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Affordable Solutions: Strengthening Disease Prevention and Detection through Appropriate Technologies

An Expert Interview with Victor Shi

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Despite increasing efforts to improve disease prevention, many preventable and treatable diseases, such as Human Papillomavirus (HPV), continue to pose grave threats to human health—particularly in developing countries. NBR spoke with Victor Shi (QIAGEN) about the promise that innovative health technologies hold for improving the effectiveness of disease prevention and early detection, and the key factors that must be considered when designing and/or implementing a technology in resource-poor settings.

Victor Shi is Asia Pacific President of QIAGEN, which specializes in sample and assay technologies in the field of molecular diagnostics. He has over twenty years of experience in life sciences business development, management, and investment. He is currently Deputy Secretary-General of the Chinese In-Vitro Diagnostics Industry Association and previously served as a founding board member of BayHelix, an association of senior Chinese business leaders in the life sciences industry.

Q. What potential do innovative technologies for health hold for improving access to diagnostics and treatment for preventable diseases?

In the healthcare sector, the focus now is shifting from treatment to prevention as a way to improve patient outcomes and to contain costs. Companies are aiding this shift by developing technologies that can detect diseases earlier or even prevent them through early treatment. Governments and international healthcare organizations are also actively encouraging this change. In principle, prevention is cheaper than treatment, and the benefits of prevention are even more compelling in low-resource areas, where medical resources are scarce. One of the best ways to address the higher burden of disease in developing countries is to focus on technologies that can bring prevention and treatment out of the laboratory or hospital and into the field. To this end, technologies have been developed that are portable, do not require clean water or electricity, and can withstand field conditions such as temperature swings. Such point-of-need technology can make a huge difference in bringing life-saving diagnosis and treatment to areas where there was previously no access. Improving access to diagnosis and treatment is the key to disease control and eradication—and the key to containing healthcare costs.

Q. What key factors should always be considered before implementing a new technology at the national level?

Implementing a new technology, regardless of geographical location, requires cooperation among many players and stakeholders. To reach as many people as possible for disease screening, we need to work very closely with governments and civil society. Each participant plays a role that is important to achieve successful implementation, and no player can be left out. This is especially true in developing countries. Often the patients who need innovative technologies the most do not have access to medical care or cannot afford it. When it comes to cervical cancer, for example, incidence rates are noticeably higher in rural, poor populations and in minority groups due to disparities in access to care, lack of awareness, and other social and economic factors.

Q. How has your HPV screening work in China informed your understanding of key considerations for implementation and scale-up of health technologies in low-resource settings?

China is a huge country with a developing healthcare system. Getting HPV screening technology out to women in China's rural areas required a new way of looking at the problem—including a complete redesign of the product to fit the environment. Three pieces of the puzzle were needed: affordability, meaning the price and economics; accessibility, meaning the practicality of usage; and implementation, that is, creating the processes for actual delivery of the technology. Our diagnostic test had to be simple and easy. To achieve this, the HPV test was redesigned to run on battery power, without the need for running water, and to be operated by a person with minimal training. But finding a solution does not end with technology. Women, society, and the government have to be mobilized to build an effective and efficient implementation strategy so that the test is utilized by the target population. Grassroots movements supported by the government and NGOs are very important. Without effective implementation, innovative technology will not reach its intended destinations, which in this case are rural areas where women are at risk of developing cervical cancer.

Q. What role do public-private partnerships (PPP) play in promoting access and sustainability?

PPPs can help on many different levels. As I mentioned, the three main pieces that are critical to the scale-up of an innovative technology—affordability, accessibility, and implementation—are necessary for an innovative technology to reach its full potential. PPPs can help to a great extent. For example, the Bill and Melinda Gates Foundation and PATH provided initial funding to QIAGEN to kick-start the redesign of the HPV testing technology. PPPs can also play a significant role in the implementation phase by bringing attention and focus to a unique problem. Having a third-party NGO work with the government and civil society can bolster implementation significantly. Often these entities already have good relations with the government and grassroots movements, making awareness-building and implementation more efficient. They can help the pieces fit together and enable the different players to work together more effectively.

PPPs also add credibility to a healthcare campaign. In the case of cervical cancer, it has been clearly shown that prevention is more cost-effective than treatment. New HPV testing methods for cervical cancer prevention provide a higher degree of certainty for the results, with fewer false negatives than traditional methods such as the Pap test. The new methods also require less infrastructure and medical expertise. Despite the benefits, it is often difficult for companies to change the mindsets of doctors, policymakers, and patients, as the educational process can be challenging and lengthy. PPPs can lend credibility and create more channels for education, scale-up of trust, and acceptance of technologies.

Q. As the number of patients diagnosed with a given disease increases due to the availability of improved diagnostic technology, how can we ensure that the appropriate infrastructure is in place to provide follow-up treatment and care?

More accurate and targeted screening methods do lead to an increase in the number of patients found to need treatment. Because of this, government and NGO support becomes even more important. In low-resource areas, any early prevention program will be ineffective if patients who test positive have no access to treatment. Prevention must be looked at holistically—as a complete program that includes prevention through awareness-building about the disease, screening campaigns, and follow-up treatment for those who require it. Some screening programs in countries such as India and China have used mobile labs that contain the necessary equipment to perform basic procedures, known as screen-and-treat. Only advanced-stage cancers require invasive surgery or chemotherapy, necessitating access to more substantial infrastructure.

Linking together partners across sectors can be very beneficial to ensuring a holistic approach to disease prevention. For example, my company has a screening project based in Calcutta, India, where we have joined hands with the Chittaranjan National Cancer Institute (CNCI), the only national-level cancer institute in India. As part of the program, we provide HPV tests free of charge, and the CNCI works with local NGOs to set up screening camps in neighboring villages. Women who need treatment are either treated immediately at a camp or can schedule a time to travel to the CNCI hospital in Calcutta for more advanced treatment.

Q. With the influx of more people found to be in need of treatment, are there ways to limit the strain on existing infrastructure?

Yes, but it is important to be realistic and understand how best to utilize resources. Frequent screening of patients in low-resource areas is impractical. Fortunately, HPV screening has been shown to reduce mortality by over half with just a once-in-a-lifetime screening. As a result, the technology can be maximized by better targeting of testing populations. We know that HPV is transmitted through sexual contact and that once a woman contracts HPV, if it becomes a persistent infection, it still takes about 10–15 years to develop into cervical cancer. Thus, screening young women for HPV or pre-cancerous lesions is not an effective use of resources, as HPV infections at this age usually resolve themselves. However, women in the 30–59 age group who test positive for HPV are much more likely to go on to develop cervical cancer. Therefore, targeting women in the age group about 15 years after the average age of first sexual contact is most effective for disease detection and prevention. Even once-in-a-lifetime screening is effective, as it identifies at-risk women who need follow-up, as well as those who already have cervical cancer and require treatment. By looking at regional patterns in HPV prevalence and sexual activity, this approach can be further localized to produce even better results.

Q. What is the economic argument for accurate diagnostics, and why is it critical that prevention, diagnostics, and treatment be considered equally valuable steps in the eradication of a disease?

The economic argument is simple: more accurate diagnostic technologies lead to earlier and more reliable diagnosis, even when there are no symptoms, which in turn leads to earlier treatment and improved patient outcomes. Accurate and reliable diagnosis also helps prevent transmittable diseases from spreading in the community. From these two angles, new diagnostic technologies play a central role in containing and eradicating infectious disease.

Tuberculosis (TB) is a good example. Current efforts have focused on detecting active TB, that is, when the disease attacks the lungs and causes symptoms. However, latent TB—when patients are infected with TB bacteria but are not actively ill—also poses a significant health risk. Until recently, latent TB could not be accurately or reliably diagnosed. Individuals with latent TB have no symptoms but can develop active TB at any time. Being able to identify and treat such individuals before they develop active TB and spread it to others can make a huge difference. This kind of prevention works by pairing accurate diagnostics and treatment. In the case of TB, you stop the disease from spreading in the community. All of these efforts cost less than waiting until a disease has progressed to the point of requiring urgent and more invasive treatment. The missing part here is education. Policymakers, clinicians, and the public must be educated about threats and possible solutions so we don't continue to repeat ineffective practices from the past.

Q. How might affordable health technologies that are designed for use in developing countries also be used in developed countries to reduce the increasingly unsustainable costs of healthcare?

Industry leaders should begin the innovation process with a solid understanding of the end user so that the technology can be made affordable, accessible, and easy to implement. To bring HPV testing to remote areas with little infrastructure, we recognized that we needed to make the technology accessible and the use of the tests simple and easy. The test was redesigned so that it could run on battery power, did not need running water, and could be operated by individuals with minimal training. At the same time, this redesign also made QIAGEN's careHPV test more affordable.

Undoubtedly, some technologies that are designed for developing countries can also be used to reduce healthcare costs in developed countries. The key is flexibility. If an innovative technology can be adapted to many different settings, then it can be used anywhere in the world. Point-of-need tests that are designed for use in rural regions can also take diagnostics out of the laboratory and into highly developed areas. Point-of-need diagnostics can be used to great effect—whether the patient is in a small village in rural China or a hospital bed in New York City.