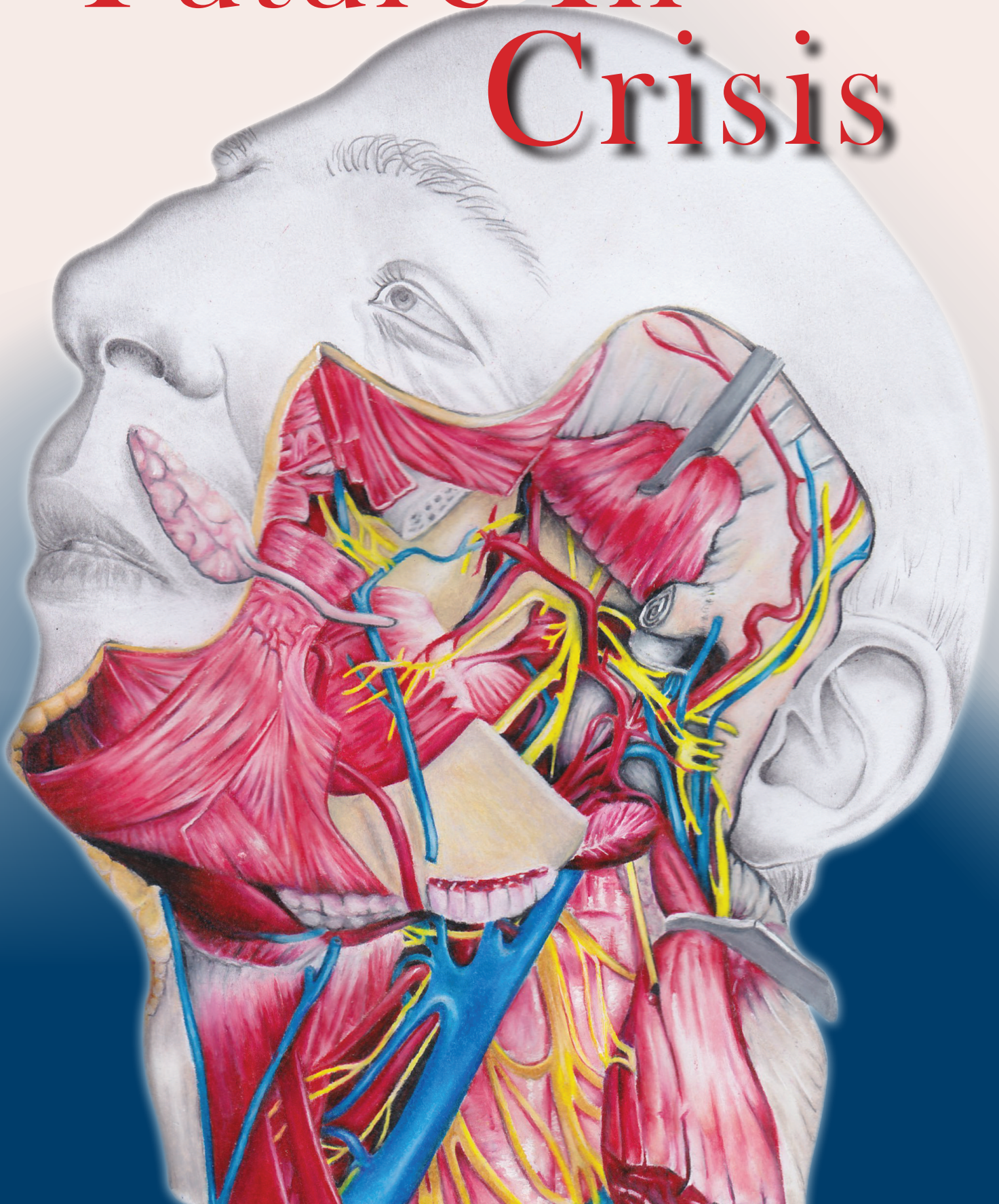


MENTOR

SUMMER 2020

Future In Crisis



From The Editors

PAVANDEEP UPPAL • ALEXANDER DAVIES • STEPHANIE YEUNG



Alexander Davies • Final Year BVetMed Student, Royal Veterinary College

Hello and welcome back to another edition of MENTOR. Firstly, the aspiring doctors, vets and dentists that contributed to this edition should be incredibly proud of their productivity and publication in these unprecedented times. Very few aspiring students can claim that whilst the world was in turmoil, they published in a national magazine and developed lifelong transferable skills. Above all, you have demonstrated a deep commitment to your chosen healthcare profession. I would also like to thank our dedicated readers for using this time to expand your wider medical reading and educate yourselves. The uncertainty caused by the COVID-19 pandemic will inevitably affect the application criteria and process for medicine, veterinary medicine and dentistry. Many of you will have cancelled examinations and work experience placements and will be feeling an overwhelming anxiety in how the pandemic will affect you and your dream of studying these healthcare disciplines. Remember that you are not alone. The universities will adapt their policies so you are not disadvantaged by matters out of your control. Medic Mentor is also here for you. Please reach out to us if you have concerns about your application and we will support you to the best of our ability. Healthcare, more than ever, needs a new generation of passionate and motivated leaders and that is where you come in!



A 'Future in Crisis' is an apt title, given the global scale of the COVID-19 pandemic. Sadly, many people have succumbed to the virus, the global economy has been shattered and the secondary effects of the virus will affect our lives for the foreseeable future in ways we cannot even predict yet. But despite the crisis, everyday we see examples of people from all walks of life coming together. I am confident that our communities will be stronger and closer as we step into our new future. In a new era of technology, despite social distancing policies we have maintained social closeness virtually. Without question we have sacrificed our normal lives to protect the most vulnerable. We have united in a shared appreciation and respect for healthcare workers and our NHS in the weekly 'clap for our carers' event. We have supported and innovated acts of philanthropy to provide financial support where it is most needed. Medical students fast-tracked their graduation and retired healthcare workers returned to frontline to vastly boost the medical workforce. Hundreds of veterinarians took up clinical posts within the NHS. A network of scientists have shared innovation in the drive to develop antibody tests and vaccines. People have volunteered to deliver food and medications to the vulnerable, write letters to the lonely and even take up a mop in hospitals. There are countless examples of how our community has adapted and pulled together. Perhaps when our future is not in crisis, we will see a new age of social prosperity with community, kindness and compassion at its heart.

Pavandeep Uppal • Fourth Year Medical Student, King's College London

I hope this issue of MENTOR finds you all keeping safe, healthy and engaged whilst we await the return of some semblance of normality. We often work remotely as editors, so thankfully our work on the magazine has been one aspect of life which is largely unchanged. Over the past few months, I've enjoyed spending more time working with contributors and my fellow editors to develop an edition of which we are very proud. Well done to all our contributors, who have worked so hard with us to build a magazine which considers personal experiences, emerging clinical science and social responsibility in health.



This magazine offers an opportunity to consider healthcare outside the media monopoly of coronavirus: whilst the clinical, financial and sociopolitical challenges of the pandemic remain at the forefront of our minds, we should remember that our healthcare services must continue to operate for other medical needs. I also hope that the articles are read with a thoughtful attitude. They all - whether educational, reflective or interrogative - provide a foundation for critical thinking and discussion. With the almost limitless variety of information outlets available to us, now is the perfect time to deeply consider what we read and how it impacts us. Please share your thoughts on the articles with us; the Medic Mentor community is thriving virtually and is a perfect example of how we can foster connection in these unsettling times.

Ji-Yun Stephanie Yeung • Final Year Dental Student, Barts and The London, Queen Mary University



I sincerely hope that this issue of MENTOR finds everyone well and safe in these unprecedented times. Current pandemic circumstances have changed the way we all live and work. The amazing NHS has risen to this immense challenge, with many of the mentors in the Medic Mentor community work on the frontline. We at MENTOR had originally planned for the theme of this issue to explore sustainability and climate change. Although the crisis at large has taken a dramatic turn due to the outbreak of COVID-19, we must still look towards the future with hope and determination. This is not the first crisis that the world has had to face and it certainly won't be the last.

Although it is uncertain how the coming months will unfold, it can be in times of crises and challenge where innovation is born. It has been a pleasure to work with so many talented students contributing both articles and artwork amidst such an upheaval. What happens in the future depends on what we do in the present. Putting together this issue makes me excited to see our student contributors emerge as future leaders of the healthcare profession.

My earnest hope is that we will be able to learn from the ways in which governments, societies and communities tackle the coronavirus pandemic. In the meantime, I hope you enjoy reading this issue of MENTOR. Take care and stay safe.

Medic Mentor: From The President



The last few months have presented immense challenges to the NHS and to society as a whole. I am immensely proud of the Medic Mentor network of doctors and dentists, who have and continue to work tirelessly, in unfamiliar settings, in frontline services to care for patients with COVID-19. Healthcare professionals working in the NHS have all just carried on as normal, despite mass staff shortages and lack of available equipment to care for such a large number of sick patients in such a short period of time. I am also very proud of many of the Medic Mentor scholarship students who have stepped up to the frontline earlier than they had anticipated, and many others working as health care assistants or other auxiliary roles, to ensure continued delivery of care for our patients. It is evident that we have a workforce of healthcare professionals whose primary aim is to make the care of their patients, their first concern.

Alongside the pressures on our health system, lockdown and social distancing have resulted in a stark change from normality for everyone. Not being able to hold or see our loved ones, because of fears of the infection spreading further, inevitably takes its toll. Every one of us will have faced our own struggles. But, it is times of adversity that show to us the true strength and resilience of humanity. We have all found ways to stay connected through video calls and online games nights. We have worked together to ensure we are protecting the most vulnerable in our society. Millions has already been raised for NHS charities and every week the public thank our health professionals on the frontline for the sacrifices they are making in these challenging times.

In this same vain, Medic Mentor has adapted and diversified in these times of national restriction. For an organisation where in-person mentoring lies the heart of everything we do, our efforts to reach out to our network have never faltered! In the last couple of months alone, we have launched a Medic Mentor blog, podcast series, revived our scholarship programme and are busy generating online modules for our aspiring students and scholars in place of delivering our national conferences. And, the strength of our network of aspiring students has shone through, as they have already raised over £5000 for the Royal Medical Benevolent fund, a charity to support struggling doctors in their greatest times of need. I would like to say a huge thank you to everyone of you who has donated your money and time to help make this campaign such a great success.

I understand for many of our aspiring students, the concerns you must have about exam results, getting work experience, and starting university. Although only time will tell how everything will unfold, it is important to stay positive and focussed on your goal, which would be in a few years time to be standing where our healthcare professionals are today. Medic Mentor are here to support you every step of the way. Make good use of your time at home to work towards the Medic Mentor awards programme, join the virtual medical society, write a blog or a magazine article, create campaign videos or initiatives, join the virtual medical leadership programme and keep that passion for becoming a doctor, dentist or vet alive. Look after yourself too, keep active around the house, eat well and let's all support our loved ones in these difficult times and we will get through and back to normality.

Thank you.

Dr Lauren Quinn, President Medic Mentor

MENTOR

JUNE 2020

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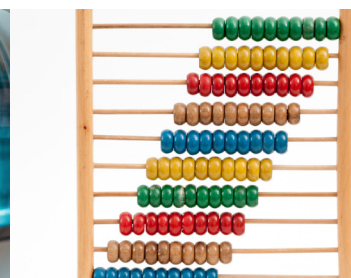
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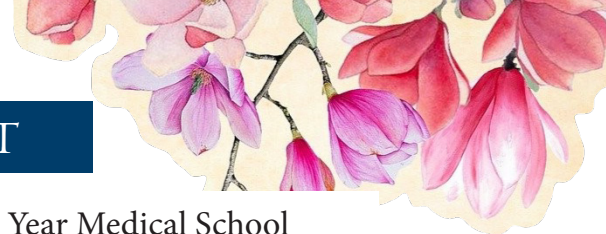
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Adhering to social distancing guidance, the editorial team has worked virtually for this issue of MENTOR.

EDITORIAL



We have received a stream of emails with suggestions for articles commenting on the current coronavirus pandemic. While we recognise the importance of not sweeping the ‘c’ word under the carpet, our current editorial stance on content related to the virus is guided by time to publication. MENTOR is a quarterly publication. Hence there is a delay of a few weeks for any content from the moment of acceptance to appearance in the print publication. The situation is fast-moving, so any information we print risks being out of date – possibly contradictory – within our publishing timeframe. In the meantime, we are keeping ourselves informed and advising our readers to seek COVID-19 communication via other forms of media from reputable sources, including the DHSC, PHE and WHO.

Responses to the coronavirus pandemic have evidenced commitment, innovation and fortitude. This crisis is pushing the dynamic nature of healthcare to its limits. Practitioners and patients are rapidly adapting to a system which should promise connection but whose practise is increasingly distanced. Many individuals who power the NHS have experienced changes to not only their work but their lives, from working in unfamiliar settings, isolating themselves from loved ones and risking their health in the service of others. This year’s graduates have assumed the mantle and are stepping into their careers in a time of huge uncertainty and unease; we wish them luck and hope that they are comforted by the knowledge that they are playing a vital and highly appreciated role in overcoming this crisis. All healthcare professionals have adapted to the formidable challenge and continued support from within and without the NHS is vital to see us through the challenging months ahead.

We are proud that MENTOR is a platform for the promotion of the ‘One Health’ initiative between the medical, veterinary and dental disciplines. One Health is an increasingly relevant and important concept in modern healthcare and promotes a collaborative effort between multiple healthcare disciplines at local, national and global levels to achieve the optimal health for humans, animals and the environment. The COVID-19 pandemic is undoubtedly the most important ‘One Health’ issue of our time. It was a veterinarian who first described a coronavirus causing infectious bronchitis in chickens in 1931. Even today, vaccinations struggle to keep up with the development of new strains as the chicken coronavirus mutates. Perhaps there are important lessons to derive from the past as the race to develop a vaccine for COVID-19 continues. The close link between the COVID-19 genome and bat betacoronavirus genomes has been widely reported. In a world where the lives of humans and animals increasingly overlap and impede on our environment, the only logical and robust strategy to fight an unseen enemy is a collaborative and global front. ◀



The Teenage Opinion On The Future Of The NHS

TOM KRYS

The editorial team at MENTOR are delighted to recognise this article as the recipient of the Editors' Choice Award. This has been awarded to Tom Kryz for proactively carrying out research to explore a subject both topical and important to healthcare. Congratulations to Tom for an excellent article!

EDITORS'
CHOICE

At the beginning of 2020, the media would seemingly have us believe that the NHS is in a state of crisis. At the time of writing it was voted as the second most important issue facing the UK (first being Brexit). To give some context onto the so-called crisis, November 2019 saw waiting times at their "worst ever level". The BBC reported that there were 4.42 million patients on the waiting list for surgery at the end of September, with just 84.8% of them waiting under 18 weeks - below the 92% target. Even worse, just 83.6% of A&E patients were admitted or transferred within four hours during October, significantly below the target of 95% (1). Part of this problem is due to a lack of staff. It is estimated there are 100,000 job vacancies in the NHS, 10,000 of which are doctors (2).

"The NHS is our most valued national institution."

While satisfaction seems to remain high, with 53% of people in a British Social Action poll stating they were satisfied with their care, compared to 30% saying they were not and 17% remaining neutral, there has been a downwards trend in percentage of waiting times met in A&E, routine care, cancer care, and an upwards trend in patients on the waiting list for almost the whole decade (3).

Amid the uncertainty of Brexit, with conflicting political opinion, there are inevitably calls for major upheaval. Political views on the future of the NHS is very divided. Prime Minister Johnson has in the past stated he would move for insurance-based healthcare and private involvement in the NHS (4), while Labour Leader (at the time of writing) Corbyn calls the NHS "our most valued national institution" and condemns the conservatives for "privatising the NHS by stealth" on his website (5).

It's fair to say that the NHS is in a state of turmoil at the start of the decade. As someone with hopes of being a doctor and working for the NHS in the

future, the level of uncertainty around the institution worries me. I question how social pressure and politics will play into the next 10 years of healthcare, and how the system will differ in that time for better or worse. And it is members of my generation who will soon be making those decisions that affect the healthcare of the future. Change is inevitable, one must adapt to the many challenges that time throws at them (in fact it is stated in the NHS constitution that patients have the right to expect the NHS to make efforts to improve continuously), but I am uncertain about just how this will play out.

Where there is uncertainty, there are questions to be asked. This is something I set out to do, to ask teenagers who will soon be voting for the future of the NHS what their opinion is. I am a college student, and of course it is going to be difficult for me to conduct nationwide surveys on public opinion, but I was keen to get opinions from as many teenagers as I could in my area. So, I created a survey with a number of questions designed to ask people their

responses from a small area, and I would call for a larger survey to be done to get the opinion of more teenagers.

Method

The questionnaire I sent contained questions on age, gender, ethnicity, education, frequency of NHS use, family working in the NHS, rating of care received and treatment by staff (from 0 to 5 with 5 being the highest), cleanliness of the facility and their opinion on what the future of the NHS should be. For the latter question, the options were keeping it as it is and striving for greater efficiency, increasing taxation for potentially better healthcare, a system where a base level of healthcare is free and more premium healthcare is paid for (the Australian system), a system where health insurance is bought and one pays for care if necessary (the American system), other or an option of no interest. I was interested to see if demographic factors affected how one would answer.

- *Have they been affected by the apparent crisis that is occurring?*
- *Have they been caught in the waiting times?*
- *Do they see a need for change? And if so, how would they go about it?*

thoughts and opinions. Have they been affected by the apparent crisis that is occurring? Have they been caught in the waiting times? Do they see a need for change? And if so, how would they go about it?

The following shows my hypotheses, methodology and results, and I reflect afterwards. I must stress this pilot study considers a small number of

I was pleased to receive over 50 responses, and that people seemed both keen to get involved and interested in the results. I had the following hypotheses:

- People would tend to rate the treatment by the staff higher than they rated the care received.
- Keeping the NHS as it is would be the most popular option.

- Those who visited the NHS more would be more likely to rate it higher.
- NHS facilities would generally be clean.

Results

The results I got were predominantly from 16 and 17 year olds, with a few respondents aged 15 and 18. Around 1/3 of responses were female and 2/3 male, and 3/4 were of white British ethnicity compared to 1/4 that were not. 2/5 were in private education and 3/5 were in state education.

Firstly, I wanted to analyse the score people gave. The perception that I have got from the media is that while staff are highly competent, they face issues out of their control. Overuse, lack of funding and staffing and other issues mean workers are struggling to keep up with demands and are forced to spend less time on each patient. Were this to be the case, it is likely that there would be a higher average score for the treatment by the staff than the care received. The treatment by the staff, meaning each individual interaction with a member of staff, would not necessarily be the same as the actual care they received. This was my first hypothesis.

49.0% of people stated they would keep the NHS as it is and strive for greater efficiency.


When taking the data as a census, this seemed to be true. The average score for care received was 3.55 and average score for treatment by the staff was 4.33 (rounded to 3 S.E.). This was constant across every demographic: when dividing the data by gender, ethnicity and frequency of use, the average score for treatment by staff was always higher. In fact, 96.1% of all responses voted the treatment by staff as higher than the care they received.

What were preferences for moving forward in the NHS? I expected that with people so used to having a free NHS at the point of delivery, the most popular option to keep it that way, so this was my second hypothesis. 49.0% of people stated they would keep the NHS as it is and strive for greater efficiency. This is almost a majority of the results, suggesting that my second hypothesis seemed to be true, although the number was lower than I expected. However, it remained the most selected option when splitting

that data into groups based on demographic as well, and the figure of around 50% actually stayed consistent in all groups, being within $\pm 10\%$ of the 50% figure. The Australian system of a base level of healthcare being free before paying for more premium healthcare was the next most popular option, chosen by 24.5%, closely followed by increasing taxation with 22.5%, although this seemed to vary a lot more when dividing into groups. The other options picked up very few votes. Which factors skewed results? Probably the most significant was if the respondent had family or close friends that worked in the NHS. I expected that those with family in the NHS would be more likely to show bias and give a higher rating. When taking a stratified sample of those with and without family in the NHS and comparing their score for care received and staff treatment, those who had family in the NHS had a higher average score: 3.75 compared to 3.30 for care received and 4.46 compared to 4.17 for staff treatment. I took this one step further and divided other demographic groups (i.e., male and female, state education and private education, frequency of visit etc.) again by whether they had family in the NHS. These groups always had a higher average score for care received than those without, and almost always had a higher ranking for treatment by staff; there was only one anomaly that didn't. The bias of having a close contact in the system seemed to be the factor that swayed the score given the most, so I considered this when looking at my other hypotheses moving forwards.

I expected that those with family in the NHS would be more likely to show bias and give a higher rating.

Next, I wanted to see how the frequency of attendance played into how the NHS was rated. I expected that the more often people visited the NHS, the more likely people were to give it a higher score. Having completed work experience shadowing consultants and sitting in outpatient clinics, I had seen they were run efficiently. Patients were able to get to know their doctor on a personal level and get the professional medical advice they needed. I expected that these people, who frequently visited their GP or went to clinics over something like a longstanding sports injury would be inclined to give the NHS a



higher score, as they were familiar with the system. It seemed that those who visited less frequently, who got caught in one of the long A&E waits or were potentially nervous about visiting a doctor they didn't know, were more likely to give the care they received and the treatment by the staff a lower score.

The NHS constitution states that patients have the right to clean facilities of care.

When comparing the two stratified samples, this seemed to be correct. The average score given to care received went up between those who visited the NHS once or twice a year, those who visited a few times a year, those who visited monthly and those who visited weekly (3.43 – 3.55 – 3.66 – 4.00 respectively). The average score given to treatment by the staff showed a similar increase between the groups, although there was a decrease between monthly and weekly (4.12 – 4.55 – 4.66 – 4.00 respectively). When I split the groups further into those with and without family working in the NHS, as a factor likely to skew results, the same trends were visible. For those with family in the NHS, the average score for care went up between visiting once or twice and visiting a few times from 3.55 to 3.92, and for treatment by the staff from 4.38 to 4.55. For those without, the increase was 3.10 to 3.50 for care received, and 3.80 to 4.50. I didn't have enough responses to accurately analyse the next two options.

Moving on from this, it seems the more one visited, the more likely they were to choose

the option of keeping the system as it is or increasing taxation; the options that didn't involve changes. 73% of people who visited once or twice per year voted for one of these options, but this went up to 79% in those who visited a few times. Small sample size means the results for the next two options are likely to be unreliable.

Finally, amidst the turmoil, one would hope that hospitals were still at least being kept clean. The survey seemed to show that they were, with 64% of people saying the NHS facility they visited was very clean, and a further 22% saying it was clean but could have been cleaner. It is stated in the NHS constitution that patients have the right to clean facilities of care, so high scores in this category are a big positive. Furthermore, of those who did not think facilities were clean, most stated that they did not notice and of those who said it wasn't clean, 100% of them visited the NHS only once or twice per year. This means their opinions are subjective to very limited interactions, and thus are potentially less reliable.

In short, typically, people rate their care reasonably highly, and their treatment by staff higher. Around 50% of people will vote to keep the NHS as it is regardless of demographic, with the Australia system and increasing taxation as the next most popular choices. Those with family working for the NHS were far more likely to give the NHS a higher score. People who visit the NHS more are more likely to give it a higher score, and in turn more likely to want to keep the system as is and improve it. Facilities are also kept clean.

Reflections

My first thought on the results of the questionnaire was that people seemed not only happy, but genuinely interested to partake. I had worried that people may not be interested in the future of healthcare, after the relatively low number of young people voting on Brexit (6). But in fact, many young people got involved, gave such different scores and had varying opinions. Everyone has had a different experience with the NHS, and the people who responded all had something to say, drawing on their experiences, thinking critically and voice their individual opinions. It made for a varied and interesting dataset well worth analysing and is a huge positive for me.

Contrary to the doom and gloom in the media, the NHS receives high scores and the more you visit, the more you experience it, the higher on average you will rate it. Generally, most people would say that the system does well by them, and calls for major upheaval seem a little premature based on these results. It reassures me that many people still have faith in the system of healthcare free at the point of delivery. Major change is something I know I wouldn't want during my foundation years. Having said this, it is clear issues exist and need to be acknowledged.

Everyone has had a different experience with the NHS, and the people who responded all had something to say.

Based on my own experience, I think the NHS system is excellent. I broke my leg a few years ago and experienced short waiting times, excellent care that had my leg fixed within 6 weeks, and follow-up physiotherapy that had me back to fitness quickly. The facilities were always clean, the staff diligent and competent, and if I had filled the questionnaire out, I would have given 5 for both scores and voted to keep it as it is. I did expect generally people to give similar scores, as from my experience, the system deserved them. Having said all this, my mother is an NHS worker, so potentially my opinion is biased.



However, I am fully aware that a sample size of 50 people is in no way a representation of the thoughts of students nationwide. Is this sample representative of the views of the rest of the country? Would you see the same trends? I would be interested to see a larger survey performed with more data to give a more representative view of students nationwide. ◀

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Going Green: Plants On Prescription

ISABELLA KWIECINSKI

FEATURES

Plants and pharmacy are more closely related than you may originally consider. The history of their use is rich, and there are many different ways in which plants are used in pharmacy. For example there is herbalism, a branch of traditional medicine where herbs are used directly to treat illnesses, but there are also plant-based medicines. This is where organic compounds in the final product have been synthesised to be similar to the compounds which occur naturally in the plant and provide its medicinal value. Although the final medicine does not contain any of the plant, as would be the case in herbal medicines, it does contain organic molecules which have been derived from the plant after analysis. The contrast between the two worlds, plants and pharmacy - the natural and seemingly unnatural, is fascinating. Now more than ever it is essential that we appreciate the importance of plants in healthcare, and take a closer look at how our detrimental impacts on the environment will eventually impact us.

The number of people opting to try herbal medicines and other alternative treatments has rapidly increased in recent years.

Humans have been using plants in medicine for thousands of years, back to a time when there is no written history. Historians believe that plants have been used in folk medicine since humans became able to reason, and the medicinally-beneficial plants were identified by a process of trial and error. Some of the earliest written records of the use of herbal medicines come from India in 800BCE where herbs were used to treat fevers, seizure, tumours and skin diseases. Until the fourteenth century, when world trade became more common, the epicentre of herbal use in medicine was Asia. During this century herbs such as ginger, cardamom and cinnamon began to appear in Europe and their medicinal values were put to use.

Ginger would be commonly used to treat nausea, digestion problems and the flu. Currently 80% of the population rely on herbal medicines to treat illnesses, and the number of people opting to try herbal medicines and other alternative treatments has been rapidly increasing in recent years. There has been more interest in traditional medicine, as well as preventative therapies.

One example of a medicine which has been derived from plants is the antimalarial drug artemisinin. Originating from the common herb *Artemisia annua*, its use has roots in traditional Chinese medicine and it has been used in the treatment of malaria since 200BCE. The herb was used in 1967 during the Vietnam War to treat malaria in the warm and humid jungles; five years after this event the compound responsible for its antimalarial properties was discovered. Scientists identified the key compound, an endoperoxide 1,2,4-trioxane ring, and then tested the action of this compound on living cells. They decided how best to synthesise this compound in a laboratory, made any alterations to produce a more effective drug, before packing it into a tablet form and testing it on humans. The first tablet form of artemisinin was produced in 1981.

So why are plants still vital to pharmacy? It is estimated that there are over 1.5 million plant species which we are yet to discover, and every year 1700 new species of medicinal plants are found. However, plant species are disappearing faster than we can discover them. The threat is that medicinally-powerful plants, such as those with antimalarial and anticancer properties, will be lost before we are able to discover them. Considering that many anticancer drugs are already derived from plants, such as vinblastine which is synthesised with compounds found in the Madagascan Periwinkle, and that in areas affected by malaria 1200 plants are used as local remedies, it is highly likely that important medicinal plants are yet to be discovered. The key threats are deforestation, which leads to 7 million hectares of forest being lost annually, climate change and forest fires such as those seen earlier this year in Australia.

Greta Thunberg recently criticised the UK's aim of net-zero emissions by 2050.



We have all read and heard a lot about climate change in the past year, with school strikes alerting politicians to young people's rising concern over the issue. Unlike animals, plants cannot move to find more favourable conditions - this means that as the earth's climate changes, and individual habitats become hotter, wetter, drier or more windy, the plants local to that area will be put at risk. If plants cannot deal with the new conditions they will begin to die, and eventually entire species may be lost. As well as this, deforestation poses a huge threat, as expansive areas of land are cleared at a time, leaving nothing behind. This is a very easy way to lose entire species of rare plants. Rainforests act as carbon sinks, this means that they take in more carbon dioxide than they produce. When forests are cleared all of the carbon dioxide that the trees have been storing and converting to oxygen is released into the atmosphere. As carbon dioxide is a greenhouse

gas this means that deforestation will contribute to global warming. The scary reality is that if we do nothing, not only will we be damaging the earth by allowing species to become extinct, but we will be sabotaging the future of our own healthcare.

So what is being done? Although recently there has been an increase in the

amount of news coverage that climate activists have been given, with Greta Thunberg and Extinction Rebellion being common headline holders, we are yet to see new plans put in place. However, organisations such as Greenpeace have been pressuring corporate organisations into

being more accountable for their environmental impact. This has led to some companies, such as Burger King, dropping all unsustainable suppliers from their supply chains. On a smaller scale, Amazon Watch is working to protect indigenous communities living in the Amazon. This work is vital in conserving their homes and also in medical advances as the communities often have extensive knowledge on medicinal properties of local plants. The WWF is working to protect forested areas and in China reforestation is being highly encouraged, with aims of everyone planting a tree each spring. This initiative has resulted in 42 billion trees being planted between 1982-2003.

We have only scratched the surface of plants' medicinal use.

Although there have been positive movements in the past few years in increasing the public awareness of our environmental impact and holding corporate companies accountable for their actions, it is still

not enough. Greta Thunberg recently criticised the UK's aim to have net-zero emissions by 2050, claiming that at the current rate they would not achieve this goal. However even these goals do not address the huge losses of forested land each year for palm oil farming and mining as they focus on emissions and climate change.

The reality is that if we do nothing, not only will we be damaging the earth by allowing species to become extinct, but we will be sabotaging the future of our own healthcare.

I believe the future of plants' relationship with pharmacy to be exciting, with so much potential that is yet to be unleashed. We have only scratched the surface of plants' medicinal use; it would be a shame to never have the opportunity to discover their full potential. To ensure that we have this future, companies who are directly involved in deforestation or whose factories are releasing large quantities of greenhouse gases need to be held accountable. On a smaller scale we can each individually try to help the cause, either by making simple swaps such as walking or cycling to work rather than driving, or on a bigger scale by buying an acre of land to protect it from deforestation. ◀





Can You Be Healthy With A Disorder? A Case Of Fish Odour Syndrome

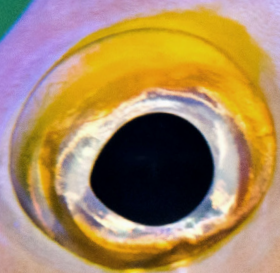
PETRA OLIVER-RUSSELL

A relative of mine suffers from a rare metabolic disorder called Trimethylaminuria (TMAU). Also known as fish odour syndrome, it manifests itself through the emission of a fishy odour affecting the patient's sweat, urine and breath. The disorder is not associated with other health-related problems but can be socially challenging and have a negative effect on emotional wellbeing. I am writing this article to raise awareness of this condition since many patients do not realise they have an abnormal odour and due to its intermittent character, many sufferers are undiagnosed. As a result of a lack of awareness and medical research, social stigma can impose itself on mental wellbeing. TMAU remains a rare disorder affecting "about one person in every 40,000" [1]. As the National Organisation

of Rare Disorders (NORD) reported "some physicians do not recognize the symptoms of trimethylaminuria when a person with body odour seeks a diagnosis" [2].

TMAU is a rare metabolic disorder due to, in most cases, a hereditary genetic change to the flavin containing dimethylaniline monooxygenase 3 (FMO3) gene which encodes for the FMO3 enzyme. The FMO3 enzyme is responsible for breaking down trimethylamine (TMA) derived from certain foods, into an odourless break-down product that is naturally excreted. In individuals where the enzyme doesn't function or functions poorly, TMA is not broken down and its pungent odour is then excreted from the body through urine, sweat and breath, smelling strongly of fish.

Although found in both sexes, it may be more common in women, whose symptoms can be more noticeable at certain times of the menstrual cycle. It has been suggested that higher hormone levels may aggravate symptoms [3]. Since the odour is present in sweat, anything which results in perspiration can also exacerbate the symptoms such as sport, warm weather and stress.



Punnett Square 1		Mother unaffected but is a carrier	
		T: Normal allele	t: Recessive allele
Father unaffected but is a carrier	T: Normal allele	TT Child has no TMAU and is not a carrier	Tt Child has no TMAU but is a carrier
	t: Recessive allele	Tt Child has no TMAU but is a carrier	tt Child has TMAU and can pass the gene down to future generations
Likelihood of inheritance to offspring		Affected = 25% Unaffected and not a carrier = 25% Carrier but unaffected = 50%	

Punnett Square 2		Mother unaffected but is a carrier	
		T: Normal allele	t: Recessive allele
Father unaffected and is not a carrier	T: Normal allele	TT Child has no TMAU and is not a carrier	Tt Child has no TMAU but is a carrier
	T: Normal allele	TT Child has no TMAU and is not a carrier	Tt Child has no TMAU but is a carrier
Likelihood of inheritance to offspring		Affected = 0% Unaffected and not a carrier = 50% Carrier but unaffected = 50%	

Punnett Square 3		Mother affected and is a carrier	
		t: Recessive allele	t: Recessive allele
Father unaffected but is a carrier	T: Normal allele	Tt Child has no TMAU but is a carrier	Tt Child has no TMAU but is a carrier
	t: Recessive allele	tt Child has TMAU and can pass the gene down to future generations	tt Child has TMAU and can pass the gene down to future generations
Likelihood of inheritance to offspring		Affected = 50% Unaffected and not a carrier = 0% Carrier but unaffected = 50%	

Figure 1. Punnett squares explaining the likelihood of offspring inheriting a genetic disorder such as trimethylaminuria (TMAU). Punnett square 1 compares the likelihoods of the child having or being a carrier of TMAU when both parents are carriers but unaffected by the condition. Punnett square 2 shows the likelihood of a child inheriting the condition if one parent carries the recessive gene but is unaffected and the other parent is not a carrier. Punnett square 3 shows the inheritance of the disorder when one parent has TMAU and the other is a carrier.

Types Of TMAU

1) **Primary TMAU** is genetic with autosomal recessive inheritance (Figure 1) and will be the focus of this article. In this instance, if one parent is a carrier of the gene mutation then the offspring will not show any symptoms but will be ‘carriers’ of the gene mutation. Meanwhile, if both parents are carriers, the child will have a 25 percent chance of being affected. Primary genetic TMAU will be the focus of this article.

2) **Secondary TMAU** is not genetic. It occurs in people who have a normal FMO3 gene but the FMO3 enzyme becomes overloaded. This can occur when an individual suffers from an excessive growth of TMA generating gut bacteria.

Cause Of Primary TMAU

The symptoms are triggered by the ingestion of foods rich in choline (an important nutrient for brain development) and TMA. These foods include sea fish (most river fish contain insignificant amounts of TMA), egg yolks, brassicas, peas, beans, peanuts, milk (from wheat-fed cows), liver, kidney and soy products. In my relative's case, it is primarily triggered by sea fish and soy products.

Usually when these foods are eaten, 'friendly' gut bacteria which aid digestion break down the foods, forming the strong-smelling TMA. This then travels via the bloodstream to the liver, where the FMO3 enzyme breaks down TMA to an odourless alternative, trimethylamine N-Oxide (TMAO) (Figure 2).

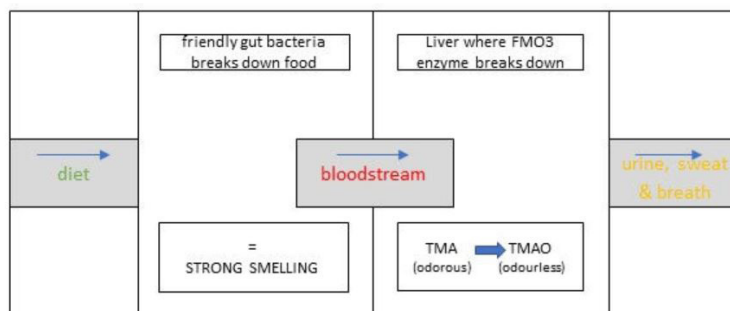


Figure 2. A schematic illustrating how trimethylamine N-oxide (TMAO) is formed and excreted following the breakdown of food in a normal individual.

In people affected by the condition, the strong-smelling TMA is not broken down into the odourless version but is excreted in its pungent form through breath, sweat and urine (Figure 3).

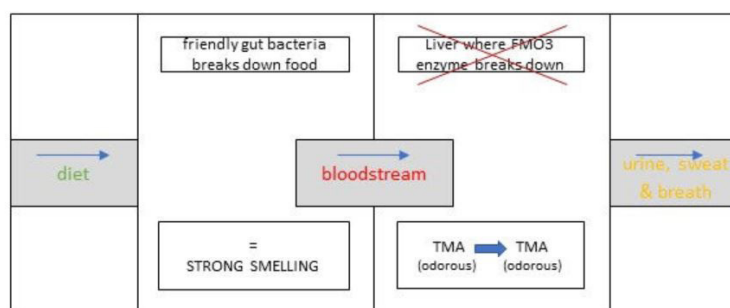


Figure 3. A schematic illustrating how the odorous trimethylamine (TMA) is excreted in its pungent form in an individual with the genetic condition, trimethylaminuria (TMAU).

Impact

While TMAU is not associated with other physical health problems, the condition can have a burden on the mental and emotional health and wellbeing of affected individuals. Ayesh et al. (1993) describe numerous accounts of people with psychosocial reactions to their diagnosis. These can include, "strong feelings of shame, embarrassment, low self-esteem, social isolation, frustration, anxiety, depression, paranoia, suicidal personality, educational and career dis-advantages, failure to maintain relationships, and addiction to cigarettes, alcohol, and drugs" [4]. My relative does not suffer with compromised mental wellbeing but does find the condition socially challenging on occasions. It can be difficult when people unknowingly comment on the smell in social groups. They once commented, "the hardest thing is not knowing when I've got it". Sometimes sufferers do not recognize their own symptoms, which means that without a diagnosis, they may be shunned or socially isolated without understanding why [4].

It should also be noted that the FMO3 enzyme is responsible for breaking down certain medicines; therefore a fault on this gene may have an impact on some drug metabolism making TMAU patients resistant to their beneficial effects. Examples of these are clozapine (an antipsychotic); selegiline (treatment for Parkinson's or depressive conditions); ranitidine (antihistamine); tamoxifen (anti-oestrogen drug to treat breast cancer) and benzydamine (non-steroidal anti-inflammatory) [5].

Treatment

Unfortunately, there is currently no cure for TMAU. Table 1 shows some of the treatments used by doctors to reduce the symptoms. It is important to appreciate that none of these methods have undergone large randomized trials to prove the efficacy due to the lack of participants, unawareness in society and the rareness of the condition.

Table 1. The symptomatic treatments used for trimethylaminuria and their medical reasoning.

Treatment	Reasoning
Dietary restrictions	Aiming to reduce the ingestion of choline or TMA containing foods
Activated charcoal and copper chlorophyll	To combat TMA produced in the gut
Soaps and body lotions with an acid Ph	To neutralize the alkalinity of the chemical producing the odour
Antibiotics	To reduce TMA producing gut bacteria
Laxatives	To reduce transit time in the intestine
Riboflavin supplements	To enhance FMO3 enzyme activity

Raising Awareness Of TMAU

It is likely that TMAU has been affecting individuals for hundreds of years but until recently no one knew the cause. It was first mentioned in 1970 in the medical journal *The Lancet*, though can probably be traced back further [6]. In the early 17th century Shakespeare alludes to the symptoms in *The Tempest*: “What have we here? A man or a fish? Dead or alive? A fish. He smells like a fish, a very ancient and fish-like smell” [7]. It is important to raise awareness about this metabolic disorder as it remains under-diagnosed by medical professionals. Indeed, this condition poses challenges but with a proper diagnosis, people can understand and manage their symptoms. A diagnosis can provide relief by explaining a condition rather than apportioning self-blame, isolation or a feeling of hopelessness caused by not knowing why they smell. Many affected individuals could have improved mental wellbeing from a shared medical and societal understanding.

My family and I are hoping to continue to raise awareness at a national level, both in TMAU and rare diseases networks. We are also involved in discussions with NHS paediatricians who are interested in researching novel therapies.◀



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Prosthetic Dentistry: Out With The Old?

MURRAY IRVING



Prosthodontics, also known as prosthetic dentistry, is a specialty pertaining to the diagnosis, rehabilitation, and maintenance of the oral function, appearance and health of patients with clinical conditions involving missing or deficient teeth, as well as maxillofacial tissue defects. This is via means of biocompatible substitutes – a prosthesis. For many years, the use of ‘conventional’ methods to fabricate dental and facial prostheses has been considered the gold standard in prosthetic dentistry. However, with the rapid evolution of digital dentistry, these conventional methods are being challenged. Computer-Aided Design, Computer-Aided Manufacture (CAD/CAM), specifically subtractive manufacturing (SM) and more recently, additive manufacturing (AM)/3D printing are all disrupting not only prosthodontics, but also numerous healthcare realms beyond.

The construction of dental prostheses is still dominated by non-digital manufacturing procedures, the outcome of which are not only highly dependent on the knowledge and skill of the dental technician, but also the quality of impressions taken by the dental practitioner. Additionally, due to the complex integration of the patient, clinician and dental laboratory, detailed communication is imperative to ensure the success of the treatment. Digital prosthodontic techniques such as SM and AM may improve the accuracy of prostheses and

thus enhance patient care. This article will review both digital manufacturing systems, comparing them to conventional approaches based on the current literature.



Figure 1 (1) - Custom designed-made silicone orbital prosthesis

Conventional Techniques

Conventional fabrication of dental prostheses involves the dental clinician taking an impression or mould, sending it to the dental laboratory to be cast up in dental stone. This enables the required prosthesis to be constructed from that cast, whether it is a crown, bridge or denture. Numerous stages are involved and this inevitably increases the risk of human error. Conventional techniques are useful for common prostheses, but when more uncommon ones are requested to treat facial disfigurement, for example extraoral maxillofacial silicone prostheses as shown in Figure 1, there is a higher chance of

failure. Patients requiring these prostheses are more likely to be deprived of access to adequate care owing to the complexity of treatment and limited availability of specialist expertise. Particularly in cases of this nature, computerised design and manufacture have the potential to produce more reliable prostheses and increase the treatment accessibility to a high needs population.

CAD/CAM

CAD/CAM involves three stages:

1. Data acquisition
2. Data processing
3. Manufacturing

All of these stages can be done in the dental practice, a dental laboratory or in a centralised fabrication centre.

Data Acquisition

Data acquisition simply obtains required data via a scanner, converting the anatomy of the patient, either from directly inside the mouth or a dental stone model, into digital data. There are two different types of scanners: optical and mechanical. Optical scanners use triangulation in order to collect data of three-dimensional structures. Mechanical scanners (also known as contact scanners) on the other hand, assess the stone casts mechanically by means of a ruby ball in order to obtain 3D measurements.

Data Processing

Special software processes data from the scanner, which is then used to form a design for the final product, these range from crowns to dentures. Software is becoming increasingly user-friendly and more companies are involving open systems as opposed to closed systems. The former enables communication between different systems or brands, and therefore greater flexibility for both the dental clinician and laboratory.

Manufacturing

The final stage of CAD/CAM is the computer-aided manufacture. In subtractive manufacturing, computer-controlled machines, such as milling machines, saws, lathes and drill presses, are used in conjunction with sharp cutting tools to

carve a selected material into its required shape, for example a dental crown. Materials range from metals to ceramics and start out as a solid block in which the machine removes areas that are not needed. Although accurate and effective, this process is wasteful since more material is removed in comparison with what is used in the final prosthesis (2).

As populations live longer there will be an increased need for tooth replacement.

Additive manufacturing (3D printing) is defined as the process of fusing materials to make objects based on 3D data, usually layer upon layer (3, 4). Once a design is made, it is converted into multislice images, each millimetre of material consisting of 5-20 slices. The printing machine lays these segments down successively to eventually be fused together, usually via a binding agent or sintering to form the final product. This is followed by the removal of excess material and supporting arm.

Subtractive Manufacturing Versus Conventional Methods

When we provide a prosthesis to a patient, our aim is to replace what has been lost in terms of anatomy, aesthetics and function. It is therefore important to be as accurate as possible. Studies have shown subtractive CAD systems to be more accurate compared to conventional methods when reconstructing the occlusal (biting) surfaces of teeth. It has also been shown that CAD/CAM provisional crowns are more accurate and stronger than conventional ones (5). However, the accuracy of digital methods is still reliant on a number of factors such as operator experience and patient compliance.

As populations live longer there will be an increased need for tooth replacement; another use for CAD/CAM is the manufacture of complete dentures. CAD/CAM use in complete dentures has been shown to have a number of benefits, such as reducing the number of visits and time spent



in the dental chair, better retention and improved physical properties (6). An aging population also brings the challenge of an increased prevalence of Alzheimer's disease.

Patients with this disease can

become agitated or aggressive, particularly when in new, unfamiliar environments, so the benefit of faster, less invasive treatment cannot be understated (7).

One major downside to digital fabrication methods is cost. Initial setup and maintenance of new technology is always going to be expensive, but as shown by the move to digital note taking, as the technology becomes more common, increase in market competition drives the price down. When this occurs, practitioners are more likely to convert to digital.

Additive Manufacturing Versus Conventional Methods

3D printing in dentistry is relatively new, so the evidence on its accuracy, longevity and success is limited. However, it is a rapidly growing field and some studies have already reviewed its risks and benefits. One paper compared 3D printed provisional crown and bridge materials to conventionally cured materials (8). They showed 3D printed prostheses had similar physical properties, but up to 22% error in accuracy. Despite this, the authors concluded that 3D printed provisionals are suitable for clinical use.

With regards to dental implants, another study measuring the survival of 110 3D printed titanium dental implants in 82 patients found a 94.5% success rate after 3 years. The authors concluded that AM implants were a viable clinical

option for treating single-tooth gaps in both the maxilla and mandible. However, this evidence is only valid within a three-year period. Given that the longevity of implants is a major factor influencing patients' treatment decisions, further clinical studies are necessary to establish long-term success rates (9).

In conclusion, conventional manufacturing methods continue to be useful and will most likely remain the default for the near future due to their availability and lower costs. However, CAD/CAM dentistry has seen great advances since its implementation and is certainly here to stay. Automated systems are making previously manual tasks faster, cheaper and replicable. Moreover, they are decreasing the likelihood of human error within each stage of the manufacturing process.

Additive manufacturing provides the ability to produce complex shapes with comparatively less waste, while subtractive manufacturing has the advantage of using material that is homogenous and strong. The need for post-processing is also minimised and the equipment is considerably less costly. Nevertheless, as 3D printing becomes more commonplace in the dental world, this will most likely decrease. Cost is the main challenge currently facing digital dentistry. There's no question that digital fabrication techniques will follow the footsteps of dental radiology in moving away from traditional methods. It's only exactly when this will happen that remains uncertain. ◀

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Canines And The Community

EVA BRAND WHITEHEAD



All artwork for this article 'Canines in The Community' was created by Haniyah Omer Khan.

Today there is a clear difference between domesticated dogs and wild wolves, but it hasn't always been this clear cut. So how did wild wolves evolve into domesticated dogs?

It is thought that the first domestication happened around 14,000 years ago, with the nomadic hunters and gatherers taming grey wolves (*Canis lupus*) to hunt for them. To explore this Morey (Archaeologist, 2006) suggested, in his abstract piece, 'Burying key evidence: the social bond between dogs and people', that the most effective way to explore the domestication of dogs would be to take into account the metamorphosing structure of the wolf, as well as closely examining the relationship between humans and dogs [1]. This is exactly what Dr. Nobis had done, 27 years before that.

In 1979 Dr. Nobis (earth scientist) discovered 14,000-year-old burial remains from what was thought to be a human burial [2]. Interestingly, the skeletal remains of a canine species were discovered in close proximity to the human skeletons highlighting the intimate relationship between man and dog - in life and in death (Figure 1). The dimensions of the well-preserved lower bones indicate that the dog was domesticated. Its bones were structurally similar to that of modern-day sheep dog breeds. This marked the discovery of the earliest known domesticated dog.

This evidence provided both structural evidence of a wolf's domestication, as well as 'closely examining the relationship between humans and dogs' through burial rituals. This evidence can therefore be seen as effective exploration of the domestication of dogs. There are two main theories of canine domestication that can be explored: domestication and gradual utilisation. The animals may have become domesticated when human hunters 'adopted' abandoned orphan dogs, and by hand-rearing them they became comfortable around humans. Secondly, it is considered that wild dogs were trained, via gradual utilisation, with scraps of food to perform tasks such as retrieving game and hunting larger prey. Since this time, the use of dogs in human society has



vastly increased and become more varied. Between 12,000 BC and the First World War (WW1), dogs were further domesticated to a point where they no longer relied on a pack of their own species, but instead, on their human pack. Dr Santos (Yale



Figure 1. The identified bones of the Bonn-Oberkassel dog skeleton. Elements of the skull are at top left; bones of the forelimb are at centre and below; the axial skeleton (ribs, vertebrae) extend across the top of the photograph (Photo: J. Vogel, LVR-Landes Museum Bonn).

University), in the Smithsonian magazine by Brain Handwerk [3], explains that multiple researchers have conducted studies in which dogs, and wolves, were faced with a problem they couldn't solve by themselves. They found that wolves, as a pack, would

"try lots of different trial and error tactics to solve the problem—they would get at it physically". The dogs, however, merely stare back at their human companion, looking for guidance and help. This clearly shows the shift in dependence, from a wolf that works with its pack, to a dog that waits on its owners' cues. Some could argue that as the wolves became domesticated dogs, they replaced their wolf pack with a

human pack. Whilst we are clearly shown to rely on dogs, they also rely heavily on us for: food, shelter,

and guidance. This relationship between mankind and canines continued to flourish.



Pre-war the role of the dogs began to evolve into a companion-focused role. This era witnessed the rise in popularity of the selective breeding of dogs, mainly to inherit traits more visually appealing to pet owners. One example of historic selective breeding is the rise in popularity of French Bulldogs in 1850s France. Since this was the time of the industrial revolution the smaller French Bulldog, with its loving nature, was ideal for the cramped city living conditions of the factory workers. Fast forward to today and we have witnessed the intense selective breeding of French Bulldogs for an increasingly shortened muzzle to a point of respiratory compromise in many dogs. Furthermore, after realising that many dogs were not just fashion accessories, but prime athletes that demonstrated high class agility and endurance, dog competitions arose. Competitions aimed to identify the cream of the crop in dogs tested with agility courses, obedience tests and disc-retrieval. This dates back to over 150 years ago with the first English dog show held in Newcastle in 1859 later followed by Crufts, which is still happening to this day, being held annually, in London, from 1886.

Even during WW1, dogs played a vital role. It is estimated that by 1918 Germany had employed 30,000 dogs, Britain, France and Belgian over 20,000 and Italy 3,000 [4]. Many different dog breeds were utilised during WW1 and it quickly became apparent that some breeds outperformed others in

their desired war-time roles. The two main breeds used during WW1 were the Doberman Pinschers and the German Shepherds. Their strength, speed, intelligence and trainability made them favourable additions to the war-time effort. Other breeds of smaller dogs, such as terriers, were also used as 'Ratters' to hunt and kill rats in the trenches.

The wider role of dogs has diversified in line with modern society.

By the time of the Second World War (WW2), 1939 to 1945, the role of dogs expanded, and arguably crossed an ethical line in some countries. William A. Prestre, a Swiss expatriate living in New Mexico, approached the U.S. government with a bold plan to train dogs to only target Japanese soldiers, without the supervision of a human trainer or dog handler [5]. In order to train these dogs, 25 selected Japanese American servicemen on Cat Island 'volunteered' for the role of bait. The volunteers were scarred both mentally and physically. Not only were the human volunteers scarred but it is reported that the dogs were brutally trained, using techniques such as electrocution and physical abuse, to incite the dogs to violence. Ultimately, these trials were unsuccessful, and extremely unethical, and the plan was adapted to training groups of dogs to attack on the command of a dog handler.

Over the years canine companionship has become the most popular form of dog ownership. However, many dogs are still highly trained and play a crucial role in modern society for example, dogs for the blind. In Wirral in 1931, the first four guide dogs were trained - Judy, Flash, Folly and Meta. The Guide Dogs for the Blind Association was established three years later, and the organisation has continued to grow providing a life-changing and essential service to blind people [6]. In 1965, the value of guide dogs became more widely appreciated after a popular television programme, Blue Peter, followed Honey, a trainee puppy. Honey inspired the UK audience and cemented a nationwide respect for guide dogs and the charity in our society.

The training protocol for guide dogs begins from birth. Puppies are carefully assessed for suitability as a guide dog. Most people associate Labradors with the most common guide dog, and this is because they are highly motivated by food, more so than other breeds, and are therefore easier to train. However, as guide dogs have become more common, the range of people they go to increases, and this can include people that are allergic to fur. Therefore, various breeding programs, including the National Breeding Centre [7] have started to train poodles, and poodle crosses like a Labradoodle (Labrador and Poodle).

Some of the tests in the first five weeks of puppyhood include introduction and reaction to a novel object, surface and sound. Trainers look for personality traits including curiosity and braveness. At eight weeks old, recruits live with puppy raisers that continue intense training over the next 12 months focusing on desensitisation to the surroundings and reinforcing commands. Following this, puppies complete two months of



they can ignore olfactory and visual distractions such as food or other animals. Successful recruits then spend five months with a specialist guide dog trainer before being assigned to a visually impaired owner for the foreseeable future [8].

This process is both very expensive (costing around £55,000) and intensive and not all puppies will go on to become working guide dogs, a tiny number – around 30 a year of the 1,500 puppies that apply. [9] As a society, we should always value and respect the sacrifice and commitment of working guide dogs and their trainers.



‘guide dog school’ and eventually leave their puppy raiser at 14 months old. Recruits then undergo an intense series of tests, including assessments on long walks on how eager they are to work, and how well

The wider role of dogs has diversified in line with modern society. Today, dogs are trained as crime detection dogs (to identify bombs or illegal drugs), medical detection dogs (to identify when owners with chronic diseases have abnormal blood pressure or blood glucose levels), as search and rescue dogs, and even as emotional support for humans affected by epilepsy, severe autism or psychiatric disorders. There is seemingly no end to what a dog can be trained to do.

Many of the above roles of dogs are centred around a dog’s highly developed acute sense of smell (up to 10,000 times better than ours - enough to detect ½ a teaspoon of sugar in an Olympic sized swimming pool!). A common method of training involves the use of a towel or blanket to create a toy [10]. A food treat is hidden inside the blanket to encourage play and interaction. Once the system is established as a fun and positive memory for the dog, the treat

is replaced with a drug or bomb scent. Dogs will then associate the smell of the drug with the towel. The trainer can now hide the towel in one of three suitcases, for example, and ask the dog to locate it. In real life, for example in airports, the dog's favourite play towel is not present in people's luggage. As such, on identification of any drug scent on passengers or in their luggage, the trainer will provide the dog with their favourite towel to play with as a reward. This training method can take up to two years, but is very robust. The Animal Breeding of the Polish Academy of Science found that on average, dogs found hidden drugs correctly 87.7% of the time in one study [11].

Recent research has explored the numerous ways in which dogs are beneficial to human physical and mental health. One study showed that dog owners were 34% more likely to hit the NHS recommended goal, of 150 minutes of moderate intensity activity a week, when walking their pets regularly [12].

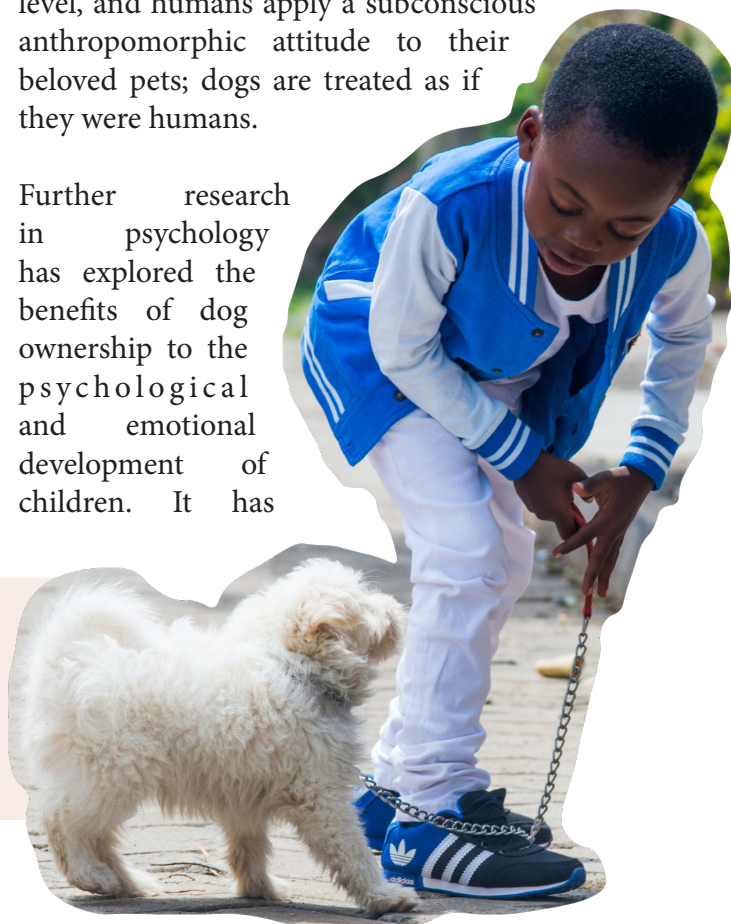
Besides providing a daily excuse to exercise, there are many mental health benefits. This is especially important since society is increasingly paying more attention to mental health and wellbeing. For example, many dog owners find that their pet is a conversation starter and facilitates interactions with the wider community. Psychology studies show that social interactions boost self-esteem and confidence and even increase the formation of close friendships. This can particularly be seen in dog breed clubs, where owners of the same breed meet regularly for various activities and events involving their dog, with owners uniting in their shared love and passion for the breed. On 03.02.20 I asked 30, randomly selected, people whether they were more likely to talk to members of the community with or without their dogs. I found that 25 of these people (83%) were much more likely to initiate conversation with a new member of the public if their dog was present.

of acute myocardial infarction, ischemic stroke, heart failure, and composite cardiovascular disease in 40-80 years olds - likely linked to increased physical activity [13]. Furthermore, in 2011 a study was published in the European Journal of Medical Research titled 'Elderly people in many respects benefit from interaction with dogs' [14]. The study interviewed elderly individuals who had recently lost their dog. One question was 'What did your dog mean to you whilst you were alive?' There were many heart-warming responses such as, "He wasn't a dog to me. When I ate, he sat at the table with me; when I was sick, he instantly noticed it and became extremely nervous" and "My poodle always understood me, and when my husband passed away, he was as sad as I was." Drawing particular attention to the first quotation, the interviewee mentions that the dog could sense when the owner was unwell. This demonstrates the unique and deep human-canine bond; it is also arguable that through the dog's altered behaviour, the owner was more likely to notice and do something about their illness. By doing so the dog would have kept his owner safe, provided support, companionship, and a welcome distraction from the pain. Both interview responses demonstrate that humans and their dogs are connected on a complex emotional level, and humans apply a subconscious anthropomorphic attitude to their beloved pets; dogs are treated as if they were humans.

Further research in psychology has explored the benefits of dog ownership to the psychological and emotional development of children. It has

Growing up in a household with a pet enhances children's emotional control, sense of responsibility, and confidence.

Dogs have also been shown to have many positive benefits to the lives of the elderly. In one study, dog ownership was associated with a reduced risk



been shown that growing up in a household with a pet enhances children's emotional control, sense of responsibility, and confidence. In 1988, Charles E. Hendrix and Robert H. Poresky proved that growing up in a dog household made children more socially competent, and more empathetic; traits that can increase chances of success later in life. In addition, children confide openly with their pets and express all their emotions without judgement. This encourages emotional expression, an important wellbeing skill that can later be applied with family, friends, colleagues and others throughout life.

Sadly, dog ownership provides early exposure to bereavement, especially since most dog breeds have a life expectancy of around 12 years old, which commonly falls within their childhood. Although, this experience provides a lifelong and valuable experience to deal with – and cope with – upsetting emotions in the correct way.

Dogs have also been proven to have physical benefits to children as well as the psychological benefits discussed above. Dog ownership is associated with better cardiovascular health (lower blood pressure, lower triglycerides and in boys, lower cholesterol) and increase physical activity. Growing up with a dog has also been proven to reduce the number of times that a child has to go to the doctor, therefore reducing the demand on the NHS, according to the RSPCA knowledge database [15]. They claim that “growing up with a dog (and other pets to a lesser extent) during infancy may help to strengthen the immune system and may reduce the risk of allergies”. The Telegraph have also published an article that explains how dogs may reduce allergies in children [16]. Within this article researchers found that having a dog seemed to make allergies four times less likely in children, owing to a level of ‘immunotherapy’ related to living with a dog. The effects of dog ownership on the health and emotional development of children is an ongoing research focus for many medical researchers and psychologists.

People value their dog for different reasons. I interviewed a close friend on her human-canine bond. She described the value of Minnie, her 4-year-old Jack Russell Terrier crossbreed, as “a comfort” and she makes her “feel safer at home.” She also remarked on how Minnie facilitated regular exercise through walks. It was interesting to hear about a perception of emotional understanding from Minnie, as we discussed Minnie's ability to “register

her mood”. The owner reported that Minnie was often more loving if she could sense sadness with her owner, which is an invaluable emotional support.

The role of canines within society is hugely diverse. Many people could not carry out their day to day lives without the support of their specially trained canine companion. Many of us are protected in everyday society by dogs that are trained to combat crime. Many people simply value the multitude of benefits of having a furry addition to our families. In many respects, canines ARE the community. ◀

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