Sir William Borlase's Grammar School

Medical Newsletter

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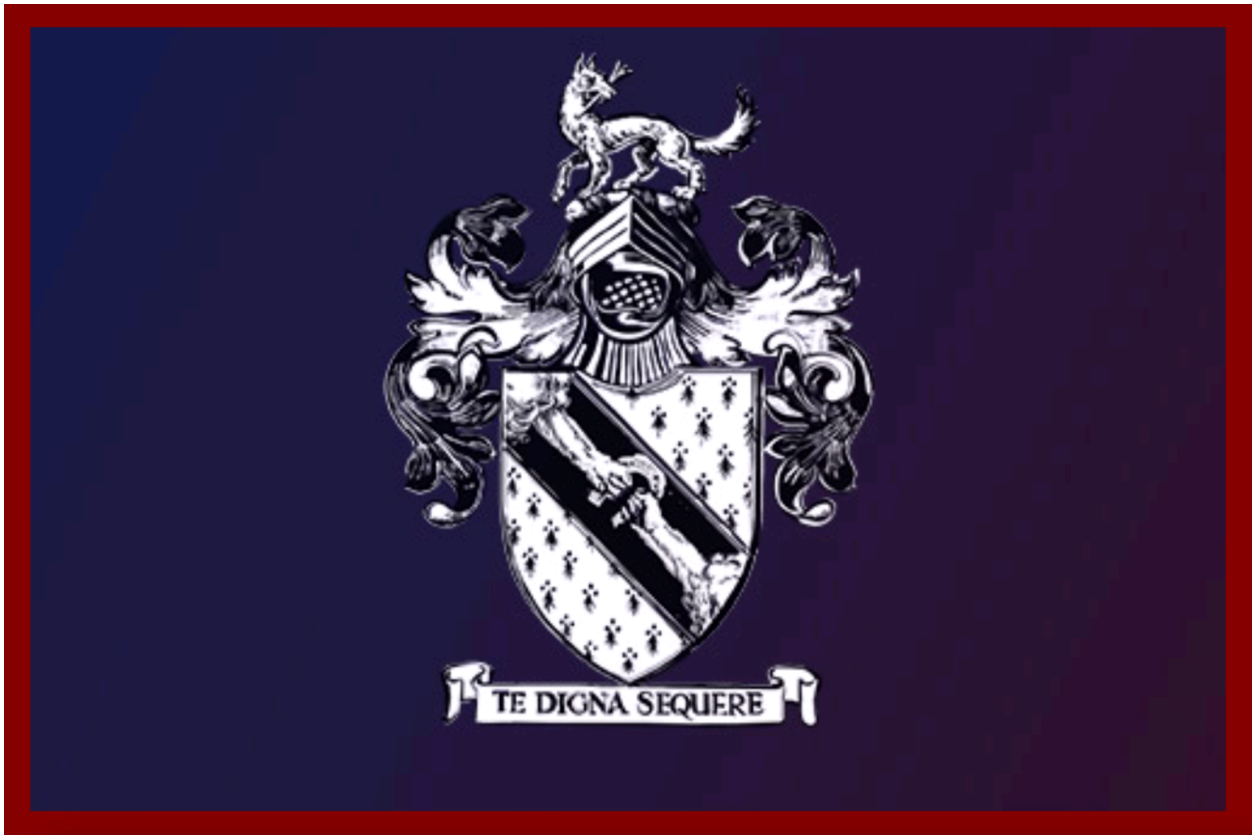


Editor: Nikita D'Souza

- The future of AI in vaccines.
- Should all young athletes be subject to ECG screenings?
- How UV exposure damages skin beyond sunburn.
- Cosmeticorexia: A sign of the changing health climate.
- The growing threat of antimicrobial resistance in respiratory infections.

The future of AI in vaccines

By Nikita D'Souza

What is a vaccine? A biological preparation that stimulates the body's immune system to produce active immunity against a specific disease. Vaccines have been a vital part of healthcare for centuries, dating back to 1796, when the smallpox vaccine was introduced ultimately leading to the eradication of the disease. However, as we have all recently experienced, new viruses can cause new diseases and infections, which require new vaccines. Corona Virus is an example of how viruses adapt to spread faster, and eventually form new variants.

A large problem with the roll out of vaccines is that scientists are always behind the infection. By the time the proposed vaccine has been developed, is successful in clinical trials and has been reviewed, the virus would have likely changed. So the question is: how can we get in front of outbreaks of new diseases? What can predict the next Covid-19?

The answer is now becoming slightly more obvious: Artificial Intelligence. AI has the ability to sort through variants of all diseases known and analyse viral evolution in order to estimate which variants are likely to dominate before they emerge. This would, theoretically, save time and money, but more importantly has the potential to save countless lives.

Correlates of Protection are immune biomarkers that signal whether someone is protected from a disease- knowing this helps speed up the process of getting regulatory approval as it will be known which candidates will be effective in clinical trials. During the Covid-19 pandemic, a simple antibody blood test was a reliable indicator of protection. By identifying COPs, the time from vaccine discovery to delivery can be significantly reduced.

Scientists at the University of Cambridge have developed what they describe as the world's first vaccine designed using artificial intelligence. Instead of this vaccine that targets just one virus, they used AI to analyse the genetic information of many related viruses in order to design a "super-antigen" that could protect against whole families of viruses, including future variant strains. While the immune response was modest, the trials showed that the vaccine was safe, and so a larger trial of 200 people is in the works.

AI is already transforming other stages of vaccine development. Machine learning algorithms can identify promising vaccine candidates, design proteins that produce a stronger immune response and potentially predict side effects before human trials begin. Currently, by using AI alongside researchers, clinical trials can be optimised by allowing artificial intelligence to select

the diverse patient groups and analyse the results. Therefore scientists can make faster evidence-based decisions. Beyond developing vaccines, AI also plays an important role in disease surveillance. By analysing data from hospitals, laboratories, travel patterns and even online search trends, AI systems can detect unusual outbreaks earlier than traditional monitoring methods. These early warning systems give governments and health organisations valuable time to contain outbreaks before they develop into global pandemics.

However, AI is not a replacement for scientists, doctors or clinical trials. Predictions are only as reliable as the data they are trained on, and every AI-generated recommendation must still be validated through rigorous scientific testing. Ethical concerns, data privacy and ensuring fair access to new technologies are also challenges that must be addressed as AI becomes more integrated into healthcare.

The COVID-19 pandemic demonstrated both the power of modern science and the importance of rapid collaboration. As artificial intelligence becomes more sophisticated, the future of vaccine development may shift from reacting to emerging diseases to anticipating them. While no technology can prevent every outbreak, AI offers the possibility of creating safer, faster and more effective vaccines than ever before.

Should all young athletes be subject to ECG screenings?

By Siddarth Sridhar

Every week in the UK, around twelve apparently healthy young people die from undiagnosed heart conditions. Sudden cardiac arrest can strike without warning even in the fittest and most dedicated athletes, directly challenging the widespread assumption that youth and physical fitness guarantees cardiovascular health. Research at St George's University Hospital found that one in every 266 footballers affiliated with the English Football Association had died of sudden cardiac death - a figure that raises urgent questions about the efficiency of existing screening practices. The electrocardiogram (ECG), a non-invasive test that records the heart's electrical activity through electrodes placed on the chest, arms, and legs, offers a way of detecting many of the conditions responsible for these deaths before they become fatal.

The most common single cause of sudden cardiac death in young competitive athletes is hypertrophic cardiomyopathy, a genetic condition in which the heart muscle abnormally thickens, impairing blood flow and increasing the risk of fatal arrhythmias under physical exertion. The overwhelming majority of affected athletes are entirely asymptomatic. This profile makes formal screening a medical necessity. A landmark meta-analysis pooling data from over 47,000 athletes demonstrated that ECG achieved a sensitivity of 94% and specificity of 93%, making it five times more sensitive than a medical history questionnaire and ten times more sensitive than physical examination alone. One potentially lethal cardiovascular condition was identified for every 294 athletes screened - conditions that would otherwise have remained entirely hidden. Italy's nationwide mandatory ECG programme, in operation since 1982, provides the most compelling real-world evidence: a study tracking the Veneto region over 25 years showed a marked reduction in sudden cardiac death among screened athletes, driven principally by the early identification of cardiomyopathies at pre-participation screening. Improvements in ECG interpretation criteria have since reduced false-positive rates to just 3% and cut screening costs by 25%, directly addressing the two biggest objections to mandatory implementation. Since conditions like hypertrophic cardiomyopathy are inherited in an autosomal dominant pattern, a single positive result can also trigger cascade family screening that protects an entire bloodline - multiplying the benefit of one diagnosis well beyond the individual athlete.

The principal challenge comes from a study of Israel's mandatory ECG law, which found no significant change in sudden cardiac death incidence following its introduction. However, that study's dataset was constructed entirely from newspaper searches, meaning any death that did not receive press coverage was excluded from the analysis - a flaw that fundamentally undermines the null finding. Guidance from American health authorities recommending against routine ECG screening has also been referred to, but that guidance concerns the general adult population, whose cardiovascular risk profile is entirely different from young athletes.

The standard alternative to ECG - a history and physical examination - has a pooled sensitivity of just 20% for history-based questioning and 9% for physical examination alone. In young athletes, sudden death is the first manifestation of a cardiac disorder in up to 80% of cases, making reliance on self-reported symptoms an inadequate safeguard. Advanced imaging such as cardiac MRI offers greater diagnostic depth but is far too resource-intensive for population-scale primary screening, and is better suited as a follow-up investigation after an abnormal ECG result. No existing alternative matches ECG on the combination of sensitivity, specificity, speed, cost, and scalability that a national programme would require. On balance, the evidence supports making ECG screening mandatory for young athletes. False positives remain a concern, and the infrastructure to deliver competent screening - trained interpreters, clear referral pathways, consistent protocols - does not yet exist uniformly across the UK, let alone globally. These are not reasons to reject mandatory screening; they are conditions that must be met for it to function as intended. The evidence does not demand perfection from ECG screening - it just needs to be better than doing nothing, and hoping that the next athlete who collapses is lucky enough to survive it.

How UV Exposure Damages Skin Beyond Sunburn

By Ini Orolugbagbe

"If my skin doesn't burn, I am safe" Is a common phrase people say when tanning outside in this hot weather. However, even small sun exposure can increase the risk of developing skin cancer. Too much UV radiation from the sun can damage the DNA in our skin cells. DNA tells our cells how to function. If enough DNA damage builds up over time, it can cause cells to grow out of control, which can lead to skin cancer. Anyone can develop skin cancer regardless of their skin tone. Sunburn is simply just a visible warning. Most harm happens without you even noticing.

What UV Actually Is & How It Reaches You

Ultraviolet Radiation (UV) is a type of invisible electromagnetic radiation produced and released by the sun. Too much exposure to UV radiation is the main cause of skin cancer in the UK. According to Cancer Research UK, "Up to 9 in 10 cases of melanoma, the most serious type of skin cancer, could be prevented by staying in the sun and avoiding sunbeds."

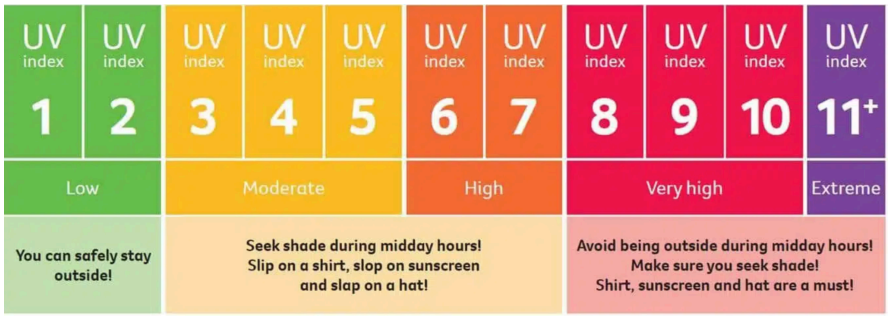
There are two main types of UV rays. Both types can damage our skin and cause skin cancer:
UVB- Reaches the outer layer of the skin (the **epidermis**) and causes most sunburns.
UVA- Penetrates deeper into the inner layer of the skin (the **dermis**). It is responsible for ageing the skin but contributes less towards sunburn.

There is a third type of UV ray called **UVC** but it is completely blocked out by the ozone layer and doesn't reach the earth's surface.

Hidden Damage: Beyond Redness & Peeling

You cannot tell whether you are at risk of skin damage and sunburn from the temperature outside. This is because you can't feel UV rays. The warmth you feel from the sun is a different type of ray, called **infrared radiation**.

The UV index can tell you how strong the sun's UV rays are each day. If the UV index is **3 (moderate)** or more, you should consider protecting your skin from the sun.



While too much UV can cause skin damage, a bit of sun can help our bodies to make the vitamin D it needs for things like healthy bones. But, there is no need to sunbathe or risk getting sunburnt to get vitamin D.

How To Protect Yourself From The Sun

Wear sunscreen: Use **SPF30 or higher** for daily use and **SPF50+** for long outdoors. Make sure to apply generously and reapply every two hours.OBJ OBJ OBJ

Cover up: Wear lightweight, loose clothing, wide hats and sunglasses. Sunscreen alone isn't enough and should be used alongside.OBJ OBJ OBJ OBJ OBJ OBJ

Find a balance: Short daily periods of sun helps vitamin D but longer sessions need proper protection to reduce the risk of skin cancer.

Cosmeticorexia: A sign of the changing health climate

By Nik Kolev

What is it?

Cosmeticorexia is the new term created by dermatologists and academics, defined as having an unhealthy obsession with achieving “flawless” skin from a young age, leading to obsessive use of cosmetic products.

How has it developed?

It has exploded ever since the recent increasing medicalisation of beauty by beauty companies to grow their own cosmetics market. This rhetoric is perpetuated by funding and sponsorships of young girls to promote these products on social media, which rewards appearance and routine based content. Google Trend (a platform that records search demand) has shown a consistent increase in cosmetic searches since COVID-19, with #skincare exceeding 64 million posts on TikTok and Instagram.

The social media algorithms particularly showcases regularly posting creators, like those who post daily skincare routines, which therefore often perpetuates the bubble that young girls can be surrounded by. When in a social media bubble, the prevalence of healthy habits and role models in daily life decreases, leading to increased body and beauty image concerns.

What are the resulting effects?

The resulting behaviours of cosmeticorexia include increasing time and money spent on skincare routines, and an obsessive, compulsive approach to their routines, causing anxiety and depression when the routines are not completed.

However, the active ingredients used within these skincare products are very powerful medications that should only be used within a clinical setting under the guidance of a dermatologist. Dermatologists analysed skincare routines posted on TikTok and found irritating active ingredients, infrequent sunscreen use and patterns increasing risk of dermatitis or increasing risk of relapse of previous skin conditions. Specifically, the anti-aging active ingredients as an example increase risk beyond benefit, therefore overall, dermatologists recognise cosmeticorexia as a psychodermatologic concern that

has standardised criteria, assessment and tracking and requires more research to fully understand all its implications.

What does this mean about the future of health?

Cosmeticorexia is only another addition to the list of disorders that are increasing in prevalence, particularly with young girls. It further highlights the increasing challenge of online health misinformation in the wider health world, with recent examples of COVID-19 and declining administration of the Measles vaccine costing the economy £3.6 billion.

This simultaneously requires cosmetic companies to stop targeting and actively communicate that these products are not for younger consumers, with crackdowns by authorities taking place already in Italy on Sephora and Benefit Cosmetics for their marketing that appeared to target girls under 10.

Cosmeticorexia also questions whether this is a sign that we are regressing on our targets of body positivity and self esteem. The report recognises the very high possibility (but not a proven prevalence of a link) between cosmeticorexia and body dysmorphia. The introduction and promotion of weight loss injections like Ozempic also being fuelled by creators on social media and celebrities in a range of gossip magazines. Once again, this displays another example of medicalisation of beauty, that a slimmer appearance now can be obtained through simple yet expensive medication.

Therefore, it is clear that cosmeticorexia is yet another wakeup call of the changing health information and literacy climate that we find ourselves in. It is becoming increasingly urgent that we need to simultaneously increase the prevalence and visibility of accurate, free, accessible medical information online while actively regulating the online environment against harmful content, in order to prevent a greater collapse of trust in health, medicine and doctors as a whole.

The growing threat of antimicrobial resistance in respiratory infections.

By Abby Milne

Antibiotics have saved millions of lives from infectious disease, and are amongst the most important discoveries of the 20th century. However, a strong increase in use, and misuse, had led to microbes developing acquired antimicrobial resistance (AMR). This has been recognised as a global threat to human health by national healthcare agencies, governments and medical society's, as well as the World Health Organisation. However, there are several types of antimicrobial agents which includes antibiotics, antifungals, antivirals, disinfectants and food preservatives that either suppress the growth of, or kill, microbes- with antibiotics being by far the most commonly used to combat infections. Although AMR is a natural and unavoidable evolutionary phenomenon that helps safeguard against lethal selection pressure, the overuse of antibiotics has led to it being ranked 3rd in causes of death in 2019 with an estimated 1.27 million people dying from strains of AMR bacteria. By 2050, these deaths are expected to rise to over 10 million deaths a year- far exceeding those caused by cancer.

One major contributor to antibiotic resistance is inappropriate antibiotic use, including patients failing to complete prescribed treatment courses. Many people assume that just because they feel better, they can stop- not knowing the hidden dangers. Another cause of antibiotic resistance is the over-prescription of antibiotics by physicians where they give these drugs to people suffering from other pathogens, such as viruses. Although rapid diagnostic testing would reduce unnecessary prescribing, it is not currently practical to perform lavatory identification of every suspected bacterial infection due to financial costs, limited lavatory capacity and the need to begin treatment quickly in severely ill patients. Whilst antibiotics kill susceptible bacteria, the resistant bacteria survive and reproduce, producing resistant strains for generations to come. Furthermore, these resistant genes can also be spread rapidly between bacteria through horizontal gene transfer, including conjugation via plasmid, transformation and transduction.

A 'superbug' is a pathogen that is resistant to most known antimicrobials. A common superbug is a variant of drug-resistant tuberculous (TB). Globally, 10.7 million people per year contract TB, and approximately 1.23 million people died in 2024 from the disease. Primarily, drug resistant TB is transmitted by person-to-person contact, however this strain can also be developed by acquired resistance: where the TB bacteria becomes resistant during treatment. There are several types of antibiotic-resistant TB such as mono-resistant TB (resistant to one drug), poly-resistant TB (resistant to at least two TB drugs- but not both isoniazid and rifampin), multidrug-resistant TB (resistant to at least isoniazid and rifampin) and extensively drug-resistant TB (resistant to most antibiotics). In the United States, in 2023, 8.5% of cases

were reported as resistant to at least isoniazid, including 1.4% of overall cases being multidrug-resistant. Isoniazid and rifampin are the two frontline, most-effective antibiotics used to combat TB. As people are exposed to drug-resistant TB, or it is created in their bodies, the chances of antibiotics fighting off the infection becomes less and less, inevitably increasing the chances of the patient passing. TB bacteria primarily attack the lungs by destroying tissue and triggering a strong immune response. This process creates pockets of dead tissue (caseous necrosis) and cavities in the lung walls. This damage is irreversible and causes permanent scaring, restricted breathing and narrowed airways, even after the infection is treated. Whooping cough (pertussis), caused by the bacterium Bordettella pertussis, is another respiratory infection where antimicrobial resistance is becoming an increasing concern. Although vaccination has become the primary method of prevention, antibiotics such as macrolides are commonly used to reduce transmission and treat infections in their early stages. However, macrolide resistant strains have emerged in several countries, particularly in China, where resistance rates have reached over 70% in some regions. Resistance most commonly occurs through mutations in the 23S rRNA gene, which alters the antibiotic's target site and prevents macrolides from inhibiting bacterial protein synthesis- and thereby stopping the spread of infection. Although these strains of resistant whooping cough remain uncommon in countries such as the United Kingdom, the emergence of resistance strains highlights the importance of continued surveillance on the topic of antibiotic resistance.

Respiratory infections are particularly concerning as they spread easily through airborne droplets and aerosols released when an infected person coughs, sneezes, talks or breathes, These pathogens can be inhaled be others, enabling particles to spread rapidly through households, schools, workplaces and healthcare settings where people are in close contact. When the infecting bacteria are antimicrobial resistant, transmission allows resistant strains to establish themselves within the wider population, increasing the number of infections that are difficult to treat. This can lead to longer periods of illness, increased hospital admissions and greater use of second-line antibiotics, which are often more expensive, less effective and associated with a higher risk of side effects. In hospitals, the rapid spread of resistant respiratory pathogens is particularly problematic because patients are often elderly, immunocompromised or have underlying health conditions, making them more susceptible to severe disease.

The emergence of drug-resistant tuberculosis and whooping cough demonstrates how antimicrobial resistance can transform a treatable respiratory infection into a life-threatening disease. As resistance continues to increase, treatment becomes longer, more expensive and less successful, placing enormous pressure on healthcare systems worldwide and highlighting the urgent need for improved antibiotic stewardship and the development of new antimicrobial therapies.