Enabling Sustainable and Healthier Living in the Urban Era: the Healthier Cities Maturity Model

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IN THIS WHITE PAPER

IDC Health Insights Opinion

Healthier Living is a key factor for City long term competitiveness and sustainability. Stakeholders and processes involved in ensuring Sustainable and Healthier Living span beyond the traditional health ecosystem. Therefore, cities need to embrace a holistic approach, changing the legacy management culture, built around siloed budgeting processes, local bylaws and governance structures, and outdated ways of measuring success.

To help cities find the right approach and understand investments and other factors that enable and inhibit progress, IDC Health Insights developed this Healthier Cities maturity model. This model is meant to be used to develop clarity of vision, common language, and a strategic roadmap with key leaders and innovators in the city ecosystem. It is important for the city to work toward a balance in maturity, across all the measures described by the model. As many of the issues are related to people, process, and culture, to progress towards the optimized stage of the model IDC Health Insights recommends to City leaders to:

- Aim for a systemic vision powered by dynamic multi-stakeholder governance.
- Focus on citizens and professionals empowerment and outcome measurement, so that collaboration and innovation contribute to continuously improve business processes efficiency and effectiveness.
- Harness the power of third-platform technologies' nexus, leveraging open and secure data to pre-empt and adapt to healthier living needs.

Executive summary

The 21st century is characterized by the "cities momentum." The majority of the world population lives in cities and urbanization is growing rapidly. The health status of the population is an aspect that cannot be sidelined, as it has a direct impact on city's long term sustainability and competitiveness. In a tightly knit environment like a city, the wide-reaching implications of a healthy (or unhealthy) population make achieving a Healthier City vision a team game that goes beyond the traditional acute care setting. Services need to be integrated along the care continuum, looking at the integration of secondary and primary care with social services, and at other impactful aspects of the city administration, such as public transport, public health, education, and urban planning.
To support Cities in their journey toward sustainable and healthier living, IDC Health Insights developed the Healthier Cities maturity model. The five stages of the model outline the progression of the city in this journey. The five stages – Ad Hoc, Opportunistic, Repeatable, Managed, and Optimized – are measured against five dimensions - Strategy, Culture, Process, Technology, and Data - based on the people-process-technology trinomial. Each dimension evolves along a fragmentation-integration axis, drawing the lines between successful cities, which will optimize for health and sustainability, and those that will remain in the lower stages of the maturity pathway. This model is meant to be used to develop clarity of vision, common language, and a strategic roadmap with key leaders and innovators in the city ecosystem. In the journey toward the optimized stage, the Maturity Model can help to:

- Baseline competency in each of the five measures of the model.
- Compare against the industry benchmark to identify gaps and the desired status within a given time frame.
- Compare maturity assessments and identification of maturity gaps among business groups (e.g. GPs, Community care, agencies etc) and between business and IT within a single organization.

**SITUATION OVERVIEW**

**Why Cities need a Healthier Living Strategy?**

While the 20th century was the age of nations, the 21st century is often referred as the "age of cities". For the first time ever, the majority of the world's population lives in a city, and this proportion continues to grow. One hundred years ago, 2 out of every 10 people lived in an urban area, but as of 2010, more than half of all people were living in an urban area. By 2050, this proportion will increase to 7 out of 10 people. Both in mature and emerging countries, cities of medium to large size will continue attracting new residents looking for economic opportunities and the intellectual challenge brought about by cultural events. High-tech industries, and companies will be attracted by cities as they look for talent and opportunities to partner and compete with other businesses, in order to innovate and grow their value.

In such a dynamic environment, sustainable and affordable high quality of life can be superseded, while everybody enjoy the lower-hanging fruits of fast economic growth, in the short-term. But it cannot be neglected in the long-run. Quality of life is highly dependent on the health conditions of the population. The sheer number and increasing proportion of people living in an urban environment necessarily implies that urban health problems directly affect more than half of the world population. Health conditions of the urban population are determinant of the sustainability and the competiveness of cities around the world.

A healthy population that can access good health services can work productively. A healthy population that can access good social services that make care affordable can plan to stay and contribute to economic growth in the future. Unhealthy residents that cannot count on services that make staying healthy financially sustainable will contribute less productively and eventually seek opportunities to move. Most importantly, in a tightly knitted environment, like a city, it is not just the healthcare services delivered in hospitals and doctor offices, or the adult care offered in nursing homes that count; the systemic effect of the quality of air and water, the ability to travel safely and without long waiting times, the availability of green spaces, and so forth, all impact on making a city healthier.
Policy-makers must be aware of the magnitude and the opportunity costs (i.e. the benefits forgone) of doing too little to prevent and mitigate health risks that are typical of a city environment:

- **Infectious diseases and pandemics.** Densely populated areas have traditionally had to deal with communicable diseases caused by poor sanitation, and pollution of waters, air and food. City executives need to continuously invest to prevent and mitigate these public health risks, while dealing with newer risks generated by the rise in global trades and growing influx of tourists and migrants, which have intensified the scale and the velocity at which epidemics and pandemics can spread.

- **Injuries and violence.** According to the WHO, about 5.8 million people die each year as a result of injuries and violence, such as road traffic accidents, suicide and homicide, accounting for 10% of the world’s deaths. In fact, in many countries, cities’ increased traffic has not been dealt with adequate transport infrastructures, new traffic regulations, or measures to ensure improved road safety and to decrease congestion. And urban violence needs to be analyzed and tackled in the context of contributing factors, such as social exclusion, poverty, unemployment and poor housing conditions.

- **The incidence of non-communicable diseases**, such as chronic cardiovascular and respiratory diseases, cancer, and mental illnesses, is exacerbated in cities, where people live more sedentary lives, are more affected by air pollution, eat unhealthy food and are more subject to stress related to unemployment, traffic and other determinants that can lead to depression and other mental illnesses. According to the WHO, non-communicable diseases are expected to make the biggest negative impact on people healthy life years and on the cost of delivering care services. Therefore they should be a primary focus for city administrators, across both emerging and developed countries: preventing some of those costs and productivity decreases to materialize by ensuring the “healthy years” of the city population last longer, and remediating the trade-off between caring for the productivity of healthy workers and ensuring elderly have a good quality of life.

**Finding real impact beyond the hospital setting**

City population today enjoys better health than their rural peers. But a more granular look systematically reveals harsh health inequalities within the city environment. Urban health inequalities show a consistent pattern across the population dependent to socioeconomic status (work, age, education, the health system and services they can access) or geographical location (natural, social and built environment, as well as access to services). For example, a 2010 research from the Public Health Intelligent team of NHS Central Lancashire (UK) showed that life expectancy significantly varies by 14.7 years for men and 10 years for women, between the most affluent and most deprived areas.

The need for a coordinated approach to reduce the risks and costs of communicable diseases has been understood for a long-time. Water, waste treatment, transport and other authorities (and corporations) contribute ensuring the quality of water, air and food, public health departments in local governments take care of controlling the safety of the environment, and first responders, including emergency and infective care units in hospitals, take care of acute episodes to minimize the spreading of the diseases. But it is increasingly clear that coordination across the continuum of care is paramount for non-communicable diseases. Hospitals’ highly specialized services can appropriately address the acute phase of these illnesses, but their long term management requires a constant monitoring of the patient and follow ups that cannot be effectively delivered in the hospital setting, because of hospitalization costs, patient experience and care safety issues. A coordinated approach, including a range of services from prevention to disease management, is therefore needed. Effective urban governance that includes government, education, private sector, the civil society and community groups will help reduce the breadth of health inequalities, and thus
the incidence of chronic diseases. In fact, reducing pollution, educating children to eat healthier food, or making public healthy spaces available can contribute prevent residents contracting cardiovascular and respiratory diseases, as well as cancer. Similarly, for those residents that are affected by these diseases, social services, such as housing, occupational therapy, meals-on-wheels, rehabilitation and psychotherapy, must be coordinated by local governments adult and child care departments and primary care, after hospital discharge. City administration matters, encompassing crisis management, environmental protection regulation, urban planning laws, education, and public transport, must be addressed.

**A Healthier City is a team game**

The healthcare sector cannot alone tackle the various healthcare challenges that are present in the City environment. The wide-reaching implications of a healthy (or un-healthy) population make achieving a Healthier City vision a team game. City administrators should take the lead by defining a strategy that leverages on the power of coordination. Collaborative governance will help make sure city departments and agencies and non-government partners understand what the intended outcomes are, while the mayor and his staff can keep track of their progress in the whole enterprise context.

*Community participation has been fundamental for the implementation of the 9 Neighborhood Health Plans in the city of Barcelona. The public health agency of Barcelona is responsible for organizing the interventions, but relies on the ongoing support of primary care, the regional Department of Health of Catalonia, the city council with its administrative districts and their community workers. A community group is formed in each participating neighborhood and with the support of a range local partner is responsible for all aspects of planning and implementation of initiatives aimed at reducing healthcare inequalities.*

The key steps that city administrators should consider to foster such collaborative ecosystem include:

- Designing and clearly communicating a concise set of strategic goals.
- Changing regulations and organizations, processes and skills to align stakeholders,
- Allocate funds and align them with strategic goals to kick-start initiatives, but also incentivize other stakeholders to contribute so that the program financial sustainability is stronger.
- Set up and nurture cross-boundary committees and empower them to take decisions.
- Manage performance for continuous improvement.

Collaborating with businesses, both those whose activities directly affects health, such as transportation companies, utilities, or those with factories emitting the most dangerous pollutants, and others that can implement organizational changes for a safer working environment, for instance reducing demands that workers travel to the office at peak hours or health unhealthy food in a canteen, is equally important in pursuing Healthier City goals.
THE APPROACH

A Maturity Model for integrated and sustainable Healthier City

Mainstreaming Healthier Living policies, services and processes requires adopting a holistic approach that changes the legacy management culture built around siloed budgeting processes, local bylaws and governance structures, and outdated ways of measuring success. To help City executives in assessing their progress, IDC Health Insights developed a maturity model that identifies five stages, describing a roadmap to the integration of Healthier Living policies into the wider and long term city vision. Each of these stages is measured against five dimensions. Every dimension evolves, through the five stages, along a fragmentation-integration axis, drawing the lines between successful cities, which optimize for health and sustainability, versus others, who will remain in the lower stages of the maturity pathway, because they operate in siloes and do not leverage the power that sits at the nexus of third platform technologies (cloud computing-social business-mobility-big data and analytics) to offer more agile responses to emerging business and policy needs.

Five Maturity Stages to Healthier Living

The five stages and their key attributes identified by IDC are:

Ad Hoc: This stage is the traditional modus operandi with ad hoc programs, department-based planning, and discrete pilot projects.

- The goal of the Ad Hoc stage is to begin to prove the value of the Healthier City concept and develop the business case via demonstrated ROI from pilot projects (proof of concept).

Opportunistic: Opportunistic project deployments result in proactive collaboration within and between healthcare providers and other city departments (e.g. social services).

- The goal at the Opportunistic stage is to engage key stakeholders and get their buy-in and alignment, as the strategy and road map are developed. In this phase, leaders need to identify good practices and common languages to enable business process change that will help with scalability and repeatability.

Repeatable: At this stage, recurring projects, events, and processes are identified for integration. Formal committees document defined strategies, policies, and technology investment needs with stakeholder buy-in.

- The goal of the Repeatable stage of maturity is improved outcomes and service delivery, as a result of repeatable standard processes and architectures for Healthier City projects and their coordination beyond the single department / single organization level. More formalized processes develop measures of both outputs and outcomes, to determine sustainability of the initiatives. Specific initiatives and related governance models are scaled and integration begins.

Managed: Formal systems for work/data flows and leveraging technology assets are in place and standards emerge. Outcomes based performance management shifts culture, budgets, IT investment, and governance structure to a broader city context.

- The goal of the Managed stage of maturity is for cities to be able to predict the healthcare needs of their residents and provide prevention services before problems arise.
Leveraging a shared understanding of performance metrics and a common information framework, city leaders and stakeholders are able to predict and prevent new evolutions of care needs, through a coordinated and efficient approach.

**Optimized:** A holistic citywide platform is in place. Superior outcomes deliver differentiation from other cities.

- The ultimate goal of the Optimized Healthier City is integration of Healthier Living in the long term city vision. Agile strategy, IT, and governance allow for autonomy within an integrated system of systems, while continuous improvements guarantee sustainability. The Healthier City approach is Mature. Healthier City will attract investments, visitors, and citizens, because it provides affordable, integrated high-quality services and offers a healthier quality of life.

**Five Dimensions for enabling Healthier City**

Each of the above described stages is measured against 5 dimensions (strategy, culture, process, technology and data) that need to be addressed to mainstream the Healthier City concept and make it fully operational. Many of these are not technology-related measures since the largest challenges that cities face are related to people and process (see figure 1 and Annex 1).

**FIGURE 1**

Healthier Cities Maturity Model: A Five-Stage Evolution

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Culture</th>
<th>Process</th>
<th>Technology</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad hoc</td>
<td>No strategy generalizes Healthier Living aligned to citizens needs.</td>
<td>No formal process to engage with new ideas within risk-averse culture.</td>
<td>Enterprise architecture is fragmented.</td>
<td>Data is underutilized and housed in disparate systems.</td>
</tr>
<tr>
<td>Opportunistic</td>
<td>Strategy begins at city department level, starting with pilots engaging diverse healthcare stakeholders.</td>
<td>The city experiments with patient/citizen engagement, but on a limited and purely transactional basis.</td>
<td>City moves toward a broader adoption and build-out of collaborative tools.</td>
<td>City’s stakeholders start to open data, as collaboration and big data and analytics projects are launched.</td>
</tr>
<tr>
<td>Repeatable</td>
<td>A city's vision for cross-department strategic outcomes is stated in a formal document.</td>
<td>The city proactively engages citizens, though partially personalized innovative processes.</td>
<td>Collaborative tools are integrated with business applications. SOA is adopted as an open platform.</td>
<td>City’s stakeholders start to develop a more holistic approach to integrated data management.</td>
</tr>
<tr>
<td>Managed</td>
<td>The strategy involves players beyond city administration, and healthcare providers.</td>
<td>Citizens engage with the city through multiple, customized channels.</td>
<td>Information is shared and service delivery processes are coordinated in alignment with wider city long-term vision.</td>
<td>Data is made available in open formats to provide actionable insights to further Healthier City goals.</td>
</tr>
<tr>
<td>Optimized</td>
<td>Governance enables continuous evolution and improvement of a holistic strategy for healthier living.</td>
<td>Citizen/patient experience is inclusive, personalized, and collaborative.</td>
<td>Processes are continuously improved and re-configured to achieve strategic healthier living outcomes.</td>
<td>Data are liquid, secure and personalized to preempt and adapt to healthier city needs.</td>
</tr>
</tbody>
</table>

Source: IDC Health Insights, 2013
Strategy: Defining City’s intent for Healthier Living

The strategy dimension is about City’s vision for healthcare, how the healthier living approach will be mainstreamed and embedded in the City general vision and identity. In this dimension the City identifies its sustainable “Healthier Living” objectives. The strategy dimension can be analyzed along three elements:

- A City strategic plan, defining the desired healthcare vision, mission and goals; identifying how City’s strengths and weaknesses will be leveraged and addressed.
- Development of the business case: to ensure long term sustainability of the investment plans
- Leadership: for the promotion of the city vision and communication of the benefits. Leaders typically include mayors, CIOs, and community and business leaders.

Culture: enabling a culture of innovation and people engagement

Especially when it comes to people’s healthcare conditions, city leaders tend to be risk averse, because of resource constraints and because failure, impacting citizens life, can negatively impact City executives’ reputation and career. Risk aversion makes more difficult for cities to take advantage of citizens’ (including community and business leaders) source of talent and ideas, empowered by third platform technologies. Society in the 21st century is moving from welfare state values (aimed at assuring the same level of services to all citizens- following a one size fits for all concept) toward the empowerment of individuals. Thanks to the impact of third generation platform technologies (cloud big data and analytics, social media and mobile), citizens want to adapt and personalize services according their needs. It is not an ideological question about more or less state: it is about enabling choice. It is a societal change. And third generation technologies applied to healthcare and government are forward looking instruments to enable this change. At the European level, the Malmö Ministerial Declaration introduced two important concepts:

- Empowerment of citizens and businesses, through technologies that involve them in the design and operation of services.
- Maximization of public value through the joint production of services to the public by governmental, private and civic parties.

Cultural change is needed to make sure the city capitalizes on the resources of citizens and engages with them; by becoming more experimental and innovative in the use of emerging technologies and new ideas, to solve long-standing healthcare problems.

Process: governance for an extended ecosystem

The process measures the capability to integrate business workflows, information and partnership. This is a key dimension for long term operational sustainability of a Healthier City.

- Process integration. City stakeholders need to understand how services are delivered, what type of information is needed and produced in each process, which stakeholders are involved. In a Healthier City, care processes and information need to be integrated and optimized with the citizens’ needs and behavior in mind. Analytical tools increasingly blur the boundaries between transactional and collaborative processes.
- Partnership capability influences the governance of the extended ecosystems that a Healthier City requires. Solid collaboration frameworks will require the inclusion of healthcare and public administration with external partners such as academia, private industry, ICT vendors and community groups.
Technology: the Healthier City technology architecture framework

Technology measures the adoption and penetration of ICT infrastructure and related technologies, as well as the development of the Healthier City technology architecture framework. A robust telecom infrastructure is the backbone on which the Healthier City will grow. To cover the extended ecosystems of institutions and people, ICT needs to solidly support data production, consumption and sharing in different care contexts (at patient home, in the practice, at school, at work), through the most appropriate device (e.g. desktop and mobile). Information is created and used through:

- Health and social care specific applications supporting the work of health and social care professionals.
- Social media, mobile apps and other end user interfaces, such as portals, enabling the participation of citizens and private sector, as well as city and healthcare professionals.
- Advanced and intelligent sensors, cameras, medical devices and other appliances used as data collection points, as well as triggers of event-driven workflows.

City leaders need to think at how they will ensure interoperability and systems consolidation across third platform technologies, legacy systems and the Internet of Things; for example via a Service Oriented Architecture, coherent and reliable data centers (managing data for apps and applications, as well as for advanced analytics functionalities) and shared collaboration infrastructures.

Data: increasing accessibility for transparency, collaboration and insights

The Data dimension measures how data is used and accessed. Cities have a wealth of data in their current systems, and a flood of new data coming into systems every day, such as, real time data produced by mobile devices, wearable technologies, sensors and social media. Data accessibility is paramount to better inform and engage citizens and automate processes. Increased openness and advanced analytical capabilities will enable the Healthier City vision through the provision of:

- A coherent technical and semantic framework, enabling collaboration, citizen engagement and transparency.
- A reference for crowd-sourcing and co-production, involving the private sector and the community and driving innovation (for example in areas like new mobile apps development).

Inspired by principles as transparency and accountability of institutions, the number of governments adopting open data platforms is rapidly increasing. The value of open data is, however, not limited to greater capability to control public institutions' conduct. Achieving healthier living objectives requires defining and reporting City health problems, but most importantly turning information into actionable insights. In an information dependent sector as healthcare, “liquid” data combined with Big Data and analytics can unlock real value in areas, such as services personalization, process efficiency and new care delivery model effectiveness. Healthier Cities rest on using Big Data and analytics to mine data for predictive and preventative resource allocations and planning. Big Data requires a new approach to data accessibility, accuracy and use. Open data models will be tied to culture around innovation, data protection legislation evolution, and citizen engagement. Most of the Big Data and analytic solutions deployed will incorporate multi-structured data, from multiple sources. Therefore, a significant portion of the data management budget will be dedicated to information management, security, and privacy protection.
FUTURE OUTLOOK

Healthier Cities reality and promises

The path to the Optimized stage is a long-term effort that will take years rather than months to achieve. Today there is sporadic adoption of Healthier City solutions, with only a handful of cities worldwide actively in the Opportunistic or Repeatable implementation stage. Most cities are focused on researching and evaluating use cases and technology capabilities, along with defining their vision of a Healthier City and identifying barriers to adoption. Cities, today, show more mature approach in the Strategy and the Technology dimension (see figure 2). Data, process and culture are the areas where city stakeholders need greater improvement, to move toward repeatable and more mature stage.

FIGURE 2

Average maturity of Healthier Cities in 2013

<table>
<thead>
<tr>
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<th>Repeatable</th>
<th>Managed</th>
<th>Optimized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>City experiments with citizen/patient engagement, but on a limited and purely transactional basis</td>
<td>City proactively engages citizens, though partially personalized innovative processes</td>
<td>City leaders define key services, processes and governance for integration on a broader scale</td>
<td>The strategy involves players beyond city administration, and healthcare providers</td>
</tr>
<tr>
<td>Culture</td>
<td></td>
<td>Vision for alignment among stakeholders is important</td>
<td>Citizens engage with the city through multiple, customized channels</td>
<td>Citizens/patient experience is inclusive, personalized, and collaborative</td>
</tr>
<tr>
<td>Process</td>
<td></td>
<td>Information is shared and service delivery processes are coordinated in alignment with wider city long term vision</td>
<td>Processes are continuously improved and re-configured to achieve strategic healthier living outcomes</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>City’s stakeholders start to open up collaboration and big data and analytics projects are launched</td>
<td>City’s stakeholders start to develop a more holistic approach to integrated data management</td>
<td>Data made available in open formats to provide actionable insights to further Healthier City goals</td>
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The five dimensions are closely interwoven and interdependent; therefore Cities will need partners able to understand the complexity and the breadth of a Healthier City to progress toward the more advanced stages of the model. City leaders will need to look for solutions platforms and ecosystems supporting not only the technological and data related aspects, but also processes and strategies, such as, the Microsoft City Next framework with, more in particular, its Healthier Cities Coalition of partners.
The following paragraphs describe how the 5 dimensions of the Maturity Model will be likely to evolve in the short and in the longer term, highlighting key inhibitors and drivers. In the journey toward the optimized stage, the Maturity Model can help to:

- Baseline competency in each of the five measures of the model.
- Compare against the industry benchmark to identify gaps and the desired status within a given time frame.
- Compare maturity assessments and identification of maturity gaps among business groups (e.g. GPs, Community care, agencies etc) and between business and IT within a single organization.

**Strategy**

Examples of Healthier Living thought leadership exist now in many cities, also thanks to international initiatives like the WHO European Healthy Cities Network. In the short term, a growing number of City leaders will openly state their plans to become a Healthier City; however the specifics of the vision may not be fully developed. The vision of City innovators will be frustrated by the slowness of progress for a variety of reasons, mainly around internal risk-averse cultures, governance issues, and the rigidity of engagement models with external partners, such as citizens and the private sector.

In the longer term, as these elements become more flexible and City constituents become more aware of Healthier Living benefits, City will develop its own Healthier City vision that highlights unique strengths and how they are mainstreamed in the City general identity. Areas that may have previously been handled distinctly, like public transportation, education and safety, will begin to be coordinated, especially where business groups and citizen groups of interest are engaged with city leaders.

For example, the city of Manchester (UK) is working on a broad reform of “people services” (Health and social care integration, Troubled Families, Early Years, Transforming Justice, Worklessness and Low Skills) focusing on greater collaboration among departments and a renewed approach to data collection and analysis. In particular, the Early Years initiative (addressing health and education with the aim that all children are ready for school so to reduce dependency and improve life chances) is focused on harmonizing data about children 0-5 years, today collected and managed by a number of professionals (commissioners, Early Years outreach workers, health visitors and social workers, and carers) as well as parents. The early help, early intervention public sector reform model is a new data management framework that will enable a complete, transparent and progressive view of a child’s needs, appropriately triggering and measuring interventions, self/referrals, viewing assessments, supporting decisions, knowledge of contacts/who’s involved, getting helpful information/guidance and general case management solutions and enabling more accurate strategic planning of universal and targeted family services.

**Culture**

In the short term, only a small set of Cities will be really pushing the Healthier City concept and adopt innovative frameworks and solutions, setting best practices and identifying success factors. Civic innovation models will spread and citizen engagement will continue in terms of bringing ideas in from the community or using citizen-developed health apps. With time, Cities will approach services evolution in a more systematic way, thus creating and supporting frameworks for
innovation (regular hack-days, incubators) and public private partnerships to further develop the healthcare economy.

Citizen engagement will have a steep growth curve, but it may run the risk of backsliding, if Cities do not strive to keep engagement up with fresh apps, challenges, and open data sets. Emerging cities will struggle with how much to engage citizens, given the initial high cost of educating the public on the use of some services, as well as the high cost of engagement (i.e. call center calls increasing as engagement increases).

Process

Advances in processes optimizations will materialize as partnership and cooperation models evolve. Business process optimization will be initially limited to support confined pilot projects, but the experience developed in these settings will build a solid reference framework as the City strategy advances. To find funds that can help scale projects, Cities will need to pull resource also from the private sector, as changes to existing bylaws or structures take much longer.

Cities’ leader will find difficulties in managing the extended ecosystem. In the long term, the creation of collaboration models shared and accepted by all participants, as well as the use of dashboards and indicators will be essential for the viability of the Healthier City. They will ensure that processes are optimized and reconfigured as conditions and population needs change, and that the contribution of the various players is appropriate.

Technology

Current maturity in the technology dimension is the result of the many initiatives and pilots launched in the area of disease management, especially for chronic patients, and population health management. The 3rd generation platform is emerging as the platform for smarter health and care delivery. Technology adoption is growing rapidly, especially in Big Data, analytics, and mobility. Cities that are capable to harness the value at the nexus of cloud, social, mobile and big data will take the lead and rapidly build collaboration infrastructure and solutions that can also capture data from devices, like cameras and sensors. Cities with higher technology adoption and penetration will start to take inventory of assets and think of how they can be leveraged across multiple projects and/or departments.

In the longer term, Cities will better harness the rapidly growing information production. Big Data applications will ensure that analytic functionality is made available to the largest possible number of staff and executives, supporting the shift toward evidence-based service delivery and assessment. Open and consensus-set standards will evolve and emerge to mitigate technology risks and to improve interoperability across the stack and across vendor solutions. Cities will ask technology vendors to provide platforms for add-on development by partners, citizens and cities themselves. To do so, point solutions will not be enough, it will be more important to deploy solution frameworks that enable to put an interoperability and collaboration layer on top of siloed applications; for example, by enabling CRM systems to be shared across different departments to enable great personalization of services.

Mobile and social media will be increasingly used as channels for interactive prevention and disease management campaigns. Increased strategic value of data as an asset will add additional pressure and scrutiny of a technology’s country of origin (especially when considering cloud service and data centers location), as the risk of data loss or contamination increases.
Data

Data "liquidity" will be tied very much to culture around innovation and citizen engagement. Even if more cities adopted open data strategies, health data sets available are limited and presented in deferred timeframe. Most of legacy healthcare information systems still produce data in proprietary format, hindering health information exchange and analysis. Healthcare decision makers are increasingly looking at standards and interoperability in the procurement of new systems. In the next two years, many IT-led Big Data and analytics projects will lack a connection to Healthier City goals, because of the lack of sufficient IT and business collaboration. This misalignment will lead to slow adoption of solutions and difficulty in securing additional rounds of project funding. In the longer term, program managers and city executives will become the lead for data and analytics initiatives, reducing the risk of misalignment of IT and line of business priorities.

Increasing data availability will spur bottom up innovation, with citizen and healthcare professionals inventing new apps for specific care and wellness services. With time, a growing percentage of the population will opt to share behavioral, demographic, purchasing, financial, and other personal data, though there will be backlash in some cities over the non-voluntary data collection of information, especially if there are data leaks or misuse. Privacy regulation will continue influencing an increasing portion of the data management budget in the longer term, as executives in both local government and healthcare understand integrated and secure access to data are paramount (see figure 3).

It is worth noting that progress across the five variables of this maturity model is not a steady and consistent march from one stage to the next. The move from Ad Hoc to Opportunistic takes less time and effort than the progression from Opportunistic to Repeatable, which requires significant effort to address how to scale and fund projects. Similarly, moving from Repeatable to Managed takes longer, with process issues at the forefront, but going from Managed to Optimized may take less time because all of the foundational strategic, process, and cultural issues will have been largely resolved.
# BUILDING A ROADMAP FOR HEALTHIER CITIES

City leaders looking to establish a roadmap for their Healthier City vision need to consider the different roles that will be played by the various stakeholders and the different scenarios from which they might start their journey.

## Which role for the Healthier City Stakeholders?

A Healthier City is a team game that includes a large and variable number of stakeholders, dynamically combining their capabilities to improve quality of life for citizens. This dynamic ecosystem includes the citizen who is actively engaged in his/her health choices. The different role of education institutions, primary and secondary care providers and local government services is coherently functional to this citizen centric view, and it will drive investment in specific technologies that will support the needed organizational and cultural changes. The following sections identify the role that key stakeholders -citizens, education, primary care, social services and the other city services, and hospitals- will play in the Healthier City.

**Citizens will be enabled to be actively engaged in prevention and disease management**

Public health authorities, healthcare providers, payers and education institutions should engage citizens by encouraging them to take a more active role:

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### FIGURE 3

**Top IT priorities**

*Using a scale ranging from 1 to 5 where 1 = 'Not at all Important' and 5 = 'Extremely Important' how important would you rate each of the following objectives for your IT organization?*

<table>
<thead>
<tr>
<th>Objective</th>
<th>Local government</th>
<th>Healthcare providers</th>
</tr>
</thead>
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<tr>
<td>Proven data privacy protection</td>
<td></td>
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<tr>
<td>Integrated and secure access to data and applications</td>
<td>4.10</td>
<td>4.05</td>
</tr>
<tr>
<td>Speed and cost of regulatory compliance adaptation</td>
<td>3.92</td>
<td></td>
</tr>
<tr>
<td>Improve the quality of IT skills within the organization</td>
<td>3.90</td>
<td>3.90</td>
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<tr>
<td>Improve IT governance</td>
<td>3.79</td>
<td>3.90</td>
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<tr>
<td>Lower costs of IT</td>
<td>3.79</td>
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<tr>
<td>Align IT projects and build Flexible IT systems to support strategic business priorities</td>
<td>3.83</td>
<td>3.90</td>
</tr>
<tr>
<td>IT systems consolidation</td>
<td>3.73</td>
<td>3.94</td>
</tr>
<tr>
<td>Real-time monitoring of business performance</td>
<td>3.73</td>
<td></td>
</tr>
</tbody>
</table>

Source: IDC Health Insights, 2013
• They should promote usage of mobile apps and online services that allow patients to transmit data from personal medical devices, such as glucose monitors, to their doctors.
• They should disseminate information on nutrition, wellness, availability of services and care providers by engaging with community social media, or promoting gaming apps.
• They should develop user-friendly online tools and platforms aimed at organizing and managing health information coming from the various providers.

For example, NHS Choice, UK’s largest health information website, in collaboration with 3chillies, has developed the “Health Choices” app, which optimizes information on NHS providers’ access in a mobile environment. The apps can be integrated with Microsoft HealthVault adding the ability to save condition and NHS service information against a secure personal account.

The role of education institutions is fundamental to empower citizens on their health choices since early ages. Educating and informing children and adolescents about healthier behaviors (for example on the benefits of a balanced diet and physical exercise, and on the risks associated to smoke, alcohol and of a sedentary life). To this end:

• The use of social networks can be functional in supporting key messages around prevention of diseases, increasing awareness on services available, and getting feedback from children and adolescents about their habits, how they would like to address certain issues, etc.
• Online games can be useful tools for increasing awareness about healthy behaviors, as, for example, the use of a special version of the popular game "Angry Birds" aimed at explaining and fighting the causes of child obesity. Gaming has been used also in mental health (for example, for cognitive tests) and in rehabilitation activities to make sure the repetition of exercises is less boring and executed in the right way.

Schools and higher education will provide health professionals with new skills

On the care providers’ side, professional schools and universities have also a fundamental role in training new health and social professionals, helping them to develop new expertise and skills. The wider adoption of clinical information systems, as well as the developments of genomics, proteomics, microbiomics and genetic engineering, which sit at the cross-road between medical studies and computer science mean IT skills are fundamental to leverage information systems that enable a coordinated care approach. Education institutions need to tackle IT skills gaps across generations of health professionals and at the same time to leverage and to encourage knowledge and talents within health and city’s organizations through initiatives, such as, the NHS Hack days. As the implementation of a Healthier City strategy implies management change, city leaders have to cooperate with clinicians and nurses associations to promote and deliver trainings and related activities. To this end, the use of online learning platforms can effectively support on the job trainings. Online learning platforms, which can be accessed through different devices, can flexibly support the continuous education of health professionals, without interfering to their busy schedule.

Primary care need to become the trusted patient coach

Primary care professionals, such as GPs and pediatricians, and community care professionals, such as field nurses and midwives, should avoid being cornered as gatekeepers and instead coach patients to take advantage of their collaboration with hospitals and other care and wellness providers. This will ensure that the most appropriate and affordable treatment is delivered through
adequate referrals, when acute episodes occur, and that follow-ups are built around the patient to avoid re-admission. Cities aiming to achieve healthier living objective must support the pivotal role of primary care and enable seamless:

- Sharing of medical information (prescriptions, images, videos, referrals, laboratory tests, diagnosis etc) through solutions like EHR, ePrescription systems and Health Information Exchange platforms.
- Collaboration with other care providers and the patient, through solutions that includes secure email, videoconference, instant messaging, and apps.

For example, in The Hague (Netherlands) primary care provider Florence deployed a cloud-based collaboration intranet portal in collaboration with Microsoft and Rapid Circle. The new portal allow staff member to securely access to personal mailboxes and to develop a hub for manage collaborative care projects.

- Delivery of patient centric services through relationship management solutions, supporting follow up through automated processes, pre-planned reminders, tailored reports and online portal and apps the allow patient to access their data and care plan.

Social services and wider city services will act on health inequities

City government social care departments should monitor and act on social determinants of health status, such as demographic attributes, education level, employment, housing conditions, safety and security, and gender equality. They should collaborate with community and primary care providers, as well as with education institutions, to remove inequalities that can improve the health status of City's dwellers, particularly for the elderly, mental health patients, children and disabled citizens. ICT can ease the bureaucratic burden of social care workers, and consequently free up time for services delivery. In particular ICT will enable faster case management through:

- Shared CRM systems.
- Document and content management solutions.

These solutions will manage all structured and unstructured data and support social workers in repetitive processes, such as forms and reports submission. The same technologies offering a complete view of the citizen's case can:

- Streamline claims management allowing faster response to citizens' expectations.
- Support fraud detection making sure that there are no abuses and misallocation of resources.

Along with social services, a number of other City services, such as utilities management (waste, water, gas, electricity), as well as transports, urban planning will contribute to initiatives aimed at reducing health inequalities, through the provision of data on services usage, mobility, etc, that will give insights to further dimensions of citizens social and care needs.

Hospital services use will be driven by appropriateness principles

Hospitals must ensure appropriateness of their inpatient and outpatient care services, to reduce the rate of re-admission and the number of unnecessary day-hospital admissions and tests for chronically ill patients, and slash waiting times for patients with injuries or affected by pandemics. The focus on appropriate treatment will not only improve patient safety, but also increase
productivity, because hospitals will be able to operate with fewer beds, faster patient turnover and more timely allocation of assets, supplies and people.

To achieve these objectives, hospitals will have to collaborate closely with primary and community care to optimize referrals, so not to create bottlenecks for the most urgent admissions and to follow up on patient treatment after discharge. Cities leaders should include hospitals in coordinated care initiatives and support investment in solutions like:

- EHR, ePrescription systems, and Health Information Exchange platforms.
- Collaboration suites (secure email, videoconference etc) for communications, consultations and referrals to primary care and social services.

Building on the experience of CareOptimizer (a project focused on improving the handover and care planning for elderly and fragile patients at the Ängelholm hospital, coordinating hospital and municipality services), Region Skane and the municipality of Ängelholm started an ambitious and visionary project, "Hälostaden" (Health City), aimed at further integrating health and care services within the area. The first pilot project will last for the next three years is aimed at improving appropriateness of care services, avoiding unnecessary hospital stays, by providing care at the right level and at the right time through greater interaction between healthcare and social care, hence increasing the availability of service and the patient safety, while better allocating the financial and human resources of the municipality and the care providers. The cooperation will include the creation of a new organization, that will count on 600 employees (coming from the three organizations), and will be located within the hospital or in an adjacent structure that will cover some of the region's activities at Ängelholm hospital and part of the municipality's social services. Services under the remit of this organization will include those provided by: (1) primary care and social care services, such as the integrated primary care health center (Laxen) and the primary care call of duty (available 7/7) the care planning unit, the integrated home care services and the home visit team (delivering specialist care); (2) Hospital care, through the short term stay services, the department of medicine (outpatient/inpatient) and the rehabilitation & geriatric departments. The project leaders are working with their ICT partners on the development of information systems that will integrate documents and information coming from fragmented legacy solution. Building on the experience of CareOptimizer, developed by Capgemini in partnership with Microsoft, the systems is expected to help automating and streamlining the processes, avoiding unnecessary duplication of services, easing the bureaucratic burden of the health staff and reallocating resources more effectively. Project leaders want this project to be integrated with national infrastructures as the future Swedish care record (the NPO) to accompany citizens’ care path in a complete way.

Scenarios at the nexus of the health value chain

The journey toward an optimized Healthier City sees a combination of process, people and technology evolving with citizen expectation and needs. Getting the right combination will take time and cannot be achieved with a big-bang program. Scalability and reusability of solutions developed through pilots will make the evolution more sustainable. The following paragraphs present a series of scenarios from where, according to the city vision and mission, City leaders can start their Healthier City strategy.
Remote care and case management

The increasing incidence of chronic diseases and the needs of an aging population drive Cities and healthcare providers to rethink the point of care; moving it away from the hospital setting to get closer to patients’ homes to meet patient expectations about quality of care and also to contain costs. The use of medical devices and mobile solutions, powered by cloud-based shared infrastructures and collaboration platforms enable to move the point of care to the most appropriate level - whether at home, in community centers, or in the workplace, without affecting the quality of care and the patient safety. These technologies increase access to healthcare and allow a more autonomous and engaged participation of the patient to his/her healthcare path. For example, many rehabilitation facilities already use technologies, such as Kinect and other gaming capabilities, that can help patients do physical therapy or cognitive rehabilitation also at home.

By combining medical devices, mobile phones, videoconferencing tools, CRM and content management, care teams can collaborate regardless of their location providing rapid and specialized care.

Locala Community Partnerships is a social enterprise that provides community healthcare services, such as district nursing, health visiting, school nursing, community dentistry, podiatry, stop-smoking support and continence services, in Kirklees in West Yorkshire (UK). Locala was one of the first organizations in the UK to establish Community Care Teams, where health and social care teams work together to support patients with long term conditions to stay in their own homes. To support this project Locala is implementing a new hybrid cloud based service that will deliver critical clinical and administrative information at the point of care on the move. The new service, implemented by Dell, will connect the staff with all their required clinical applications as well as the NHS N3 network, Microsoft Office 365 and Microsoft Lync. Via the internet, staff will be able to access all relevant patient information, corporate systems and unified communications tools ensuring a more efficient, agile workforce.

Pandemic and Emergency management

Migrations, tourism, international traders are exposing Cities, regions, and entire nations to emergency episodes, such as influenza virus outbreaks and food alerts, that require reactive and flexible emergency and pandemics management. Local emergencies also make it imperative for cities, heads of hospitals, and other decision-makers to take advantage of Big Data and analytics solutions that rapidly help recording, classifying, grouping, analyzing and visualizing information related to emergency patterns and support fast decision making to provide the right resources and prevent recrudescence or complications. As in these situations hospital emergency departments rapidly reach full capacity, empowering field workers and make them able to provide substantial care on the spot by providing them with mobility solutions and applications that track incidents, cases and allow consultation with hospital specialists to immediately run the triage process is important. Emergency services logistic requirements need to be included in public transport and mobility plans, providing for easier movements of citizens and health professionals within the city, therefore intelligent systems regulating traffic flow and public services usage have to be part of the wider emergency management strategy.
**Population health management**

Urban health is not a homogeneous landscape. Cities are the places where healthcare inequalities and differences of health conditions between different social groups - rich and poor, young and old, men or women, immigrants or long term residents - are exacerbated. City leaders are asked to improve the conditions of specific groups. In order to do so, a broad range of information related to social determinants need to be disaggregated and analyzed at a granular level. Cities need solutions able to cope with large amount of structured and unstructured data, coming from different sources that include hospital information systems, as well as social media and search engines.

*Leeds Teaching Hospitals have been testing a syndromic surveillance proof of concept that create a standardized approach to healthcare data analysis to support emergency preparedness and service planning. The system was developed by Ascribe, Two10Degrees and Microsoft. It consists on an end-to-end, cloud-based Big Data solution with business intelligence tools that analyses Leeds A&E records. Leeds generates up to half a million records each year and approximately one million unstructured case files each month through its Accident and Emergency Department system (Symphony). Using the system, Leeds Teaching Hospital was able to look at patterns in the data to identify potential outbreaks of infectious disease and effectiveness of vaccination programs, as well as trends that are typically more difficult to analyze, such as alcohol-related visits to the emergency room and injuries from accidents in the home. Symphony has been also optimized for the mobile environment enabling more accurate and real time collection of patient data.*

**HEALTHIER CITIES: A CALL FOR ACTION**

**Starting the journey toward the Optimized Stage**

Independently from the scenario chosen to start building a Healthier City, at the very early stage, it is important to use the model described in this paper, to develop clarity of vision, common language, and a strategic roadmap with key leaders and innovators in the city ecosystem.

As many of the issues with cities are related to people, process, and culture, it is important to work toward a balance in maturity across measures, since the inhibitors toward fully optimized benefits are related to slower maturity in process and culture. To progress towards the optimized stage IDC Health Insights recommends:

- **Strategy:** aim for a systemic vision powered by dynamic multi-stakeholder governance
- **Culture:** empower citizens and professionals to engage in a collaborative and innovative collaborative experiences
- **Process:** continuously improve business processes configuration and operations to achieve long-term outcomes
- **Technology:** harness the power of third-platform technologies’ nexus
- **Data:** make data liquid and secure to pre-empt and adapt to healthier city needs
Moreover, although each of the 5 variables have their specific development patterns from the ad hoc to the optimized stage (see appendix), it will be important for City leaders to set specific timelines in order maximize the benefit of the Healthier City Maturity Model. In particular:

- **Now:** Assess the business and IT Healthier City “as is” situation. Identify opportunities to use existing data, technology, workers, and citizens in new ways. Explore opportunities to experiment cloud and open source options as they emerge, including citizen sourcing of app development.

- **In the next one to two years (the next budget cycle):** Use early quantifiable wins to demonstrate potential and justify budget allocations. Assess architecture and skills gaps and plan to acquire capabilities. Identify business sponsors and champions that will support and promote scaling of Healthier City pilot projects to help define architectural standards. Begin governance and performance management discussions; by using a set of KPIs or performance measures to define the success of each stage (for instance, WHO has developed Urban HEART-Urban Health Equity Assessment and Response Tool).
**APPENDIX**

**TABLE 1**

<table>
<thead>
<tr>
<th></th>
<th>Ad Hoc</th>
<th>Opportunistic</th>
<th>Repeatable</th>
<th>Managed</th>
<th>Optimized</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>No strategy in place.</td>
<td>Strategy begins to take form at single city department level.</td>
<td>Strategy begins to span the borders of the single department and involves multiple organizations.</td>
<td>Strategy involves a vast array of players across city administration and healthcare providers and beyond the public sector.</td>
<td>A governance system allows continuous evolution and improvement of the strategy.</td>
</tr>
<tr>
<td></td>
<td>▪ Population health needs are not addressed in the general policies of the city</td>
<td>▪ Healthcare needs are analyzed and desired outcomes start being defined.</td>
<td>▪ Application of a common business cases and its expansion to new, but related, initiatives.</td>
<td>▪ Objectives are clearly communicated and accepted citywide</td>
<td>▪ The leadership is engaged into a holistic and broad scale transformation of processes, culture, and operations.</td>
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<td></td>
<td>▪ Investments are focused on discrete and scattered areas (for instance, limited tele-monitoring projects run by the city hospital, as research initiatives) with no business case for generalizing Healthier Living initiatives.</td>
<td>▪ Pilot projects are instrumental to demonstrate ROI. Data collected at the ad hoc stage are formalized into business cases and methodologies informing investment management decisions, and corroborating the business case for a future scaling of the solution.</td>
<td>▪ City’s vision with expected outcomes is stated in formal documentation.</td>
<td>▪ Value for money, developed at the opportunistic stage and then standardized at the repeatable stage, is used for benefits realization to manage performance against strategic objectives.</td>
<td>▪ Strategy evolves based on continuous feedback enabling a continuous progress on KPIs against mission-based performance.</td>
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<td></td>
<td>▪ City leaders do not engage with healthcare processes stakeholders: healthcare is still perceived outside city’s remit.</td>
<td>▪ City leadership start engaging with healthcare stakeholders, but not in a structured way</td>
<td>▪ Leadership and key stakeholders invest in projects with vision of long-term scalability (for example, starting identifying possible funding within the involved organizations’ budgets on a case by case scenario)</td>
<td>▪ Leadership provides dedicated budgeted funding mechanisms.</td>
<td>▪ Healthier living objectives are embedded within overall city strategy</td>
</tr>
<tr>
<td>Culture</td>
<td>Ad Hoc</td>
<td>Opportunistic</td>
<td>Repeatable</td>
<td>Managed</td>
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<tr>
<td>No formal process to engage those with new ideas inside or outside of</td>
<td>City experiments with citizen/patient engagement on healthcare related initiatives via social networks and mobile apps as a new channel.</td>
<td>City proactively engages citizens, though partially personalized direct communications.</td>
<td>New services enabled and driven by the interaction of citizens via mobile, sensors and social networks interactions (for instance, prevention campaigns delivered via social media integrating location based and personalized advices or through online gaming activities).</td>
<td>Citizens independently engage with the City through multiple channels according to their needs.</td>
<td>City has cultivated engagement models that are inclusive, personalized, and multidirectional ongoing collaborations.</td>
</tr>
<tr>
<td>healthcare related initiatives. Pockets of innovation exist within</td>
<td>• In this phase, the interaction with citizens is still limited and purely transactional.</td>
<td>• Innovation culture supported by processes that allow risk.</td>
<td>• Innovation culture supported by processes that allow risk.</td>
<td>• The City provides a broader range of services in new, easier, more accessible and affordable ways, engaging with citizens on their terms (for example, with health and social services mobile apps that are available 24/7).</td>
<td>• The personalization of services and the education activities on Healthier Living include not only the interactions between the city departments and citizens, but also, on a voluntary basis, the interactions that citizens have with one another (for example interactions between patients and their families), adding a further dimension to engagement.</td>
</tr>
<tr>
<td>risk-averse culture (impromptu &quot;rogue innovators&quot; within city departments), with no specific programs aimed at supporting the work of innovators and new entrepreneurs.</td>
<td>• Social media are used to increase people awareness on services availability and getting instant feedback on single initiatives (e.g. more advanced techniques such as social sentiment analysis are not in use).</td>
<td>• New initiatives that capitalize on 3rd platform technologies (cloud, mobile, big data and social media) are funded and/or city starts providing resources and infrastructures to different public and private</td>
<td>• New initiatives that capitalize on 3rd platform technologies (cloud, mobile, big data and social media) are funded and/or city starts providing resources and infrastructures to different public and private</td>
<td>• Healthier living policies are assessed and adjusted in almost real time, leveraging network analysis and big data capabilities. Health and social care innovation is institutionalized and managed within the</td>
<td>• Healthier living policies are assessed and adjusted in almost real time, leveraging network analysis and big data capabilities. Health and social care innovation is institutionalized and managed within the</td>
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<td></td>
<td>• Innovation is supported through specific and time limited initiatives, generally at department-level, where city employees start innovation initiatives agreed with management.</td>
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### TABLE 1

**Evolution of the Five Dimensions in the Five Healthier City Maturity Stages**

<table>
<thead>
<tr>
<th>Dimension</th>
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<th>Repeatable</th>
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</table>
| Process            | Health and care processes are managed at single department/single institution level, budgets are siloed and decision making is fragmented. Where present partnerships are managed in a traditional one to one relationship and have a very limited span. | City leaders start analyzing specific citizens' needs and which processes support their fulfillment. Several initiatives are launched with ad hoc process rationalization and optimization.  
- Project base multi-department initiatives as well as new models of engagement with external partners are tested, but shared processes, budget and decision making still have very limited time span.  
- Typical areas where collaboration is tested | City leaders identify key services categories for integration on a broader scale.  
- Formal committees, that represent stakeholders involved, define and document processes needs for optimization and standardization.  
- Specific initiatives begin to be scaled and real integration begins. Better use of information and the processes in place to respond to events drives improved outcomes and service delivery. | The various processes are coordinated at the program level and integrated in the wider city vision.  
- Information flows are standardized and shared. Collaborative processes are a key component of stakeholders' mission.  
- Accountability and performance management is for end-to-end processes, not limited to organizational units.  
- Program budgets cut across departments and multiyear planning and | Processes are continuously improved and re-configured depending on what's needed to achieve strategic outcomes and their impact on the whole city.  
- Decisions about processes optimization and reconfiguration are outcome-driven, and not anymore driven by the single organization logic.  
- People and organizational units' participation depends on their capabilities to contribute to outcome, not on their hierarchical |
### TABLE 1
Evolution of the Five Dimensions in the Five Healthier City Maturity Stages

<table>
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<tr>
<th>Ad Hoc</th>
<th>Opportunistic</th>
<th>Repeatable</th>
<th>Managed</th>
<th>Optimized</th>
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<tbody>
<tr>
<td>include elderly care and children care services. A narrow number of organizations or departments are involved in these coordinated care initiatives.</td>
<td>• Process sustainability through dedicated funding models becomes a focus.</td>
<td>• The maturity of the relationship with partners evolves to include benefits sharing and co-development of solutions.</td>
<td>budgeting for common programs, services, and infrastructures is in place.</td>
<td>role.</td>
</tr>
<tr>
<td>Technology</td>
<td>The overall ICT environment present functional and integration gaps</td>
<td>• City moves toward a broader adoption and build-out of wireless broadband to support the launch of specific projects, such as remote monitoring of chronic patients, using sensors, cameras, medical and mobile devices.</td>
<td>Collaborative tools are integrated with the business process applications in use.</td>
<td>Shared infrastructural and back office solutions create the conditions to leverage on common data set and processes</td>
</tr>
<tr>
<td>• Broadband/wireless infrastructure adoption and use is inconsistent.</td>
<td>• The involvement of different organization units spurs the adoption of collaboration and health information exchange platforms that need to be available on different devices.</td>
<td>• SOA is pervasively adopted as an open platform in which data, business logic and presentation layers are separated for more flexible management.</td>
<td>• Ubiquitous broadband network, leveraging an extended ecosystem of smart devices and sensors, leads to real time dynamic data output to support Healthier Living services.</td>
<td></td>
</tr>
<tr>
<td>• The enterprise architecture is fragmented and transaction between systems is based on duplication.</td>
<td>• Processes continue to</td>
<td>• User friendly interfaces and apps are developed to support health and social professionals, and to engage citizens involvement in their care path.</td>
<td>• Data center harmonization and cloud services enable the set up of shared back office systems such as ERP and CRM, allowing a</td>
<td></td>
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<tr>
<td>• Health and social care professionals use fragmented applications supporting separate transactional processes in each unit.</td>
<td></td>
<td>• IT decision makers</td>
<td>A sustainable city &quot;technology platform&quot; is in place. Third platform technologies and IoT (Internet of Things) are fully interoperable with legacy systems and open to new development such as in BYOA, allowing agile configuration of new collaborative processes.</td>
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<td></td>
<td></td>
<td></td>
<td>• Compliance to data security and privacy regulation is delivered through a federated identity management system.</td>
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<td></td>
<td></td>
<td></td>
<td>• Contextual information of IoT, mobile and social</td>
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### TABLE 1

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</thead>
<tbody>
<tr>
<td></td>
<td>Social media and apps usage is very limited.</td>
<td></td>
<td>embark on data center rationalization and consolidation to support long term multi-organizations projects.</td>
<td>more efficient and comprehensive allocation of resources and understanding of citizens needs.</td>
<td>are used to nurture two-way collaboration between public servants and empowered citizens.</td>
</tr>
<tr>
<td></td>
<td>rely on dedicated transactional systems, but IT departments across the various units start adopting a service-oriented architecture (SOA) approach to enable consolidation.</td>
<td></td>
<td>Data are collected and organized to inform performance management across organizational units.</td>
<td></td>
<td>The enormous amount of data produced, along with greater standardization of data sets and an efficient data center management drive larger adoption of Big Data and Analytics</td>
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<td></td>
<td>Access to information and security policies are still managed in isolation at single organization level.</td>
<td></td>
<td>ID management starts to be standardized at the enterprise level. As the role of mobile technology becomes essential to services delivery, the adoption of comprehensive device management strategy becomes paramount.</td>
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<td></td>
<td>ICT departments start exploring the opportunity offered by cloud as they focus on accelerating services deployment and on decreasing maintenance and compliance costs.</td>
<td></td>
<td>Collaboration processes starts to leverage the inputs from social media, although information flux is still mainly one-way.</td>
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</tr>
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</table>

Data analysis includes different contexts and purposes (public health policies efficacy, chronic disease management, definition of optimal treatment pathways, spend management, fraud detection, etc), contributing to the transformation of the City information systems into an intuitive and performance driven environment.
**TABLE 1**

Evolution of the Five Dimensions in the Five Healthier City Maturity Stages

<table>
<thead>
<tr>
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</thead>
</table>
| **Data** | Data is underutilized and housed in disparate systems with proprietary specifications that limit information exchange capabilities.  
- The secondary use of citizens health data is limited to specific data set and for very specific initiatives.  
- Access and use of data is limited to single organizations because of issues with data integrity, privacy/security and integration. | City's stakeholders start to address data integrity and data interoperability as collaboration and big data and advanced analytics projects are launched.  
- Some data sets are opened to public. Data becomes more widely shared across departments, although sharing is limited to single initiatives scope.  
- In this stage, whether they are technically solid or not, many data and analytics IT-led projects will lack a connection to business goals, and a continued lack of sufficient IT and business collaboration will lead to slow adoption of solutions and difficulty in securing additional rounds of project funding. | Data is used to provide actionable information to further Healthier City goals.  
- Progress is made in accuracy and semantic consistency, as data center rationalization initiatives are launched and interoperability standards become an almost mandatory element in the selection of line of business solutions.  
- Formal systems for data flow between different organizations are set up.  
- Data use is focused on maintaining quality for big data and analytics use cases, that are more and more lead by business leader rather than IT departments.  
- Open data becomes strategic to start leveraging skills and | Data is used for predictive models for improved services. Information is ubiquitous, open, and personalized.  
- The availability of data in real-time fashion combined with analytical capabilities and shared business processes enable City leaders to predict most of the needs of their residents and provide preventative services before problems arise.  
- Real-time data is displayed using dashboards, GIS, and other visualization tools for improved decision making allowing faster response for non predictable events.  
- Big Data and Analytics help City's decision makers to prevent inefficiencies and adapt workflows for improved |
**TABLE 1**

Evolution of the Five Dimensions in the Five Healthier City Maturity Stages

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>ideas from many organizations and citizens’ community groups.</td>
<td></td>
<td></td>
<td></td>
<td>by the extended Healthier City environment.</td>
<td>outcomes.</td>
</tr>
<tr>
<td>• Citizens use data to make more informed choices about their health, to manage their care path in coordination with care services providers.</td>
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Note:

Source: IDC Health Insights 2013
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