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Dr Helen Lee: Application of technology to diagnostic development and the creation of 'test and treat' regimes

Dr Lee described the journey of a team who wanted to provide low-cost diagnostics to societies where resources were limited. Diagnostic methods fall into two groups – those suitable for centralized laboratories with automated equipment, handling large batch sizes, and those appropriate for near-patient testing. Her work focuses on the latter.

About 20% of blood donors in Kumasi, Ghana were infected by Hepatitis A or B or HIV. Similar statistics hold for other developing countries. This rate of infection is ten thousand times higher than in the UK. Yet in Ghana there is only $1.50 available for all testing on each blood bag, whereas in Germany €3.8 million is spent for each extra case of HIV detected. This imbalance between developing and developed countries holds across the whole healthcare budget. Furthermore, those tests which are available have been developed to detect the viral subtypes which have been prevalent in developed countries, rather than those in developing countries (travel and migration are, however, now causing the latter subtypes to spread to developed countries).

Academia alone cannot tackle the problem of producing diagnostics for resource-limited settings, because academics lack the motivation and expertise for product development. Nor will large companies tackle it, because profit margins are too low and because of difficulties in adapting production procedures which are tightly regulated. Dr Lee and three colleagues from Abbott therefore went to Cambridge to start a spinout company, with the help of seed capital from WHO, NIH and Wellcome, bringing together industrial and academic expertise plus access to public research funding.

They chose to go for an antibody-based dipstick assay as this is a format which can be made to be cheap and stable, and is easy to use and non-invasive. Their first target was *chlamydia trachomatis*, the major cause of infertility and pelvic inflammatory disease in women. Treatment is very effective and simple – one pill taken once. The assay uses self-collected vaginal swabs for women and the first few mls of urine for men. Dr Lee demonstrated (using coloured water!) the award-wining 'FirstBurst' device to collect and retain this urine. Field development work and trials in the Philippines, Amsterdam and Birmingham showed that the assay is even more effective than the 'gold standard' nucleic acid-based test, because the slightly lower sensitivity is more than compensated by people being able to be treated on the spot, after only a half-hour wait, instead of having to return to a clinic after two or three weeks.

In the UK national chlamydia screening programme, only about 70,000 people have so far been screened out of a relevant population of 4.5 million, at a cost of many tens of £millions. Prevalence can be up to 25% in some groups.

Another target is blinding trachoma. Worldwide, 146 million are infected, and 3 million are blind or visually impaired. The Cambridge rapid test is as sensitive and specific as nucleic acid testing, and is much better than relying on early clinical symptoms. The technology platform the team has developed ('SAMBA') is simple and cheap, and total assay time is only 1.5 hours.

They have also developed a dipstick which can detect hepatitis A, hepatitis B, and HIV all at once. In general for HIV, there is a need to be able to monitor patients as the disease progresses, to adjust treatment according to the viral load. The Cambridge team has developed a semi-quantitative dipstick to do this.

Dr Lee said that the UK has a funding gap between research and scale-up when new products are developed. The US has a better funding regime for this phase. The team therefore set up its company – 'Diagnostics for the Real World Ltd' – in California. She wants the company to become a sustainable business, selling at cost plus in developing countries and at what the market will bear elsewhere. Her 2006 goal is to test and treat 1 million women for chlamydia. The challenge for a business of this type is to 'create and maintain a balance between doing well and doing good.'

Discussion

The assays could also be used in developed countries. The technology platform, which had taken years to develop, could be adapted for other diseases (e.g. bird flu) if disease-specific problems could be overcome. In general, Dr Lee thought that it made sense to have testing near the event/patient. It was however necessary to maintain campaigns (e.g. on television) to persuade people to take the tests.

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