. Health systems worldwide have long sought to develop efficient algorithms to estimate workforce requirements across professions and care settings, as this directly impacts both the quantity and quality of services delivered. In order to enhance national workforce planning initiatives in Italy – particularly relevant in the current context – it is crucial to gain a comprehensive understanding of the international methodologies used to estimate staffing needs in healthcare management. Pirrotta et al. (2023) examines the most recognized and widely used global tools for estimating healthcare workforce requirements, aiming to determine whether a standard reference exists or to identify recurring key variables across the various instruments analyzed. By combining an exploratory review with a systematic synthesis of 69 articles, the study finds that no single algorithm prevails. Most models account for variables such as current service output and historical trends in workforce evolution, while only a minority incorporate organizational models. The article discusses the managerial implications of these findings, offering insights to improve the methodology for estimating healthcare staffing needs in Italy. In fact, a key instrument in this area is the staffing needs algorithm developed by the National Agency for Regional Healthcare Services. This algorithm estimates personnel requirements by comparing the number of full-time equivalent staff with projected needs, taking into account activity levels and structural indicators such as hospital beds, outpatient volumes, emergency visits, and births. Using this approach, healthcare organizations can categorize operational units as appropriately staffed, understaffed, or overstaffed (Deliverable 10_1_20). This structured assessment provides managers with a clear framework for evidence-informed decisions regarding recruitment, budgeting, and service redesign, helping to optimize workforce allocation across complex healthcare systems. Importantly, this tool allows managers to visualize staffing imbalances in a comparative context, highlighting areas that may require immediate attention and supporting long-term strategic workforce planning.

The analysis begins by comparing operational units with similar organizational structures and situated within comparable geographic areas. From this baseline, the evaluation can expand to include adjacent or functionally connected facilities, offering a broader perspective on staffing dynamics across the system. This multi-layered approach helps identify critical gaps or surpluses and informs whether task shifting or adjustments in skill mix may be appropriate. Longitudinal analysis adds further value by tracking trends over time, enabling managers to anticipate future workforce needs and plan proactively for evolving service demands. In addition, this process provides opportunities to evaluate the effectiveness of previous staffing adjustments, ensuring continuous improvement and supporting evidence-based governance.

Within the Tuscany Health Ecosystem, the algorithm on staffing needs was applied, for each medical specialty, to the four target hospitals of the project: Sta-

bilimento Ospedaliero San Francesco and Stabilimento Ospedaliero Santa Croce in the Garfagnana area, Ospedale di Portoferraio on the Island of Elba, and Ospedale del Casentino in the Casentino area. To meet regional planning requirements and maintain all services active, these hospitals collectively require approximately 97 full-time equivalent (FTE) medical positions. No significant overstaffing was observed, except for a slight surplus in general medicine. The most critical staffing shortages are found at Ospedale di Portoferraio (-38 FTE) and Ospedale del Casentino (-34 FTE), while Stabilimento Ospedaliero San Francesco (-16 FTE) and Stabilimento Ospedaliero Santa Croce (-8 FTE) face milder deficits. The shortages primarily affect disciplines for which operational units have been planned but staff have not yet been properly allocated. For example, orthopedics and traumatology at Ospedale del Casentino is short by 6 FTEs, and nephrology at Ospedale di Portoferraio is deficient by 7 FTEs. Ospedale del Casentino has deficits in eight of its ten specialties, with the largest gaps in intensive care (-9 FTE) and nephrology (-7 FTE). The two Garfagnana hospitals and Ospedale di Portoferraio share similar patterns, with shortages across nearly all specialties, except for general medicine. The most significant shortages in Ospedale di Portoferraio include orthopedics and traumatology, the emergency department, nephrology, and pediatrics. At Stabilimento Ospedaliero Santa Croce, oncology has the largest deficit (-4 FTE). The comparison of these peripheral hospitals with urban reference hub hospitals possibly reveals compensatory mechanisms, where staffing surpluses in the hubs offset shortages in peripheral facilities. For instance, the staffing of Ospedale Area Aretina Nord may compensate for Ospedale del Casentino's shortages in obstetrics and gynecology (+6 FTE vs. -4 FTE) and general medicine (+2 FTE vs. -3 FTE). However, for several specialties, such as cardiology, general surgery, oncology, and orthopedics, peripheral deficits are not directly offset by reference hub hospitals. Overall, the hubs show balanced staffing across most disciplines, while the peripheral hospital exhibits widespread shortages, highlighting that rural locations face more pronounced staffing challenges regardless of specialty. A similar pattern emerges in the Garfagnana area. Presidio Ospedaliero San Luca, the reference hub, appear to have very little surpluses in most disciplines, particularly radiology (+16 FTE) and obstetrics and gynecology (+9 FTE), which likely help cover shortages in Stabilimento Ospedaliero San Francesco and Stabilimento Ospedaliero Santa Croce. An exception occurs in general medicine, where Presidio Ospedaliero San Luca has a slight shortage (-1.78 FTE) while Stabilimento Ospedaliero Santa Croce is on par (+0.94 FTE). As to Ospedale di Portoferraio, the staffing situation is shaped by its position relative to intermediate and hub facilities: Ospedale di Villamarina, Ospedale Civile di Cecina, and the hub Ospedale di Livorno. Staffing shortages follow the geographic hierarchy, with Portoferraio (-42 FTE), Villamarina (-13 FTE), and Cecina (-12 FTE), while the hub hospital registers a slight surplus (+56 FTE). Shortages in orthopedics and traumatology (-6 FTE) and nephrology (-6 FTE) at Portoferraio are only partially offset by other facilities.

When analyzing nursing healthcare professionals, then, the pattern remains similar, though with more variability. Hub hospitals generally show more adequate staffing, whereas peripheral hospitals have mixed staffing needs. In some cases, compensatory logic between physicians and nurses is observed. Ospedale di Portoferraio, instead, exhibits clear shortages in both medical (-39 FTE) and nursing (-28 FTE) staff. Overall, shortages or surpluses in medical staff often mirror those in nursing staff across most areas, with exceptions in the emergency and post-acute areas.

It is important to note, however, that algorithms are not static solutions. Their parameters require regular review and updating to remain relevant, accurate, and fair across different organizational and geographic contexts. Despite these limitations, staffing algorithms offer a robust, structured starting point for aligning human resources with the evolving needs of healthcare systems in both urban and rural areas, supporting strategic workforce planning and sustainable service delivery. They also provide a foundation for integrating complementary tools, such as workforce simulations and scenario planning, which further enhance strategic decision-making. Significant and continuous improvements to the staffing needs algorithm are necessary to ensure more accurate and effective workforce planning. First and foremost, the quality of administrative data must be enhanced. Accurate recording of hours worked and precise assignment of staff to operational units are critical to producing reliable analyses and avoiding misallocation of resources. In addition, the use of diagnosis-related groups as a production parameter should be assessed and possibly substituted with other indicators in order to test the robustness of results. This allows for a more precise correlation between the type and volume of healthcare services provided and the personnel needed to deliver them efficiently. Regional resolutions that regulate specific services and define the corresponding staffing levels must also be incorporated into algorithms, ensuring that workforce planning aligns with legal and regulatory frameworks of regional healthcare systems. Furthermore, the algorithm should account for the actual needs of the population served, including demographic trends, epidemiological data, and service utilization patterns. This ensures that staffing levels are responsive to demand and can adapt to changes in the population's healthcare requirements. Finally, comprehensive job descriptions for all professional roles are essential. These provide clarity regarding responsibilities, competencies, and required qualifications, enabling the algorithm to match personnel to roles accurately and optimize team composition. Job satisfaction and skill mix are also relevant variable that should be accounted for into numerical estimates. By addressing these areas – such as, administrative data quality, diagnosis-related groups production parameters, regional regulatory requirements, population needs, and detailed job descriptions – and others that may also be pivotal, the staffing needs algorithm can become a robust and reliable tool. Such improvements will support evidence-based staffing decisions, enhance operational efficiency, and ultimately improve the quality of care provided to patients.

In-depth qualitative and experimental research complements these quantitative assessments for units identified as priorities for staffing interventions. Structured interviews, focus groups, and workflow observations would allow organizations to map existing processes and pinpoint roles or tasks that could be reallocated or redesigned. Experimental surveys provide additional insight by capturing staff perspectives on the feasibility and acceptability of potential changes. By combining these methods, interventions become both evidence-based and sensitive to the human realities of clinical work, balancing operational efficiency with staff engagement and well-being (Deliverable 10_1_21). Furthermore, the integration of experimental approaches helps managers understand behavioral responses to staffing changes, including factors that may influence motivation, collaboration, and job satisfaction.

Ongoing research continues to examine the gap between objective staffing levels and staff perceptions, particularly regarding workload, task distribution, and job satisfaction (Pirrotta et al., 2025). In particular, ensuring employee well-being and maintaining high levels of productivity in healthcare settings requires a deep understanding of the complex relationship between job demands and the resources available to meet them. The Job Demands-Resources theory provides a useful framework for analyzing this interplay, particularly within public healthcare organizations, where workloads are often high and resources may be limited. This study explores the balance between staffing requirements, job demands, and available resources, examining how these factors influence employee satisfaction and overall organizational performance. By integrating both employees' perceptions and objective administrative data, the study conducted by Pirrotta et al. (2025) aims to provide a comprehensive view of workforce dynamics and highlight how human resource management strategies can support a resilient and motivated workforce. Using a cross-sectional design, the study combines self-reported survey data from 26,577 employees with administrative records on working hours and staffing allocations. Objective staffing needs were calculated according to the standardized national methodology mentioned before, allowing for a direct comparison between employees' experiences and organizational staffing policies. The findings indicate that adequate staffing, whether perceived by employees or calculated objectively, is associated with perceptions of more reasonable workloads and lower levels of stress. Interestingly, the relationship between staffing and job satisfaction is nuanced; while insufficient staffing negatively affects satisfaction, overstaffing may sometimes reduce engagement or create underutilization, highlighting the importance of finding the right balance. Furthermore, employees who perceive equipment and resources as sufficient show smaller gaps between subjective and objective assessments of staffing adequacy, suggesting that resource availability can mitigate the effects of workload pressures. These results underscore the importance of accurately assessing staffing needs using both objective data and employee feedback to prevent burnout and enhance job satisfaction. Healthcare organizations should address gaps between perceived and actual staffing levels, invest in technical resources, and foster effective management to ensure that personnel allocation supports both operational efficiency and employee well-being. The originality of this study lies in its combined use of self-reported and administrative data, providing empirical evidence of how staffing policies influence individual experiences. By highlighting the interaction between job demands, resources, and staffing levels, this research contributes to a deeper understanding of workforce management in healthcare and offers actionable insights for optimizing productivity and employee satisfaction.

Furthermore, recent reviews (Meda et al., under review) highlight the growing evidence on task shifting, especially in resource-constrained contexts. The study employs a rapid systematic review of reviews to exam-

ine the implementation, outcomes, and influencing factors of task shifting and skill mix strategies in healthcare. Rapid systematic reviews are designed to synthesize high-quality evidence in a shortened timeframe while maintaining methodological rigor, providing timely insights for policy and practice decisions. This approach is particularly appropriate for task shifting, as it is a policy-relevant area where the rapid identification of evidence can inform ongoing workforce reforms and strategic health planning. The search strategy focused on review articles published in English from 2004 onward, capturing literature relevant to contemporary workforce practices. The search was conducted in a large, multidisciplinary database and targeted studies that examined task shifting or skill mix strategies in healthcare settings. Search terms were organized into three conceptual areas: the phenomenon of task shifting, the healthcare context, and the professional groups involved, including physicians, nurses, therapists, technicians, social workers, and community health workers. The final search algorithm was constructed to balance comprehensiveness, ensuring a wide capture of relevant literature, and specificity, maintaining feasibility within the rapid review format. Study selection prioritized review articles that analyzed health workers engaged in task shifting or skill mix strategies. Eligible interventions included the reassignment, delegation, or sharing of tasks among healthcare professionals across any disease area or medical condition. Data extraction involved systematic collection of bibliographic and study characteristics, including authorship, year of publication, review type, number and type of included studies, geographical context, healthcare setting, clinical specialty, and the professional cadres involved in task shifting. Reviews were also assessed to determine whether a definition of task shifting was explicitly provided. Data were analyzed interpretatively, categorizing reviews according to the type of task shifting described, such as substitution, role enhancement, or innovation, following the theoretical framework of Sibbald et al. (2004). From an initial pool of 791 publications, 43 reviews met inclusion criteria. The majority of these were systematic reviews, with a smaller number of non-systematic reviews, narrative reviews, scoping reviews, and meta-analyses. Collectively, the included reviews synthesized evidence from over a thousand individual studies, spanning diverse healthcare contexts and disease areas. Meta-analyses focused primarily on low- and middle-income countries and examined the effects of task shifting on conditions such as cardiovascular risk, HIV, and type 2 diabetes, evaluating whether transferring responsibilities from physicians to nurses or other healthcare workers could achieve comparable patient outcomes. The included studies demonstrate that task shifting is applied across a broad spectrum of healthcare services and professional roles. Most reviews conceptualized task shifting as the inter-professional redistribution of tasks among different healthcare cadres, including nurses, physicians, midwives, technicians, therapists, community health workers, and volunteers. Intra-professional task shifting, in which responsibilities are expanded within a single professional group, was also observed, though less frequently. A smaller number of studies highlighted innovative role creation, such as integrating new technologies or introducing novel care coordination roles to support service delivery. Task shifting as substitution is the most commonly documented form, where responsibilities traditionally held by higher-level professionals are transferred to others with shorter training or lower qualifications. Evidence shows that substitution is feasible and effective in managing both communicable and non-communicable diseases. In HIV care, for example, nurses and community health workers successfully initiated and managed antiretroviral therapy, achieving outcomes equivalent to or better than physician-led care, including improved patient retention and reduced loss to follow-up. Similar results were found in diabetes and cardiovascular care, where nurses and pharmacists managed medication adjustments, patient education, and monitoring of clinical markers with positive outcomes. Substitution has also been implemented in surgical and maternal health services, with non-physician clinicians performing procedures such as caesarean sections, hernia repairs, and antenatal screenings safely when appropriate training and supervision were provided. In primary care, advanced nurse practitioners and physician associates assumed responsibilities traditionally managed by general practitioners, including diagnosis, treatment, prescribing, and preventive care, effectively alleviating physician workload while maintaining care quality. These examples illustrate that substitution can safely expand access to essential healthcare services, particularly in resource-limited settings. Task shifting as role enhancement involves expanding the scope of practice within a professional group, allowing individuals to take on additional responsibilities, develop new competencies, and provide leadership or supervisory functions. Nurses and midwives frequently undertake enhanced roles, managing staffing, coordinating care, and leading community-based programs, particularly in fragile health systems. Role enhancement often emerges organically in response to workforce shortages or service gaps, with healthcare professionals adapting flexibly to meet local needs. Such expansion, while beneficial for service continuity and patient care, requires adequate training, supervision, and support to prevent overwork, legal vulnerability, or professional stress. Role innovation, while less common, represents the creation of entirely new professional roles or the introduction of novel care delivery models. Examples include the deployment of digital tools to augment diagnostic capabilities, such as computer-assisted auscultation for cardiac screening, enabling community health workers and nurses to perform tasks traditionally requiring specialist input. Other innovations involve restructured care teams, integrating roles such as care coordinators, chronic disease navigators, or digitally augmented health workers to enhance service delivery and continuity. These innovations reflect adaptive strategies to address structural workforce challenges and expand the capacity of healthcare systems in a sustainable manner.

Outcomes of task shifting interventions are observed across patient, service, and workforce dimensions. At the patient level, evidence indicates that task shifting maintains or improves clinical outcomes in both communicable and non-communicable diseases. Patients managed by nurses, midwives, or community health workers generally achieve comparable or superior clinical results, including improved biomarker control, higher adherence rates, and increased satisfaction. In family planning and maternal health, task shifting has enhanced access, service uptake, and continuity of care, particularly in underserved populations. Service-level outcomes include expanded coverage, improved responsiveness, reduced waiting times, and more efficient allocation of healthcare resources. Cost-effectiveness analyses indicate that nurse-led and community health worker-led interventions can maintain or improve outcomes without increasing overall system costs, if task allocation matches skills with patient needs. Workforce-level outcomes show that task shifting can increase job satisfaction, autonomy, and professional engagement, particularly when roles are clearly defined, supported by training, and formally recognized. Conversely, poorly planned task shifting can lead to role overload, burnout, and interprofessional tensions.

Implementation of task shifting is influenced by a combination of organizational, legal, cultural, and professional factors. Barriers include the absence of clear legal authority, inadequate training and supervision, professional resistance, and infrastructural constraints such as insufficient equipment or medication supply. Facilitators of successful task shifting include structured clinical protocols, decision-support tools, ongoing supervision and mentorship, policy alignment, interprofessional collaboration, and role clarity. Evidence highlights that enabling governance, stakeholder engagement, and continuous professional development are essential to ensure the safety, effectiveness, and sustainability of task shifting initiatives.

Within the Tuscany Health Ecosystem, experimental data indicate that healthcare professionals with managerial roles are more comfortable delegating tasks that remain internal to the organization, while tasks that are highly visible, personally rewarding, or affect large numbers of patients tend to be considered less suitable for delegation. Factors such as task complexity, client contact, or required effort appear to have minimal influence on delegation preferences. Task shifting is seen more favorably when it involves multidisciplinary teams, cross-organizational coordination, significant impact on beneficiaries, or publicly recognized collaborative work. Interestingly, neither health promotion activities nor the effort involved seems to play a decisive role in shaping staff willingness to delegate. This detailed understanding of staff preferences allows managers to design interventions that are both operationally effective and psychologically acceptable, increasing the likelihood of successful implementation and long-term sustainability. In describing the workplace context, professionals highlight both barriers and enablers to their motivation to engage in task shifting and collaboration. Need-thwarting factors include service fragmentation, resistance to change, and high work-related stress, whereas training opportunities, technological advancements, and attempts at multidisciplinary integration act as need-supporting factors. Their willingness to collaborate is framed within broader systemic challenges such as personnel shortages, rigid or unfavorable regulatory frameworks, and clearly delineated professional boundaries. These findings emerge from the analysis of 19 semi-structured interviews, which provided in-depth insights into how professionals perceive and navigate complex organizational and systemic constraints in their daily practice. (Meda et al., in progress).

Clinical Decision Support System for Emergency Departments

The final tool in the toolbox is an artificial intelligence-based clinical decision support system integrated into the FirstAid Web platform, developed by Dedalus.

This system is designed to assist emergency physicians in making timely and informed decisions about whether to admit or discharge patients, thereby optimizing patient flow, reducing wait times, and alleviating pressure on hospital beds. While its most immediate impact is on emergency services, the benefits extend throughout the broader health system, improving overall access to care, quality of services, and patient outcomes. By supporting more efficient and standardized decision-making, the system helps reduce unnecessary hospitalizations and ensures that limited resources are allocated where they are most needed.

The clinical decision support system operates with a high degree of transparency, allowing clinicians to understand the rationale behind its recommendations and fostering trust in its guidance. It enhances coordination between emergency departments, inpatient units, and supporting services, accelerates discharge planning, and improves resource allocation, particularly at critical points of transition between emergency and inpatient care. It is especially effective in addressing systemic inefficiencies – not merely patient volume – that often create bottlenecks in emergency care, such as delays in diagnostics, inconsistent triage practices, or uneven workload distribution among staff. By providing evidence-based guidance in real time, the system supports both clinical and operational decision-making, reduces variability in care, and promotes patient safety.

Equally important is recognizing that the perspective of healthcare professionals on the use of such systems cannot be ignored. Their attitudes, trust, and acceptance significantly influence the effectiveness of decision support tools. To fully understand these dynamics, it is essential to study professional perspectives using rigorous experimental and qualitative methodologies, such as structured interviews, focus groups, and scenario-based simulations. These approaches provide insights into potential barriers, usability issues, and the factors that shape clinicians' decision-making processes, allowing for the design of interventions that are both operationally effective and professionally acceptable.

For the system to be effective, it must meet rigorous standards for technological integration, certification, and organizational compatibility. Its flexible design allows it to adapt to the unique workflows of different emergency networks while maintaining consistent clinical protocols, ensuring both reliability and adaptability. The system also provides opportunities for continuous learning and improvement: data collected through its use can be analyzed to refine predictive algorithms, identify trends in patient flow, and inform training programs for staff. This capacity to generate actionable insights makes it not only a real-time support tool but also a strategic instrument for improving the health system as a whole.

Ultimately, this artificial intelligence-based clinical decision support system represents a scalable and replicable solution for improving access to acute care across diverse healthcare settings. Its integration supports a more resilient and responsive emergency care network, capable of responding effectively to both routine pressures and extraordinary events, such as mass casualty incidents or seasonal surges. By combining clinical intelligence, operational insight, and system-wide adaptability, the system exemplifies the potential of digital tools to enhance both patient-centered care and healthcare system efficiency while taking into account the critical role of healthcare professionals' perspectives in its successful implementation.

Assessment of Health Planning Mechanisms and Sustainability

The following section presents an in-depth analysis of health planning mechanisms and the sustainability of healthcare reforms in Tuscany's regional government, with a particular focus on how ongoing reform processes aim to strengthen local health services. This work draws on a multi-source methodological approach, combining insights from expert interviews, a critical review of relevant national and regional legislations, and a detailed analysis of official documents and administrative data. Through this integrated perspective, the section explores both the strategic intent and the operational translation of reforms, with particular attention to mechanisms designed to enhance service equity, continuity, and long-term viability in geographically and demographically disadvantaged territories. The final subsection examines the role of performance management dashboards as essential tools for monitoring progress, supporting data-driven decision-making, and fostering accountability within evolving territorial health systems.

Reform Processes to Strengthen Healthcare Services

In the aftermath of the Covid-19 pandemic, the Regional Government in Tuscany has launched an ambitious and comprehensive program of reforms aimed at modernizing its healthcare system, with the overarching objectives of reducing territorial disparities, enhancing overall efficiency, and addressing long-standing structural challenges that have historically affected service delivery and public health outcomes. These reforms encompass a wide and diverse array of sectors, spanning emergency transport, urgent care, territorial assistance, outpatient services, and waiting list management, as well as preventive care initiatives and chronic disease management programs. Underpinning these transformative efforts are strong commitments to digital innovation, socio-healthcare integration, and long-term sustainability – key priorities that are central to the Tuscany Health Ecosystem project (Deliverable 10_1_13) – and reflect a forward-looking vision of healthcare tailored to the evolving needs of the population while remaining attentive to resource constraints and the growing demands of an aging population. The reform program emphasizes the creation of an integrated and resilient healthcare system capable of adapting to future crises, including potential epidemics, environmental hazards, and demographic shifts that influence demand for services.

A central pillar of this reform agenda is the comprehensive restructuring of the healthcare transport system, which is critical for ensuring timely and equitable access to care across urban, peri-urban, and rural areas. At present, the use of urgent medical transport services across the region is inconsistent and unevenly distributed, particularly in relation to the Essential Levels of Care (LEA). To address these challenges, the Regional Government has implemented measures to standardize operational procedures at a regional scale and mandated the use of dematerialized prescriptions beginning January 1, 2023. These prescriptions, issued by general practitioners, pediatricians, or public specialists, are intended to improve prescribing appropriateness, enhance efficiency in service planning, and facilitate real-time monitoring and reporting. In support of particularly vulnerable individuals – those facing socioeconomic hardships, lacking family support, or unable to travel independently – a pilot transport service has been launched. This initiative streamlines administrative procedures by providing free vouchers issued by Local Health Authorities for diagnostic or therapeutic travel, significantly reducing bureaucratic burdens for these patients and ensuring equitable access to essential healthcare services while fostering a more inclusive approach to public health.

Furthermore, the Region is revising its mobility framework to rebalance spending caps related to private accredited providers, aiming to limit outbound healthcare mobility, encourage local service utilization, and attract non-resident patients more effectively. Each Local Health Authority has been allocated a single budget for agreements with private providers, with at least 90% of that budget earmarked for high-specialty services, thereby fostering more strategic use of resources and strengthening the integration of public and private care networks, improving continuity and predictability for patients requiring specialized care.

Parallel to the transport reforms, emergency-urgency response systems and continuity of care are being comprehensively overhauled. The Region has issued new guidelines to modernize and harmonize emergency structures, addressing issues such as uneven resource allocation, over-medicalization, and underutilized service points. This includes the reinforcement of the territorial emergency network, expansion of nurse-staffed ambulances, and better integration with emergency departments, urgent care units, and voluntary services. Additional measures focus on enhancing training for healthcare professionals, improving coordination across service levels, and guiding citizens toward the most appropriate care pathways, while strategically positioning medical vehicles in key emergency locations to optimize response times and reduce bottlenecks.

To tackle physician shortages and reduce service fragmentation, the continuity of care model is being reorganized. The introduction of a unified hourly service model will coincide with the launch of a single regional access number, 116117. This initiative is designed to optimize night service sites, facilitate healthcare worker training, and reallocate freed-up resources to

cover service gaps while enhancing daytime services for vulnerable populations, ultimately creating a more coherent and accessible system for patients with complex care needs.

In the pharmaceutical sector, Tuscany has established an Interorganizational Department aimed at optimizing drug use and controlling spending. Key priorities include encouraging the production of galenic medicines, streamlining integrated drug delivery pathways, and improving prescribing appropriateness. Simultaneously, energy efficiency has emerged as a pressing concern due to a staggering 145% increase in energy costs between 2021 and 2022, the third-highest rise among Italian regional governments. In response, the Region has launched a coordinated strategy focused on selecting best practices, monitoring expenditures, and implementing a regional energy plan that evaluates the impacts of efficiency interventions, promotes sustainability, and ensures that resources are allocated to maximize both environmental and economic benefits.

A major reform initiative is the creation of a new territorial care model aligned with Ministerial Decree 77/2022, which redefines the home as the primary site of care and seeks to integrate healthcare, social-healthcare, and social services into a cohesive, accessible network. Core infrastructure components of this model include Territorial Operations Centers (COTs), designed to coordinate care pathways across the system and ensure timely, efficient communication between hospital and community services. Additionally, 127 Community Health Centers are planned across Tuscany, with at least 60-70 operating seven days a week. Expansion plans also cover Community Hospitals and Integrated Home Care services, with increased bed availability, broader use of telemedicine, and enhanced staffing to meet patient demand. Palliative care access is being simplified and strengthened through improved coordination of care networks, ensuring that end-of-life care is provided in a timely and compassionate manner.

The 116117 single access number, operational 24/7, serves non-urgent healthcare needs and offers personalized care pathways based on four distinct patient profiles. It is fully integrated with the COT network and emergency services. Emergency departments are receiving targeted investments to reduce overcrowding, including “fast track” systems for specialties such as orthopedics and pediatrics, dedicated “see and treat” clinics, and new triage protocols for low-priority cases. Daily discharge planning, including weekends, alongside the reinforcement of palliative care services, aims to improve patient flow and enhance continuity of care, ensuring that patients receive appropriate care in the most suitable setting while reducing avoidable hospital stays.

Innovation plays a central role in the reform agenda. Telemedicine – including tele-visits, remote monitoring, and virtual consultations – is being extended beyond chronic disease management to other care areas, providing more flexible and patient-centered service delivery. The Region is also working to unify health and social care records, simplify operator registries, and develop a regional cloud infrastructure to ensure seamless integration between hospital and territorial systems, enabling real-time data sharing and decision support for healthcare professionals.

In parallel, a dedicated working group monitors the use and appropriateness of medical devices. Another strategic focus is the strengthening of family counseling services, reintegrated into territorial healthcare planning to promote maternal and child health, improve early intervention outcomes, and provide comprehensive support to families navigating complex care pathways.

The Region is also reinforcing socio-healthcare integration through the strategic role of territorial health districts. These 26 territorial nodes assess local health and social needs and coordinate the delivery of integrated services. Tools such as the Integrated Health Plan, the Social Zone Plan, and Community Health Centers are being used to foster this integration. A multi-level planning approach underpins this structure, with the first level encompassing individual service components like Community Health Centers and COTs, the second focusing on intra-zone interactions, the third on inter-zone connections to ensure continuity between hospital and territorial care, and the fourth on coordination with regional clinical networks. General practitioners play a key role in this framework through Functional Territorial Aggregations, supporting clinical governance via audits, shared protocols, and collaborative care initiatives.

In conclusion, Tuscany’s reforms aspire to build a healthcare system that is preventive, predictive, personalized, and participatory. By reducing fragmentation and promoting digitalization, the Region seeks to streamline services through dematerialized prescriptions, cloud computing, and expanded telemedicine. Socio-healthcare integration, closer coordination between hospitals and local services, and the use of clinical networks are central to this vision. Efficiency is pursued through waste reduction, energy savings, and more appropriate prescribing practices, while equity remains a fundamental principle, with targeted measures to support vulnerable populations, simplify access to services, and reduce territorial disparities (Figure 2).

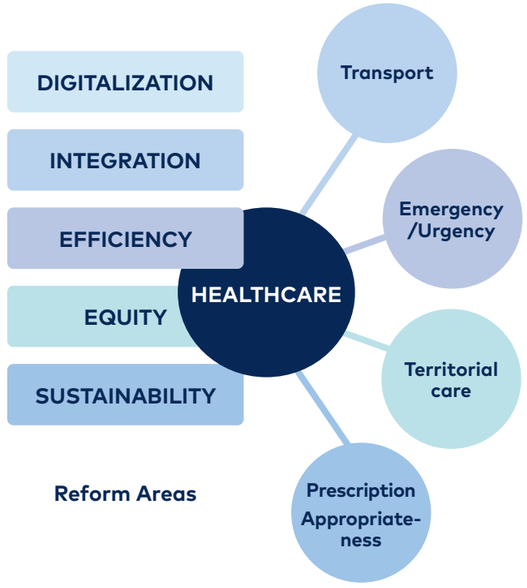

Figure 2. *Healthcare Reform Goals and tools in the Tuscany Health Ecosystem (source: Authors’ elaboration).*

Performance Management Systems

This section outlines the main performance measurement tools currently available in the healthcare and social care sectors. These tools include the National Outcomes Program (Piano Nazionale Esiti, PNE), the New Guarantee System (Nuovo Sistema di Garanzia, NSG), and the Dartboard System (Sistema Bersaglio) developed by the Network of Regional Governments of the Management and Healthcare Laboratory. These dashboards can be used in a synergistic and complementary manner, as they differ across several dimensions: the ultimate purpose of the tool, the object of analysis, the number of units analyzed, the level of analysis, the nature of primary data sources, and the methods of consultation (Table I).

National Outcomes Program

The National Outcomes Program (Piano Nazionale Esiti – PNE), developed and coordinated by the National Agency for Regional Health Services (AGENAS), represents a cornerstone in Italy’s strategy for promoting quality, transparency, and accountability within the national healthcare system. Conceived as an ongoing

Table I. *Comparative Overview of Key Healthcare Performance Management Dashboards (source: Authors’ elaboration).*

Feature	National Outcomes Program (PNE)	New Guarantee System (NSG)	Dartboard Performance Evaluation System (Bersaglio)
Since and Introduced by	2012 – National Agency for Regional Health Services (AGENAS)	2019 – Ministry of Health	2004 – Developed by Management & Healthcare Laboratory (Scuola Superiore Sant’Anna, Pisa)
Primary Objective(s)	Permanent observatory on hospital and territorial care; monitor variability; evidence-based monitoring; identify critical issues and best practices	Ensure Essential Levels of Care (LEA); assess equity, effectiveness, appropriateness; allocate financial resources	Comprehensive synthesis of health system performance; support governance and improvement; identify strengths and weaknesses
Unit of Analysis	Hospital facilities (public and private)	Regions / Autonomous Provinces	Regions, Local health authorities, districts, hospitals, primary care groups
Indicators and Measures	194 nationally validated standardized indicators (processes, outcomes, volumes)	88 indicators: 22 core (decisive for funding), 66 non-core	>700 indicators, grouped into 50 metrics across 10 dimensions (efficiency, prevention, governance, equity, resilience)
Access and Visualization	Open-access platform (*pne.agenas.it*); interactive visualizations (trends, comparisons, tree maps)	Static online reports. Regional scores benchmarked to reference values; national aggregation for international benchmarking	Online platform (*performance.santannapisa.it*) upon free registration; visual tools: target, matrix, stave, performance maps
Key Differences	Focused mainly on hospital and territorial outcomes with open data for transparency	Focused on ensuring LEA compliance and linking funding to performance	Focused on multi-dimensional performance evaluation and strategic governance, with advanced visualizations

and evidence-based observatory, the PNE provides a unified framework for measuring and interpreting the performance of healthcare services, with an orientation toward continuous improvement. Its purpose is not only to offer an analytical tool for hospital care but also to build a systematic and reliable understanding of healthcare delivery at the community and territorial level, integrating diverse dimensions of service provision within a single national perspective.

The program relies on a structured set of validated and standardized indicators that allow for the consistent evaluation of care quality, safety, appropriateness, and efficiency across healthcare institutions. By analyzing this large body of data on a regular basis and refining it according to emerging clinical and social priorities, the PNE enables the identification of differences in treatment patterns, outcomes, and access between facilities, regions, and population groups. In this way, it functions as an essential mechanism for fostering evidence-informed policy and for supporting the transformation of healthcare systems through the systematic use of performance intelligence.

The PNE's indicators cover a wide spectrum of healthcare activity, encompassing hospital and territorial services, and addressing multiple dimensions of performance – from outcomes and volumes of activity to avoidable hospitalizations and inappropriate use of emergency services. These indicators are designed to evolve dynamically, allowing the program to incorporate new dimensions such as equity in healthcare access, with a focus on differences related to gender, citizenship, and educational level. This continuous refinement underscores the program's commitment to ensuring that performance measurement reflects not only technical quality but also fairness, inclusiveness, and the social determinants of health.

At the core of the PNE's analytical model lies the hospital facility, including both public and private providers operating across the national territory. Data are made publicly available through an interactive online platform, open to all users and designed for exploration and comparison. This open-access model fosters transparency and empowers healthcare professionals, managers, and citizens alike to engage with performance data in a meaningful way. Through clear visualizations and benchmarking tools, the platform makes it possible to observe trends, measure progress, and identify areas requiring targeted improvement.

A distinctive and particularly innovative feature of the PNE is the use of treemap visualizations, which offer a synthetic yet powerful representation of hospital performance across clinical domains. Each hospital is depicted as a composite structure in which the size of each clinical area reflects its activity volume, while the color corresponds to a weighted evaluation of performance indicators. The analytical weight assigned to each indicator is based on its relevance to the overall quality of care, defined through a combination of evidence, ministerial guidelines, and statistical methodology. The resulting visual summary provides an immediate understanding of the balance and diversity of quality levels within a single hospital, while also enabling direct comparison between facilities. This capacity for both intra- and inter-hospital benchmarking has made the treemap a strategic communication tool for translating complex data into accessible insights for decision-makers.

The PNE's results are synthesized in periodic reports and integrated analyses that cover local, regional, and national levels, offering both snapshots of performance and longitudinal perspectives on progress. The data feeding the program derive from standardized national information flows, ensuring uniformity and comparability across all regional health systems. This unified data infrastructure allows the PNE to act as both a diagnostic instrument and a strategic compass for governance, highlighting variations that may indicate inefficiencies, emerging needs, or exemplary practices worthy of replication.

In parallel with the PNE, AGENAS has expanded its analytical capacity by developing an open-access statistical platform dedicated to the multidimensional assessment of managerial performance within public and university-affiliated hospital organizations. This complementary tool enables an integrated analysis of healthcare institutions across managerial domains such as investment capacity, workforce development, financial sustainability, process governance, and accessibility. Together, these platforms form an interconnected ecosystem for performance evaluation, designed to inform strategic decisions, optimize resource allocation, and guide national and regional health planning.

The policy relevance of the National Outcomes Program lies in its ability to connect measurement with action. By aligning data with strategic governance, it supports policymakers in recognizing systemic challenges, prioritizing interventions, and evaluating the impact of reforms. The program's design promotes not only the assessment of what healthcare systems achieve, but also an understanding of how and why they achieve it – linking organizational models, clinical processes, and patient outcomes through a consistent, evidence-based framework. In doing so, the PNE contributes to cultivating a culture of continuous improvement and accountability, where performance monitoring becomes an integral component of health system innovation.

Ultimately, the PNE embodies a vision of public health governance grounded in transparency, comparability, and the systematic use of knowledge. It reinforces the notion that sustainable healthcare improvement requires both data and dialogue – data to measure and understand, and dialogue to interpret and act. Through this approach, AGENAS positions the National Outcomes Program as a strategic pillar of Italy's ongoing effort to build a healthcare system that is equitable, high-performing, and resilient in the face of social, demographic, and technological change.

New Guarantee System

The New Guarantee System (Nuovo Sistema di Garanzia – NSG), introduced by the Italian Ministry of Health in 2019, represents a significant evolution in the governance and oversight of the country's healthcare system. Building upon the framework first established in 2000, the NSG serves as a comprehensive instrument to ensure that all citizens have effective and equitable access to essential levels of care as defined by the Livelli Essenziali di Assistenza (LEA). The system consolidates a vast array of data from the National Health Information System (NSIS) and transforms them into a coherent and actionable performance evaluation framework. Through its structure, the NSG promotes a modern, data-driven approach to public health management, enhancing accountability, transparency, and regional comparability within the Italian National Health Service.

The NSG encompasses about 88 indicators designed to monitor the key dimensions of equity, effectiveness, and appropriateness in the delivery of healthcare. These indicators are distributed across multiple analytical domains, covering preventive medicine, public health, territorial and hospital care, as well as contextual and pathway-based measures. They are specifically designed to assess how effectively regional health systems guarantee citizens' rights to essential services. The indicator framework includes measures related to collective prevention and public health, community and district healthcare, hospital care, contextual needs assessment, social equity, and monitoring of diagnostic-therapeutic pathways for major chronic and oncological conditions such as chronic obstructive pulmonary disease, heart failure, diabetes, breast cancer, colon cancer, and rectum cancer. This structure allows the NSG to act not only as a verification mechanism but also as a strategic learning system, offering insights into the coherence and performance of care pathways across the national territory.

Within the NSG framework, a distinction is made between core and non-core indicators, reflecting different levels of strategic relevance. The about 22 core indicators provide a concise yet comprehensive overview of how effectively each Region or Autonomous Province ensures the delivery of the essential levels of care, while the remaining indicators serve to complement and contextualize the analysis. The performance measured through the core indicators is directly linked to the verification and accountability process that determines regional eligibility for additional financial resources. Regions are required to achieve a score of at least 60 points out of 100 in each of the three main areas – collective prevention and public health, community care, and hospital care – in order to access these supplementary funds. Falling below the threshold in even one domain results in the exclusion from the incentive mechanism. This rule, while rigorous, serves as a strong driver of continuous improvement, encouraging regional governments to adopt sustained strategies for performance enhancement. Although the composition of the core indicator set may evolve over time, maintaining relative stability across multi-year cycles is considered essential to allow regions to plan long-term improvement initiatives and consolidate progress.

The primary unit of analysis in the NSG is the Region or Autonomous Province, reflecting Italy's decentralized model of healthcare governance. This structure ensures that accountability and performance measurement occur at the same level where policy and resource allocation decisions are made. The NSG provides each region with a multidimensional picture of its performance, highlighting both strengths and areas where corrective actions are needed. The system includes benchmark comparisons, time-series analyses, and the assignment of standardized scores for each indicator, which are then aggregated into a global regional score that determines whether the essential levels of care can be considered guaranteed. These scores are also aggregated at the national level, allowing for an overall assessment of healthcare quality and facilitating international comparison with other health systems.

In addition to providing performance scores, the NSG applies statistical tests of temporal and territorial variability, ensuring that the evaluation captures both con-

sistency over time and homogeneity across regions. Depending on the outcome of these analyses, regions may receive penalties or rewards that influence their overall performance results. This approach underscores the program's commitment to fairness and rigor, recognizing not only the level of achievement but also the stability and equity of results. It also reinforces the idea that regional differences must be interpreted not merely as disparities but as opportunities for targeted improvement and interregional learning.

The data and analyses produced by the NSG are made available through official reports published by the Ministry of Health, ensuring transparency and accessibility. Although results may initially serve informational purposes, the system's broader objective is to build a long-term framework for performance governance, capable of driving sustained improvements across all levels of care. The NSG is designed not only to measure compliance but also to promote transformation – encouraging the diffusion of best practices, the optimization of resource allocation, and the strengthening of policy coherence across regions.

In essence, the New Guarantee System embodies a new phase in Italy's approach to health system governance – one grounded in data, accountability, and equity. By integrating clinical, organizational, and social dimensions into a single evaluative structure, it enables policy-makers to move beyond reactive assessment toward proactive management of system performance. The NSG's real value lies in its dual function: it is both a control mechanism ensuring compliance with essential care standards and a catalyst for innovation, enabling health authorities to understand the dynamics of change, to recognize progress, and to design targeted interventions that enhance efficiency, equity, and quality of care across the country. Through this model, Italy reaffirms its commitment to a health system that not only guarantees universal access but also continuously strives for measurable and sustainable excellence.

Dartboard Performance Evaluation System

Since 2005, the Management and Health Laboratory (Laboratorio Management e Sanità, MeS) at the Institute of Management of the Scuola Superiore Sant'Anna in Pisa has been responsible for managing the performance evaluation system for regional healthcare systems that voluntarily participate in the Network of Regions. This initiative provides an evidence-based framework for systematically monitoring, assessing, and improving the performance of healthcare systems, helping policy-makers and healthcare managers make informed decisions grounded in robust data. For the Tuscany Region, the system has been in use since 2005, following a successful pilot conducted in 2004 across four healthcare organizations, establishing a model for continuous evaluation and improvement.

In 2008, the establishment of a voluntary Network of Regions enabled participating regions to benchmark and compare the performance of their healthcare systems, leveraging the insights provided by the Performance Evaluation System. For Tuscany, this participation has significantly broadened the scope of comparative analysis, encouraging organizations and professionals to learn from best practices beyond regional boundaries. This exchange of knowledge has created a culture of continuous improvement, innovation, and accountability, allowing regions to identify high-performing strategies and implement them locally. In 2021, several private healthcare facilities joined the project as well. Their inclusion highlights the system's growing role as a unified framework for evaluating performance across both public and private healthcare providers, facilitating more comprehensive and comparable data for policy analysis.

The Regional Network Performance Evaluation System allows for continuous monitoring of the value delivered to citizens in terms of efficiency, effectiveness, and appropriateness of healthcare services. Results are accessible through a publicly available online platform, requiring authentication at *www.performance.santannapisa.it*, and are presented in both synthetic forms – such as target or dartboard and pentagram visualizations – and detailed analytical reports. This dual-level presentation ensures that both high-level decision-makers and operational managers can interpret results effectively and take appropriate action. The system supports planning and programming at local, organizational, and regional levels, linking directly to the performance objectives of Tuscany's healthcare organizations.

The guiding principles of the Performance Evaluation System, continuously refined within the evolving healthcare context, include the use of the most robust evidence to analyze and understand phenomena, informing organizational and policy decisions; performance evaluation as a tool to promote accountability to the public; the adoption of multiple analytical dimensions to capture the complexity of healthcare systems; transparency, ensuring responsible management in line with the public mission; systematic benchmarking to overcome self-referential evaluation; and timeliness, ensuring data is available to support strategic interventions when they are most needed. These principles not only guide operational performance management but also provide policymakers with a structured and reliable framework to anticipate challenges and prioritize resource allocation effectively.

The system is co-designed with healthcare professionals and regional managers and evolves continuously based on input from a wide range of stakeholders. In Tuscany, the processing and interpretation of performance data are the result of a close collaboration between the Management and Healthcare Laboratory and the Regional Health Agency (ARS Toscana), ensuring rigor, reliability, and actionable insights. The system's design allows policymakers to monitor trends over time, identify areas requiring strategic intervention, and implement targeted policies to enhance healthcare delivery.

A central feature of the system is its ability to represent the performance of complex healthcare organizations graphically, accurately, and concisely. The overall performance of the Region and individual healthcare organizations is summarized through the dartboard visualization, while temporal analysis of performance variability, care pathway performance (via pentagrams), and combined trends and performance assessments (through the performance map) provide a multidimensional understanding of organizational effectiveness.

The dartboard visualization, with its five concentric rings representing different performance levels, has been used since the system's inception as a concise summary of results achieved by monitored entities – initially healthcare organizations, later extended to districts, hospitals, and Territorial Functional Aggregations. This tool communicates performance at a glance: entities achieving objectives and demonstrating strong performance are represented near the center in the green zone, while underperforming results appear in progressively outer rings. Performance is assessed across five levels, with corresponding colors and scores from 0 to 5: dark green indicates excellent performance (score 4–5); light green reflects good performance (3–4); yellow signals areas requiring improvement (2–3); orange indicates critical performance (1–2); and red represents very poor performance (0–1). This approach enables policy-makers and managers to quickly identify both successes and urgent challenges, facilitating rapid, evidence-driven decision-making.

The system tracks more than 700 indicators, organized into 50 summary indicators across key dimensions, including: efficiency and sustainability, encompassing resource use, financial management, and human resource organization; regional healthcare strategies, monitoring the ability of organizations to implement strategic regional programs; emergency and urgent care, assessing the appropriateness and timeliness of emergency responses; collective prevention, including workplace safety, food safety, nutrition, and sports medicine; governance and quality of care, monitoring demand management, service appropriateness, and outcome and process quality; responsiveness and communication, evaluating processes connecting citizens with healthcare organizations; patient experience, reflecting external evaluation; pharmaceutical and medical devices management, tracking usage across hospital and community settings; equity, assessing access to services by gender and educational attainment; and resilience, measuring the system's capacity to maintain services under stress. Some indicators are evaluative, contributing directly to performance scores, while others are observational, providing proactive intelligence for continuous improvement and benchmarking.

This multidimensional, evidence-driven framework equips policymakers and healthcare managers with the information necessary to identify strengths, address weaknesses, and implement targeted strategies that enhance the value delivered to citizens. By integrating transparency, accountability, and comparative analysis into a single system, it reinforces both the quality and sustainability of healthcare delivery, supporting informed strategic decisions that benefit the public and strengthen regional healthcare governance.

The dartboard is a well-established method for visualizing the most relevant results achieved by each entity within the healthcare system. Its primary strength lies in its ability to provide organizations with an immediate and intuitive picture of their strengths and weaknesses. By highlighting where a provider excels and where it underperforms, the dartboard offers a quick diagnostic of organizational performance. However, while informative, this approach is inherently limited. It presents performance solely within the boundaries of an individual organization or care setting, without capturing the broader context of how patients experience care across the healthcare system. In other words, it reflects what happens inside a single organization, rather than the outcomes experienced along the full journey of care.

The patient's journey, by contrast, is far more complex. It often spans multiple care settings, involving a range of healthcare professionals, institutions, and support services. To capture the value produced for patients by

the collective efforts of all organizations involved, and to provide a tool capable of guiding systemic improvements aligned with regional strategies, the Management and Healthcare Laboratory developed the stave within the Performance Evaluation System. This representation moves beyond the provider-centered perspective and offers a pathway-focused view, highlighting performance along the entire continuum of care and making the patient's experience the central point of reference.

Introduced in 2016, the stave provides a structured, visual representation of performance results along care pathways. In this model, the "notes" correspond to specific performance indicators, organized according to the main phases of the pathway, which are depicted as the "bars" of the stave. Each indicator is positioned within one of five performance bands, reflecting the level of achievement relative to established benchmarks. The stave has been developed not only at the regional level but also at the local district level, allowing for a representation that closely mirrors the realities experienced by citizens in their communities. This dual-level approach enables policymakers to identify areas of excellence, detect gaps in service integration, and monitor the impact of initiatives designed to improve care continuity.

Currently, the stave is applied to several major care pathways, including maternal and child health, oncology with a focus on breast cancer, elderly care and frailty, mental health, chronic disease management, and emergency and urgent care. By adopting this pathway-based approach, the stave provides an immediate overview of the quality of services delivered along the patient's journey, regardless of which organization provides them. Within the same stave, multiple providers may appear, and the same indicator may be measured across several organizations, reflecting the collaborative nature of healthcare delivery. For example, in the oncology pathway, indicators related to the treatment phase often appear for multiple providers, since different facilities within the same geographic area – ranging from local hospitals to university centers – may be responsible for specific interventions. This comprehensive view allows policymakers to understand performance in context and to assess the contribution of each organization to patient outcomes across the system.

Lastly, the performance map within the Performance Evaluation System is another essential tool. It is designed to highlight the progress made by healthcare entities over the course of the years, combining both the current level of performance and the trend in improvement to create a dynamic picture of system evolution. By integrating these two dimensions, the map provides a richer understanding of how an organization, a district, or a region healthcare system is performing over time, rather than offering a static snapshot.

Performance is represented along the horizontal axis, reflecting the score achieved for each indicator in the reference year. The vertical axis represents the capacity for improvement compared with the previous year, calculated as a percentage change and scaled between -2, indicating the greatest deterioration, and +2, indicating the greatest improvement. This dual-axis approach enables the identification of four distinct quadrants, helping to interpret both the current quality of care and the trajectory of change. The origin of the axes is defined by zero on the vertical axis and the regional average on the horizontal axis, providing a clear benchmark for comparison.

By combining performance level and improvement trend, the performance map allows policy-makers to identify both high-performing entities and those with significant potential for growth. It highlights where interventions have been effective and where additional support or strategic action is needed. The map's visual clarity makes it particularly valuable for decision-makers seeking to allocate resources efficiently, design targeted improvement initiatives, and track the impact of policy measures over time. Overall, when used in conjunction with the stave, the performance map offers a comprehensive framework for monitoring, evaluating, and enhancing healthcare delivery across the entire system.

Behavioral and Cognitive Insights for Public Management and Administration: The Italian Experience

This section positions the applied research initiatives presented above within the framework of the Tuscany Health Ecosystem, connecting them to the broader discourse on behavioral and cognitive approaches in Italian public administration and management. By exploring how insights from behavioral sciences intersect with public decision-making, the section aims to deepen the understanding of how rationality, its inherent limits, and the presence of bias and noise shape managerial behavior and policy outcomes. Particular attention is given to the design of decision-making architectures and to how these can foster more effective and evidence-based management practices. Within this perspective, experimentation and empirical validation emerge as crucial tools for enhancing organizational performance and public value. The discussion also outlines the ongoing transition from behavioral to cognitive public management and administration, emphasizing how this evolution broadens the analytical and operational toolkit available to managers and policy-makers. A more extensive discussion of these themes can be found in Cantarelli and Belle (in press). Ultimately, the section sets the stage for the concluding reflections of the white paper, identifying key policy lessons and future directions toward a more adaptive, informed, and efficient management of people, processes, and public policies.

Understanding Rationality and Its Limits

The evolution of Italian behavioral public administration and management mirrors a profound intellectual shift that has redefined how scholars and policy-makers understand decision-making within government. For much of the twentieth century, administrative theory was anchored in the economic conception of rational choice, rooted in Bernoulli's expected utility theory (1954) and the formal axioms articulated by von Neumann and Morgenstern (1944). According to this model, rational decision-makers evaluate potential outcomes by weighing probabilities and utilities to select the option that maximizes expected benefit. Rationality implied internal consistency, independence from irrelevant alternatives, and continuity across preferences.

Herbert A. Simon's work in the mid-twentieth century shattered this view. In Administrative Behavior (1947), Simon argued that the "language of administrative theory must be drawn from the logic and psychology of human choice." He introduced the principle of bounded rationality, emphasizing that individuals do not optimize but satisfice – seeking solutions that are good enough given limited information, attention, and time. Simon's insight transformed our understanding of administrative behavior: decision-making is not an abstract process of logical computation, but an adaptive human activity constrained by cognition and context. This perspective earned him the Nobel Prize in Economics in 1978 and laid the foundation for what is now known as behavioral public administration and management.

The recognition of bounded rationality was not a rejection of rationality itself but an acknowledgment of its boundaries. Decades later, Richard Thaler revisited this theme in Misbehaving (2015), contrasting the idealized "Econs" of classical theory – agents who always optimize and exhibit perfect self-control – with real "Humans," who are emotional, myopic, and often inconsistent. Economic models assuming perfect rationality, Thaler argued, describe a world that does not exist. Public officials, citizens, and policymakers alike are subject to bias, fatigue, and social influence. The task of public management and administration, therefore, is to design institutions that accommodate these human traits rather than ignore them.

Bias, Noise, and the Architecture of Decision-Making

The next revolution came from the work of Daniel Kahneman and Amos Tversky, whose studies of judgment under uncertainty revealed that people rely on heuristics – mental shortcuts that simplify decision-making but also produce systematic errors. The representativeness, availability, and anchoring heuristics explain how individuals substitute difficult questions with easier ones, recall vivid but unrepresentative examples, or rely excessively on initial reference points.

Prospect theory, introduced by Kahneman and Tversky (1979), offered a new model of choice under risk. It demonstrated that individuals evaluate outcomes relative to a reference point, not in absolute terms, and that losses loom larger than equivalent gains. The value function is concave for gains and convex for losses, reflecting risk aversion in positive domains and risk seeking in negative ones. For public policy, this asymmetry is crucial: citizens and civil servants are more motivated to avoid losses than to pursue gains, meaning that the framing of policy messages can significantly shape support and compliance.

Kahneman's later work with Olivier Sibony and Cass Sunstein (2021) introduced another critical concept – noise. While bias is a systematic deviation, noise is variability in judgment. Two equally competent decision-makers, given the same data, may produce divergent outcomes for reasons unrelated to the evidence: mood, context, order effects, or fatigue. In healthcare sector, for example, studies show that the timing of clinical appointments can influence doctors' prescription choices, revealing how occasion-specific variability distorts consistency. The cumulative effect of such noise is costly – reducing fairness, efficiency, and public trust. Kahneman's formulation reminds policymakers that improving judgment requires addressing not only bias (average error) but also variability (dispersion of error).

These insights underpin a practical revolution in management: if human judgment is systematically shaped by context, then context can be redesigned. Thaler and Sunstein's Nudge (2008) advanced this idea of choice architecture – the deliberate structuring of decision environments to guide behavior while preserving freedom of choice. Nudges alter the presentation of options – defaults, framing, or feedback – so that individuals are more likely to choose beneficial outcomes without coercion. This libertarian paternalism reflects the recognition that all environments influence choice, and that policymakers have a responsibility to design them ethically and effectively.

Yet the same structures can also produce their opposite. Sludge – the accumulation of administrative friction, redundant paperwork, and opaque rules – creates time taxes that drain resources from both citizens and public servants. Sunstein has called for sludge audits to identify and remove unnecessary barriers that deter access to benefits, increase inequality, and erode institutional legitimacy. In Italy, where complex bureaucracy has long been a national concern, the behavioral focus on simplification and friction reduction provides a new, evidence-based approach to administrative and management reform.

Behavioral Insights in the Italian Public Sector

Italian scholars have played a leading role in applying these theoretical insights to the realities of government organizations. Experimental and behavioral studies involving thousands of civil servants and healthcare professionals reveal how biases and contextual factors shape administrative decisions. Researchers and healthcare professionals from the Tuscany Health Ecosystem have contributed significantly to this stream of scientific work.

Experiments show that Italian public managers are susceptible to the same cognitive distortions documented elsewhere: framing effects alter judgments in health and environmental policies; anchoring biases affect responsiveness standards and performance evaluations; and the status quo bias favors existing but suboptimal contracts. Halo effects – where good performance in one dimension inflates evaluation in another – further distort appraisals. These findings underscore that public servants, like all decision-makers, react to seemingly irrelevant features of information architecture.

Debiasing efforts, such as training programs explaining cognitive mechanisms, have achieved partial success. In one large study of Italian nurses, interventions reduced some biases, such as framing and bandwagon effects, but left anchoring and halo effects largely intact. Awareness alone, it appears, is insufficient; organizational structures and incentives must also change to sustain improved judgment.

Nudging, by contrast, has demonstrated robust effects. Randomized controlled trials involving nearly 20,000 Italian healthcare professionals show that messages invoking social norms – reminding workers that most colleagues are vaccinated against influenza – increase vaccination uptake and advocacy. When messages appeal to prosocial motives, such as protecting patients or family members, they prove significantly more effective than those highlighting personal benefits. These results align with findings from behavioral science worldwide: public employees respond strongly to cues that activate moral purpose and collective identity.

Visual communication has also emerged as a key tool. Experiments with hospital managers demonstrate that performance data presented in graphical formats, enhance understanding and recall more effectively than text-heavy reports. Similarly, visual reminders outperform written notices in encouraging compliance with hygiene protocols. These results suggest that design thinking – traditionally associated with product innovation – has an essential place in public administration. The form of information delivery can be as consequential as its content.

Recent Italian research has begun to address noise – variability among experts facing identical cases. In healthcare, prescription decisions vary dramatically between doctors even when the clinical evidence is identical. Prompts reminding physicians of guideline-based best practices reduce this inconsistency, illustrating that gentle standardization can promote equity without undermining professional discretion. These findings move the behavioral agenda beyond bias toward managing the hidden variability that undermines collective reliability.

The Italian public's own decision-making provides further insight. During the COVID-19 pandemic, behavioral experiments examined how citizens balanced public health, economic, and civil liberty concerns. When forced to tradeoff between saving lives and preserving income, respondents increasingly prioritized income as potential losses grew – an empirical manifestation of loss aversion. Later studies found that Italians were more willing to share personal data when the entity handling information was public rather than private, reflecting a publicness effect rooted in institutional trust.

As vaccines became available, discrete choice experiments revealed preferences for prioritizing the chronically ill, essential workers, and older adults – preferences grounded in fairness and perceived social value rather than pure self-interest. Crucially, reducing administrative burdens – automatic appointments, shorter waiting times, and simpler communication – increased vaccination intent, especially among older populations. Even modest procedural simplifications thus had measurable public health benefits, illustrating the power of behavioral design to complement traditional policy levers.

Experimentation and Evidence-Based Administration and Management

The methodological backbone of behavioral public administration and management is experimentation, particularly randomized controlled trials. Borrowed from medical research, randomized controlled trials offer a rigorous means of establishing causal relationships between interventions and outcomes. By randomly assigning participants to treatment and control groups, researchers can isolate the impact of nudges, communication formats, or procedural reforms.

In Italy, this approach reflects what economist Esther Duflo calls the "plumber's mindset" – a commitment to iterative problem-solving. Policies are not treated as fixed blueprints but as prototypes to be tested, repaired, and refined. Conjoint experiments, which present participants with paired scenarios differing in specific attributes, have become invaluable for exploring trade-offs in decision-making – from hiring criteria to vaccine distribution priorities. Combined with qualitative analysis, these experiments allow researchers to uncover not just what people choose but why they choose it.

This experimental ethos has made Italy a hub for behavioral innovation in the public sector. Universities, regional health authorities, and national institutions increasingly collaborate on pilot studies to inform reform. The emphasis on empirical validation fosters a culture of learning and adaptation – a sharp contrast to the rule-bound rigidity often associated with bureaucracies. Nonetheless, the spread of experimentation requires attention to ethical considerations, transparency, and scalability. Behavioral interventions that succeed in one region or organization may not transfer automatically to another; context remains a crucial variable.

From Behavioral to Cognitive Public Management and Administration

The most recent development in this field moves beyond documenting biases toward understanding the cognitive mechanisms that produce them. Emerging research in cognitive economics, notably by Bordalo et al. (2025), emphasizes selective attention – the process by which in-

Figure 3. *Policy lessons and road ahead for cognitive public management and administration (source: Authors' elaboration).*

dividuals focus on salient features of information while neglecting others. This attentional asymmetry explains why beliefs can diverge even when people share the same data: each observer constructs a different representation of reality based on what stands out to them.

For public administration and management, this has transformative implications. It suggests that many biases and much noise stem not from irrationality per se but from differential attention and perception. A civil servant overwhelmed by complex information may focus on the most visible or emotionally charged elements, neglecting subtler but crucial aspects of policy. Similarly, citizens confronted with excessive detail may rely on surface cues or defaults. Understanding how attention operates thus becomes central to improving administrative performance.

This cognitive public administration and management seeks to move beyond cataloging errors to modeling the underlying processes of judgment. It bridges behavioral insight with neuroscience and information theory, asking not only how people decide but how they perceive and interpret the decision context. In practice, this means designing administrative systems that direct limited attention to the most relevant cues – simplifying forms, prioritizing essential data, and structuring digital interfaces to prevent overload.

Italy's contribution to this emerging paradigm is significant. Through extensive experimental evidence, Italian researchers have shown how biases, noise, and selective attention jointly shape public-sector behavior. The country's complex administrative landscape provides a natural laboratory for understanding how cognitive mechanisms translate into institutional outcomes. The challenge now is to convert these insights into enduring reforms that enhance both efficiency and equity.

Policy Lessons and the Road Ahead

Several key lessons emerge from Italy's behavioral and cognitive turn in public management and administration (Figure 3). First, policies must be designed for Humans, not idealized rational agents. Recognizing bounded rationality and emotional motivation allows governments to craft interventions that align with how people actually think. Second, experimentation should become routine in government. Randomized trials, pilot programs, and data-driven evaluations can replace intuition with evidence, allowing policymakers to learn continuously. Third, reducing administrative burdens (Herd and Moynihan 2018) – learning costs, compliance costs, and psychological costs – is essential for fairness and inclusion. Simplification is not merely managerial efficiency; it is a form of social justice that ensures equitable access to public services. Fourth, communication design deserves strategic attention. The framing, format, and emotional tone of information influence behavior as much as the policy substance itself. Training public managers in behavioral communication can dramatically improve program outcomes.

Finally, the future lies in integrating behavioral and cognitive approaches. Understanding attention, perception, and belief formation offers a deeper foundation for policy design. By managing not only incentives but also mental environments, governments can foster more consistent, ethical, and adaptive decision-making. In this perspective, Italy stands as both a laboratory and a model. Its behavioral experiments show that even small contextual changes – simpler procedures, visual aids, or prosocial messaging – can yield large social dividends. Its emerging cognitive research points to the next frontier: designing institutions that think with, rather than against, the human mind.

The broader implication for policymakers is clear. Good governance is not only about rational planning or political will; it is about understanding cognition itself. Behavioral and cognitive public management and administration together offer a roadmap for creating governments that are more intelligent, humane, and responsive – governments that see citizens not as data points but as complex, boundedly rational thinkers whose behavior can be guided, supported, and respected. Within this vision, the Tuscany Health Ecosystem stands as a tangible example of what such integration can achieve. Its alliance – spanning citizens, regional government, healthcare organizations, private sector companies, third-sector actors, and academic institutions – has been pivotal to its success and will remain the cornerstone of its future progress. By uniting knowledge, practice, and civic commitment, this ecosystem demonstrates that collaboration itself can be a form of collective intelligence – one capable of transforming systems, and ultimately, lives.

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