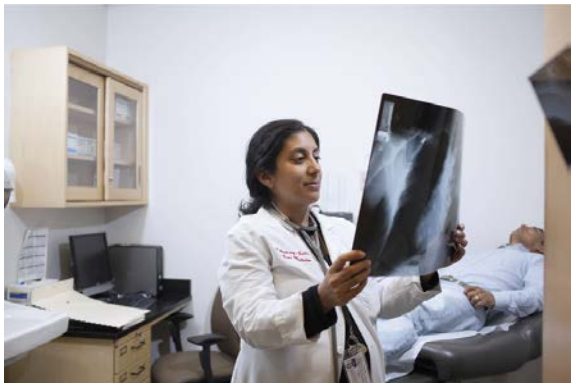
Prevention

Preventive diagnostic tools to detect diseases in patients with no clinical symptoms are an important strategy in early treatment and control.



Preventive care is an important part of public health programs tackling many major diseases such as tuberculosis or cancer. Novel diagnostic technologies enabling the early identification of disease risks help to improve the efficiency of such programs, promising better patient outcomes and cost savings. In these ways, molecular diagnostics provides modern medicine with the necessary tools for developing new strategies in the battle against widespread conditions.

Prevention is better than cure

As a healthcare strategy, preventive care involves taking specific measures to recognize and treat certain conditions in healthy patients with no obvious disease symptoms. It is an alternative to curative medicine that fights disease at a later stage through the treatment of clinical symptoms. Prevention has the potential to save lives, reduce suffering, provide opportunities to control major public threats from certain diseases and significantly reduce the amount spent on healthcare treatments.

Despite progress in therapeutic approaches, the *American Cancer Society* still expects more than half a million people in the United States to die of cancer this year.[1] Cancer is the second most common cause of death (after heart disease) and accounts for nearly one out of every four deaths in the U.S. In addition, it creates a huge economic burden. The *American Cancer Society* estimated the total cost of cancer in the U.S. as $201.5 billion in 2008.[2] One of the major costs of cancer is treatment. The *World Health Organization* (WHO) anticipates that at least one-third of all cancer cases are preventable[3] and prevention offers the most cost-effective long-term strategy for the control of cancer.[4]

Some large-scale preventive care programs already are in place. The first programs were introduced at the beginning of the 20th Century, for the control of syphilis (through blood testing) and diabetes (through urine testing). These initial programs demonstrated the value of disease prevention. With rapid advances in medical knowledge and diagnostic techniques, the principle was successfully applied to other conditions, such as cancer, certain infectious diseases and genetic defects.

However, preventive care strategies are still widely under-used. Factors hindering more widespread implementation of preventive care initiatives include difficulties in obtaining reimbursement for novel tests, continued reliance on outdated technologies, individual adherence to prevention programs, and a bias in healthcare systems towards treating instead of preventing diseases. However, the preventive diagnostics strategy holds great promise. For

optimum effectiveness, preventive care generally needs to be applied to large numbers of people and, therefore, must be reliable and highly cost-effective.

Success is driven by new diagnostic technologies, which continue to become increasingly sophisticated and sensitive. The latest techniques help to recognize tiny amounts of dormant disease in the human body before they even become active. Advances in molecular biology are finding new molecular biomarkers that help to assess the risk of many more diseases. And research is underway to find new ways of identifying pre-disease factors to make prevention programs more effective, for example, identifying the individuals that are most likely to develop active disease at a later stage so that they can be protected.

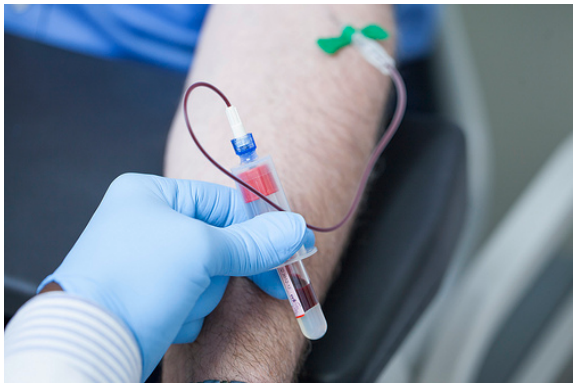
Tackling major global health threats

Tuberculosis (TB) has been one of the world's biggest and most resilient global health threats for a long time. While the active disease is generally curable (although antibiotic-resistant strains are on the rise), treatment consists of a rigorous and lengthy course of antibiotics that requires full patient compliance. Untreated, it can lead to death. According to the WHO, about nine million patients developed the active form of TB worldwide in 2013 and 1.5 million died of the disease during this year.[5] It can stay dormant in the lungs for months or even years and it is estimated that as much as one-third of the world's population carries the latent form of the disease and one in ten will develop the active form at some stage of their life. It particularly affects vulnerable groups with compromised immune systems or other primary diseases.

In Western countries, TB prevention focuses on risk groups, including immunocompromised patients, such as transplant- and HIV- patients, those taking certain drugs such as Tumor Necrosis Factor (TNF)-Alpha blockers against Rheumatoid Arthritis, healthcare workers, people living in confined conditions, and children, particularly in contact-tracing investigations.

Treating those with a latent TB infection is becoming easier. Experts thus believe that prevention programs combined with treatment of active and latent TB infections are the most promising way to sustainably alleviate the burden of this disease. "The ultimate point is to eliminate TB", says Dr. Lee Reichman of the *Global Tuberculosis Institute* in New Jersey. "To do that we need to effectively treat patients with the active disease through directly observed therapy. We need to screen for people with latent TB infection – and treat them so they don't develop active disease. And we need a tuberculosis vaccine. But globally, we have a long way to go."

QIAGEN is a global leader in the fight against TB, and the company's QuantiFERON®-TB Gold (QFT®) and QuantiFERON-TB Gold Plus (QFT-Plus) are changing the way the world looks at TB. Both of the blood-based tests act as an in-vitro diagnostic aid* to accurately identify people infected with *Mycobacterium tuberculosis*, the bacterium which causes tuberculosis (TB). They provide a modern alternative to the 100-year-old tuberculin skin test (TST or Mantoux).



The QuantiFERON technology measures the patient's immune reactivity to the TB bacterium, and is useful for initial and serial testing of persons with an increased risk of latent TB infection. QFT-Plus, which represents the latest generation of this technology, has a further improved clinical performance profile and comes with workflows improvements that enable an even more efficient implementation in large-scale screening programs. Both QFT and QFT-Plus take only one patient visit for blood extraction and produce results within 24 hours, whereas the skin test produces significantly more 'false positive' results that require follow up, involves two patient visits over 2-3 days, requires subjective interpretation with high variability and a longer wait for results. QFT and/ or QFT-Plus are approved in many international markets* including the U.S., Europe, China and Japan.

Tackling such a widespread and persistent health threat requires continual and considerable efforts. The ultimate goal is to eradicate the disease – and it is clear that diagnosing and treating both latent TB infection as well active TB is critical. Having improved tests with even greater ability to detect disease and infection, and assess which patients are likely to progress from latent to active TB infection, will greatly help to achieve this goal, and QIAGEN is committed to drive further innovation in this area through our development work as well as collaboration with third parties.

Reducing the impact of cancer

QIAGEN is also a global leader in Human Papillomavirus (HPV) testing, which is used as a part of preventive care for cervical cancer in women and is helping to save lives worldwide.

Cervical cancer is the second most common cancer in women worldwide. Infections with certain types of the human papillomavirus are considered to be the primary cause of this malignancy. The virus is easily transmitted through genital contact and it is estimated that 70 to 80 percent of all women will get a HPV infection at some point in their lives. In most cases, the infection will not cause any symptoms so it can be passed on unconsciously.

The WHO estimates that more than 500,000 women are diagnosed with cervical cancer each year and approximately 250,000 still die of this condition annually.[6] However, it can be prevented. HPV testing identifies women with high-risk HPV infections that can cause cervical cancer, enabling treatment before malignancy develops.

QIAGEN's *digene* HPV Test is approved in many countries and is currently most often used together with a regular Papanicolaou (Pap) test in women over 30. The Pap test identifies abnormal cells, and the *digene* HPV Test detects the presence of 13 high-risk types of HPV to help make sure abnormal cells are diagnosed and treated early. However, the Pap test is open to subjectivity since cells require microscopic examination by a technician. Each individual Pap test also only provides approximately 50%-80% certainly of catching the disease. But when combined with the *digene* HPV Test, the proven CIN 2+ (*cervical intraepithelial neoplasia*) sensitivity is up to 100%.

The vast majority of cervical cancer (80% of cases) occurs in emerging regions. QIAGEN therefore entered into collaboration with *The Program for Appropriate Technology in Health* (PATH), supported by the *Gates Foundation*, to develop a special version of the HPV test for use in remote, low-resource settings – *care*HPV. It is easy to use and does not require water or electricity to perform. In 2012, the test received regulatory approval in China and was launched in early 2013. Overall, QIAGEN's *digene* HPV and *care*HPV tests have become or are emerging as standard tools in the fight against cervical cancer.

** QuantiFERON®-TB Gold (QFT®) is an in vitro diagnostic test intended as an aid for detection of Mycobacterium tuberculosis infection and is for use in conjunction with risk assessment, radiography, and other medical and diagnostic evaluations. QFT results alone cannot distinguish active TB disease from latent infection.*

[1] American Cancer Society 2014: http://www.cancer.org/cancer/news/news/cancer-statistics-report-deaths-down-20-percent-in-2-decades
[2] American Cancer Society 2014: www.cancer.org/cancer/cancerbasics/economic-impact-of-cancer
[3] WHO 2014: http://www.who.int/features/factfiles/cancer/en/index.html
[4] WHO 2014: http://www.who.int/cancer/prevention/en/
[5] WHO 2015: http://www.who.int/tb/publications/global_report/gtbr14_executive_summary.pdf?ua=1
[6] WHO 2014: http://globocan.iarc.fr/Default.aspx