

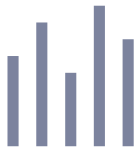
respiratory_care v2.0

Redefining value in healthcare: how data can help improve outcomes

WHITEPAPER
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_introduction



The wider economy is inextricably linked to the healthcare economy: if we cannot afford to treat people and to keep populations healthy, their ability to work will suffer and negatively impact the broader economy along with their individual wellbeing.

The current healthcare model in the United States (US) is economically unsustainable. Population growth, demographic shifts and chronic care costs all mean that something needs to change. Per capita spending on healthcare in the US almost tripled between 1996 and 2014 and there are no signs that overall spending will decrease in the near future.¹

Many efforts have been made to address the problem to a greater or lesser extent, with cost-cutting measures and drives for improved efficiency becoming commonplace. But real change will require drastic disruption – an entire mindset shift to look beyond accounting or cost savings at an individual or local level and instead think much, much bigger. To help people live healthier, more productive lives, savings and efficiencies need to be considered alongside improvement in clinical and patient-reported outcomes. To help people to see the benefits that accrue to both themselves and to wider society as a result.

The system needs to be evaluated holistically – how healthcare and well-being relate to the broader national economies and the interaction between them over the long term. The wider economy is inextricably linked to the healthcare economy: if we cannot afford to treat people and to keep populations healthy, their ability to work will suffer and negatively impact the broader economy along with their individual wellbeing. While nations have always aimed to improve health and outcomes at a population level, this needs to begin with an individual focus on personalized care. We need a more comprehensive approach to healthcare and to empower people to take more responsibility for their own health, using more reliable information and feedback

to enable smarter, effective decisions. Alongside this, we need to measure and predict the full longer-term economic impact of data-driven interventions.

Making the most of the data

Data are everywhere, collected, every time we make a cashless purchase, shop online, communicate via online platforms or query something via search engines. We increasingly rely on data in healthcare, in the form of the metrics used to determine outcomes and value. However, it is not always clear which data are valuable and which are just noise, how exactly data should be collected and how they should be applied. To make the most of the data we can collect and the treatment options we have, technology that informs and enhances human interactions and decision-making is essential. We need new ways of collecting data beyond the clinic, to give a more accurate view of both treatment and outcomes.

In our previous whitepaper we explored the need for increased collaboration between the technology and pharmaceutical industries to produce healthcare technology and services that could be of real benefit to patients, healthcare providers, and payers. In this document, we look at how we can use some of these new technologies to measure, prove, and enhance value when it comes to healthcare in the current and future US environment, particularly in the field of respiratory care. New data can offer us more insight and inform dialog about how patients take their treatment, how they feel and how well they are managing their disease. Technology isn't just transforming the way that healthcare is delivered, but it can also transform the way that we pay for it and how we collectively define value.

_reducing costs, increasing value, or both?



As early as 2009, it was estimated that eliminating duplicate testing had the potential to save up to \$8 billion.⁷

Over the past few decades, change in the US healthcare system has been driven primarily by a desire to contain or reduce costs while maintaining quality of service and improving outcomes for patients. But with a fragmented system that relies on cross-subsidizing reimbursement even within individual centers, it's not always clear exactly what individual elements cost, never mind what needs to change to reduce waste and increase value.²

Traditionally, healthcare in the US has been provided on a fee-for-service basis, with the majority of people obtaining health insurance coverage via their employer, creating a deeply entwined dynamic between health and employment.^{3,4} Healthcare providers at point of treatment provided services and then billed either the insurance company directly, or the patient who would then apply for reimbursement from the insurance company. A dissociation between receipt of healthcare and payment inevitably caused a fundamental disconnect in both perceived value and logistical coordination of healthcare. This created a system where providers were not encouraged to coordinate patient care, leading to duplication of services and waste.^{3,5} For example, prior to the introduction of health records, it is estimated that 55% of Medicare recipients experienced repeat echocardiograms within three years.⁶ As early as 2009, it was estimated that eliminating duplicate testing had the potential to save up to \$8 billion and in 2015, duplicate tests were still being reported as a systemic issue.^{7,8}

Fee-for-service to managed care

With reimbursement and revenue predicated on the delivery of more services to more people, 'quantity' of care has not always corresponded with improvement in patient outcomes.⁹ If you are paid purely for treatment, not prevention of disease, there is no strong financial incentive for keeping people healthy, reducing errors and complications, or avoiding unnecessary care.⁹ Combine this environment of fee-for-service with unconstrained patient choice and generous coverage, and the recipe was perfect for high utilization and

ballooning costs. Attempts were made to limit utilization and costs to payers through financial barriers such as deductibles and co-pays with some success, but when there were few restrictions placed on the provision of care, these attempts have had limited impact on overall costs.³

As a result, and with costs to insurers and government providers (Medicare, Medicaid) increasing, systems of managed care were introduced to try and contain costs.¹⁰ Managed care as a whole encompasses a wide range of activities and systems but in general, refers to any mechanisms designed to reduce unnecessary healthcare costs while improving outcomes.¹⁰ Such mechanisms and tactics include: incentives for the use of less costly forms of care; increased cost-sharing; controls on length of stay for inpatients; selective contracting with providers (care networks); focused referrals to select providers based on outcomes and total cost of care, and increased use of formularies among others. In addition to cost containment, these programs also looked to improve the quality of care and health by instituting pay-for-performance measures (rather than fee-for-service) and encouraging healthy choices and behaviors.¹⁰

During the 1980s and 90s, enrolment in managed care plans increased dramatically, and today, the majority of people in the US are enrolled in plans with some form of managed care.^{3,10} As with any measures introduced primarily to reduce costs, both patients and healthcare professionals initially expressed concerns about the widespread introduction of managed care, suggesting that such plans might reduce coverage and quality of care as price became a primary concern.³ In addition, where people were previously used to free choice in terms of services and treatments, reductions in patient and physician choice raised concerns about physician autonomy.^{11,12}

Research into the impact of managed care programs suggests that quality of care and outcomes have not deteriorated under these initiatives.³ However, despite initial success in reducing healthcare

spending and stabilizing premiums for patients, costs continued to increase, in part due to the development of new technologies and drugs, thus insurance companies are increasingly looking for other options for containing healthcare expenses.¹⁰ This combined with physician

concerns and patient dissatisfaction^{11,12} suggests that managed care programs had some impact on costs to insurers, but they can't be considered to have improved or provided value to all stakeholders.



The majority of people in the US are enrolled in plans with some form of managed care.³



_increasing costs without improving outcomes



Per capita spending on healthcare in the US increased by 148% between 1996 and 2014.¹

Unfortunately, the initial impact on costs seems to have been temporary. Much has been made in the past few years of dramatically increasing healthcare costs in the US without any corresponding improved outcomes for patients. Research has shown that healthcare costs are higher for Americans than Europeans, despite higher levels of healthcare utilization in Europe.^{13,14} Per capita spending on healthcare in the US increased by 148% between 1996 and 2014, and the 2014 per capita spending in the US was almost double that of France (Fig 1).¹

As employers and insurance companies attempt to reduce their own costs, the burden of healthcare spending falls more heavily on individual consumers. Today, the average cost of healthcare for a family of four in the US is \$25,000 per annum, with employees paying an average of 43% of this amount in insurance premiums and out-of-pocket expenses.¹⁵

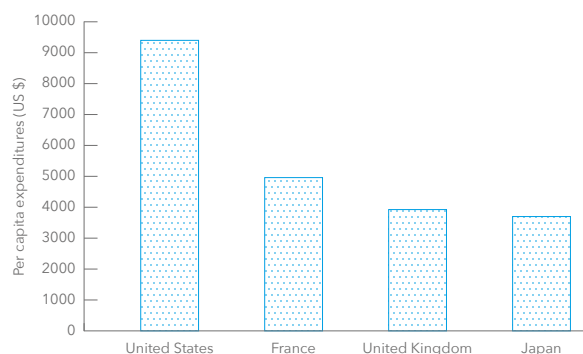


Figure 1. Annual per capita health expenditures by country in US dollars (2014). Adapted from World Health Organization Global Health Expenditure database¹

Costs without benefits

Yet, despite outspending all other wealthy nations when it comes to healthcare, outcomes such as overall life expectancy in the US are no better than those of other countries.^{16,17} In an older analysis of health system performance across member states, the World Health Organization ranked the United States at 37 of 191 (below France, Japan, the United Kingdom and Australia among others) in terms of healthcare efficiency.¹⁷ More recently, in a study of healthcare access and quality across 195 countries, the US was ranked 35th, below Australia (ranked 6th), Japan (ranked 11th),

the Nordics and other EU countries.¹⁸ Across the world, higher levels of healthcare expenditure are generally correlated with increased life expectancy; but disproportionate spending in the US has not had a corresponding effect on mortality.¹⁹ The system is obviously not performing as efficiently as it should and we need to look to new technologies and data available to us to work out how it can be improved. The reasons for high and increasing costs are varied but key among them are high medication costs, administrative costs associated with billing multiple different insurers and negotiating with providers, defensive medicine (the over-prescribing of diagnostic tests, imaging and therapies to help alleviate or defend a future lawsuit), and patient desire for the newest treatments and technologies.²⁰ When it comes to drug prices, it has been reported that the US pays the highest prices for branded medications globally.^{21,22} However, most pharma companies state that few patients or companies pay the high 'sticker' costs listed for many branded medications. Also, such comparisons fail to take into account negotiated price discounts and rebates and the multiple programs in place to reduce prices for patients such as samples and coupons.²³ While coupons and samples reduce initial costs for the end consumer, they do not reduce spending on branded medications in the long term, even increasing costs to payers if they encourage patients to use branded products over less costly generic medicines.²⁴

Proving the value of treatment

Despite this complexity, in the news and in the minds of the public, increasingly expensive healthcare is primarily seen as being caused by increased drug prices by pharmaceutical companies. This opinion is furthered by headline stories on the likes of Martin Shkreli and Mylan's epipen 'scandal'.²⁵ Such stories create and reinforce perceptions of pharmaceutical companies increasing costs without providing anything of additional value and fail to take into account the risk and investment costs of bringing new products to market. To counteract this, we need to be able



In a study of healthcare access and quality across 195 countries, the US was ranked 35th.¹⁸

to define and prove value for new and established products, whatever their impact on costs. It is here that technology and new data may help to provide an answer.

We already measure the impact of medications on efficacy outcomes pre- and post-launch. With new technology and analytics, there is no reason why we

cannot bring efficacy and productivity measures together to investigate the impact and benefits of specific interventions on the economy. But for such modelling and analysis to be useful, it needs to be valuable to patients, payers and healthcare professionals who may have very different interpretations of the concept.



_value in healthcare means more than just reducing costs



In 2013, asthma alone accounted for 13.8 million missed days of school in the US.²⁷

For both people and healthcare systems, value and costs need to be considered beyond just the healthcare economy and direct expenditure. We also need to take into account the effects on the wider economy through impact on productivity, lost earnings and other consequences of poor health.

An area in which we can easily examine value to the economy beyond cost is in respiratory disease, where even moderate disease can have a direct impact on the economy through reduced productivity, symptoms, and exacerbations if the disease is not well controlled.²⁶ In 2013, asthma alone accounted for 13.8 million missed days of school in the US²⁷ and in 2008 it was responsible for 14.2 million missed days of work.²⁸ A large proportion of these missed days can be linked to inadequately controlled disease, issues with adherence, and incorrect inhaler technique.^{27,29} Improving the 'value' of treatments in this case could be as simple as ensuring that they are being used correctly.

Encouraging healthy choices

One thing that is becoming increasingly prevalent is the provision of 'wellness' plans within employer-provided insurance.³⁰ These plans aim to encourage and incentivize healthy behaviors in individuals in the present, with incentives such as reimbursement for gym membership, to avoid expensive treatment of lifestyle-related diseases further down the line. Such plans have great potential to improve the overall health of Americans but they must also be carefully regulated to avoid discriminating against individuals based on their health status.^{30,31} Such programs can also engender pushback from patients who are resistant to being forced into healthy behaviors or concerned about the perceived invasion of privacy.³² For such programs and incentives to be truly successful, they need to be fair for all employees as well as personalized to individual needs.^{31,32} To this end, insurers such as Aetna are piloting more targeted approaches. In partnership with Newtopia, a personalized health company, Aetna

Innovation Labs used a combination of behavioral science and genetic testing to design a personalized weight management program for employees at risk for metabolic syndrome.³³ Such tailored programs have the potential to increase real engagement and improve outcomes for employees, as well as reducing healthcare costs for employers in the long term.

Towards value-based care

As costs have spiraled and budget pressures have increased, both public and private healthcare payers have turned increasingly to value-based programs. These programs are designed to reward health care providers for providing quality care to patients rather than being reimbursed purely based on the quantity of care provided.³⁴ Such programs generally subscribe to the 'Triple Aim' in healthcare: simultaneous pursuit of improved patient experience of care, improved health of populations, and reduced per capita cost.³⁵

Of course, achieving these aims means being able to measure them and so alongside these programs, payers have introduced new incentive structures and quality measures, linking quality of care and improved outcomes to reimbursement. Tools and systems such as the Healthcare Effectiveness Data and Information Set (HEDIS) measures from the National Committee for Quality Assurance, Quality measures, Star Ratings, Physician Quality Reporting System from the Centers for Medicare and Medicaid Services all capture a range of metrics. These include disease outcomes, medication usage, patient satisfaction and others to gauge the effectiveness (and so the perceived value) of health plans and even individual centers.³⁶⁻³⁹ Such metrics and outputs can be used to rank systems and continually measure improvement or failings over time.

With improved measurement of outcomes, there has also been the development of specific risk-bearing entities, which are focused on providing value and quality for patients. Patient-centered medical homes (PCMH) aim to improve healthcare by delivering primary care that is high-quality,



Each year, US physician practices in 4 common specialties – cardiology, orthopedics, primary care, and multispecialty practices – spend more than \$15.4 billion to report quality measures.⁴⁴

and accessible, but also efficient.⁴⁰ Other groups of doctors, hospitals and healthcare providers have come together voluntarily to form accountable care organizations (ACOs). In contrast with the previous system of fee-for-service where duplication of effort was financially rewarded, these organizations incentivize providers to provide coordinated quality care and avoid medical errors and unnecessary duplication of services.⁴¹ In one example of the use of analytics to improve efficiencies and reduce costs, Texas Children's Hospital identified a situation in which asthma patients were receiving a large number of unnecessary chest X-rays. By consolidating data sets, they achieved an associated reduction in unnecessary chest X-rays of 46%, with associated reduction in length of stay for patients and healthcare costs.⁴²

Together these provide alternative options to the previous system, but they are not completely coordinated offerings and specific systems are at different stages of embracing the model,⁴¹ meaning that they still have limited effects on overall costs.

Quality measures and patient outcomes

While effective to some extent in producing cost-efficiencies, some of these programs have received significant pushback from healthcare professionals with reimbursement tied to outcomes that are easy to measure, rather than those that are of particular value to patients. For instance, the HEDIS quality measure has been criticized as being almost entirely process-focused, without measuring or tracking real disease or efficacy outcomes.⁴³ To some extent this is to be expected when so many of the current metrics available to us are proxies rather than true outcome measures, and is something that may improve as technology allows us to more accurately measure outcomes. For example in respiratory care, new technology makes it possible to track real adherence to medications and to then link this with outcomes such as frequency and severity of symptoms. This improves on the previous method of tracking prescription refills – an often unreliable and incomplete measure.

In some ways the pure number of metrics and tools is itself a complication, when individual payers rely on different tools to measure value, how do you compare across systems? Each year, US physician practices in four common specialties – cardiology, orthopedics, primary care,

and multispecialty practices – spend more than \$15.4 billion to report quality measures.⁴⁴ How many of the metrics are for payer benefit rather than being designed to measure and drive improvement of patient care and are we realizing that both need to be considered together? Is it even possible to separate these aspects as we move into a future state where care, economics and society cannot be siloed? When the measurement of outcomes takes resources, can we find metrics that are cheaper to obtain as well as economically sound and of benefit to the patient?

Perhaps what we need at this stage is not more metrics. Instead, we should take a step back and identify those metrics that have a real impact on patient health and wellbeing, and ensure consistency of these across the entire healthcare ecosystem.

One entity that attempts to address this situation, to some extent at least, is the Institute for Clinical and Economic Review (ICER). The ICER Value Assessment Framework was established to understand how best to use evidence as the foundation for a more effective and sustainable health care system.⁴⁵ The Assessment Framework was developed to evaluate the evidence base for drugs, devices, tests and delivery systems and to inform and to support deliberation on medical policies related to health services (e.g. tests or treatments) and delivery system interventions.⁴⁶ Other value frameworks exist, for instance those developed for use in cancer treatment, by the American Society of Clinical Oncology, the National Comprehensive Cancer Network and Memorial Sloan Kettering Cancer Center. But these systems are only as good as the data available to them and their scale and focus on population-based recommendations are not necessarily well-suited to the environment of increasingly personalized medicine in which we find ourselves today.

Paying for outcomes, not just pills

With new technology and widespread data collection, we now have more potential opportunities for measuring the real impact of interventions beyond clinical trials at both the individual and population levels. But are we set up to utilize this data effectively, and what does it mean for assessing efficacy and value post-launch?

In the world of value-based healthcare, price and value for pharmaceutical products are intertwined. This focus on price versus outcomes leads to value-based contracting



Today, 25% of health plans have at least one outcomes based contract in place.⁴⁷

and value-based pricing. Today, 25% of health plans have at least one outcomes-based contract in place.⁴⁷ With such contracts, pharmaceutical companies provide some level of reimbursement to insurers if a patient does not achieve predefined outcomes based on expected efficacy.⁴⁷ This situation is becoming more common, with pharma expected to vouch for the anticipated efficacy of their product by assuming at least some of the risk beyond the development and approval phase. However, as with the value-based programs, the outcomes measured are generally those that are of most importance to the payer: particularly, avoidance of costly hospital stays or need for additional treatment due to inadequate efficacy.

Examples of value-based contracts include an outcomes-based refund contract between Amgen and Harvard Pilgrim, which states that Harvard Pilgrim receives a rebate for the cost of Repatha for an eligible patient who has a heart attack or stroke while on Repatha following a period of drug adherence.⁴⁸ In the field of endocrinology, Aetna and Merck signed a value-based contract for Januvia and Janumet in which Merck's rebates for Januvia and Janumet, will be partially based on how the products help members with type 2 diabetes achieve or maintain treatment objectives.⁴⁹ Meanwhile, Cigna and Novartis have signed a similar value-based contract for the heart failure medication, Entresto. This pay-for-performance agreement ties the financial terms to how well Entresto improves the relative health of health plan members, by reducing the proportion of patients with heart failure hospitalizations.⁵⁰ The long-term impact of these types of contracts on both outcomes and costs are yet to be determined, but such partnerships are being closely watched by the industry.

Value-based healthcare places significant pressure on manufacturers to deliver innovative products and resources that support the value of the brand and fulfill a unique niche in the market. Such agreements also mean increased attention on identifying the ideal patient population. All interested parties want to identify those people who will experience the greatest benefit from the point of view of both payer and pharma. This can be a particular challenge when those who are most likely to benefit from a product are the least likely to engage with it, for example, with patient support systems designed to increase adherence.

Proving value to patients

While outcomes such as reductions in hospitalization are certainly of interest to patients, they do not take into account patient satisfaction or experience in general when measuring and defining value and reimbursement. As patients become more active healthcare consumers rather than passive recipients of care, there needs to be a way to incorporate the concerns and preferences of patients into cost and value considerations. This needs to be considered alongside the upfront costs, further treatment needs and eventual long-term economic impact. And with patients bearing a larger proportion of healthcare costs themselves via co-pays and increasing premiums, perhaps there is a case to be made for value-based pricing directed at the eventual consumer, rather than the intermediary of the healthcare provider or insurance company. The entire healthcare offering – support services as well as products themselves – need to be considered when designing the brand and targeting it to the most appropriate patient population. This will enable both the provision of greater value to patients in the form of a more holistic offering, and will also help to improve engagement with treatment and positively impact both treatment outcomes and overall wellbeing.



_the right patient, the right intervention, at the right time



There is a willingness in both pharma and payers to explore new options and trial new approaches.

One of the benefits of the US healthcare system structure is the scope and opportunity for exploring new ways of both demonstrating value and managing costs. There is a willingness in both pharma and payers to explore new options and trial new approaches, both separately and collaboratively. With new technology comes increasing potential for measuring, demonstrating and improving value, through capturing data, modelling outcomes and improving health through novel interventions.

Using data to guide treatment

Increasingly, payers and providers are seeing how sharing population-based data can lead to improved efficiencies and improved outcomes. Predictive analytics are already being used to identify at-risk patients and to guide interventions in healthcare. For example, the recently extended partnership between the health benefits company Anthem and tech company Inovalon.⁵¹ Under this agreement, providers in shared risk contracts with Anthem can use the predictive analytics provided by Inovalon to identify gaps in care or issues with current management and to drive appropriate interventions. Data are utilized to see what is driving high treatment costs in their patient populations and make appropriate changes.⁵²

Pharmaceutical companies are also seeing the benefit of new technology in the potential for predictive modelling of outcomes to justify value. For instance, Biogen has started to use predictive modelling to negotiate better value-based contracts with payers for multiple sclerosis drugs.⁵³ At the heart of this approach is the identification of key patient and population characteristics that predict a positive response, making it particularly suited to niche products and the trend towards increasingly personalized medicine. This is closely related to the proliferation of biomarker measurement and companion diagnostics. For example, an FDA-approved companion diagnostic genetic test to identify patients with metastatic colorectal cancer, who are

suitable candidates for treatment with Vectibix based on KRAS gene mutation status.⁵⁴ For payers and providers alike, the key is getting the right drug, to the right patient, at the right time, so that the patient sees the maximum benefit and the system as a whole minimizes waste.

Options for improved monitoring

Technology also provides new possibilities in the form of simplified monitoring for patients. An example of this is the Freestyle Libre flash glucose monitoring system from Abbott, a small 'band-aid' style sensor which the patient wears that automatically measures glucose readings without the usual requirement for finger prick testing.⁵⁵ These devices reduce direct costs for both patients and providers through reduced need for healthcare consumables, but also provide additional benefit to patients in terms of ease of use, semi-continuous feedback loops, quality of life, convenience and the ability to easily record accurate data, which can be shared with their physician. Continuous glucose monitoring via the sensor provides insight into patterns and trends, facilitating near-term therapy titration and better long-term diabetes management.⁵⁵

With increased monitoring comes the ability to identify problems more quickly, or in situations that would otherwise be impractical. Even procedures such as an electrocardiogram (EKG), which would previously require a clinic visit, can now be conducted remotely.⁵⁶ Spending on remote patient monitors more than doubled between 2007 and 2011,⁵⁷ a trend that opens up possibilities for earlier intervention and improved management across therapy areas. For instance, in asthma care, companies and healthcare providers are already recognizing the potential of monitoring rescue inhaler use to predict risk of exacerbations.⁵⁸ Already a step forward from tracking adherence and inhaler use via highly time-delayed prescription refill data, here the confirmation of inhaler activation was provided. These data demonstrated an impact on hospitalization rates and disease



There is huge potential for technology to influence health and healthcare costs through inducing behavior change.

control,⁵⁸ and offer a potential roadmap for the use of such data for predictive opportunities in other disease areas.

Expanding remote healthcare

With increased options for remote patient monitoring (RPM) and accurate data capture come opportunities for further efficiencies in the form of telehealth. Some providers are now even offering telehealth kits including Bluetooth-enabled scales, blood pressure cuffs, pulse oximeters and an iPhone programmed with a RPM app.⁵⁹ Patients can check their daily vital signs, answer questionnaires and surveys and communicate with their case manager, with the ultimate goal of reducing expensive care episodes and hospital admissions, as well as avoiding re-admissions. For patients whose access to the clinic is limited, who value their time and convenience, or for those who struggle to keep their appointments, telehealth may offer a means of helping them stay on track with their healthcare.

Nudging patients in the right direction

Another area in which there is huge potential for technology to influence health and healthcare costs is through inducing behavior change. Insurance companies are already venturing into the world of health and wellness programs, encouraging and rewarding behaviors that are considered to be beneficial for health, for example, increasing exercise. With technology there is the opportunity to influence behavior both more subtly and on a much broader

scale. The concept of nudge theory: the use of positive reinforcement and indirect suggestions to try to influence decision-making, is already established in the world of economics and is beginning to be explored within healthcare. For example, a study evaluating the use of micro-incentives to encourage adherence in patients with acute myocardial infarction was recently conducted, with positive initial results.⁶⁰ Additionally, interventions based on the theory have shown some success in altering dietary behavior.⁶¹ Alongside more traditional patient support systems and behavior change programs, implementation of nudge theory in healthcare could have a huge impact on medication adherence and health-based decision-making. Patient education already incorporates some aspects of nudge theory, advocating informed choice and beneficial healthcare behaviors,⁶² so the careful and ethical incorporation of such techniques to improve, support, and encourage adherence is within the realms of possibility. As with all such interventions, the key aspect that needs to be taken into account is trust so that patients feel supported rather than manipulated into particular behaviors.⁶² In many ways, nudge theory and behavior change relate to the way in which information is presented to individuals, either through message framing or design, up to and including the color and font used.⁶³ But with additional technology and data we have the potential to provide real benefits in healthcare, particularly through improved adherence through the provision of reminders and feedback directly to patients.⁶³



Using technology to reduce economic burden in respiratory care



While many factors can contribute to inadequately controlled asthma, issues with adherence to maintenance medication and difficulty with inhalation technique are both strongly linked to poor outcomes.⁶⁵

Respiratory care is an area in which new technology and improved data collection have real potential to improve both outcomes and efficiency. Management of asthma costs the US \$56 billion each year²⁸ and the average cost of hospitalization for an adult asthma patient is \$12,748,⁶⁴ with costs even higher if a 9-1-1 response and ambulance are involved.

In 2009 alone, asthma caused 479,300 hospitalizations, 1.9 million emergency department visits, and 8.9 million doctor visits.²⁸ Inadequately controlled asthma is particularly costly, substantially increasing healthcare resource utilization to the extent that 20% of patients with asthma are responsible for approximately 80% of those costs.⁶⁴

While many factors can contribute to inadequately controlled asthma, issues with adherence to maintenance medication and difficulty with inhalation technique are both strongly linked to poor outcomes.⁶⁵ Recent studies have shown that 70% to 90% of people living with respiratory conditions, such as asthma, are not using their inhalers correctly.⁶⁶ To achieve maximum drug delivery in inhaled therapy, and to avoid wasting medication and inappropriate treatment escalation, correct inhaler technique is vital.⁶⁵ The problem is that neither patients nor physicians can always identify inadequate inhaler use and inhalation technique, and even demonstration and training only improves technique temporarily for the majority of patients.⁶⁷ There is currently no way to remotely determine if patients' inhaler use is correct, and therefore more likely to be effective.

Using technology to influence adherence

To improve disease management and ultimately disease control, we need to know that people are using their inhalers as prescribed and, that when they are adhering to treatment, that their dose is actually being delivered to the lungs. It is here that new technologies have the potential to improve treatment and outcomes, by providing patients and providers with real and relevant feedback and an accurate view of inhaler usage. Such feedback can enable and encourage positive behavior change and more informed decision-making. To date, several interventions and devices have been developed and clinically trialled to address some of these issues. However, there are limitations to these with regards to what stakeholders need to see in terms of adherence, device handling, cost-effectiveness and pricing. In addition, there is much more that can be done in terms of identifying those people who are at risk of exacerbations and hospitalizations, and to assess the efficacy of a range of interventions in this field.

However, with the combination of more accurate monitoring and identification, behavioral influences and, increased patient autonomy there is potential to hugely improve the efficiency and outcomes of asthma management, through the collection and collation of new data.



Teva's continued innovation to increase value



We don't just want to improve the outcomes of each individual; we want to do our bit in making the best healthcare available to those who need it.

Teva have an established heritage in respiratory products and demonstrated commitment to providing new, cost-effective treatments to patients and providers. Moving forward, we aim to be at the cutting edge of care with more than just treatments. With respiratory care as a primary focus, Teva is exploring how best to use new technology and data to improve patient outcomes and efficiency, reducing the negative impact of disease and treatment costs on the economy.

Teva is committed to providing high-quality treatments for people who suffer from respiratory diseases, including asthma, allergic rhinitis, and COPD. We are committed to a patient-first, innovative future. But there is no point spending years investing in a solution that doesn't offer value to the patients and systems we are trying to help. We don't just want to improve the outcomes of each individual; we want to do our bit in making the best healthcare available to those who need it. This means using the data and technology available to us to identify the interventions that can provide real value to all stakeholders in care.

We are committed to developing products and resources that align with value-based medicine and the future of technological development, and to working with payers to create sustainable solutions to disease-specific problems. While our initial focus is in the new technology of respiratory care, we are committed to applying our knowledge and vision across therapy areas, developing support and management options that apply throughout the healthcare system, which can be easily incorporated into people's lives.





Pharmaceutical companies are still working out how best to prove value in the current system but are becoming more open to cost sharing and value-based reimbursement models.

It is widely accepted that the current costs of healthcare in the US system are unsustainable, but at present, there is no widespread agreement on how to manage them. Healthcare systems and providers talk about patient-centered care and personalized medicine, yet payers are still focused on metrics that look primarily at short-term impact and costs.

With new technology, we have the opportunity to improve data collection and outcomes modeling, to combine population-wide statistics with individual needs to create real personalized care that has the potential to change behavior, not just track it. With targeted interventions and increased self-management enabled by feedback, awareness and behavior change, we can improve outcomes and satisfaction at the individual level with real, long-term impacts on cost at the population level.

But to achieve this, there needs to be a much greater focus on identifying the metrics that are important to all stakeholders in care and, on identifying the long-term economic impact of interventions rather than just the short-term costs. Pharmaceutical companies are still working out how best to prove value in the current system but are becoming

more open to cost sharing and value-based reimbursement models. Pharma, providers and payers will need to work together to develop best practices and payment systems to ensure that patients have access to the highest level of care without creating an unmanageable burden on insurers, government budgets or patient finances.

We need a commitment from pharma, payers and healthcare systems to use advancing technology to identify the characteristics that create value for all stakeholders and to their measurement. Going beyond short-term costs and individual diseases, we need to look holistically at the overall impact of interventions on the wider economy and how these interact across therapy areas. The first step is through agreement of what value means, with a renewed focus on improving the outcomes that matter to patients as well as payers. From there, we have the ability to determine how it should be measured and what data needs to be collected to demonstrate it. The technology is there and the data are becoming increasingly available, now we need to work out how best to use it to create a system that is both efficient and effective for everyone.

To learn more about how
Teva is looking to use
innovative technology and
data to increase value please
visit **respiratorycarev2.com**

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