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Student Health Sciences Research Journal

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Hi! Welcome to the Autumn 2023 issue of the INSPIRE Student Health Sciences Research Journal.

This issue has been written and peer-reviewed by students, with the editorial board being made up of students from the universities of Bristol, Cardiff, Exeter, and Plymouth, the journal's founding institutes. The INSPIRE Journal was created as part of the INSPIRE scheme, which aims to provide medical, dental and veterinary students across the UK with the opportunity to participate in and incorporate research into their future careers.

This year has been a politically turbulent time for the NHS, its staff, and medical students alike. The recent walkouts from staff represent the largest and most disruptive industrial action in the NHS' history, with some contracts still being disputed. Ethical questions are raised as to whether deprivation of care is the correct way to enact change, but what is for sure is that industrial action is not taken lightly by NHS workers and comes from a place of desperation. Is this acute understaffing and consequential reduction in the quality of care warranted to treat the chronic understaffing that undermines patient safety? The government's reaction to the issues has included varying back payments and single-digit pay increases. A more radical long-term solution has also been proposed for the issue of NHS staffing that will affect future medical students. A plan has been put forward to double medical school and adult nursing training places by 2030, a proposed apprenticeship scheme and a 50% increase in GP training places. There is no doubt that change is needed in the NHS, and hopefully these will help the many persisting problems.

Furthermore, the shortage of NHS appointments is creating a two-tier system as the oral health gap widens. Post-COVID, those who can afford private care, especially in children, are experiencing significantly less tooth decay.

Within the veterinary community, we have also faced many challenges this year, with the ongoing shortage of veterinarians working within the UK. To address this, two new vet schools have opened at the University of Central Lancashire and the University of Aberdeen. However, it is uncertain whether simply producing more vets will be the solution to this problem. With more vets leaving the profession every year than entering it, we may have to look more deeply at the working environment and address the problems leading to veterinarians deciding to leave veterinary medicine. Additionally, we have seen the recent changes in Extra Mural Studies (EMS) requirements for vet students graduating after 2020, with a reduction from 26 weeks to 20 weeks of placement. EMS is an area of continual discussion and plays a crucial role within our learning. However, with the recent reports of abuse during placements, it will be crucial for vet schools to discuss implementation of better safeguarding measures to ensure vet students have positive experiences on placement. Although we have faced some challenges this year, we have also seen some great improvements within vet schools, with many working to re-build community after the pandemic.

We hope you enjoy reading the INSPIRE Student Health Sciences Research Journal – the articles have been written and peer-reviewed by students throughout 2023.

Best wishes,

INSPIRE Student Health Sciences Research Journal Senior Editors

Would you like to get involved with future issues? Send us your research papers, reviews, opinion pieces, interview ideas, artwork, and creative writing via our website **www.inspirestudentjournal.co.uk**. Sign up to be a peer reviewer by emailing your details and areas of expertise to **inspirestudentjournal@gmail.com**.

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FRONT COVER

A pencil sketch by Shen Sheh – see page 39 for more information.



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Professor Jo Tarr

The GW4 INSPIRE team, past and present, are devastated by the dreadfully sad news of Professor Jo Tarr's passing and would like the INSPIRE community to remember Jo. INSPIRE continues to be a really important initiative which has seeded many students onto the path of research. We have been acknowledged as having one of the biggest and most integrated offerings nationally and this has been achieved through close cross-institutional working with academics. Jo was a truly fantastic person to work with and has inspired huge numbers of vet, medical and dental students to consider a career in research.

As Liz Coultard says: "Jo was highly skilled, dedicated and self-effacing – a pleasure to work with." Jo was an integral part of the early INSPIRE programme (as far back as 2014), and remained involved to this year, and we remember her collegiality and friendly approach.

Linda Wooldridge says: "I had the pleasure of working with Jo for the last 8 years.She was an extremely lovely person to work with so will be greatly missed."

Before INSPIRE was established, when Plymouth and Exeter universities were part of the same medical school, Jo and David Parkinson would end up on early morning bus rides with students heading off to conferences to give students a chance to present their research work, or visits to pharma companies to learn about drug development; things the students would not have done if Jo had not taken the time to help organise these things.

David says: "Jo was a friend and a very valued colleague for many years.... Jo was always warm, kind and generous with her time to all of us and her students. It's very difficult to adjust to the idea that she will not be part of all this in the future. She will be much missed by all who knew her."

Tony Pickering says: "I knew Jo from my time as the Bristol co-lead for the INSPIRE program. Jo's contribution to the INSPIRE program from the outset was huge and very important. She was generous, grounded, supportive, encouraging and kind to her students and colleagues alike. I was very fortunate to have benefitted from her efforts during our time as leads of INSPIRE."

Jo Tarr, along with Tamsin Ford, took the initiative for Exeter and Jo was a strong advocate and industrious supporter of the INSPIRE scheme (which was impressive as she was not medically trained, but had an excellent appreciation of their challenges, motivations and needs).

Jo for many years undertook the Herculean task of matching the students from all four universities with their choices of research taster days across the South West and then encouraged them to develop proposals for summer projects. She also played substantial roles in launching the INSPIRE research journal and in organising the excellent INSPIRE national conferences, where students from all over the country attended our meetings in the South West.



This included the 2020 conference which took place just before the COVID-19 pandemic fully hit the UK. This contribution has also been recognised by the Academy of Medical Sciences who have repeatedly funded our scheme to the max and Jo rightly claims credit for the Exeter share of this funding.

Richard Coward says: "Jo was a lovely, kind, considerate and beautiful person to know and work with. I am so sorry that she has gone and she will be hugely missed."

As Vehid Salih says on behalf of us all: "It was a pleasure working with her and she will be missed by many colleagues. May she rest in peace."

On behalf of the INSPIRE team past and present

University of Exeter: Dr Jane Smith

University of Plymouth: Dr Vehid Salih, Prof David Parkinson

University of Bristol: Prof Richard Coward, Prof Tony Pickering, Dr Elizabeth Coultard, Dr Becky Foster, Dr Anu Goenka, Dr Mark Gormley, Prof Linda Wooldridge, Mrs Marie Burgess, Ms Michelle Harris

Cardiff University: Prof Colin Dayan, Dr William Davies, Dr Emma Tallentyre, Dr Heather Lundbeck

Student-led approaches to mental wellbeing advocacy

Aisia Lea^a, Aishwarya Baskar^a, Ameera Haseen^a, Harsh Moldalavalasa^a, Alexandra Moody^a, Dilip Nathan^b, Georgina Shajan^a, Bethany Tremain^a, Eloise Young^a

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Abstract

Mental health issues amongst university students are rife. An increase in mental health literacy and an emphasis on wellbeing revealed the importance of having a plethora of resources available to students surrounding mental health support. The Welfare Hub is a student-led project created at the University of Nottingham Medical School to destigmatise mental health discussion, enhance mental health education, and share experiences of healthcare professionals regarding their mental health and university support.

The Welfare Hub was created in 2020 and has developed since then, delivering content primarily through an Instagram account (@welfarehub.nottsmed) (**Appendix 1**). This year, we decided to undertake a research project into the effectiveness and the impact of the Welfare Hub on its followers and its committee. Following this, discussion around improvements the Welfare Hub can make regarding its content and how to best support future students was incorporated. The hope is that the Welfare Hub can become an example of good practice regarding student-led welfare, not just for medical students, but for all students.

Why was the Welfare Hub created?

It is a well-known fact that university students have high rates of mental health issues and distress.¹ Medical students experience elevated levels of mental health including anxiety, burnout, depression and suicidal ideation compared to students from other courses but are less likely to seek help for these issues due to mental health stigma.² These factors contribute to worsening academic attainment, reduced competency and increased rate of errors in clinical practice, and also leaving medical school altogether.³ Contributions towards stress on

student's mental health include the learning environment, workload, problems with patient interactions, financial concerns and worries regarding future career progression.³

High-achieving students may also self-impose high attainment goals that can lead to the development of imposter syndrome.² Imposter syndrome – defined as "chronic feelings of self-doubt, the fear of being discovered as an intellectual fraud, a perception of being less intelligent or competent than peers, and an inability to internalise a sense of competence of skill in high-achieving individuals" by Clance and Imes in 1978 – has a prevalence of around 30 per cent amongst medical students and can be a risk factor for later burnout and psychological unrest.⁴⁵

What did this project investigate?

In December 2022, a survey in the form of an Instagram poll was distributed on the Welfare Hub Instagram account on three different occasions throughout the month. The survey aimed to garner student opinion on their perception of the Welfare Hub. Data was collected and inputted in a spreadsheet.

Each committee member was asked to complete a reflection of how they found the Welfare Hub, why they wanted to be a part of it, the remit of their role, the impact of their posts, and anything they would like to do in the future. An inductive thematic analysis was undertaken on these responses.⁶ This data was transcribed by one individual and codes were generated based on common phrases and sentiments that appeared in each committee member's reflections. Similar codes were then grouped together in order to inform and develop themes. As of 23 January 2023, the Welfare Hub had 468 followers. In the period of 26 October 2022 to 23 January 2023, there was a net gain of eight followers. The majority (47.1%) of followers are in Nottingham. The gender distribution of followers was 75.1% women and 24.8% men.

What did the research show?

This project identified that the Welfare Hub's Instagram account was closely associated with mental health awareness and education, and that the best performing posts were those that offered positive connotations of support relevant to medical students and those that detailed lived medical student's experiences and advice. For example, the highest performing posts were 'good luck' posts before the commencement of examinations (Table 1).

The Instagram poll was available for both followers and non-followers to answer. The responses and results of each question are in Table 2. The first question asked if respondents found the Welfare Hub useful. After the application of a Likert scale (where 'yes' is 1 and 'no' is 3), the mean for this question was 1.4. Once it was determined whether respondents found the Welfare Hub useful, they were asked how satisfied they were with the Welfare Hub. 'Completely satisfied' was given the value of 1 and 'somewhat dissatisfied' was given the value of 3, leading to a mean of 1.5. Finally, respondents were asked what they would like the Welfare Hub to do in the future. There were no responses to this question.

Committee members for the 2022/2023 academic year were asked to detail how they found the Welfare Hub, why they wanted to be involved, what they have achieved and future plans. Of 10 committee members, eight responded. The first theme identified was 'interest in mental health and sharing experiences,' where many committee members outlined that they discovered the Welfare Hub through recommendations on social media. They cited that they became involved due to an interest in mental health, destigmatising mental health, and personal experiences of themselves and family members with mental health. The second theme 'developing communication skills within the committee,' was highlighted when committee members detailed the posts they had created and skills they had developed as part of the committee, such as designing and researching posts, and communication skill development. The third theme found was 'the importance of supporting, destigmatising and educating medical students about mental health, where committee members focussed on the importance of the Welfare Hub in providing mental health awareness and education. The final theme identified was 'developing the Welfare Hub in the future'. When asked what they would like to do as part of the Welfare Hub in the future, a popular comment was to put on more events for students, as well as collaborating with other societies. Examples of quotations aligned with each theme can be found in Table 3.

Where do we go from here?

The Welfare Hub reached many more non-followers than it did followers, however, it was followers that were more likely to engage with the content. This reemphasises the importance of using the Instagram 'like' metric rather than accounts reached. Going forward, it seems as though it would be beneficial for the Welfare Hub to carry on with its current strategy concerning Instagram posts: a mixture of educational content with motivational and experience-sharing posts surrounding medical school. These posts align with the values of the Welfare Hub concerning mental health awareness and education, whilst staying relevant to medical students at the University of Nottingham, where the majority of the follower base seems to be located. Instagram is 'hedonic' in nature - users want to see and share things that elicit a positive reaction.⁶ An uplifting message of 'good luck' before an exam or an anxiety-reducing post about looking for housing is likely to have a positive impact on users who view these posts, and therefore they are more likely to engage with it. As far as posts go, it would be beneficial to have more input from staff members and other societies into Instagram posts to encapsulate the environment of students at the University of Nottingham Medical School

Overall, the Welfare Hub has made great strides in creating educational and supportive posts for medical students, underpinning the key project values of reducing mental health stigma among medical students and professionals. This research project illuminated the best performing Instagram posts and which posts to keep making going forward, underpinned by follower opinions in the form of an Instagram poll. These findings highlighted the importance of mental health support and education for medical students and its significance in the current time period, where we need to greater support our students to avoid the development of poor mental health. The Welfare Hub was, and will continue to be, a project made by students, for students, and will always keep the best interests of students at heart.

Contribution statement The authors of this research article meet the following ICMJE criteria: substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work, drafting the work or revising it critically for important intellectual content, and final approval of the version to be included in INSPIRE.

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References

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5.

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- 1. Storrie, K, Ahern, K, Tuckett, A (2010) 'A systematic review: students with mental health problems—a growing problem', International Journal of Nursing Practice, 16(1), pp.1-6.
- Jacob R, Li TY, Martin Z, Burren A, Watson P, Kant R, Davies R, Wood DF. 2. (2020) Taking care of our future doctors: a service evaluation of a medical student mental health service. BMC Medical Education, 20, 172.
 - Jafari N, Loghmani A, Montazeri A. (2012) Mental health of medical students in different levels of training. International Journal of Preventative Medicine, 3(1), pp. 107-112.
 - Clance PR, Imes SA (1978) The imposter phenomenon in high achieving women: dynamics and therapeutic intervention. Psychotherapy: Theory, Research and Practice, 15(3), pp. 241-247.
- Chen C. (2020) Doctor who? Reflecting on impostor syndrome in medical learners. Canadian Family Physician, 66(10), pp. 268-269. б.
 - Kiger ME and Varpio L. (2020) Thematic Analysis of Qualitative Data: AMEE Guide No. 131. Medical Teacher, pp. 846-854.
 - Mendini M, Peter PC, Maione S. (2022) The potential positive effects of time spent on Instagram on consumers' gratitude, altruism, and willingness to donate. Journal of Business Research, (143), pp. 16-26.

Type of Post	Posts	Likes	Accounts Reached	Average Likes	Average Reach
Support and Good Luck Posts	5	188	1624	37.6	324.8
Q&A/Advice Posts	4	95	1858	23.8	464.5
Introductory Posts	12	264	3519	22.0	293.3
Meet Your Med School	3	49	1573	16.3	524.3
Awareness Days	7	82	1307	11.7	186.7
A-Z of Mental Health	12	108	1976	9.0	164.7
Charity Chats	5	40	686	8.0	137.2
Total	48	826	12,543	17.2	261.3

Table 1. Analytic data from Welfare Hub Instagram posts from September to December 2022. Data is arranged to show the number of likes and accounts reached for each type of Instagram post the Welfare Hub makes, as well as the numbers of each post.

Question	Number of Responses	Results	Percentage of Responses
Do you find the Welfare Hub useful?	18	Yes	66.7%
		Sometimes	22.2%
		No	11.1%
What do you find the Welfare Hub most helpful with?	14	Mental Health Awareness	42.9%
		Mental Health Support	14.3%
		Information about Medical School	35.7%%
		Information About Charities/Wellbeing Accounts	7.1%
	12	Meet Your Med School	16.7%
What is your favourite series?		Let's Talk About Med School	58.3%
		A-Z of Mental Health	12.5%
		Mental Health Spotlight	12.5%
Do you use our website?	13	Yes	7.7%
		No	92.3%
How satisfied are you with the Welfare Hub?	13	Completely Satisfied	53.8%
		Somewhat Satisfied	38.5%
		Somewhat Dissatisfied	7.7%
		Completely Dissatisfied	0.0%
How did you hear about the Welfare Hub?	10	Through a Committee Member	20.0%
		In a Welcome/Welfare Lecture	0.0%
		Through Medsoc	30.0%
		Other	50.0%
What would you like to see the Welfare Hub do in the future?	0	Open answer question.	

Table 2. Instagram poll questions and results distributed in an Instagram story to followers of the Welfare Hub's Instagram account in December 2022.

Thematic Analysis of Committee Member Reflections				
Theme	Percentage of Total Codes (n=106)	Example Responses		
Interest in Mental Health and Sharing Experiences	21.7%	"I have always been a big advocate for destigmatising mental health problems after seeing many close friends and family members struggle with their mental health"		
Developing Skills within the Committee	19.8%	"I am responsible for developing content such as the A-Z of Mental Health series for our website and Instagram"		
The Importance of Supporting, Destigmatising and Educating Medical Students About Mental Health	46.2%	<i>"I hope that we have been able and will continue to raise awareness that people are not alone in their mental health struggle"</i>		
Developing the Welfare Hub in the Future	12.3%	<i>"In the future, I hope we can host events and collaborate with different societies to have more people in the conversation surrounding mental health"</i>		

Table 3. Results of inductive thematic analysis of Welfare Hub 2022/2023 committee reflections. Committee members were asked to detail their experience of the Welfare Hub, how they found it, why they became involved, what they do in their role and what they would like to do in the future. Each theme is shown as a percentage of total codes. Example responses for each theme is detailed for further information.

Appendix 1. An example of a typical post from the Welfare Hub.





The Welfare Hub was created in 2020 with the aims of increasing mental health literacy amongst medical students and supporting them during their time at medical school. The 2022-2023 committee came together to research the impact of the Welfare Hub and how to develop it going forward. This research was then presented at the University of Nottingham Teaching and Learning Conference 2023.

To what extent is the current UK obesity policy irresponsible considering the nature of eating disorders?

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Abstract

This article explores recent government policy towards obesity and diet, methods of reducing obesity in the UK, and evidence why the current governmental approach might be flawed, focusing on eating disorders. This is relevant in both primary and tertiary medical settings, as a high national obesity rate has far-reaching consequences.

The UK is an unhealthy nation. The UK ranks at 29 for life expectance¹ and 33 for the most obese nation,² indicating serious underperformance as one of the largest economies in the world. On 6 April 2022, new legislation from the government came into force, aiming to curb obesity by making it mandatory for restaurants to display the calorie content of their meals.³ This is a very brash strategy, criticised by many for its disregard for eating disorders, potentially exacerbating symptoms in those who suffer with eating disorders.

Eating disorders such as anorexia nervosa, bulimia nervosa and binge eating disorder affect an estimated 1.25 million people in the UK⁴ and remain an important yet under-represented issue in modern politics.⁵ In terms of severity, the Office for National Statistics reports a yearly average of 22 deaths due to eating disorders.⁶ However, when taking into account suicides and comorbidities, this number is estimated to be as high as 20% of sufferers.⁷ Calorie counting is often abused by those suffering with eating disorders.⁸ Despite this, there is no mention of eating disorders on the government's press release. They are briefly mentioned elsewhere, on one of the 76-pages of the 'Impact Assessment'. Here, eating disorders are dismissed, despite the majority of studies that the assessment itself cites agreeing that the Calorie Labelling scheme would worsen eating disorders.⁹

Calorie counting is a controversial concept of weight manipulation. Certain communities promote it as a tool that makes the process of weight loss easier and more convenient. This is the case with 'r/fitness', an online physical health forum with almost ten million members, who use calorie counting as a core strategy of weight loss.¹⁰ However, this method is hardly harmless, and can have adverse effects on the unfortunately large section of the population susceptible to eating disorders. As a consultant psychiatrist and specialist in eating disorders, Dr Sandeep Ranote states: "Some of what we know from those with lived experience [of eating disorders] is that seeing calories printed on menus could be a huge trigger to their anxiety."¹¹

Beat¹² is a prominent UK charity focusing on helping those suffering with eating disorders. In response to the calorie labelling scheme, its Chief Executive Andre Radford stated "calorie labelling exacerbates eating disorders of all kinds".¹³ These exacerbations can cause dangerous weight loss and are strongly linked with depression¹⁴ and an increased risk of suicide.¹⁵ Emerging from this evidence, it appears that in order to make calorie counting safer the element of choice is key.

A less controversial scheme, the 2018 'Sugar Tax,'¹⁶ displays a different method of decreasing obesity. The scheme (which put charges up to 24p per litre on sugary drinks) was ultimately successful, decreasing sugary drink purchases by 10% in the following year.¹⁷ In 2020, plans were put in place for similar monetary deterrents for high-calorie foods, however, these plans were recently shelved over concerns over their impact on the British economy.¹⁸ It is worth noting that this scheme, owing to its monetary deterrent, did "disproportionately impact the poor".¹⁹

Another solution, proposed by nutritionist Virginia Hendry,²⁰ is introducing cooking into schools in a more integrated manner than simply offering 'Food Technology' as a GCSE. She states that "cooking from scratch and teaching children to cook from scratch in schools is really important". It is easy to see why; ready meals, which are consumed by an estimated 2 in 5 UK families every week, feature high levels of salt, fat and sugar.²¹ High fat and sugar content have

been heavily linked to obesity²² and salt has been indirectly linked to obesity as well.²³ By educating children at an early stage about the health benefits of home cooking whilst equipping them with the necessary skills to cook their own meals, we might see a decrease in childhood obesity. Childhood obesity is a major risk factor for adult obesity, therefore we can expect to see the rates of adult obesity fall as well.²⁴ Additionally, compared to the Sugar Tax, this method would empower lower-income families as, per meal, home cooking is generally cheaper than buying ready meals.²⁵

The government's 'Calorie Labelling' scheme ignores eating disorders and more ethical methods of decreasing obesity, such as taxation and food education. The scheme ultimately forces people with eating disorders, who make up a significant portion of the population, to participate in calorie counting. This is known to worsen their health outcomes and demonstrates that the government acts irresponsibly in its scant consideration of eating disorders. It is for these reasons, I believe, in future, policy targeting obesity should not feature mandatory calorie counting.

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References

- World Bank Group. Life expectancy at birth, total (years) | Data [Internet]. 1. Data.worldbank.org. 2022 [cited 6 July 2022]. Available from: https://data. worldbank.org/indicator/SP.DYN.LE00.IN.
- World Health Organization. Countries [Internet]. Who.int. 2022 [cited 6 July 2 2022]. Available from: https://www.who.int/data/gho/data/countries.
- Department of Health and Social Care, Churchill J. Calorie labelling on 3. menus to be introduced in cafes, restaurants and takeaways [Internet]. GOV. UK. 2022 [cited 6 July 2022]. Available from: https://www.gov.uk/government/news/calorie-labelling-on-menus-to-be-introduced-in-cafes-restaurants-and-takeaways.
- 4. beateatingdisorders.org.uk. How many people have an eating disorder in the UK? - Beat [Internet]. Beat. 2022 [cited 6 July 2022]. Available from: https://www.beateatingdisorders.org.uk/get-information-and-support/ about-eating-disorders/how-many-people-eating-disorder-uk/
- 5 Mental Health Foundation. [Internet]. https://www.mentalhealth.org.uk/. 2022 [cited 6 July 2022]. Available from: https://www.mentalhealth.org.uk/ blog/lets-talk-about-eating-disorders.
- Office for National Statistics. Deaths from eating disorders and other mental 6. illnesses - Office for National Statistics [Internet], Ons.gov.uk, 2022 [cited 6 July 2022]. Available from: https://www.ons.gov.uk/aboutus/transparencyand governance/freedomofin formation foi/deaths from eating disorders and othermentalillnesses.
- Papyrus UK. Eating Disorder Awareness Week Papyrus UK | Suicide 7. Prevention Charity [Internet]. Papyrus UK | Suicide Prevention Charity. 2022 [cited 6 July 2022]. Available from: https://www.papyrus-uk.org/eating-disorder-awareness-week/.
- 8. 1. Walsh BT, Attia E, Glasofer DR, Sysko R. Handbook of Assessment and treatment of eating disorders. Arlington, Virginia: American Psychiatric Association Publishing; 2016.
- Department of Health and Social Care. Impact assessment: mandating 9 calorie labelling of food and drink in out-of-home settings [Internet]. 2022 [cited 6 July 2022]. Available from: https://assets.publishing.service.gov.uk/ government/uploads/system/uploads/attachment data/file/992872/calorie-labelling-impact-assessment.pdf.
- r/fitness. Weight Loss 101 | The Fitness Wiki [Internet]. Reddit.com. 2022 10. [cited 6 July 2022]. Available from: https://thefitness.wiki/weight-loss-101/.
- Rackham A. What's the problem with calories on restaurant menus? [Inter-11. net]. BBC News. 2022 [cited 26 September 2022]. Available from: https:// www.bbc.co.uk/news/health-61078447.
- 12. The UK's eating disorder charity [Internet]. Beat. [cited 18 April 2023]. Available from: https://www.beateatingdisorders.org.uk/.
- Beat's response to government plan for calorie counts on Menus [Internet]. 13 Beat. [cited 18 April 2023]. Available from: https://www.beateatingdisorders.org.uk/news/beats-response-government-plan-calorie-count/.

- 14. Sander J. Moessner M. Bauer S. Depression, anxiety and eating disorder-related impairment: Moderators in female adolescents and young adults. International Journal of Environmental Research and Public Health. 2021:18(5):2779. 15.
 - Fennig S, Hadas A. Suicidal behavior and depression in adolescents with eating disorders. Nordic Journal of Psychiatry. 2009;64(1):32-9.
- HM Treasury. Soft drinks industry levy comes into effect [Internet]. GOV.UK. 2022 [cited 6 July 2022]. Available from: https://www.gov.uk/government/ news/soft-drinks-industry-levy-comes-into-effect. 17.
 - Pell D, Mytton O, Penney T, Briggs A, Cummins S, Penn-Jones C et al. Changes in soft drinks purchased by British households associated with the UK soft drinks industry levy: controlled interrupted time series analysis. BMJ. 2021;:n254.
- 18. Financial Times. Boris Johnson delays plans to ban multibuy deals on unhealthy food [Internet]. Ft.com. 2022 [cited 6 July 2022]. Available from: https://www.ft.com/content/39c4b175-cc79-4cd4-bb30-4c1c8c557d1c.
- 19 Institute of Economic Affairs. Taxing sugary drinks invariably hurts the poor Institute of Economic Affairs [Internet]. Institute of Economic Affairs. 2022 [cited 6 July 2022]. Available from: https://iea.org.uk/blog/taxing-sugarv-drinks-invariably-hurts-the-poor
- Oak J. Suffolk nutritionist suggests alternative to calories on menus 20. [Internet]. Greatest Hits Radio (Ipswich & Suffolk). 2022 [cited 26 September 2022]. Available from: https://planetradio.co.uk/greatest-hits/suffolk/news/ calories-menus-nutritionist-suffolk/.
- British United Provident Association. The truth about ready meals [Internet]. 21. Bupa.co.uk. 2022 [cited 6 July 2022]. Available from: https://www.bupa. co.uk/newsroom/ourviews/ready-meals.
- National Health Service. Obesity Causes [Internet]. nhs.uk. 2022 [cited 6 22.
- July 2022]. Available from: https://www.nhs.uk/conditions/obesity/causes/. 23. Ma Y, He F, MacGregor G. High Salt Intake. Hypertension. 2015;66(4):843-849
- Simmonds M, Llewellyn A, Owen C, Woolacott N, Predicting adult obesity 24. from childhood obesity: a systematic review and meta-analysis. Obesity Reviews. 2015;17(2):95-107.
- Thisismoney.co.uk. Is it cheaper to cook from scratch or buy a ready meal? 25 [Internet]. Mail Online. 2022 [cited 7 July 2022]. Available from: https:// www.thisismoney.co.uk/money/bills/article-2119413/amp/ls-cheapercook-scratch-buy-ready-meal.html.



16.

Arya Rassi

Arya Rassi is a third year medical student at the University of Bristol, now intercalating in Medical Education at the University of Brighton and Sussex Medical School. His keen interest in social issues led him to discussing current medical policy with several peers and friends. The topic of eating disorders and the

government's attitude towards them became a recurring theme. As the government moved to put calories on menus in April 2022, this inspired Arya to research how this decision might affect eating disorders, and the result was this article.

Exploring the link between adverse childhood experiences (ACEs) and substance abuse, and how this can inform ACE-aware policies and practices

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Abstract

This article aims to explore the existing understanding between adverse childhood experiences (ACEs) and substance use disorders (SUDs), and how this can inform trauma informed care. There is a growing interest in evaluating the relationship between ACEs and SUDs and the significant socioeconomic costs associated with this. Encouraging discussions on developing trauma-informed care strategies is therefore necessary in reducing the rates and associated health risks of subsequent substance misuse. Included is an overview of the theoretical concept behind ACEs, an evaluation of their inclusion criteria in the current literature, and proposed links to health-harming behaviours. The article further explores the current deficit in existing long-term management, highlighting the need for primary, secondary and tertiary prevention strategies. Principally, dismantling intergenerational cycles of childhood trauma and strengthening familial support systems long-term remains the crux of tackling this mental and social health crisis.

Abbreviations

ACE(s) – adverse childhood experience(s) CDC – Centers for Disease Control NICE – National Institute For Health And Care Excellence SUD(s) – substance use disorder(s) WHO – World Health Organization

There exists extensive literature exploring the short and long term impacts of adverse childhood experiences (ACEs). Whereas research evaluating the relationship between ACEs and substance use disorders (SUDs) is a relatively recent development and one of growing interest.¹The costs of ACEs were estimated at over £43 billion

for England and Wales, with drug use being the most prevalent risk factor when attributing costs – 52.6% in England and 58.8% in Wales.² Crucial to this is the development of trauma-informed care strategies on how ACEs can be prevented or mitigated to reduce the risks of subsequent substance misuse in adulthood. With one in ten estimated to have experienced four or more ACEs,³ the unrealised potential to avoid burdening societal costs and relieve healthcare services for current and future generations urgently needs addressing.^{4,5}

The definition of an adverse childhood experience relates to the exposure to a traumatic event before the age of 18.6 The concept of ACEs was first coined within a landmark study in America by the Centers for Disease Control (CDC) and Kaiser Permanente, a nonprofit healthcare plan provider.⁷ Conducted between 1995 and 1997, ten types of childhood trauma, separated into three categories, were examined concerning outcomes of health. Those examined were abuse: physical, psychological and sexual; neglect: emotional and physical; and household dysfunction: living with a parent/caregiver with a substance use disorder, parental separation or divorce, living with a parent/caregiver with a mental illness, witnessing maternal abuse, or having an incarcerated parent/caregiver.⁷ Over 17,000 participants within South California were assessed for childhood trauma, and strikingly the outcomes of the study proposed that the majority of individuals experienced at least one ACE (64%), and 12% experienced four or more ACEs.⁷ Those with a score of four or greater had higher risks of developing health-harming behaviours; a sevenfold increase in the likelihood of substance misuse. Furthermore, when comparing individuals who experienced no ACEs, against those with two or more, there was a two to four-fold increase in the risk of early age onset of substance use.⁷ Only a risk could be inferred however, as it is improbable to predict health-harming behaviours of an individual with childhood trauma due to the complexity of external factors interplayed throughout a child's development.

Subsequent studies have since criticised the lack of variety in the types of ACEs evaluated, and thus widened the number of different types of ACEs to cover a wider demographic.⁸ The inclusion of social disadvantages as a major determinant for health and wellbeing has meant experiences such as racism, exposure to community violence, being a victim of bullying, homelessness, and living in poverty are now greater represented in research,⁹ further expressing the higher prevalence of these ACEs in low socioeconomic areas. In widening the categories of ACEs, this empowers individuals to discuss these issues more openly, further enabling more to come forward and do the same. Normalising the impacts of ACEs should not just apply in healthcare settings, but in education and the justice system,¹⁰ thereby encouraging collaboration between public services to prevent adverse health and social outcomes.

Establishing the complex link between ACEs and substance use disorders is one of these outcomes of concern, especially given the growing prevalence of opioid dependency in North America and Western Europe in recent years. The World Health Organization's (WHO) global drug report has estimated a rise of 22% in drug misuse since 2010,¹¹ with the most vulnerable groups being in areas of high socioeconomic deprivation. It is unsurprising therefore that ACEs are notably more prevalent among those diagnosed with substance use disorders when compared to the general population.^{12,13} As such, the narrative that substance misuse can be resultant of childhood trauma (for which a child is not responsible) is becoming more widely accepted and less stigmatised.

Whilst the neurobiological mechanism of ACEs itself and their link to health-harming behaviours is still not fully understood, there is behavioural evidence to support the effects of toxic stress on cognitive development during childhood. Trauma can result in a heightened stress response, meaning the individual is primed to specific stressors, and unable to perceive neutral threats from actual harm. This can dysregulate their fight or flight response, resulting in a difficulty to form resilience that would usually allow for selfregulation in response to an adverse experience.¹ Maladaptive behaviours provide an escape from traumatic stress, as a way to cope with or make sense of their childhood trauma.¹⁴ Some may selfmedicate to relieve their heightened sense of stress, as a response to traumatic triggers, or block distressing memories of their trauma. Others may use it as a form of self-harm, such as through attempted overdosing, further internalising their trauma.14 The complexity and multifaceted nature of addictive coping mechanisms mean that intervention strategies must work on a trauma-informed basis to provide specialist support that truly comprehends an individual's reasoning behind their addictive behaviour.

A systematic review of 12 studies by Fernandez-Montalvo et al has further contextualised the relationship between ACEs and substance use disorders. The papers reviewed were published between 2016 to 2020, with the ages of participants ranging from 15 to 85. It established that those with substance use disorders had a higher prevalence of ACEs. Furthermore, a positive relationship between the number of ACEs and the overall severity of the substance use disorder could be inferred.¹ Adolescents with two or more ACEs had over a two-fold increased risk of developing a substance use disorder, whilst those with three or more ACEs had a seven-fold increased risk, compared to those with no exposure to ACEs.¹ The most prevalent form of ACE was parental separation or divorce (26.9%), whilst exposure to a household member with a substance use disorder was the second most common ACE (24.6%) experienced by those in addiction treatment centres.¹ It also found that those with an ACE score of one or more using substances, but not currently misusing them, were most vulnerable to developing an addiction.¹ As such, targeting these populations to mitigate health-harming behaviours is imperative. Further research should also focus on evaluating different forms of ACEs and whether specific substances are related to certain categories of ACEs.

In reviewing strategies to support those exposed to ACEs, many interventions were psychologically based, with very little focused on social policies or behavioural interventions.¹⁵ Broader intervention strategies are necessary to target societal factors, rather than treating the health related outcomes of ACEs. The development of primary, secondary and tertiary prevention strategies is therefore essential if ACEs are to be addressed through a public health lens.¹⁶

Primary preventions relate to ensuring children have the best possible start in life, by reducing their exposure to ACEs and building resilience practices.^{10,15} A greater focus should therefore be placed upon educational providers who can assist with a child's development. For example, the integration of psychoeducation through the teaching of resilience practices would empower young adults in making informed decisions about alcohol and drug use.¹⁴ In addition, learning through lived experiences and listening to individuals in recovery can develop conversations around susceptibility to substance misuse, encouraging the narrative that addiction is not the individuals' fault. Such initiatives should be commissioned in collaboration with local services, proving beneficial in areas with higher rates of substance misuse misuse in particular.¹⁷

Secondary prevention initiatives are rather focused on identifying ACEs at the earliest opportunity to reduce their impact on an individual's health and wellbeing. Childhood trauma is something that is often missed in emergency care,¹⁸ resulting in an inability to signpost or refer patients to the appropriate support service. One such strategy is that healthcare providers could integrate screening and assessment tools into their policies and practices.

Introducing routine enquiries through screening of ACEs has been topically debated.¹⁶ ACE assessment tools have been criticised for their restricted ranges and simplistic numerical scoring; the issue being the complexity of childhood trauma should not be defined by a score alone.¹⁹ Additionally, there are several ethical dilemmas with screening: mental health needs could be identified without the appropriate care services being provided, as well as abusive parents potentially being alerted to their child being asked such questions, posing further child safety risks. Moreover, NICE does not currently have standardised criteria for assessing ACEs.¹⁹ Therefore, alternative assessment methods should be developed to become more rigorous and quantifiable. Proper oversight and evaluation of ACE screening tools are necessary, and this should be prioritised in further research to avoid unintended harm to both child and parent.

With tertiary prevention strategies, the focus should be on supporting those with exposure to ACEs, such as through specialist support being developed by mental health and social services. One supported initiative is developing whole family models of care: addressing the parent or caregivers' substance abuse, whilst at the same time providing support, such as psychotherapy, to the child.¹⁷ This could be achieved through parenting classes, welfare checks, and home visitation programmes.¹⁶ Helping parents and caregivers handle stress and manage their emotions as well as ensuring they can access emotional or financial support services throughout their child's life should be a target of interest.

The initiative of developing whole family support services is also crucial to ending intergenerational cycles of childhood trauma. Those affected by ACEs are at an increased risk of exposing their child to ACEs,²⁰ particularly if their childhood trauma is left unaddressed. Recent statistics released by Public Health England estimate that 17% of parents are reliant on drugs, and 16% are dependent on alcohol.²¹ Moreover, parental substance abuse is more prevalent within areas of high deprivation, which may be due to less established and underfunded support services in these areas. If a parent is abusing substances, their child is at greater risk of developing a substance use disorder. They are more likely to copy harmful behaviours and could have easier access to illicit substances.¹⁴ With an earlier age of onset, the stronger the potency and frequency of drug use

may become, resulting in more detrimental health and social outcomes during adolescence and beyond. Social services must therefore identify and support those families most vulnerable to prevent the intergenerational development of substance abuse.¹⁷ The development of whole family care models, therefore, provides the best opportunity to break these intergenerational cycles and strengthen familial support systems.

A greater understanding of this complex relationship between ACEs and SUDs is necessary to inform holistic and comprehensive policies and programmes, with long term social initiatives being prioritised to promote ACE free childhoods. With Northern Ireland,^{22,23} Wales²⁴ and Scotland^{25,26} already having more developed initiatives in incorporating the awareness of ACEs into education, training and intervention policies,⁸ England must follow similar initiatives or risks exacerbating the severe health and social burdens of ACEs.

Contribution Statement The author made substantial contributions to the conception or design of the work, drafted the work and gave final approval of the version to be included in INSPIRE.

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References

- Leza L, Siria S, Lopez-Goñi JJ and Fernandez-Montalvo J. Adverse childhood experiences (ACEs) and substance use disorder (SUD): a scoping review. Drug Alcohol Depend, 2021; 221: 108563.
- Hughes K, Ford K, Kadel R, Sharp CA and Bellis MA. Health and financial burden of adverse childhood experiences in England and Wales: a combined primary data study of five surveys. BMJ Open, 2020; 10: e036374.
- Bellis MA, Lowey H, Leckenby N, Hughes K and Harrison D. Adverse childhood experiences: retrospective study to determine their impact on adult health behaviours and health outcomes in a UK population. J Public Health (Oxf), 2014; 36(1): 81-91.
- 4. Bellis MA, Hughes K, Ford K, Ramos Rodriguez G, Sethi D and Passmore J. Life course health consequences and associated annual costs of adverse childhood experiences across Europe and North America: a systematic review and meta-analysis. The Lancet Public Health, 2019; 4(10): e517-e528.
- Hughes K, Ford K, Bellis MA, Glendinning F, Harrison E and Passmore J. Health and financial costs of adverse childhood experiences in 28 European countries: a systematic review and meta-analysis. The Lancet Public Health, 2021; 6(11): e848-e857.
- National Society for the Prevention of Cruelty to Children (2021) Statistics briefing: neglect. Available from: https://learning.nspcc.org.uk/media/2621/-statistics-briefing-neglect.pdf. Accessed: 12 July 2023.
- Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP and Marks JS. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. American Journal of Preventive Medicine, 1998; 14(4): 245-258.
- Asmussen K, Fischer F, Drayton E and McBride T (2020) Early Intervention Foundation. Adverse childhood experiences: What we know, what we don't know, and what should happen next. Available from: https://www.eif.org. uk/report/adverse-childhood-experiences-what-we-know-what-we-dontknow-and-what-should-happen-next. Accessed: 12 July 2023.
- Zarse EM, Neff MR, Yoder R, Hulvershorn L, Chambers JE and Chambers RA. The adverse childhood experiences questionnaire: Two decades of research on childhood trauma as a primary cause of adult mental illness, addiction, and medical diseases. Cogent Medicine, 2019; 6(1):1581447.
- Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, Jones L and Dunne MP. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. The Lancet Public Health, 2017; 2(8): e356-e366.
- 11. World Health Organization (2019) World Drug Report Global Overview: Drug demand drug supply. Available from: https://www.unodc.org/res/ wdr2021/field-/WDR21_Booklet_2.pdf. Accessed: 12 July 2023.

- 12. Charles NE, Ryan SR, Acheson A, Mathias CW, Liang Y and Dougherty DM. Childhood stress exposure among preadolescents with and without family histories of substance use disorders. Psychol Addict Behav, 2015; 29(1): 192-200.
- Bellis MA, Hughes K, Leckenby N, Perkins C and Lowey H. National household survey of adverse childhood experiences and their relationship with resilience to health-harming behaviours in England. BMC Med, 2014; 12(1): 72.
- Aynsley A, Bradley R, Buchanan L, Burrows N and Bush M (2017) Childhood adversity, substance misuse and young people's mental health. Youngminds. London: Addaction. Available from: https://www.drugsandalcohol. ie/27500/1/-Addaction-briefing_childhood_adversity.pdf. Accessed: 12 July 2023.
- 15. Lorenc T, Lester S, Sutcliffe K, Stansfield C and Thomas J. Interventions to support people exposed to adverse childhood experiences: systematic review of systematic reviews. BMC Public Health, 2020; 20(1): 657.
- Jones CM, Merrick MT and Houry DE. Identifying and preventing adverse childhood experiences. Implications for Clinical Practice. JAMA, 2020; 323(1): 25-26.
- 17. Bethell CD, Carle A, Hudziak J, Gombojav N, Powers K, Wade R and Braveman P. Methods to assess adverse childhood experiences of children and families: toward approaches to promote child well-being in policy and practice. Acad Pediatr, 2017; 17(7s):551-s69.
- Bryant DJ, Coman EN and Damian AJ. Association of adverse childhood experiences (ACEs) and substance use disorders (SUDs) in a multi-site safety net healthcare setting. Addict Behav Rep, 2020; 12: 100293.
- 19. National Institute For Health And Care Excellence (2018) Quality standard topic: child abuse and neglect. Available from: https://www.nice.org.uk/guidance-/qs179/documents/briefing-paper. Accessed: 12 July 2023.
- Charles NE, Ryan SR, Acheson A, Mathias CW, Liang Y and Dougherty DM. Childhood stress exposure among preadolescents with and without family histories of substance use disorders. Psychol Addict Behav, 2015; 29(1): 192-200.
- Public Health England (2021) Parents with alcohol and drug problems: adult treatment and children and family services. Available from: https://www. gov.uk/government/publications/parents-with-alcohol-and-drug-problems-support-resources/parents-with-alcohol-and-drug-problems-guidance-for-adult-treatment-and-children-and-family-services. Accessed: 12 July 2023.
- 22. Thompson, S (2019) Safeguarding Board for Northern Ireland. Supporting agencies to tackle childhood adversity across Northern Ireland. Available from: https://www.safeguardingni.org/aces-trauma-informed-practice. Accessed: 12 July 2023.
- 23. Safeguarding Board for Northern Ireland (2020) Trauma Informed Practice (TIP) Project 2020. Available from: https://www.safeguardingni.org/resources/trauma-informed-practice-tip-project-2020. Accessed: 12 July 2023.
- 24. Welsh Government (2021) Review of Adverse Childhood Experiences (ACE) policy: report How the ACE policy has performed and how it can be developed in the future. Available from: https://www.gov.wales/sites/default/ files/pdf-versions/2021/3/3/1615991408/review-adverse-childhood-experiences-ace-policy-report.pdf. Accessed: 12 July 2023.
- Health Scotland (2017) Tackling the attainment gap by preventing and responding to Adverse Childhood Experiences (ACEs). Available from: https://www.healthscotland.scot/media-/1517/tackling-the-attainment-gap-by-preventing-and-responding-to-adverse-childhood-experiences.pdf. Accessed: 12 July 2023.
- NHS Education for Scotland and Scottish Government (2019) The Scottish psychological trauma training plan. Available from: https://transformingpsychologicaltrauma.scot-/media/5lvh0lsu/trauma-training-plan-final. pdf. Accessed: 12 July 2023.



Cameron Case

Hi, I am Cameron, and I am a third year medical student at Plymouth. Within medicine, my personal interests are in paeds, public health, and medical ethics. Having an eager interest in medical journalism, I hope to be involved in academic writing and research further during my studies and beyond.

Faecal microbiota transplantation should replace antibiotic treatment of recurrent *Clostridioides difficile* infection

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Abstract

Clostridioides difficile infection is a common cause of antibiotic associated diarrhoea in healthcare settings. It is a highly transmissible infection and there is growing concern about its resistance to antibiotics. Faecal microbiota transplantation (FMT) is only offered as a last resort for those with recurrent infections. FMT has been shown to have a high success rate in treating recurrent *C. difficile* infections and there is evidence to suggest that it is also more cost-effective than using antibiotics. There are advancements on how we can deliver FMT in healthcare with research into frozen capsules. There are some concerns around safety and standardisation of FMT but with the growing research surrounding our gut microbiota we can understand how to optimise this treatment method. This article aims to establish the potential use of FMT to treat recurrent *C. difficile* as a first-line treatment instead of antibiotics and how future research could optimise the delivery of FMT.

Abbreviations

CDI – Clostridioides difficile infection cFMT – capsule based faecal microbiota transplantation FMT – faecal microbiota transplantation NICE – National Institute for Health and Care Excellence rCDI – recurrent Clostridioides difficile infection

Introduction

Clostridioides difficile is a Gram positive, spore-forming anaerobe that is a common cause of antibiotic associated diarrhoea in both healthcare settings and the community. *C. difficile* has both non-toxigenic strains and toxigenic strains where only the latter causes disease.¹ In healthy individuals the gut microbiota exists in a delicate

balance and is thought to protect against *C. difficile* infection (CDI). The microbiota is comprised of many types of microorganisms that have co-evolved with the host to be mutually beneficial. The composition of microorganisms is determined by many factors such as diet and antibiotic use. Antibiotics can cause dysbiosis of the gut microbiota and this is why there is a strong association between antibiotic use and CDI.

In the environment, C. difficile exists in spore form where it can survive most environmental insults and is resistant to many disinfectants. The spores can persist on surfaces for up to 12 months making it very difficult to eradicate them² thus leading to relatively easy transmission to other patients. Once ingested, the spores reach the jejunum where they will begin to germinate due to the high concentration of bile, before passing into the caecum where they can become metabolically active.² When metabolically active, if a toxigenic strain is present, this is where they will begin to produce their toxins which will disrupt the epithelial barrier and cause diarrhoea. In the healthy gut, the microbiota can protect against colonisation and growth of C. difficile by metabolising bile salts. However, when antibiotics have disrupted this microbiota the bile salts can increase in concentration creating a favourable environment for C. difficile to proliferate.² CDI can range from mild disease through to causing life-threatening conditions such as pseudomembranous colitis, sepsis and in some cases, this can lead to death.³

CDI is a notifiable disease in the UK with all toxin positive samples needing to be reported for any patient over the age of two years.⁴ In the financial year 2021/22 Public Health England reported 14,249 cases both in healthcare and community settings.⁵ These case rates have remained relatively stable in the UK and a similar pattern has also been seen across Europe. This is thought to be as a result of *C. difficile* infection control, detection and surveillance guidelines introduced by the World Health Organization in 2010.⁶ The current National

Institute for Health and Care Excellence (NICE) guidelines outline that the first line of treatment is vancomycin, which can be progressed to fidaxomicin if treatment is unsuccessful. For life-threatening cases vancomycin can be given in combination with metronidazole.⁷

Emerging antibiotic resistance is a cause for concern in healthcare and there is reported non-susceptibility to first line antibiotics for C. difficile. Research into resistance to antibiotics is vital and a metaanalysis conducted in 2020 found that only 1% of C. difficile isolates were resistant to vancomycin and metronidazole.8 However, another meta-analysis in 2022 found that the average resistance of C. difficile isolates to vancomycin and metronidazole in hospitalised patients worldwide were 3% and 5%, respectively.9 Although only small, this increase in resistance over a two-year period is a cause for concern. C. difficile is currently being referred to as being non-susceptible to vancomycin, which under the European Committee for the Study of Antimicrobial Susceptibility definitions would put it into the intermediate category. This means that the bacteria can be inhibited but may require higher doses of antibiotic and the therapeutic effect is uncertain. Resistance is defined as when there is a high chance of therapeutic failure.¹⁰ Resistance to vancomycin for vancomycin resistant enterococci was determined to be at 32µg/ml of the antibiotic.¹¹ C. difficile isolates from infected patients have been found to be non-susceptible to vancomycin at a concentration of 32µg/ml¹¹ leading to concern of possible resistance despite mechanisms yet to be known. In addition to this, both vancomycin and metronidazole are only effective against the germinated, metabolically active C. difficile as they target cell wall synthesis and DNA, respectively.² This therefore could be contributing to the significant percentage of patients that will suffer from recurrent infections because spores are remaining and these may eventually germinate.

A recurrence is defined by NICE as having a CDI infection more than 12 weeks after symptoms have resolved and a relapse is as an episode within 12 weeks of symptom resolution.⁷ However, amongst the literature, recurrent CDI (rCDI) is typically defined as a relapse of the previous infection by the same strain or reinfection by a different strain within 8 weeks.¹² This could indicate the need for a potential review of NICE guidelines definitions which will ultimately alter patient treatment pathways. This is because despite research highlighting the importance of a healthy gut microbiota in helping to prevent the growth of C. difficile, faecal microbiota transplants to restore the patient's microbiota are not recommended unless a patient is having a recurrent episode and have already had two or more previous episodes.¹³ It has been found that 35% of patients experience rCDI6 and that once you have one recurrence, the risk of further recurrences increases.¹² It is therefore not only important to try and successfully treat a first CDI but also prevent rCDI to improve patient outcomes.

It is already widely understood in the literature the importance of the healthy gut microbiome in protecting against CDI and hence the use of faecal microbiota transplantation (FMT) in some cases of rCDI. FMT involves collection of faeces from a healthy donor with no history of malignant or autoimmune diseases and is screened for infectious pathogens. The sample is then prepared by mixing with water or saline and can then be administered to the patient in a variety of methods.¹⁴ Currently the most popular methods of administration are via nasogastric tube or colonoscopy. In one study of 16 patients, duodenal infusion via a nasogastric tube was found to resolve a rCDI in 81% of patients after the first infusion. Of those needing a second infusion only one person still showed symptoms.¹⁵ This was a huge success compared with the standard vancomycin regimen only resolving 31% of the rCDI cases in this study.¹⁵ Most studies are done on a small number of cases but when these studies are combined the overall success rate of FMT for resolving rCDI is about 90%.¹⁴ It should therefore be considered as an earlier treatment option rather than waiting for antibiotic therapy to fail three times.

In addition to the evidence showing FMT is more efficacious than antibiotic therapy. Its cost-effectiveness has also been evaluated and the results are promising. It has shown that treatment with vancomycin could cost £17,279 per patient whilst FMT via nasogastric tube costs £8877 per patient and colonoscopy £11,716 per patient.¹⁶ This suggests that by switching from antibiotics to FMT the NHS would not only improve patient recovery outcomes but also save a huge sum of money.

Evidence for FMT for treating rCDI is growing and in future could replace treatment with antibiotics but it is important to address the challenges of FMT as a treatment. One such challenge is clinical practicality as stool samples delivered via colonoscopy or nasogastric tube have to be fresh² and these procedures are invasive for the patient. A method that is currently being tested to improve administration is capsule based FMT (cFMT) where the donor stool is frozen or freeze dried into a capsule that is swallowed as a pill.¹⁷ A meta-analysis comparing the efficacy of FMT delivered by different routes found that the cure rate of rCDI via frozen capsules was 92.1% which was not significantly different to the cure rate via colonoscopy.¹⁸ These findings are promising for a more practical delivery and there have been suggestions that this could even be used in an outpatient setting to treat rCDI due to the ease of administration.¹⁷ This in turn would reduce the need for hospitalisation and free up bed space and resources which would have been otherwise used for the invasive FMT treatments. Furthermore, cFMT would be equally as practical as antibiotic therapy if not more practical as vancomycin is administered orally and if metronidazole is given this requires intravenous administration.7

The adverse effects from FMT are not well evaluated but the most common is abdominal pain.¹⁹ A systematic review found that this was more common when FMT was delivered via the upper gastrointestinal tract e.g. nasogastric tube (29.9%) compared to delivery via the lower gastrointestinal tract e.g. colonoscopy or enema (13%).¹⁹ Of the reported severe adverse effects, only one death was definitely caused by FMT due to aspiration during sedation for the colonoscopy.¹⁹ This could be prevented by the less invasive method of cFMT as it avoids procedural complications¹⁹ and other studies have found a low rate of adverse events which were not definitely attributed to cFMT.²⁰ The systematic review into adverse effects of FMT recognised that adverse effects such as abdominal pain and bloating are subjective and that other health conditions could impact on the reporting of such effects.¹⁹ With further research into the use of FMT and cFMT adverse effects will become better classified and understood so that serious adverse events can be avoided.

Another major concern of FMT is that stool samples are not standardised and that there is a potential risk of transmission of pathogens. Screening of donors helps to minimise the risks by first conducting an interview about their medical history, drug use, infectious diseases and dietary habits. This is then followed up by blood and stool screening to check the health of the donor and for presence of any infectious pathogens including antibiotic resistant bacteria.²¹ Despite thorough screening, there have been some reported pathogen infections following FMT,¹² so further research needs to be conducted to optimise the screening process to ensure safety for all recipients.

However, there is also an argument that FMT should not be standardised and should be treated in the same way as solid organ donation, where a donor should be matched to a recipient.²¹ It has been suggested there could be 'super donors', who have a high microbial gut diversity and this has been linked to successful outcomes of FMT, compared to donors with a low microbial gut diversity.²² In addition to this, research has found that the donor microbial content is more likely to establish in the recipient if they also have that species of bacteria within their microbiome. This led to the suggestion that success of FMT may also be based on compatibility between the donor and recipient microbiome.²³ The current evidence only comes from small-scale studies and so more evidence is needed in this but so far supports the idea that donor-recipient matching will contribute to FMT success and help standardise patient responses.

Overall, FMT is not only more successful at treating rCDI in comparison

to antibiotics but is also more cost-effective and should therefore be considered as a gold-standard treatment moving forward. The increasing antibiotic non-susceptibility and resistance poses a huge problem for the NHS in treating infections, yet FMT is not currently being utilised enough to stop rCDI due to failure of antibiotics. There are concerns with FMT's safety due to the invasive nature of delivery but with the development of the capsule delivery this could help reduce the number of adverse effects and improve patient experience. There should also be further research conducted into understanding FMT and the relationship between donor and recipient to maximise success rate and begin to standardise the therapy.

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References

- 1. Vedantam G, Clark A, Chu M, McQuade R, Mallozzi M, Viswanathan VK. Clostridium difficile infection. Gut Microbes. 2012; 3:121–34.
- Rineh A, Kelso MJ, Vatansever F, Tegos GP, Hamblin MR. Clostridium difficile infection: molecular pathogenesis and novel therapeutics. Expert Rev Anti Infect Ther. 2014; 12:131–50.
- Schäffler H, Breitrück A. Clostridium difficile from colonization to infection. Front Microbiol. 2018; 9:00646.
- Public Health England. Inclusion criteria for reporting C. difficile infection to the surveillance system. 2014 https://www.gov.uk/government/publications/clostridium-difficile-infection-criteria-for-reporting. Accessed: 9 February 2023
- 5. Office for Health Improvement and Disparities. Public health profiles. 2023 https://fingertips.phe.org.uk/search/c%20diff. Accessed: 9 February 2023
- Fu Y, Luo Y, Grinspan AM. Epidemiology of community-acquired and recurrent Clostridioides difficile infection. Therap Adv in Gastroenterol. 2021; 14:175628482110162.
- National Institute for Health and Care Excellence. Clostridioides difficile infection: antimicrobial prescribing (NG199). 2021 https://www.nice.org. uk/guidance/ng199/chapter/recommendations#choice-of-antibiotic. Accessed: 9 February 2023
- Sholeh M, Krutova M, Forouzesh M, Mironov S et al. Antimicrobial resistance in Clostridioides (clostridium) difficile derived from humans: a systematic review and meta-analysis. Antimicrob Resist Infect Control. 2020; 9:158.
- Dilnessa T, Getaneh A, Hailu W, Moges F, Gelaw B. Prevalence and antimicrobial resistance pattern of clostridium difficile among hospitalized diarrheal patients: a systematic review and meta-analysis. PLOS ONE. 2022; 17:0262597.
- Nabal Díaz SG, Algara Robles O, García-Lechuz Moya JM. New definitions of susceptibility categories EUCAST 2019: Clinic application. Revista Española de Quimioterapia. 2022; 35:84–8.
- 11. Darkoh C, Keita K, Odo C, Oyaro M et al. Emergence of clinical Clostridioides difficile isolates with decreased susceptibility to vancomycin. Clin Infect Dis. 2021; 74:120–6.
- 12. Song JH, Kim YS. Recurrent Clostridium difficile infection: risk factors, treatment, and prevention. Gut Liver. 2019; 13:16–24.
- National Institute for Health and Care Excellence. Faecal microbiota transplant for recurrent Clostridium difficile infection (IPG485). 2014 https:// www.nice.org.uk/guidance/ipg485/chapter/1-Recommendations. Accessed: 9 February 2023
- Gupta S, Allen-Vercoe E, Petrof EO. Fecal microbiota transplantation: in perspective. Therap Adv Gastorenterol. 2016; 9:229–39.
- van Nood E, Vrieze A, Nieuwdorp M, Fuentes S, Zoetendal EG, de Vos WM, et al. Duodenal infusion of donor feces for recurrent Clostridium difficile. N Engl J Med. 2013; 368:407–15.
- Abdali ZI, Roberts TE, Barton P, Hawkey PM. Economic evaluation of faecal microbiota transplantation compared to antibiotics for the treatment of recurrent Clostridioides difficile infection. eClinicalMedicine. 2020; 24:100420.
- Halaweish HF, Boatman S, Staley C. Encapsulated fecal microbiota transplantation: development, efficacy, and clinical application. Front Cell Infect Microbiol. 2022; 12:826114.
- Ramai D, Zakhia K, Fields PJ, Ofosu A, Patel G, Shahnazarian V, et al. Fecal microbiota transplantation (FMT) with colonoscopy is superior to enema and nasogastric tube while comparable to capsule for the treatment of recurrent Clostridioides difficile infection: a systematic review and meta-analysis. Dig Dis Sci. 2020; 66:369–80.
- Wang S, Xu M, Wang W, Cao X, Piao M, Khan S, et al. Systematic review: adverse events of fecal microbiota transplantation. PLoS ONE. 2016; 11:0161174.

- Du C, Luo Y, Walsh S, Grinspan A. Oral fecal microbiota transplant capsules are safe and effective for recurrent Clostridioides difficile infection. J Clin Gastroenterol. 2021; 55:300–8.
 Bibbò S. Settanni CR. Porcari S. Bocchino E. Ianiro G. Cammarota G. et al.
 - Bibbò S, Settanni CR, Porcari S, Bocchino E, Ianiro G, Cammarota G, et al. Fecal microbiota transplantation: screening and selection to choose the optimal donor. J Clin Med. 2020; 9:1757.
 - Wilson BC, Vatanen T, Cutfield WS, O'Sullivan JM. The super-donor phenomenon in fecal microbiota transplantation. Front Cell Infect Microbiol. 2019; 9:00002.
- Li SS, Zhu A, Benes V, Costea PI, Hercog R, Hildebrand F, et al. Durable coexistence of donor and recipient strains after fecal microbiota transplantation. Science. 2016; 352:586–9.



22.

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I'm Niamh and I study medicine at Peninsula Medical School in Plymouth. I have a passion for microbiome research and antimicrobial resistance so this research put two of my favourite topics together. I look forward to one day being a part of delivering these new treatments to patients contributing to the fight against antimicrobial resistance.

Guidance controversy may impact individuals with chronic pain

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Abstract

Chronic pain affects around 20% of UK adults, impacting individuals significantly, leading to disability, depression and adverse social consequences, with many unable to work.

This article looks at the recently published NICE guidelines, including the Chronic Primary and Secondary Pain (CPP and CSP) categorisation, and the evidence based used in their development. The guidelines are a step in the right direction, with the potential to raise awareness of the condition, encourage consistency in treatment and shared decision-making and ultimately improve the quality of life of people who have often previously felt neglected by the healthcare system. However, their publication has not been without controversy. This includes the clear shift away from initiating painkillers, particularly opioids, with anti-depressants being the only pharmacological treatment recommended, along with nonpharmacological treatments such as acupuncture. Another concern is that the distinction between CPP and CSP has not been widely implemented into clinical practice which may limit the effectiveness of the guidelines. Creating such guidelines that attempt to generalise across a vast variety of conditions that can be highly individual was always going to be a challenge. However, drawing upon a broader evidence base to mitigate the current lack of large-scale clinical trials could have addressed some of the controversies.

Abbreviations

CBT – cognitive behavioural therapy FOPM – Faculty of pain medicine GPs – General Practitioners NICE – National institute for health care excellence TENs – Transcutaneous electrical nerve stimulation

Key terms

Pain – unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.¹

Chronic pain (CP) – pain characterised by significant emotional distress or functional disability² that persists or reoccurs for more than three months.³

Chronic Primary Pain (CPP) – chronic pain with no underlying condition that adequately accounts for the pain or impact.³

Chronic Secondary Pain (CSP) – caused by an underlying condition such as osteoarthritis, rheumatoid arthritis and endometriosis.³

The National Institute for Health and Care Excellence (NICE) released the first guidelines for the management of chronic primary pain on 7 April 2021.

This article describes CPP from a medical perspective in the context of the recently published NICE guidelines. It draws upon freely accessible studies referenced in the guidance along with systematic reviews highlighted by commentators in their response to the guideline's release.

Around 20% of UK adults suffer from CP,^{1,4} which is likely to increase with an ageing population.⁵ The new guidelines categorise CP into CSP and CPP3 both impacting individuals significantly, leading to disability,² depression,^{4,6} adverse social consequences⁶ and sleep disturbances⁴ with many unable to work.^{1,6} Creating clinical guidelines can improve not only the quality of life but the consistency of care for people who often feel neglected by the healthcare system,⁷ with individuals referring to their CP as an invisible illness.⁶

The guideline's key aim³ was to focus on person-centred collaborative care and shared decision making for those aged 16 and above. This includes understanding the contributing patient-related factors of the pain as well other aspects that may influence it, including substance misuse, housing and employment. A consequence of the guidelines was a shift away from the routine use of opioids,¹ non-steroid anti-inflammatory (NSAIDs), anti-epileptic drugs and a shift towards anti-depressants.³ The guidelines recommended other non-pharmacological approaches such as exercise, CBT and acupuncture but did not encourage other methods such as TENs machines.³

Shared-decision making has become a widely used practice in which patients and clinicians share information and opinions to reach

a treatment decision. Although this has been linked to improved outcomes and better adherence, it may be particularly challenging in chronic pain. The new guidelines may introduce challenges, for example around the use of opioids. The wide use of opioids in the past is now discouraged and this could create disagreements between patient and clinician.⁸

The reception to the guidelines was mixed. The majority of responses were supportive of person-centred care,⁹ but the Faculty of Pain Medicine (FoPM) and Cochrane are concerned about some of the bigger changes to current care such as the pharmacological management changes.^{7,9} Fewer than 15% of surveyed FoPM members have used the diagnosis of CPP in clinical practice, with over 80% disagreeing with the guidance on managing CPP from the released guidelines.⁶ In general, there is little consensus amongst the healthcare community on diagnosing and managing CP, which may be in large part due to the challenges in its study and the potential stigma.¹⁰

Why is studying CP so difficul and what are the key concerns with the new guidelines?

Pain is subjective and, therefore, a challenge to capture personal and contrasting experiences of pain.⁷ Due to this, how data involving pain are analysed can substantially influence the outcome.⁹ Focusing on CPP, which encompasses a broad range of conditions, creates a challenge in defining recommendations that would be appropriate and workable for all patients.⁷

A fundamental concern with the guidelines was that the evidence used was based on small sample sizes. Research has shown that trial with sample sizes of less than 50 participants return 48% larger effect estimates for treatments than for those with over 1000.¹¹ Furthermore, seemingly valuable Cochrane systematic reviews looking at interventions (pharmacological and non-pharmacological) were excluded from the evidence used to underpin the guidance.⁹ Also, conditions (e.g. lower back pain and sciatica) already covered by their own guidelines were excluded. Further, these guidelines were for those aged 16 and above; however, 16–17-year-olds would be included in paediatric-focused studies and therefore not part of the evidence used to inform this guidance. This can lead to a void in evidence for this age group due to not being represented in the studies used.⁷ Such factors could suggest a relatively narrow evidence scope and risk a selection bias.⁷

Pharmacological management

Table 1 summarises the recommendations for pharmacological interventions for CPP in the NICE guidelines.

Table 1. Pharmacological recommendations for CPP in the NICE guidelines³

Recommended	Not recommended	
	Antiepileptic drugs: including gabapentinoids	
	Antipsychotic	
	Benzodiazepines	
	Corticosteroid trigger point injections	
	Ketamine	
Antidepressants: amitriptyline, citalopram, duloxetine, fluoxetine,	Non-steroidal anti-inflammatory drugs	
paroxetine or sertraline	Local anaesthetics (topical or intravenous), unless as part of a clinical trial for complex regional pain syndrome	
	Local anaesthetic/corticosteroid combination trigger point injections	
	Opioids	
	Paracetamol	

A key concern was that GPs (General Practitioners) could stop useful prescriptions (e.g. painkillers).⁹ However, the guidelines emphasise shared-decision making; if existing medication is causing little harm, they can continue on a safe dose.³ A meta-analysis on CP has highlighted the difficulties in establishing the efficacy of painkillers. The results were found to not be normally distributed, often with a bimodal distribution with very good or very little pain relief. Another key issue is the high placebo response rates. In both crossover and parallel trials, there were modest response rates with active treatments over the placebo.¹²

A commonly used drug to treat CP is opioids. However, the safety and efficacy of opioids remain controversial, with the risk of serious adverse reactions of addiction, overdose, death,¹ sleep problems and depression.¹³ Additionally, other side effects include constipation, dizziness and nausea.¹³

Despite the lack of strong evidence for its effectiveness and safety concerns, opioid dosage has been increasing in recent years.¹ A 50mg increase in morphine almost doubles the risk of developing an addiction.¹⁴ Widespread media reporting highlights that this is a global issue, with many countries facing issues from adverse risks associated with opioid use. In Canada, the worker's compensation board found in 1998 the average dose was less than 500mg of morphine or equivalent rising dramatically to over 6000mg in 2010.¹⁵ Although the trend over time is less clear in the UK, the prescription rate of codeine has increased five-fold between 2006 and 2017.¹⁶

High-dose¹ opioids (more than 200mg) have previously been used for the treatment of CP prior to these guidelines being published. However, an overview of Cochrane reviews found no studies covering high-dose use for CP, showing the critical lack of evidence in this area. Normally, it would be recommended to conduct more research into the efficacy of high-dose opioids. However, this should be done with caution due to the high risk of serious adverse reactions. The author states, "no evidence base argument can be made on the use of highdose opioids in clinical practice."

Another Cochrane review¹³ looked at adverse events associated with medium- and long-term opioid use. This review found that due to the high adverse risks associated with opioid use, the clinically relevant benefit must be demonstrated before long-term use could be considered with additional concerns when moving from medium to long-term use. Although the quality of the reviews was strong, there was limited reporting of adverse events, which would need to be improved for future trials.

Over recent years there has been a consensus emerging that although long-term opioid use may work in individual cases, it should not be the general rule.^{1,13} Delays in accessing timely care from the right professional leads to the declining potential for rehabilitation and ultimately can result in people relying on addictive substances.⁶ Such factors support the intentions of the published guidance to reduce the reliance on opioids. However, given that this has been known for many years, it raises questions as to why it took so long for the guidelines to be released and how many more people could have benefitted in the interim.

The only pharmacological intervention recommended by NICE was six different anti-depressants for those over 18. It highlighted the benefit of anti-depressants, even without a depression diagnosis, in improving quality of life, sleep and psychological distress.³ However, a Cochrane meta-analysis looking at anti-depressants in the management of CP found no previous systematic reviews or meta-analyses comparing the difference in efficacy of different anti-depressants.¹⁷ At this point in time there is no clear guidance to inform the choice of which anti-depressant to optimise patient outcomes.

Non-pharmacological

Table 2 summarises the recommendations for non-pharmacological interventions for CPP in the NICE guidelines.

Table 2. Non-pharmacological recommendations for CPP in the NICE guidelines³

Recommended	Not recommended
Exercise and physical exercise programmes	Electrical physical modalities: TENS, ultrasound, interferential therapy
Psychological therapy: ACT and CBT	
Acupuncture	Psychological therapy: Biofeedback

One controversy was the recommended use of acupuncture.³ One randomised controlled trial in the guidelines compared acupuncture to sham acupuncture for 100 individuals with fibromyalgia. However, the study found acupuncture did not perform any better than sham acupuncture. One limitation was no group went through the usual care pathway.¹⁸ Another was that the required duration and frequency could not be achieved of an acupuncture session through the allowed 5 hours, as an average session is between 20 minutes and one hour.¹⁹ It is striking that in contrast to these guidelines, the NICE guidance on lower back pain and osteoarthritis classify acupuncture as "do not offer" due to the lack of evidence on its efficacy.⁷ The focus on acupuncture may suggest that the majority of CPP is musculoskeletal and could encourage an overly sedentary lifestyle when exercise and physical activity have been shown to offer benefits.⁹

On exercise, the guidelines recommended supervised programmes and staying physically active long-term for general health benefits. The evidence, from a total of 91 studies and 3 Cochrane reviews, was dominated by two conditions: fibromyalgia (58 studies and all 3 Cochrane reviews) and chronic neck pain (31 studies).²⁰

One study, with a small sample size (54), looked at aquatic training on symptom improvement for women with fibromyalgia. Although they gained improved fitness, no clinical association could be made to improving symptoms.²¹ A key limitation is that not everyone can access such facilities. Another trial looked at the impact of Zumba and aerobic exercise on working memory and motor function.¹⁹ This trial included 60 individuals with fibromyalgia randomly allocated to either of these or the standard care control group. Although significant improvement in both were seen, as well as the controls remaining virtually unchanged, these were not followed up to monitor long-term outcomes. A key positive is that exercise is likely to carry minimal risk of serious adverse reactions,²² as seen in a Cochrane meta-analysis on fibromyalgia⁴ and another study on chronic neck pain.²³

Tens, 'pain relief involving the use of mild electrical current'²⁴ was not recommended due to a lack of evidence supporting its efficacy.³ A Cochrane review did not conclude whether they were effective due to the small sample sizes and poor data quality. There was minimal risk of adverse reactions. There is a clear need for more reliable studies considering the devices are simple to use, portable and relatively inexpensive with the possibility to scale up.²⁵

Conclusion

Effective management of CP can significantly improve quality of life and reduce the strain on the NHS. While the publication of these guidelines has been controversial, with several concerns raised by key medical bodies, they are a step in the right direction. The emphasis on shared decision making begins to address the issue of many patients feeling unheard by their practitioner. The publication has also raised awareness of the key challenges in managing CP.

A key controversy is the shift away from initiating painkillers, particularly opioids, for individuals with CPP, which have historically

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been a common approach up until now. Although this distinction between CPP and CSP have been adopted by the NICE guidelines it has not been widely implemented into clinical practice. This raises concerns that many individuals with CPP will continue to reply on opioids.

Considering a wider evidence base to inform the guidance could address some of the controversies including the emphasis on acupuncture. Furthermore, there needs to be more large-scale trails for chronic primary pain given the limited research on the CPP and CSP classification within the new guidelines.

The guidelines are only one element of effective management for CP and therefore there needs to be more co-operation between pain specialists who are working on the front line with individuals with CP and those who commission care, which would ultimately lead to better outcomes for the patients.

What works for CP seems to be very much down to an individual, therefore, making guidelines that try and generalise treatments for such a vast variety of conditions is inevitability going to be a challenge. Would a trial-and-error approach between doctor and patient, with greater flexibility than the guidelines currently allow, lead to better outcomes?

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References

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- Els C, Jackson TD, Hagtvedt R, Kunyk D, Sonnenberg B, Lappi VG, et al. High-dose opioids for chronic non-cancer pain: an overview of Cochrane Reviews.Cochrane Database of systematic Reviews. 2017; 10: 1465-1858
 ISAP. Definitions of chronic pain syndromes https://www.iasp-pain.org/ad-
- ISAP. Definitions of chronic pain syndromes https://www.iasp-pain.org/advocacy/definitions-of-chronic-pain-syndromes/ Accessed: 10 February 2023
 NICE guideline [NG193]. Chronic pain (primary and secondary) in over 16s:
- assessment of all chronic pain and management of chronic primary pain. https://www.nice.org.uk/guidance/ng193 Accessed: 10 February 2023
 Geneen LJ, Moore RA, Clarke C, Martin D, Colvin LA, Smith BH. Physical
 - activity and exercise for chronic pain in adults: an overview of Cochrane Reviews. Cochrane Database of Systematic Reviews. 2017; 1:1465-1858
 - Fayaz A, Croft P, Langford RM, Donaldson LJ, Jones GT. Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. BMJ Open. 2016; 6:10-364
 - Faculty of Pain Medicine. Practical Pain Management in Specialist Care: How to help people with chronic pain when population based national guidance fails to help Promoting individualised care for people with complex pain. https://fpm.ac.uk/new-guidance-practical-pain-management-specialist-care Accessed: 10 February 2023
 - Cochrane Pain, Palliative and Supportive Care. Stakeholder feedback from the Cochrane Pain, Palliative and Supportive Care (PaPaS) Review Group on the National Institute of Health and Care Excellence (NICE) draft clinical guideline GIDNG10069 Chronic pain: assessment and management. https:// papas.cochrane.org/news/papas-response-nice-draft-guidance-chronicpain-assessment-and-management Accessed: 10 February 2023
 - crisis: what is the role of shared decision-making?, Health Commun. 2020; 35: 1239-1247.
 - Faculty of Pain Medicine Statement on National Institute for Health and Care Excellence Guideline on Chronic Pain (Primary and Secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain. https://fpm.ac.uk/sites/fpm/files/documents/2021-04/FPM%20Statement%200n%20NICE%20Chronic%20Pain%20Guidelines%202021-04-07. pdf Accessed: 10 February 2023

Perugino F, De Angelis V, Pompili M, Martelletti P. Stigma and chronic pain, Pain Ther. 2022; 11:1085-1094.

Dechartres A, Trinquart L, Boutron I, Ravaud P. Influence of trial sample size on treatment effect estimates: meta-epidemiological study. BMJ : British Medical Journal. 2013; 346-2304.

- 12. Häuser W, Tolle Tr. Meta-analyses of pain studies: what we have learned. Best Pract Res Clin Rheumatol. 2015; 1:131-146.
- Els C, Jackson T, Kunyk D, Lappi V, Sonnenberg B, Hagtvedt R, et al. Adverse events associated with medium- and long-term use of opioids for chronic non-cancer pain: an overview of Cochrane Reviews. Cochrane Database of Systematic Reviews. 2017; 10: 1465-1858
- Huffman KL, Shella ER, Sweis G, Griffith SD, Scheman J, Covington, EC. Nonopioid substance use disorders and opioid dose predict therapeutic opioid addiction.2015; 2:126-134.
- Kraut A, Shafer LA, Raymond CB. Proportion of opioid use due to compensated workers' compensation claims in Manitoba, Canada, Am J Ind Med. 2015; 58:33-39.
- Jani M, Birlie Yimer B, Sheppard T, Lunt M, Dixon WG. Time trends and prescribing patterns of opioid drugs in UK primary care patients with non-cancer pain: A retrospective cohort study, PLoS Med. 2020; 17
- 17. Birkinshaw H, Friedrich C, Cole P, Eccleston C, Serfaty M, Stewart G, et al. Antidepressants for pain management in adults with chronic pain: a network meta-analysis Cochrane Database of Systematic Reviews. 2021; 1
- Assefi NP, Sherman KJ, Jacobsen C, Goldberg J, Smith WR, Buchwald DA randomized clinical trial of acupuncture compared with sham acupuncture in fibromyalgia, Ann Intern Med. 2005; 1:10-9.
- 19. NHS. Acupuncture. https://www.nhs.uk/conditions/acupuncture/ Accessed: 10 February 2023
- NICE guideline NG193.Chronic pain (primary and secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain [E] Evidence review for exercise for chronic primary pain https://www. nice.org.uk/guidance/ng193/evidence/e-exercise-for-chronic-primary-pain-pdf-9071987010 Accessed: 10 February 2023
- Andrade CP, Zamunér AR, Forti M, Tamburús NY, Silva E. Effects of aquatic training and detraining on women with fibromyalgia: controlled randomized clinical trial, Eur J Phys Rehabil Med. 2019; 55:79-88.
- 22. Norouzi E, Hosseini F, Vaezmosavi M, Gerber M, Pühse U, Brand S. Zumba dancing and aerobic exercise can improve working memory, motor function, and depressive symptoms in female patients with Fibromyalgia. Eur J Sport Sci. 2020; 7:981-991.
- Borisut S, Vongsirinavarat M, Vachalathiti R, Sakulsriprasert P. Effects of strength and endurance training of superficial and deep neck muscles on muscle activities and pain levels of females with chronic neck pain, J Phys
 Ther Sci. 2013; 25: 1157-1162.
- NHS. TENS (transcutaneous electrical nerve stimulation) https://www.nhs. uk/conditions/transcutaneous-electrical-nerve-stimulation-tens/ Accessed: 10 February 2023)
- Gibson W, Wand BM, Meads C, Catley MJ, O'Connell NE. Transcutaneous electrical nerve stimulation (TENS) for chronic pain - an overview of Cochrane Reviews Cochrane Database of Systematic Reviews. 2019;2



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The increased burden of cardiovascular disease in South Asian communities

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Abstract

This article highlights the increased burden of cardiovascular disease (CVD) in South Asian communities. South Asians are at a significantly higher risk of developing CVD due to a higher prevalence of traditional risk factors such as high blood pressure, high cholesterol, and obesity. In addition, high levels of insulin resistance and metabolic dysfunction in this population may contribute to their higher risk of developing CVD. Despite the increased burden of CVD in South Asian communities, there is a lack of research and public health interventions targeting this population. The need for culturally tailored public health interventions and education on CVD is emphasised to address the increased burden of CVD in South Asian communities. Community-based programs, involving community leaders and cultural organisations, can educate the community on the importance of CVD and guide them on the importance of screening and risk factor management. The article highlights the importance of addressing this pressing public health issue in the South Asian community

Abbreviations

CVD - cardiovascular disease

Introduction

Cardiovascular disease (CVD) poses a significant public health issue affecting millions of people worldwide, accounting for a substantial number of global deaths in 2019 - with South Asian communities being particularly vulnerable to this condition. "An estimated 17.9 million people died from CVDs."¹ This article aims to review the

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available evidence on the link between South Asian communities and cardiac disease and emphasises the need for targeted public health interventions. By doing so, it seeks to shed light on the underlying mechanisms contributing to the increased burden of CVD in this population and advocate for targeted public health measures.

Prevalence of CVD in South Asian communities

Research from McKeigue et al (1989) indicates that the South Asian community is at a significantly higher risk of developing cardiac disease compared to other populations in the UK. Mortality from CVD in South Asians is 1.5 times that of the general population.² Prevalence studies have shown that South Asians exhibit a higher incidence of traditional risk factors for CVD, such as high blood pressure, high cholesterol and obesity. A cohort study conducted in 2006 by Pursnani and Merchant, with a 10-year follow-up, demonstrated that after adjusting for traditional risk factors, South Asians are associated with an increased risk of coronary heart disease outcomes compared to other ethnic groups.³ South Asians suffer up to a 50% higher CVD mortality rate compared to indigenous white Europeans in the UK.4,5 Furthermore, the prevalence of cardiovascular disease in people aged 55 years and above was found to be highest in Pakistani men (35.1%) and Indian women (14.7%).⁶ These findings highlight the increased burden of CVD in South Asian communities and call for a closer examination of the underlying mechanisms.

Possible explanations for the increased burden

A study published in Diabetes Care in 2013 found that South Asians had a higher prevalence of insulin resistance compared to individuals of European descent.⁷ Insulin resistance has been identified as a

potential contributing factor to the increased risk of CVD among South Asians. The figure below shows a simplified model of insulin resistance at a cellular level. Understanding alternative mechanisms and evaluating available evidence can provide valuable insights into the increased burden of CVD in South Asian communities.

Interventions and public health measures

To strengthen the discussion on interventions to reduce the prevalence of CVD, it is important to provide clear statements about the methodology and presentation of results, where relevant. Drawing on recent research papers or journal articles can offer supporting evidence for these interventions.⁹ Culturally tailored public health interventions are of utmost importance in addressing the increased burden of cardiac disease in South Asian communities. These interventions should be specifically designed to cater to the needs and beliefs of the community. Involving community leaders and cultural organisations can help provide culturally sensitive information and increase adherence to interventions.¹⁰ Exploring the government's current efforts and future goals in addressing this issue can provide stronger statistics, emphasising the necessity to increase the number of public health interventions and research to combat the elevated risk of CVD in South Asian communities.³

Conclusion

In conclusion, South Asian communities face a significantly higher risk of developing cardiac disease compared to other populations, with factors such as insulin resistance potentially contributing to this increased burden. To address this pressing issue, it is crucial to undertake targeted public health interventions and research efforts.

To enhance the quality and impact of this article, some improvements can be implemented. The article could benefit from addressing specific factors that influence the prevalence of CVD in South Asian communities, such as the role of food, lifestyle and genetic factors. Expanding the scope of the study to explore the prevalence of CVD in various age groups within South Asian communities, rather than focusing solely on individuals aged 55 and above, would provide a more comprehensive understanding of the issue.

Lastly, a stronger and more cohesive conclusion can be established by emphasising the connection between why South Asian communities are more prone to CVD and why increasing the number of public health interventions and research is crucial to addressing this problem.

By incorporating these suggested improvements, this article can provide a more comprehensive analysis of the prevalence of CVD in South Asian communities and contribute to the development of effective strategies to combat this issue.

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References

5.

6.

7.

8.

9.

10.

- Cardiovascular diseases [Internet]. World Health Organization. World Health Organization; 2021 [cited 2023Feb8]. Available from: https://www.who.int/ news-room/factsheets/detail/cardiovascular-diseases-(cvds)
 McKeigue PM. Miller GJ. Marmot MG. Coronary heart disease in South
 - McKeigue PM, Miller GJ, Marmot MG. Coronary heart disease in South Asians overseas – a review. J Clin Epidemiol1989;42:597–609.
- Pursnani S, Merchant M. South Asian ethnicity as a risk factor for coronary heart disease. Atherosclerosis. 2020;315:126–30.
 Gill PS, Kai J, Bhopal RS, Wild S. Black and minority ethnic groups. Health
 - Gill PS, Kai J, Bhopal RS, Wild S. Black and minority ethnic groups. Health Care Needs Assessment. 2018;:227–400.
 - Raftery J. Health Care Needs Assessment: The epidemiologically based needs assessment reviews. BMJ. 1994;309(6963):1241–1241. doi:10.1136/ bmj.309.6963.1241
 - The Health Survey for England, The health of ethnic minority groups., 2004 Kanaya, A. M. et al. (2013). Association between insulin resistance and cardiovascular disease in South Asian Americans. Diabetes Care, 36(6), 1620-1628
 - Ormazabal V, Nair S, Elfeky O, Aguayo C, Salomon C, Zuñiga FA. Association between insulin resistance and the development of cardiovascular disease. Cardiovascular Diabetology. 2018;17(1). doi:10.1186/s12933-018-0762-4
 - Boon MR, Bakker LE, van der Linden RA, van OuwerkerkAF, de Goeje PL, Counotte J, et al. High prevalence of cardiovascular disease in South Asians: Central role for brown adipose tissue? Critical Reviews in Clinical Laboratory Sciences. 2015;52(3):150–7.
 - Rankin J, Bhopal R. Understanding of heart disease and diabetes in a south asian community. Public Health. 2001 Jul;115(4):253–60. doi:10.1038/ sj.ph.1900777



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My name is Malaika and I am a third year medical student the University of Plymouth. My journey into medicine was inspired by my personal experiences and my unwavering determination to make a positive impact on people's lives. My primary interests lie in cardiology and paediatrics.



Figure 1. A simplified model of insulin resistance reprinted from Ormazabal et al (2018)⁸

The potential use of food therapy to modulate cognitive decline

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Abstract

The incidence of cognitive diseases such as Alzheimer's Dementia is expected to grow and the impacts of these diseases on wellbeing is drastic, therefore requires exploration of contributing factors for their development as well as investigation of potential therapies. Some of these are available in food sources and already available for clinical use. This literature review discusses some of the mechanisms of specific chemicals modulators that prevent neurogenerative decline (mainly polyphenols such as resveratrol, curcumin, flavonoids and EGCG) as well as oral health and food texture which may influence cognitive function.

The main findings are that polyphonic compounds are effective at reducing oxidative stress and, subsequently, A β plaque formation, a hallmark of Alzheimer's Dementia. Greater chewing force was related to reduction in stress hormones, depression and central nervous system changes.

Abbreviations

AD – Alzheimer's disease APP – Amyloid precursor protein EGCG – Epigallocatechin gallate MDA – Malondialdehyde NAD – Nicotinamide adenine dinucleotide NAPP – N-terminal amyloid precursor protein NMDA – N-methyl-D-aspartate ROS – Reactive oxygen species SGZ – Subgranular zone SIRT – Sirtuins SVZ – Subventricular zone

Introduction

Neurogenesis is the process of new neurons being formed in the brain. Previously, neurogenesis had been thought to have stopped in the adult brain but is now widely accepted to continue in adults.¹

Adult neurogenesis mainly occurs in the subventricular zone, subgranular zone and dentate gyrus of the hippocampus,² an area that functions to form and consolidate memories and makes up part of the limbic system which functions to influence mood. This area of the brain is majorly affected in Alzheimer's disease causing the symptoms of memory loss and depression, so protection of this area is vital to prevent instances and progression of the disease.³ This article explores how altering diet may protect the hippocampus and the interactions between the food we eat and neurogenesis.

Methods

To investigate the potential use of food as a diagnostic and protective measure against cognitive decline, literature searches were carried out on PubMed and Google Scholar to specify dietary components that have been implicated in neurology, mainly their oxidative stress mitigation. Less researched areas, such as the effects of EGCG and chewing, were explored via citation chaining and Google Scholar. Articles included were chosen to cover a range of dietary factors, components and composition, to emphasise different elements of diet as well as research that already has clinical implications to further validate usage.

Results

The search initially found 14 articles, however, eight were removed as they were not specific to dietary content or hippocampal neurogenesis in adults.

Discussion

The role of oxidative stress in cognitive decline

One contributor to cognitive decline is oxidative stress which exerts its effects via a plethora of mechanisms.⁴ One such mechanism is A β metal ion redox potential whereby metal ions such as zinc²⁺ and iron³⁺ bind to the ends of A β peptides producing high numbers of reactive oxygen species (ROS) and promoting pathological

plaque development. These ROS then produce a positive feedback loop of oxidation and ROS production, creating a self-sustaining environment in which neuronal cell death is imminent. This is partly because increases of ROS in the brain negatively affect the enzymes glutamine synthetase and creatine kinase⁵ leading to damage to the brain. Glutamate synthetase reduces levels of glutamate in the brain however, when oxidised, the enzyme is unable to carry out its function causing a build-up of glutamate.⁶ The higher level of glutamate activates NMDA receptors in the surrounding extrasynaptic region of the postsynaptic neuron which then overcome the protective measures of NMDA receptors in the synaptic region leading to excitotoxicity and eventual neuronal cell death.⁷ Creatine kinase plays a key role in regulating ATP levels in neural cells therefore its oxidation, and subsequent damage, leads to reduced energy metabolism contributing to cell death. Therefore, oxidative stress and ROS production play major roles in the development of Alzheimer's disease and cognitive decline: aiming to reduce the effects of oxidative stress by modulating the number of ROS may be beneficial to those afflicted.

Polyphonic protection of neurons and cognitive decline

Multiple studies⁸ show polyphenols, found naturally in plants, have the ability to directly stimulate neuronal cell proliferation, reduce effects of oxidative stress and attenuate inflammation. For example, resveratrol (RSV), found in grapes and red wine, is a highly studied polyphenol that is able to induce beneficial effects to the brain by activating sirtuins (SIRTs).9 These are regulatory enzymes involved in a variety of functions including metabolism and brain function, which primarily work by editing histones to prevent DNA damage. SIRTs increase the content of NAD in cells, which increases energy production, thereby enabling greater cell survival, synaptic plasticity and neuronal stress resistance.¹⁰ One study¹¹ found SIRT1 activation reduced tau protein phosphorylation, premature cell death and synaptic loss in the brains of pathological mice models. This had the downstream effect of reducing behavioural deficits, hence supporting the use SIRT1 activation as a therapeutic method for AD and other neurological conditions. Furthermore, resveratrol is able to reduce ROS, scavenge free radicals and upregulate enzymes such as glutathione peroxidase, which protects cells from oxidative damage, therefore the properties of resveratrol allow it to produce powerful antioxidant effects. Additional actions include inhibiting pro-inflammatory mechanisms such as tumour necrotic factor-a production and cytokine release, indicating that resveratrol could produce positive clinical effects in patients suffering from neurological conditions.¹² However, resveratrol has low bioavailability in humans and little work has been done to tackle this problem for clinical use.¹³ Additionally, the bioavailability measurements may be inaccurate as the distribution to other tissues is not considered. Hence, future research needs to fully explore targeted therapy in order to fully utilise the benefits of resveratrol and make use of it in a clinical setting.

Like resveratrol, curcumin can reduce oxidative stress and inflammatory responses in the brain to prevent damage. It is also useful to diagnose Alzheimer's disease at an earlier stage through its ability to bind to A β plagues and produce a strong fluorescent signal, making it useful for positron emission tomography (PET), magnetic resonance imaging (MRI)¹⁴ as well as other modalities. Its use has already been approved by the US Food and Drug Administration for clinical use and earlier diagnosis allows for patients to plan ahead. It gives people greater autonomy when making decisions about their healthcare while they have capacity and increases the opportunity to live independently.¹⁵ Additionally, curcumin significantly reduced BACE-1 levels (an enzyme involved in Aß plaque production) so its inhibition prevents amyloid precursor protein maturation thus may be used to provide therapeutic benefit in AD.¹⁶ However, when administered orally, curcumin showed no difference in cognitive impairment amongst AD patients when trialled clinically which may be due to low bioavailability. This mirrored the same problem as resveratrol hence these findings, again, emphasise the need to find

modalities to make polyphenols more available in the brain in order to achieve therapeutic effects and for clinical use.

Flavonoids are also implicated to be protective against dementia and reverse some deficit in cognitive function. They have an ability to interact with multiple pathways to produce resistance to oxidants and inflammatory mediators and influence neuronal differentiation, long-term potentiation and memory.¹⁷ Already there is evidence that flavonoid intake is associated with improved cognitive function in people aged 65 or over. For example, a study found intake of flavonoids produced better Mini-Mental State Examination scores in a dose-dependent relationship over a 10-year period.¹⁸ One mode flavonoids are able to exhibit neuroprotective effects is through the inhibition of β-secretase and activation of α-secretase.¹⁹ β-secretase is essential for the generation of β -amyloid plaques due its function of cleaving APP into $A\beta$ peptides and N-APP bringing about apoptotic destruction of neuronal cells²⁰ which are hallmarks of AD. Hence, inhibition of β -secretase would prevent cleavage of APP from occurring and reduce risk of plaque and disease development.

EGCG, the main flavonoid in green tea, was investigated for its potential therapeutic effect on cognition. A study²¹ conducted in Wuhan, China explored the relationship between green tea consumption and cognitive function in Chinese middle-aged and elderly people. The results showed individuals consuming green tea had significantly lower levels of tau proteins and AB peptide levels in comparison to those who did not as well as lower levels of oxidative stress markers in serum, such as MDA, indicating green tea consumption may reduce AD pathology through antioxidant mechanisms. ECGC is able to produce neuroprotective effects through many mechanisms, one of which is the increased expression of antioxidant enzymes such as glutamate-cysteine ligase.²² This enzyme produces glutathione, a major antioxidant, which is significantly lower in AD patients²³ so increasing glutathione levels may be protective against oxidative stress. Additionally, ECGC is able to prevent hyperphosphorylation of tau proteins and accumulation of neurofibrillary tangles in the brain via activation of the Akt signalling pathway. This functions to reduce tau hyperphosphorylation²⁴, a key feature in AD therefore, supplementation with ECGC may increase antioxidant abilities in patients and reduce abnormal build-up of these tangles.

Importance of oral health

Not only does the contents influence dementia occurrence, the mode of ingestion contributes to its progression. As people age, oral health reduces and they experience more oral problems that impair mastication such as dental caries, tooth loss and periodontal disease.²⁵ This makes people more likely to opt for a softer diet²⁶ causing them to miss out on preventative measures such as nutrients sourced in hard foods putting them at greater risk of malnutrition. Those experiencing dental problems opt to avoid harder foods such as fruits and vegetables which exposes them to low grade inflammation and oxidative stress²⁷, a major factor during pathological conditions such as Parkinson's disease and AD.²⁸

Impact of food texture on neuroprotection

The action of chewing itself may also prevent dementia. Some studies show chewing increases blood oxygen level dependent signals in MRI scans in the primary sensorimotor cortex, cerebellum, thalamus and prefrontal cortex.²⁹ The prefrontal cortex is important for the consolidation of memories in the hippocampus as information from the prefrontal cortex streams into areas of the hippocampus where objects and places are encoded within a context.³⁰ This information can then be retrieved and relayed back to the prefrontal cortex when stimulated. This hippocampal-prefrontal relay system is impaired in AD and other cognitive impairments³¹, which partly explains why affected patients struggle to form new memories and retrieve old memories. Increased blood flow to this region serves as a protective force to its degradation. Another investigation³² explored the effects of hard-diet feeding and soft-diet feeding on neurogenesis in the

subventricular zone of mice. It revealed that mice on a soft-diet had reduced neurogenesis and reduced odour avoidance suggesting a soft-diet can induce adverse effects on adult neurogenesis such as long-term memory loss and hyposmia, key features in Alzheimer's disease.

Chewing hard foods has additional effects which may contribute to a person's risk of developing dementia. It attenuates corticosterone and catecholamine levels in stressful situations and reduces changes in the central nervous system, particularly the hippocampus and hypothalamus which are especially sensitive to stress.³³ In rats, it was observed to prevent impairment of NMDA receptors suggesting chewing is a useful mechanism to cope with stress by suppressing endocrine responses. These NMDA receptors increase glutamate uptake in the hippocampus and contribute to neuronal cell death which is a key feature in dementia. Furthermore, a study explored the effects of chewing on nutritional status and rates of depression in elderly people. It found those with chewing problems consumed less energy than those with no chewing problems and there was a significant difference between the two groups; the prevalence of depression in those with chewing problems was twice as high as those without chewing problems.³⁴ The study considered socio-economic factors which may have contributed to depression prevalence and adjusted depression scores to account for this. Other studies³⁵ have similar findings that show chewing ability is significantly associated with health-related guality of life, as well as other aspects of the EQ-5D which includes aspects of pain, anxiety and depression. This indicates some causal relationship between chewing and depression.

Depression in later life is also suggested to increase the risk of developing dementia.³⁶ A study investigating the association between depression and cognitive decline found that those with late onset depression performed worse in verbal skills, delayed memory and global cognitive function in comparison to those who were never depressed.³⁷ Therefore, factors such as nutrition and oral health which influence depression development need to be modulated to reduce risks of depression associated with dementia.

Conclusion

Overall, diet has the potential to influence neurogenesis through multiple pathways, such as polyphonic activation of sirtuins which downregulate inflammatory markers and combat oxidative stress as well as directly influencing enzymes involved in AB plaque development and tau hyperphosphorylation. The importance of oral health is emphasised as it affects food choice, nutrition and improves blood oxygen flow to the brain reducing incidence of depression and subsequent cognitive decline. Therefore, there is much potential to modulate diet to prevent AD incidence and utilise polyphenols for clinical use. Advances in medical knowledge³⁸ enable better survival and allows people to live longer however this gives rise to greater incidence of dementia and the number of people affected is expected to grow.³⁹ Hence it is vitally important to explore the domains which influence these conditions such as dietary factors, to compose new treatment, earlier diagnosis and provide individuals with better knowledge of preventative measures to influence health outcomes.

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References

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- Eriksson PS, Perfilieva E, Björk-Eriksson T et al Neurogenesis in the adult 1. human hippocampus. Nature Medicine. 1998; 4: 1313 -1317 2. Spalding KL, Bergmann O, Alkass K, et al. Dynamics of hippocampal neuro
 - genesis in adult humans. Cell. 2013; 153: 1219-1227 Rodríguez JJ, Verkhratsky A. Neurogenesis in Alzheimer's disease. Journal of
 - Anatomy. 2011; 219: 78-89 Cassidy L, Fernandez F, Johnson JB et al. Oxidative stress in Alzheimer's disease: a review on emergent natural polyphenolic therapeutics. Complementary Therapies in Medicine. 2020; 49: 102294
 - Huang WJ, Zhang X, Chen WW. Role of oxidative stress in Alzheimer's disease (review). Biomedical Reports. 2016; 4: 519-522
 - Madeira C. Vargas-Lopes C. Brandão C et al. Elevated glutamate and glutamine levels in the cerebrospinal fluid of patients with probable Alzheimer's disease and depression. Frontiers in Psychiatry. 2018; 9: 561
 - Wang R, Reddy P.H. Role of glutamate and NMDA receptors in Alzheimer's disease. Journal of Alzheimer's disease. 2017; 57: 1041-1048
 - Sarubbo F, Moranta D, Pani G. Dietary polyphenols and neurogenesis: Molecular interactions and implication for brain ageing and cognition. Neuroscience & Biobehavioral Reviews. 2018; 90: 456–470
- Moraes DS, Moreira DC, Andrade JMO et al. Sirtuins, brain and cognition: a review of resveratrol effects. IBRO Neuroscience Reports. 2020; 9: 46-51 Lautrup S, Sinclair DA, Mattson MP et al. NAD+ in Brain aging and neurode-10.
- generative disorders. Cell Metabolism. 2019; 30: 630-655 11.
 - Min SW, Sohn PD, Li Y et al. SIRT1 deacetylates tau and reduces pathogenic tau spread in a mouse model of tauopathy. The Journal of Neuroscience. 2018: 38: 3680-3688
- Cicero AFG. Ruscica M. Banach M. Resveratrol and cognitive decline: a clini-12 cian perspective. Archives of Medical Science 2019; 15: 936-943
 - Smoliga J.M, Blanchard O. Enhancing the delivery of resveratrol in humans: if low bioavailability is the problem, what is the solution? Molecules. 2014; 19:17154-17172
 - Chen M, Du ZY, Zheng X et al. Use of curcumin in diagnosis, prevention, and treatment of Alzheimer's disease. Neural Regeneration Research. 2018; 13: 742-752
- SCIE. Why early diagnosis is important Dementia SCIE. https://www.scie. 15. org.uk/dementia/symptoms/diagnosis/early-diagnosis.asp Accessed: 13 September 2022
- 16. Huang P, Zheng N, Zhou H et al. Curcumin inhibits BACE1 expression through the interaction between ERB and NFkB signaling pathway in SH-SY5Y cells. Molecular and Cellular Biochemistry. 2020; 463: 161-173 17.
 - Williams RJ, Spencer JPE. Flavonoids, cognition, and dementia: actions mechanisms, and potential therapeutic utility for Alzheimer's disease. Free Radical Biology and Medicine. 2012: 52: 35-45
 - Letenneur L, Proust-Lima C, Le Gouge A et al. Flavonoid intake and cognitive decline over a 10-year period. American Journal of Epidemiology. 2007; 165: 1364-1371
 - Flanagan E, Müller M, Hornberger M et al. Impact of flavonoids on cellular and molecular mechanisms underlying age-related cognitive decline and neurodegeneration. Current Nutrition Reports. 2018; 7: 49-57
- 20. Cole SL, Vassar R. The Alzheimer's disease β-secretase enzyme, BACE1. Molecular Neurodegeneration. 2007; 2: 22
- 21. Zhang R, Zhang L, Li Z et al. Green tea improves cognitive function through reducing AD-pathology and improving anti-oxidative stress capacity in Chinese middle-aged and elderly people. Frontiers in Aging Neuroscience. 2022: 14: 919766
 - Singh NA, Mandal AKA, Khan ZA. Potential neuroprotective properties of epigallocatechin-3-gallate (EGCG), Nutrition Journal, 2016: 15: 60
 - Mandal PK, Shukla D, Tripathi M et al. Cognitive improvement with glutathione supplement in Alzheimer's disease: a way forward. Journal of Alzheimer's Disease: JAD. 2019; 68: 531–535
- Singh NA, Mandal AKA, Khan ZA. Potential neuroprotective properties of 24. epigallocatechin-3-gallate (EGCG). Nutrition Journal. 2016; 15: 60
- 25. Chan AKY, Tamrakar M, Jiang CM. Common medical and dental problems of older adults: a narrative review. Geriatrics. 2021; 6: 76
- Cichero JAY. Age-related changes to eating and swallowing impact frailty: 26 aspiration, choking risk, modified food texture and autonomy of choice. Geriatrics. 2018; 3: 69
- 27. Azzolino D, Passarelli PC, De Angelis P et al. Poor oral health as a determinant of malnutrition and sarcopenia. Nutrients. 2019; 11: 2898
- Santos JR, Gois AM, Mendonça DMF et al. Nutritional status, oxidative stress 28. and dementia: the role of selenium in Alzheimer's disease. Frontiers in Aging Neuroscience. 2014: 6: 206
- Onozuka M, Fujita M, Watanabe K et al. Age-related changes in brain region-29. al activity during chewing: a functional magnetic resonance imaging study. Journal of Dental Research. 2003; 82: 657-660
 - Preston AR, Eichenbaum H. Interplay of hippocampus and prefrontal cortex in memory. Current Biology: CB. 2013; 23: R764-R773
 - Li M, Long C, Yang L. Hippocampal-prefrontal circuit and disrupted functional connectivity in psychiatric and neurodegenerative disorders. BioMed Research International. 2015; 2015: 810548
 - Utsugi C, Miyazono S, Osada K, Sasajima H, Noguchi T, Matsuda M et al (2014) Hard-diet feeding recovers neurogenesis in the subventricular zone and olfactory functions of mice impaired by soft-diet feeding. PLoS One; 9: e97309
 - Kubo K, linuma M, Chen H. Mastication as a stress-coping behavior. BioMed Research International. 2015; 2015: e876409
- Chun H, Doo M, Factors related to depression associated with chewing 34 problems in the Korean elderly population. International Journal of Environmental Research and Public Health. 2021; 18: 6158

- Cho MJ, Kim EK. Subjective chewing ability and health-related quality of life among the elderly. Gerodontology. 2019; 36: 99-106
- 36. Green R, Cupples LA, Kurz A, et al. Depression as a risk factor for Alzheimer's disease: The MIRAGE Study. Archives of Neurology. 2003; 60: 753–759
- Ly M, Karim HT, Becker JT et al. Late-life depression and increased risk of dementia: a longitudinal cohort study. Translational Psychiatry. Transitional Psychiatry. 2021; 11: 147–157
- 38. Brown GC. Living too long. EMBO Reports. 2015; 16: 137-141
- WHO. Dementia. https://www.who.int/news-room/fact-sheets/detail/dementia Accessed 7 October 2022

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The use and effectiveness of cohorting RSV paediatric patients in infection control – a review of the evidence

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Abstract

Respiratory syncytial virus (RSV) is a contributing factor to an epidemic of respiratory tract infections every year, resulting in significant illness and hospitalisation for many children up to two years of age. As RSV is classified as a 'droplet infection', patients are typically placed in a single room, so as to reduce nosocomial transmission. However, there are potential adverse effects to patient safety and wellbeing by using single rooms. For example, healthcare workers are around two times less likely to enter a single/isolation room than see patients not in cubicles. This means patients are not reviewed or checked as frequently as those not isolated. Due to limited availability of single rooms and the potential adverse effects of single rooms, cohorting children with the same infection may be an alternate safe option. The search strategy identified relevant papers that included primary search terms such as 'RSV' or 'infection control' since 2009. Cohorting was shown to reduce nosocomial transmission by 39-67% indicating that it is an effective infection control measure. Considering the costs of nosocomial infections, it can be argued that an infection control plan which includes cohorting patients is both effective at preventing transmission and cost effective. However, there is insufficient evidence to suggest cohorting should replace single room use in clinical practice.

Abbreviations

RNA - Ribonucleic acid RSV – Respiratory syncytial virus

Introduction

Respiratory syncytial virus (RSV) is an RNA virus that is the most common respiratory pathogen in infants worldwide.¹ In addition to being highly contagious, it commonly leads to severe infections such as bronchiolitis and pneumonia, both of which are causes of infant mortality. RSV has seven to nine times more deaths than influenza and significantly more morbidity and mortality in children than SARS-CoV-2.^{2,3,4} Symptoms for RSV start two to five days after contact with the virus; common symptoms include: runny nose, fever, cough, difficulty eating, drinking and swallowing, wheezing, apnoea, flaring of the nostrils and respiratory distress.⁵ Symptoms may not arrive all at once but in stages, with infants only displaying irritability, decreased activity, apnoea or breathing difficulties.⁶

RSV is highly transmissible making it a major nosocomial problem (infections arising as a result of a stay in hospital) for paediatric wards.^{5,7} It is transmitted via airborne droplets, which land on fomites such as beds, toys and furniture. These can survive for up to six hours as well as living on contaminated skin for around 25 minutes.⁸ Therefore, this is an important topic for infection control in hospitals. The purpose of this review is to examine the evidence for potential measures to prevent transmission of RSV in hospitals; in particular, the evidence for the effectiveness of 'cohorting' and any potential risks or hazards associated with it.

A cohort area is a bay or ward in which a group of patients with the same infection are placed.⁷ A cohort of patients can be chosen based on the clinical diagnosis, microbiological confirmation, epidemiology and mode of transmission of the infection. It is an alternate solution to an isolation room or a single room to prevent transmission. This review will compare cohorting patients with the use of single rooms which are defined as "room with a self-contained toilet and its own hand basin".⁹

Methods

Critical literature review

For this literature review Primo, Pubmed and Google Scholar were searched from January 2009 to December 2021 to identify relevant

The search strategy employed the primary search terms of interest: 'RSV,' cohorting', 'infection control', and 'nosocomial' to identify studies specific for the population of RSV paediatric patients. Studies looking at cohorting with non-RSV infections were also included if they were either: other droplet-based infections, or had reviewed the impact of an infection control measure on patient wellbeing. The search was restricted to papers published in the preceding 10-year period. Several papers published prior to this were selected from citations in review articles previously identified. These were included due to their contribution to the evidence base in relation to underlying guidelines.

Results

The original search identified several papers that were not relevant to this review as they did not focus on nosocomial transmission or infection control. On screening, the papers that did not contain at least two of the primary search terms in the title or abstract were excluded. In the search conducted in 2019, 23 papers were reviewed and assessed for eligibility and 10 were excluded. The 2021 search found an additional seven that needed to be reviewed and from that five were excluded. From citations in those studies an additional seven papers were identified that were published before 2009 and have been included in the number screened. The search results are seen in **Figure 1** and **Figure 2** below. Systematic database searches were supplemented by a manual search of Google Scholar. This returned a large proportion of studies that were not relevant.



Use of cohorting as an infection control measure

When considering whether cohorting is an appropriate infection control measure, many factors are taken into consideration. With regard to the type of infection, a risk assessment taking into account the typical route of transmission as well as symptoms is the first factor. Symptoms that increase the risk of cross transmission are vomiting, diarrhoea and respiratory symptoms. Current protocol states if an isolation room is available then it should be used if the microorganism is airborne.¹⁰ According to Public Health England, a single room should be used if the microorganism is spread by contact or droplet route where available.^{10,11} Therefore, as RSV is transmitted by contact with droplets, single rooms are optimal. However, in the UK, there is a seasonal epidemic of respiratory tract infections in hospitals with RSV bronchiolitis being responsible for around one in six of all UK paediatric admissions.¹² In these circumstances, accommodating each patient in their own single room may not be possible.¹³ Furthermore, single rooms may not be the best way to control the spread of infection whilst providing optimal patient care.

The overall goal in preventing a breakout of RSV infection within a hospital is to stop or reduce nosocomial transmission.¹³ Hospital acquired RSV infections are associated with negative clinical outcomes, including increased mortality and longer length of stay.^{8,14} A systematic review in 2016 estimated the median risk of transmission for RSV in hospitals to be 28.5%.¹⁵ For comparison, an estimate done of the risk of nosocomial transmission when a patient is admitted into an Ebola holding unit in Sierra Leone was 3.3% or less.¹⁶ This high transmission rate demonstrates the need for effective infection control (including aseptic techniques, environmental factors and staff training) across any hospital setting. To reduce nosocomial transmission, infection control measures need to be thorough, involving compliance of the staff as well as the patient's family, regardless of single room or cohort arrangements.

An example of effective cohorting was shown in a study looking at the infection control of an outbreak of diverse multi-drug resistant organisms which used some of the strictest control measures.¹⁷ In this study, six patients were isolated in the intensive care unit of the hospital with people traffic redirected away from the entrance to the ward and nursing staff being assigned to only those patients within the cohort. This method improved hand hygiene and reduced hospital acquired infections by reducing the interactions that staff have with isolation patients whilst infected patients were treated. Since the start of 'super-isolation' cohorting there were no infections transmitted nosocomially over the patients' hospital stay of up to 117 days. This demonstrates that when cohorting is used, and compliance to infection control measures are high, it is an effective way of diminishing nosocomial transmission.¹⁷

In order to reduce nosocomial transmission from RSV paediatric patients during epidemics, one option is to isolate vulnerable (non-RSV infected) patients that have the highest risks of complications from infection. Vulnerable patients include immunocompromised or premature infants.¹⁸ The vulnerable patients in single rooms are placed away from other infants with RSV, followed by which RSV patients can be accommodated in separate rooms or cohorted with other infants with the same infection. Apart from the location of the patient, there are several other factors involved in achieving effective infection control. Cohorting staff, equipment and toys, as well as explaining to parents about droplet infections and the precautions that need to be upheld, are essential.^{19,22} When these are adhered to in children with RSV infections, nosocomial transmission can be reduced by 39-67%, thereby highlighting these steps to be effective intervention.^{20,21}

The effect of cohorting on patient safety

Hospital guidelines in the UK regarding infection control for RSV patients are very clear.¹⁰ There is research into the effects on patient safety when a patient is put into a single room, however, there is minimal evidence to compare this within cohorting patients with the same infection. A systematic review of the psychological wellbeing of patients in isolation rooms found a negative impact on the patients' mental health.²³ The patients' satisfaction was affected and their behaviour and psychology showed higher amounts of anger, anxiety and depression. Kirkland and Weinstein found that healthcare workers were around two times less likely to enter the rooms of patients in contact isolation which may result in adverse outcomes.²⁴ This suggests that there may be adverse effects of isolating patients. The negative consequences of patients in isolation

has been recorded in a systematic review with meta analysis looking at the impact of isolation on hospitalised patients who are infectious. The review indicated that there were higher levels of depression and anxiety with pooled standardised mean differences of 1.28 and 1.45, respectively. Although both had high levels of heterogeneity, there were also worse outcomes for a range of care-related factors.²⁵

These studies analysed the adult population and therefore the psychological harm may not be directly applicable to infants. However, the behaviour of healthcare professionals in the context of isolation rooms are likely to be just as relevant for infants, particularly if parents are not staying with them. The perceptions of different healthcare professionals on the effects of isolation on patients are not universal. Khan et al found that nursing staff did not think there was any difference in care between isolation patients and others, but physicians believed patients were more prone to adverse events if they were in isolation.²⁶ Healthcare staff have 90% compliance with infection control measures for patients in single rooms.²² However, the fact that patients may not be monitored as closely as they would be when cohorted shows that patient safety may be compromised to uphold proper infection control. Mansbach found that one in three infants with viral bronchiolitis will have multiple infections at the point of admission, which raises issues around transmission of other viruses while in the cohort.27

Cost-effectiveness

There is a clear annual burden of RSV and other respiratory tract infections on NHS resources so if patient safety is not adversely affected by cohorting, using it to replace single room use could decrease the strain on beds that arrives every winter.¹³ However, cohorting also requires rapid RSV testing at additional cost. Infection control measures, such as personal protective equipment, have associated costs that need to be taken into account. The estimated average cost of each nosocomial infection prevented is estimated to be around \$170,228; although this is from an American study and costs may be different in the UK setting. Considering the costs of nosocomial infections, the authors concluded that a targeted infection control plan including cohorting patients is both effective and economically worthwhile.²⁸

Discussion

Evidence suggests that cohorting is effective in reducing nosocomial transmission and may not possess some of the potential disadvantages of isolating patients. Negative effects such as decreased monitoring and adverse mental health outcomes in single rooms are well documented. However, there remains some unanswered questions with regard to patient safety. There is a concern of cross-infection with other viruses between cohorting infants with one type of infection as they may still infect each other with other viruses. Therefore, patient safety in the cohort room is compromised as nosocomial transmission between cohorted patients can still occur. The potential for a decrease in patient monitoring, and therefore safety, in single rooms is also a potential harm. This in addition to the negative effects of isolation on wellbeing would have been compounded by the decreased visits during the pandemic. As there is decreased hand hygiene compliance and monitoring in single rooms, there is an impact in the effectiveness of infection control measures. Nosocomial transmission rates would be negatively affected by this decrease but this is not currently documented. The safety and wellbeing of the isolated patient must be balanced against the safety of other patients in the hospital. Cohorting patients with only RSV infections while isolating vulnerable patients or patients with multiple infections may remove such a compromise.

Conclusion

When creating a targeted infection control plan there is clear value in using cohorting during seasonal outbreaks of RSV to reduce

nosocomial transmission. It is economically valuable and effective as a control measure. However, there is a need for further research into the effects on patient safety in the cohort or research comparing both methods against each other for the purposes of an informed evaluation of current guidelines. Research including factors such as compliance and frequency of patient monitoring, in addition to patient mental wellbeing, would be valuable across both settings. Cohorting should still be considered when developing an infection control plan in preparing for seasonal epidemics of RSV due to its benefits in practicality as well as in patient mental wellbeing. As hospitals recover from a pandemic, an infection control plan for upcoming seasonal epidemics should focus on whether these measures are achievable with reduced resources. To conclude, cohorting patients may be a more effective strategy to reduce nosocomial transmission compared to isolation, and more suitable when staff and equipment resources are limited.

Author contribution

All substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work were by the listed author. I partook in the drafting of the work and revising it critically for important intellectual content and for final approval of the version to be included in INSPIRE at all stages.

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References

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- Nair H, Nokes DJ, Gessner BD, Dherani M, Madhi SA, Singleton RJ, O'Brien KL, Roca A, Wright PF, Bruce N, Chandran A. Global burden of acute lower respiratory infections due to respiratory syncytial virus in young children: a systematic review and meta-analysis. The Lancet. 2010 May 1;375(9725):1545-55.
- Thompson WW, Shay DK, Weintraub E, Brammer L, Cox N, Anderson LJ, Fukuda K. Mortality associated with influenza and respiratory syncytial virus in the United States. Jama. 2003 Jan 8;289(2):179-86.
 Wald ER. Schmit KM, Gusland DY. A pediatric infectious disease perspec-
 - Wald ER, Schmit KM, Gusland DY. A pediatric infectious disease perspective on COVID-19. Clin Infect Dis. 2020 Aug 7:ciaa1095. doi: 10.1093/cid/ ciaa1095.
 - Alkan Ozdemir S, Soysal B, Calkavur S, Gökmen Yıldırım T, Kıymet E, Kalkanlı O, Çolak R, Devrim İ. Is respiratory syncytial virus infection more dangerous than COVID 19 in the neonatal period? J Matern Fetal Neonatal Med. 2020 Nov 22:1-6. doi: 10.1080/14767058.2020.1849125.
 - Aitken C, Jeffries DJ. Nosocomial spread of viral disease. Clinical Microbiology Reviews. 2001 Jul 1;14(3):528-46.
 - National Center for Immunization and Respiratory Diseases (NCIRD), Division of Viral Diseases. Centres for Disease Control and Prevention. Respiratory syncytial virus infection (RSV): symptoms and care Last reviewed: 2018 Jul. Available from: https://www.cdc.gov/rsv/about/symptoms.html Accessed: 23 April 2023.
 - Drysdale SB, Green CA, Sande CJ. Best practice in the prevention and management of paediatric respiratory syncytial virus infection. Therapeutic advances in infectious disease. 2016 Apr;3(2):63-71.
 - Hall CB, Douglas Jr RG, Geiman JM. Possible transmission by fomites of respiratory syncytial virus. Journal of Infectious Diseases. 1980 Jan 1;141(1):98-102.
 - Humphreys H, Grundmann H, Skov R, Lucet JC, Cauda R. Prevention and control of methicillinresistant Staphylococcus aureus. Clinical Microbiology & Infection 2009 Feb;15(2):120-4.
 - Respiratory Diseases Department, National Infections Service, PHE. Public Health England, Infection control precautions to minimise transmission of acute respiratory tract infections in healthcare settings. Last reviewed: 2016 Nov. Available from: https://assets.publishing.service.gov.uk/government/ uploads/system/uploads/attachment_data/file/585584/RTI_infection_control_guidance.pdf Accessed: 23 April 2023

- Kilpatrick C, Prieto J, Wigglesworth N. Single room isolation to prevent the transmission of infection: development of a patient journey tool to support safe practice. British Journal of Infection Control. 2008 Nov:9(6):19-25.
- Oxford Vaccine Group, Respiratory Syncytial Virus (RSV). Vaccine Knowledge Project. Respiratory Syncytial Virus (RSV). Reviewed: 2019 Nov. Available from: https://vk.ovg.ox.ac.uk/vk/rsv. Accessed: 23 April 2023
- Mills JM, Harper J, Broomfield D, Templeton KE. Rapid testing for respiratory syncytial virus in a paediatric emergency department: benefits for infection control and bed management. J Hosp Infect. 2011 Mar;77(3):248-51.
- Simon A, Müller A, Khurana K, Engelhart S, Exner M, Schildgen O. Nosocomial infection: a risk factor for a complicated course in children with respiratory syncytial virus infection – results from a prospective multicenter German surveillance study. Int J Hyg Environ Health. 2008 211: 241–250.
- French CE, McKenzie BC, Coope C, Rajanaidu S, Paranthaman K, Pebody R, Nguyen-Van-Tam JS, Noso-RSV Study Group, Higgins JP, Beck CR. Risk of nosocomial respiratory syncytial virus infection and effectiveness of control measures to prevent transmission events: a systematic review. Influenza and other respiratory viruses. 2016 Jul;10(4):268-90.
- 16. Arkell P, Youkee D, Brown CS, Kamara A, Kamara TB, Johnson O, Lado M, George V, Koroma F, King MB, Parker BE. Quantifying the risk of nosocomial infection within Ebola Holding Units: a retrospective cohort study of negative patients discharged from five Ebola Holding Units in Western Area, Sierra Leone. Tropical Medicine & International Health. 2017 Jan;22(1):32-40
- Rosenberger LH, Hranjec T, Politano AD, Swenson BR, Metzger R, Bonatti H, Sawyer RG. Effective cohorting and "superisolation" in a single intensive care unit in response to an outbreak of diverse multi-drug-resistant organisms. Surgical infections. 2011 Oct 1;12(5):345-50.
- Mlinarić-Galinović G, Varda-Brkić D. Nosocomial respiratory syncytial virus infections in children's wards. Diagnostic microbiology and infectious disease. 2000 Aug 1;37(4):237-46.
- Tablan OC, Anderson LJ, Arden NH, Breiman RP, Butler JC, McNeil MM, Hospital Infection Control Practices Advisory Committee. Guideline for prevention of nosocomial pneumonia. Infection Control & Hospital Epidemiology. 1994 Sep;15(9):588-627.
- Madge P, Paton JY, McColl JH and Mackie, PLK. Prospective controlled study of four infection-control procedures to prevent nosocomial infection with respiratory syncytial virus. The Lancet. 1992 340(8827), pp.1079-1083.
- Isaacs D, Dickson H, O'Callaghan C, Sheaves R, Winter A and Moxon ER. Handwashing and cohorting in prevention of hospital acquired infections with respiratory syncytial virus. Archives of disease in childhood. 1991 66(2), pp.227-231.
- 22. Groothuis J, Bauman J, Malinoski F, Eggleston M. Strategies for prevention of RSV nosocomial infection. J Perinatol. 2008 28: 319–323.
- Abad C, Fearday A, Safdar N. Adverse effects of isolation in hospitalised patients: a systematic review. Journal of Hospital Infection. 2010 Oct 1;76(2):97-102.
- 24. Kirkland KB, Weinstein JM. Adverse effects of contact isolation. The Lancet. 1999 Oct 2;354(9185):1177-8
- Purssell E, Gould D and Chudleigh J. Impact of isolation on hospitalised patients who are infectious: systematic review with meta-analysis. BMJ Open. 2020 10(2), p.e030371.
- Khan FA, Khakoo RA, Hobbs GR. Impact of contact isolation on healthcare workers at a tertiary care center. American Journal of Infection Control. 2006 Sep 1;34(7):408-13.
- 27. Mansbach J, Piedra P, Teach S, Ashley F, Forgey T, Clark S. Prospective, multicenter study of viral etiology and hospital length-of-stay in children with severe bronchiolitis. Arch Pediatr Adolesc Med. 2012 166: 700–706
- Macartney K, Gorelick M, Hodinka R et al. Cost effectiveness of an infection control program to reduce nosocomial respiratory syncytial virus infection. 875. Pediatr Res. 1998 43, 151



Josh Roderick

Hello! I'm Josh, a fourth year medical student studying at Peninsula Medical School, Plymouth University. My current medical career interests are in infectious disease, paediatrics and academia so being able to write this review and get involved in the research process has been really exciting for me. In my spare time I love

surfing in South Devon and Cornwall, playing basketball and visiting Dartmoor National Park when the weather allows.

Evaluating the use of selective serotonin reuptake inhibitors (SSRIs) in patients with neurodevelopmental disorders, autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD)

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Abstract

Background Autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) are neurodevelopmental conditions that cause a significant risk of comorbid disorders such as anxiety and depression. Therefore, many individuals with neurodevelopmental disorders are prescribed mood regulating medication such as selective serotonin reuptake inhibitors (SSRIs).

Aim The primary aim of this service evaluation is to find out the proportion of Child and Adolescent Mental Health Service (CAMHS) patients with ASD or ADHD that are prescribed SSRIs.

Method A total of 60 individuals with ASD or ADHD between the ages of 11 and 18 were found to be under the care of CAMHS at St. David's Hospital, Cardiff. Digital notes of these patients, stored on the healthcare software 'Paris', were then reviewed.

Results 33 patients were prescribed SSRIs. 20 (60.6%) of those had ASD alone, 5 (15.2%) had ADHD alone and 8 (24.2%) had both ASD and ADHD. Sixty-five per cent of the study population had at least one comorbidity, with anxiety disorders being the most common (n=21, 35.0%).

Conclusion These findings are consistent with previous research, suggesting that a significant proportion of individuals with ASD and/ or ADHD also have comorbid psychiatric conditions, and many of them require treatment with SSRIs.

Abbreviations

ADHD – Attention deficit hyperactivity disorder ASD – Autism spectrum disorder CAMHS – Child and Adolescent Mental Health Services SSRIs – Selective serotonin reuptake inhibitors

Introduction

Autism spectrum disorder (ASD) is a common neurodevelopmental disorder characterised by difficulties in social interaction, communication, and repetitive or restrictive behaviours. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) outlines the core symptoms of ASD, which include deficits in developing relationships, social-emotional reciprocity, and nonverbal behaviours used for social interaction.¹

Individuals with ASD are also at a higher risk of having conditions such as attention deficit hyperactivity disorder (ADHD), a neurodevelopmental condition which is characterised by symptoms of inattention, hyperactivity and impulsivity.² The spectrum of ASD and ADHD disorders show considerable overlap in presentation.³

Increasing evidence suggests that depression and anxiety are very prevalent comorbidities in both ASD and ADHD.^{2,4} These conditions can have a significant impact on an individual's daily life, leading to difficulties in relationships and functioning. As a result, many patients

with ASD or ADHD are prescribed antidepressant medication, specifically selective serotonin reuptake inhibitors (SSRIs). SSRIs can regulate mood and reduce symptoms of depression and anxiety.

This service evaluation therefore aims to analyse ASD and ADHD patients in the Child and Adolescent Mental Health Service (CAMHS) at St David's Hospital. CAMHS is an NHS run service that assesses and treats young people with significant mental health problems. They are involved in the care of some of the more complex cases from the separate neurodevelopmental and community services.

Despite the significance of comorbid psychiatric conditions being well cited in the literature, there is currently little research into the use of SSRIs in this specific population with neurodevelopmental conditions in CAMHS. Thus, the evaluation aims to find how significant SSRI use is in CAMHS patients with ASD or ADHD, to be able to address the needs and treatment options of these children with complex comorbidities.

The evaluation aims to achieve the following objectives: 1. Find out the proportion of CAMHS patients with ASD or ADHD that are prescribed SSRIs. 2. Compare SSRI use in ASD and ADHD in male and female patients. 3. Compare SSRI use in ASD and ADHD and additional diagnoses.

Methods

The research method used was a retrospective data analysis, where data was collected from patients' medical records after they had been involved in treatment. All patients who had received treatment for ASD or ADHD at St David's Hospital CAMHS and were under the age of 18 years on 31 March 2023, were included. Those awaiting a formal assessment for neurodevelopmental conditions were excluded for the purpose of this evaluation, as their diagnosis was not yet confirmed.

To collect data for this study, all doctors in the service were asked to provide a list of their current patients with ASD and ADHD, including names and PARIS ID numbers for each patient. PARIS is the electronic care record system used to store information about patients. It allows healthcare professionals to access patients' up to date, relevant medical history, securely.

The PARIS system allowed clinical information, including sex and age of the patient to be recorded, both of which are important demographic factors. All correspondence and case notes from healthcare professionals were then reviewed to determine the diagnosis of ASD and ADHD in each individual. Additional diagnoses, such as anxiety and depression, were only noted if the correspondence explicitly described a diagnosis. If the information gathering on the PARIS system did not verify any of these details, the case note holder, usually the patient's doctor, was consulted to find out. This approach ensured that the results were based on confirmed diagnoses. The latest prescribed medication, dose and frequency were also recorded to determine which patients were prescribed SSRIs.

This data was organised using a password protected Microsoft Excel spreadsheet, with all patient identifiable information removed to maintain confidentiality. Analysis of the results was also performed on Excel.

As all information used in the study was collected from previous routine clinical care, as a service evaluation, ethical approval was not required. Patient confidentiality and privacy were ensured throughout the study to protect patients' rights.

Results

Sixty patients were recruited for the service evaluation, with an age range from 11—18 years. Of these, 26 (43.3%) had a diagnosis of ASD alone, 20 (33.3%) had ADHD alone, and 14 (23.3%) had both ASD and

ADHD. Thus, the total number of individuals with ASD was 40 (66.7%), and with ADHD, 34 (56.7%).

The number of males and females were roughly equal, with 31 male (51.7%) and 29 (48.3%) female. Of the 31 male patients, 9 (29.0%) were diagnosed with ASD, 15 (48.4%) with ADHD, and 7 (22.6%) with both. Of the 29 female patients, 17 (58.6%) were diagnosed with ASD, 5 (17.2%) with ADHD, and 7 (24.1%) with both.

When considering the use of SSRIs in this demographic, overall, 33 patients were found to be on SSRIs, 55.0% of all patients with a neurodevelopmental condition. The prescription of SSRIs varied with the specific diagnosis; 20 (60.6%) were on SSRIs with ASD alone, 5 (15.2%) with ADHD alone and 8 (24.2%) with both ASD and ADHD. **Figures 1-3** demonstrate these proportions, and the variation with males and females.

The study also analysed the prevalence of additional diagnoses and found a result of 39 out of 60 patients with at least one comorbidity. Of particular importance, anxiety disorders were the most common (n=21, 35.0%). Furthermore, 9 (15.0%) patients had a diagnosis of depression/depressive episode, 2 (3.3%) had OCD, and 4 (6.7%) had Tourette's. **Figure 4** summarises the proportion of SSRI use with diagnosis of anxiety and mood disorders.

Of the 33 patients on SSRIs, sertraline was prescribed most often (n=18), followed by fluoxetine (n=14) and citalopram (n=1). An additional finding was the frequent use of Circadin, which contains the active substance melatonin. 18 (30.0%) patients were prescribed Circadin at differing doses to help with sleep.

Discussion

The data provided shows the demographic breakdown of individuals with the neurodevelopmental disorders ASD and ADHD, in addition to any comorbid psychiatric conditions and their medication history. The findings show that a diagnosis of ASD alone was most prevalent in the sample population, 10% higher than the prevalence of ADHD. This is in contrast to the general UK population, where there is a higher prevalence of ADHD than ASD.^{5,6} However, the existence of an ADHD clinic for less complex cases, separate to general CAMHS, could account for the lower number of children with ADHD found. It is also noteworthy that a substantial number of individuals were diagnosed with both ASD and ADHD, as this dual diagnosis is relatively common in clinical practice.⁷

Out of the 60 patients in total, the evaluation considered a nearly equal ratio of boys and girls. The results indicate that more males than females were diagnosed with ADHD, while more females were diagnosed with ASD. It is interesting to observe the high proportion of autistic girls in CAMHS because much of the literature shows that both conditions normally predominate in males, with a male to female ratio of approximately 3:1.^{5,6,8} There is much debate regarding the true prevalence as there are many differences in samples and because there tends to be a gender bias, where girls have a disproportionate risk of not being diagnosed.

The higher rate of girls with ASD found in this research could therefore be due to the nature of CAMHS itself. Due to CAMHS' involvement in highly complex cases, the healthcare team are likely to be particularly experienced in noticing and diagnosing neurodevelopmental conditions, even in girls. Compared to symptomatic children in the community or seeing GPs or paediatricians, the CAMHS team have longer to spend with a child and are well versed in symptoms to look out for in girls. Thus, the underreporting of autistic traits in the community⁹ are caught by the service. It is widely found that females are diagnosed with ASD much later than males.¹⁰ As CAMHS caters towards older children, it is likely that missed diagnoses in girls are caught up when they enter the service.

In terms of comorbid psychiatric conditions, the prevalence varies

widely, due to the wide spectrum of neurodevelopmental conditions. However, it is estimated that around 40% of children with ASD have at least one comorbid anxiety disorder,¹¹ and around 30% for depressive disorders.¹² In addition, around 15-35% of children with ADHD have a comorbid anxiety disorder, and 12-50%, a depressive disorder.¹³Therefore, the values in CAMHS match the trend in broader data, where there are much higher rates of comorbid psychiatric conditions, and where anxiety is the most common. The significant proportion of patients with additional diagnoses and on SSRIs in the study population could again, be due to the specialised features of CAMHS, where compared to community services, a disproportionate number of children with complex comorbid emotional disorders are seen.¹⁴ Figure 4 demonstrates the strong link between anxiety and depression, and the use of SSRIs – CAMHS patients with a psychiatric condition were more likely to be on SSRIs than the average CAMHS patient with a neurodevelopmental condition.

As in the literature, the disparities between the sexes extend to the prescription of SSRIs too. **Figure 3** shows that females in CAMHS are generally prescribed SSRIs more often than males, whichever neurodevelopmental conditions they have. This could be due to the higher rate of anxiety and depression in women in the wider population.^{15,16}

In the service studied, it is significant to find that sertraline was the most prescribed SSRI despite NICE guidelines recommending fluoxetine as the optimal treatment for young people.¹⁷ Although, this could be due to the fact sertraline is commonly prescribed second line, after a trial of fluoxetine. This was seen in the clinical notes for some patients with severe psychological disorders.

Use of other medication such as melatonin is also significant as it regulates sleep, which is commonly disturbed in children with ASD and ADHD. Levels of melatonin are often low in children with these conditions. Thus, the incidental finding of 30.0% of patients on melatonin reinforces research that show its use in children with neurodevelopmental disorders.¹⁸

The main strength of this retrospective data analysis is the ability to analyse the whole CAMHS population with ASD and ADHD, quickly, and cost effectively. As the data was already collected for clinical purposes, more time could be spent examining the use of SSRIs in this population.

On the other hand, the main limitation of the study is the small sample size of 60 individuals that reduces generalisability to the general population. In addition, there was no analysis of other demographic factors such as economic background and ethnicity, which can significantly alter research outcomes. Finally, as there is much overlap between the multiple children's mental health services, there is likely to be overlap in the patient populations. This makes it difficult to identify true subsets of children with comorbidities.

Conclusion

In conclusion, the majority (n=39, 65.0%) of children with ASD and/ or ADHD in CAMHS have at least one comorbid psychiatric condition, with anxiety, then depression, being the most common. 55.0% of all patients with a neurodevelopmental condition are on SSRIs to regulate symptoms of these comorbidities. Females in CAMHS were generally found to be prescribed SSRIs more often than males, despite which neurodevelopmental condition they had.

Unfortunately, because of the small sample size and limited population that could be enrolled into the study, it is difficult to determine a conclusion that could be applied to the general population. However, the results found are hugely beneficial for evaluating the specific mental health service. The data provided sheds light on the demographic characteristics and significant comorbidity burden on patients with neurodevelopmental disorders, specifically ASD and ADHD. The variance in SSRI use with different comorbidities, and different sex, highlights the importance of conducting further research into the efficacy of SSRIs within these demographics and further populations. Overall, the substantial number of children requiring SSRIs indicates the necessity for future research into the impact on patients, long-term effects of SSRIs, and other treatment options available.

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Contribution statement

The author was solely responsible for the collection, analysis, and interpretation of all the data involved. The author was involved in the drafting of the work and gave approval for the final version to be included in INSPIRE.



Figure 1. Flow chart noting the number of individuals with neurodevelopmental conditions prescribed SSRIs.



Figure 2. Flow chart noting the number of individuals with neurodevelopmental conditions according to gender.



Figure 3. Chart showing the proportion of children with a neurodevelopmental condition that are prescribed SSRIs – ASD male SSRIs (n=7), ASD female SSRIs (n=13), ADHD male SSRIs (n=2), ADHD female SSRIs (n=3), Both male (n=2), Both female (n=6).



Figure 4. Chart showing the proportion of children taking SSRIs with comorbid anxiety and depression, compared to the average proportion taking SSRIs in the CAMHS study population.

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References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders : DSM-5: Arlington, Va. : American Psychiatric Association; 2013.
- Lord C, Brugha TS, Charman T, et al. Autism spectrum disorder. Nature reviews Disease primers. 2020;6(1):5-.
- Morris-Rosendahl DJ, Crocq M-A. Neurodevelopmental disorders-the history and future of a diagnostic concept. Dialogues in clinical neuroscience. 2020;22(1):65-72.
- Tarver J, Daley D, Sayal K. Attention-deficit hyperactivity disorder (ADHD): an updated review of the essential facts. Child : care, health & development. 2014;40(6):762-74.
- NICE. Attention deficit hyperactivity disorder: How common is it? : NICE; 2022 [Available from: https://cks.nice.org.uk/topics/attention-deficit-hyperactivity-disorder/background-information/prevalence/#:~:text=ln%20 the%20UK%2C%20prevalence%20of,of%20approximately%203%20to%20 1.
- NICE. Autism spectrum disorder in under 19s: support and management: NICE; 2013 [Available from: https://www.nice.org.uk/guidance/cg170/ chapter/introduction#:~:text=Although%20autism%20was%20once%20 thought,diagnosed%20more%20frequently%20in%20boys.

- Rong Y, Yang C-J, Jin Y, et al. Prevalence of attention-deficit/hyperactivity disorder in individuals with autism spectrum disorder: A meta-analysis. Research in autism spectrum disorders. 2021;83:101759.
- Loomes RD, Hull LM, Mandy WPLDP. What Is the Male-to-Female Ratio in Autism Spectrum Disorder? A Systematic Review and Meta-Analysis. Journal of the American Academy of Child and Adolescent Psychiatry. 2017;56(6):466-74.
- Bargiela S, Steward R, Mandy W. The Experiences of Late-diagnosed Women with Autism Spectrum Conditions: An Investigation of the Female Autism Phenotype. Journal of autism and developmental disorders. 2016;46(10):3281-94.
- Giarelli EED, Wiggins LDPD, Rice CEPD, et al. Sex differences in the evaluation and diagnosis of autism spectrum disorders among children. Disability and health journal. 2010;3(2):107-16.
- van Steensel FJA, Bögels SM, Perrin S. Anxiety disorders in children and adolescents with autistic spectrum disorders: a meta-analysis. Clinical child and family psychology review. 2011;14(3):302-17.
- Hollocks MJ, Lerh JW, Magiati I, et al. Anxiety and depression in adults with autism spectrum disorder: a systematic review and meta-analysis. Psychological medicine. 2019;49(4):559-72.
- Gnanavel S, Sharma P, Kaushal P, et al. Attention deficit hyperactivity disorder and comorbidity: A review of literature. World journal of clinical cases. 2019;7(17):2420-6.
 Brattfiell ML, Jozefiak T, Wichstrøm L. Predictors of community versus spe-
 - Brattfjell ML, Jozefiak T, Wichstrøm L. Predictors of community versus specialty mental health service use: a prospective cohort study. European child & adolescent psychiatry. 2021;30(6):953-60.
 - McLean CP, Asnaani A, Litz BT, et al. Gender differences in anxiety disorders: Prevalence, course of illness, comorbidity and burden of illness. Journal of psychiatric research. 2011;45(8):1027-35.
- Shorey S, Ng ED, Wong CHJ. Global prevalence of depression and elevated depressive symptoms among adolescents: A systematic review and metaanalysis. British journal of clinical psychology. 2022;61(2):287-305.
- 17. NICE. Depression in children and young people: identification and management: NICE; 2019 [Available from: https://www-nice-org-uk.abc.cardiff. ac.uk/guidance/ng134.
- Rossignol DA, Frye RE. Melatonin in autism spectrum disorders: a systematic review and meta-analysis. Developmental medicine and child neurology. 2011;53(9):783-92.



15.

Sasangi Wickrama Gunaratne

I am currently a fourth year medical student at Cardiff University. My interest in medicine and psychiatry stems from a love of communicating with patients to get to the root of their problems. This is what led me to select a project in CAMHS for my third year SSC. Children seen in CAMHS are some of the most vulnerable, but psychiatry

is far behind general medicine in diagnosis and management. That is why I hope to contribute to mental health awareness and further research throughout my career.

VETERINARY

Resolution of diabetic neuropathy-associated tetraparesis and Horner's syndrome in a Labrador Retriever: a case report

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Abstract

This case report describes a 10-year-old neutered female Labrador with concurrent symptoms of weakness, ptosis, miosis, nictitating membrane prolapse, enophthalmos and diabetes mellitus. Insulin therapy initially improved the symptoms but failed to control hyperglycaemia. The dog was subsequently diagnosed with tetraparesis and Horner's syndrome due to diabetic neuropathy. Adjustments to insulin treatment improved glycaemic control but did not alleviate the neurological conditions. Gradual improvement was observed over three weeks, leading to complete resolution after five months. The neuropathic process involves glycation, oxidative stress and neural lesions.

Phenylephrine denervation hypersensitivity testing indicated a preganglionic lesion in the ocular sympathetic pathway. This case highlights the first diagnosis of diabetic neuropathy-related bilateral Horner's syndrome in a canine, expanding our understanding of clinical manifestations in diabetic neuropathy.

Keywords

Diabetic neuropathy; Tetraparesis; Horner's syndrome; Labrador Retriever; Canine diabetes mellitus; Glycation; Insulin therapy; Neural lesions; Ocular sympathetic pathway; Case report.

Abbreviations

BHS- bilateral Horner's syndrome CDM - canine diabetes mellitus OSP - ocular sympathetic pathway

Clinical condition and description of clinical presentation¹

A 10-year-old neutered female Labrador presented with general weakness, bilateral ptosis (drooping eyelids), miosis (pupil constriction), nictitating membrane prolapse, and enophthalmos (sunken eyes), in addition to concomitant symptoms of canine diabetes mellitus (CDM). A urinalysis confirmed CDM and daily insulin therapy commenced. Although the concomitant symptoms partially improved after eight days, uncontrolled hyperglycaemia persisted. The dog was diagnosed with lower motor neuron tetraparesis (weakness of all limbs) and bilateral Horner's syndrome (BHS), both attributed to the same diabetic neuropathy. The patient's glycaemic control improved after adjusting the insulin treatment to twice daily. However, there was no improvement in tetraparesis or BHS. After three weeks, there was a partial improvement in the neuropathy and complete resolution of tetraparesis, and BHS resolved at five months. The tetraparesis and BHS were caused by neural lesions, indicating a neuropathic process of glycation and oxidation stress.²

Glycation is a process where blood glucose binds to proteins, lipids, or nucleic acids, occurring without enzymes. In CDM, glycation is triggered by hyperglycaemia resulting from reduced insulin dependency.³ Excess glucose affects nerve tissue, impairing nerve cell function and structure.⁴ Over time, this process forms advanced glycation end products, accumulating systemically and causing BHS autonomic neuropathy.⁵

Phenylephrine was used topically for denervation hypersensitivity testing, causing significant pupillary dilation after 30 minutes. This indicates a preganglionic location for the BHS-causing lesion to

the ocular sympathetic pathway.⁶ BHS is a well-recognised diabetic neuropathy in humans.⁷ Although commonly diagnosed in canines⁸, this case marks the first published diagnosis of canine BHS as a clinical diabetic neuropathy.

Unlike humans, dogs lack anamnesis – the ability to describe symptoms verbally. Therefore, diagnosis relies on the observation of appearance or behaviour changes. Since dogs cannot verbally convey discomfort during physical examination, observing their posture and response to specific stimuli is crucial.⁹ Moreover, testing, such as imaging or invasive procedures, may be less practical and feasible for dogs than humans.

Relevant anatomy and physiology

Sympathetic nervous system

The sympathetic nervous system in all mammals is responsible for the "fight or flight" response, mobilising the body's energy and resources in response to a threat.¹⁰ The ocular sympathetic pathway (OSP) originates from the hypothalamus, descends through the brainstem, and emerges from the spinal cord at thoracic vertebrae T1-T3, synapsing at the cranial cervical ganglion.¹¹ The neurotransmitter acetylcholine is released by the fine terminal branches of the axon, binding to nicotinic cholinergic receptors at the postganglionic cell body.¹² From the cavernous sinus, post-ganglionic fibres run parallel to the ophthalmic division of the trigeminal nerve before synapsing at smooth muscle targets.⁶ A lesion anywhere along the OSP can cause BHS.¹³ In the case discussed, the lesion was localised to the preganglionic region. Such a localisation enables the potential for disruption of the sympathetic nervous system further along the pathway.

Canine diabetes mellitus may cause secondary bilateral Horner's syndrome in dogs and humans

Damage to the OSP by such underlying conditions as tumours, traumas, infections and neurological disorders can lead to symptoms of BHS. CDM can potentially result in diabetic neuropathy from nerve fibre degeneration and blood supply disruption to specific nerve structures such as the OSP.¹⁵ Interruption of blood flow reduces nerve function, namely mitochondrial stress, leading to increased dysfunction.¹⁶ Such damage in this neurological context is termed a lesion. This disruption interferes with the normal eye-related functioning of these nerves and may present as BHS.¹⁷ Consequently, BHS could be a secondary consequence of diabetic neuropathy.¹⁴ Importantly, CDM is not the primary causal factor behind BHS. Additionally, CDM showcases a spectrum of effects and uniquely impacts individuals. When diagnosing BHS as an indirect result of CDM, meticulous consideration of these two aspects is imperative.¹⁸ BHS presents similarly in humans and dogs, encompassing three classic signs: miosis, ptosis and enophthalmos.¹⁹ However, the fourth sign, anhydrosis (reduced sweating), can be challenging to identify in dogs.¹¹ Diagnosis in dogs necessitates special consideration due to differences in communication and examination techniques.

Autonomic neuropathic lesions

Prolonged uncontrolled CDM can damage neurons by glycation, a process whereby the accumulation of glucose end-product molecules leads to oxidative stress, inflammation and nerve damage.²⁰ Lesions can then form on nerves, disrupting function and causing diabetic neuropathy symptoms², including those observed in the above BHS case. Approximately fifteen post-ganglionic axons exit the cranial cervical ganglion for each preganglionic axon that enters, supplying the sympathetic nerve structures of the head and neck²¹, demonstrating how a lesion located on a preganglionic nerve of the OSP produces the varied symptoms in the above BHS case.

Innervation of the eyelids and nictitating membrane

Ptosis and nictitating membrane prolapse occur in this case due to the lesion interrupting sympathetic innervation of smooth muscle associated with their respective functions. The drooping eyelid is a result of the inability of the superior tarsal muscle to contract appropriately⁶, thereby narrowing the palpebral fissures.²² Similarly, the smooth muscle usually responsible for holding the nictitating membrane in place becomes impaired, leading to prolapse.²³ The patient's apparent enophthalmos results from ptosis and nictitating membrane prolapse.⁹ True enophthalmos is caused by a loss of volume in the orbit or function of extraocular muscles, unaffected by impaired sympathetic tone in this case.²⁴

Innervation of the iris dilator muscle

The iris dilator smooth muscle plays a crucial role in regulating the amount of light that enters the eye. It is innervated by sympathetic nerves, which contract myoepithelial cells to temporarily dilate the pupil during the "fight or flight" response. However, due to the interruption of the sympathetic pathway via lesion damage, the iris muscle remains relaxed, and the parasympathetic tone is unopposed in activating the iris sphincter smooth muscle.⁶ A lesion located on the preganglionic OSP would interrupt the innervation of the iris dilator muscle, which presents as miosis in this case.

Conclusion and treatment

Achieving control of the dog's glycaemic levels resolved the BHS symptoms. Maintaining glycaemic levels helps alleviate diabetic neuropathy symptoms by enhancing blood flow to vessels that supply the OSP, promoting nerve health and function. While a complete reversal of nerve damage may not be possible, a stable glycaemic environment can be conducive to nerve regeneration and repair. Continued control of glycaemic levels assists in minimising OSP dysfunction and supporting healthy mitochondrial function.¹⁶

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References

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- 1. Holland CT. Bilateral Horner's syndrome in a dog with diabetes mellitus. The Veterinary Record. 2007 May 12;160(19):662. Accessed: 6 September 2023
- Walker D, Siddique I, Anderson H, Gardiner TA, Archer DB, Boulton AJ, Malik RA. Nerve pathology in the type 1 diabetic dog: effects of treatment with sulindac. Journal of the Peripheral Nervous System. 2001 Dec;6(4):219-26.
- Sugimoto K, Yasujima M, Yagihashi S. Role of advanced glycation end products in diabetic neuropathy. Current pharmaceutical design. 2008 Apr 1;14(10):953-61.
 - Singh VP, Bali A, Singh N, Jaggi AS. Advanced glycation end products and diabetic complications. The Korean journal of physiology & pharmacology: official journal of the Korean Physiological Society and the Korean Society of Pharmacology. 2014 Feb;18(1):1.
 - Ognenovski V, Buras ED. Musculoskeletal disorders associated with diabetes. InDiabetes Mellitus 2020 Jan 1 (pp. 225-248). Academic Press.
- 6. Zwueste DM, Grahn BH. A review of Horner's syndrome in small animals. The Canadian Veterinary Journal. 2019 Jan;60(1):81.
- Smith SA, Smith SE. Bilateral Horner's syndrome: detection and occurrence. Journal of Neurology, Neurosurgery & Psychiatry. 1999 Jan 1;66(1):48-51.
 Misselbrook NG. Peripheral neuropathy in diabetic bitch. The Veterinary
 - record. 1987 Sep 19;121(12):287. Van den Broek AH. Horner's syndrome in cats and dogs: a review. Journal of
 - Van den Broek AH. Horner's syndrome in cats and dogs: a review. Journal of Small Animal Practice. 1987 Oct;28(10):929-40.

- Hernández-Avalos I, Flores-Gasca E, Mota-Rojas D, Casas-Alvarado A, Miranda-Cortés AE, Domínguez-Oliva A. Neurobiology of anesthetic-surgical stress and induced behavioral changes in dogs and cats: A review. Veterinary world. 2021 Feb;14(2):393. Accessed 6 September 2023.
- Penderis J. Diagnosis of Horner's syndrome in dogs and cats. In Practice. 2015 Mar;37(3):107-19.
- 12. Simpson KM, Williams DL, Cherubini GB. Neuropharmacological lesion localization in idiopathic H orner's syndrome in Golden Retrievers and dogs of other breeds. Veterinary Ophthalmology. 2015 Jan;18(1):1-5.
- Lockhart RL, Tzouganakis I, Tsvetanova A, Smith KM, Smith PM. The diagnostic yield of advanced imaging in dogs with Horner's syndrome presenting with and without additional clinical signs: A retrospective study of 120 cases (2000–2018). Veterinary Ophthalmology. 2022 May;25:51-9.
- 14. Kanagalingam S, Miller NR. Horner syndrome: clinical perspectives. Eye and brain. 2015 Apr 10:35-46.
- 15. Panciera RJ, Ritchey JW, Baker JE, DiGregorio M. Trigeminal and polyradiculoneuritis in a dog presenting with masticatory muscle atrophy and Horner's syndrome. Veterinary pathology. 2002 Jan;39(1):146-9.
- Fernyhough P, Roy Chowdhury SK, Schmidt RE. Mitochondrial stress and the pathogenesis of diabetic neuropathy. Expert review of endocrinology & metabolism. 2010 Jan 1;5(1):39-49.
- Mason RM, Wahab NA. Extracellular matrix metabolism in diabetic nephropathy. Journal of the American Society of Nephrology. 2003 May 1;14(5):1358-73.
- Kern TJ, Aromando MC, Erb HN. Horner's syndrome in dogs and cats: 100 cases (1975-1985). Journal of the American Veterinary Medical Association. 1989 Aug 1;195(3):369-73.

- Jaffe NS. Localization of lesions causing Horner's syndrome. AMA Archives of Ophthalmology. 1950 Nov 1;44(5):710-28.
 Weber K, Schmahl W, Münch G. Distribution of advanced glycation end products in the cerebellar neurons of dogs. Brain research. 1998 Apr 27;791(1-2):11-7.
- Maloney WF, Younge BR, Moyer NJ. Evaluation of the causes and accuracy of pharmacologic localization in Horner's syndrome. American journal of ophthalmology. 1980 Sep 1;90(3):394-402.
- 22. Mughal M, Longmuir R. Current pharmacologic testing for Horner syndrome. Current neurology and neuroscience reports. 2009 Sep;9(5):384-9.
- Mazzucchelli S, Vaillant MD, Wéverberg F, Arnold-Tavernier H, Honegger N, Payen G, Vanore M, Liscoet L, Thomas O, Clerc B, Chahory S. Retrospective study of 155 cases of prolapse of the nictitating membrane gland in dogs. Veterinary record. 2012 Apr;170(17):443-.
- 24. HS T. Disorder of pupillary function, accommodation, and lacrimation. Walsh & Hoyt's Clinical Neuro-ophthalmology. 1998;1:961-1040.



Adam Maher

Adam Maher is a veterinary science student at the University of Bristol, particularly interested in research and small animal emergency medicine. Adam is also an international theatre and opera director and probably the only undergraduate vet student with a Laurence Olivier award.



Shen Sheh

"The pencil sketch is a combination of bovine and cervine skulls, inspired by my learning of differences between horns and antlers in the second year of my veterinary degree at the Royal Veterinary College. With horns being slow-growing and permanent in contrast to antlers being grown and shed in cycles, it signified to me the profound relationship between life and death, growth and wear.

"It has been four years since I drew this; I have since graduated and am working as a small animal vet with aspirations to work towards progressing animal welfare and equality within the profession."





Anithra De Mel

"I'm a fourth year medical student at the University of Exeter and I've had a passion for art from a very young age. As I've grown older, I've held onto that passion and used it whenever I needed to wind down after a busy week.

These life drawings were a result of a medical humanities module facilitated by the university. It was inspired by the beauty and complexity of the human form and offered me a deeper understanding of the human anatomy and the vulnerability associated with the human condition. The mediums used were charcoal and white chalk on kraft paper."



Anna Gurung

"The project I created was made in part of a Student Selected Unit (SSU) for the fourth year of the University of Exeter Medical School. It is a part of my medical humanities project, where we explored Graphic Medicine. I wanted my stories to highlight racism within healthcare, with a special focus on microaggressions.

"This comic anthology endeavours to provide insight into a South Asian perspective. The aim was to show that those experiences are not singular and they're not alone. Additionally, this comic strives to provide a new perspective for people who are not BAME. Therefore, I have created three pieces reflecting events experienced by myself and my peers.



"The title Surface Tension has two meaning behind it:

The tensions that occur due to the 'surface' of the person - the colour of their skin etc.

The second is an analogy of droplets of water signifying microaggressions filling an emotional 'cup'. The droplets do not seem much initially, but it will lead to the point where the cup is fully loaded, causing surface tension, before the emotional cup is overfilled and it becomes too much for the person to cope.

"I've started an Instagram channel where I will be uploading the comics @dragonfruitsdoodles."



Elena Kirwan

"My name is Elena and I am a fourth year medical student. This year I chose a medical humanities module on the visual cultures of humour, health and illness and I would like to submit my final piece to your journal!

"We started the module by looking at 18th century medical satirical prints, and I was shocked to find a stark lack of female representation in the imagery. In fact, the only prints I came across with women as the subject were to do with sex and sex work, and the now debunked diagnosis of hysteria. This led me to read into the history of women's health, and to find out why it was swept under the rug for so long. My research started with Hippocrates and his theory of the 'wandering womb', where it was believed that the uterus had the ability to travel around the body and cause symptoms from shortness of breath to limb paralysis. It included the gruesome and disturbing treatments that women were put through, such as vaginal fumigation, clitoridectomy, oophorectomy and the rest cure, where women were not allowed to leave their bed, read, write or have any mental stimulation, in order to cure infertility.

"I finished the module by creating a satirical image myself, which questions how far we have really come since the days of the wandering womb.

"It shows two women separated by hundreds of years, the first in a

classical 'hysterical' pose, the second bent over in pain surrounded by endometriosis leaflets. In both images, the doctor says "your womb has travelled around your body but there is nothing we can do". This image plays with the idea of the wandering womb and its ability to move around the body, and endometriosis, where the lining of the uterus does in fact grow in other areas of the body, causing debilitating pain, bleeding and infertility. It is one of the most common gynaecological conditions in the world, affecting 1 in 10 women, and yet there is still no cure.

"The first image is in the style of 18th century satire, where the more you look at it, the more details you find. The theatrical setting and crowds of men refer to the infamous displays that the French neurologist Charcot would put on, where he would wheel out women from the Parisian psychiatric hospital and 'hypnotise' them into having hysterical fits, to the delight of the onlooking male crowd. I also replaced the doctor's stethoscope with a hypnosis pendulum to further play with this idea. The bag of equipment contains flowers, as sweet smells were used as a way of trying to lure the misbehaving uterus to its rightful place in the body, and also mustard and sulphuric acid, as some women were forced to bathe in these substances to cure their hysteria. There is also an electrotherapy machine, as these were commonly used to try and treat hysteria. The second image is much simpler, showing a struggling woman in a sterile room, abandoned and alone.

"This image was created using watercolour pencils."



Ishani Rakshit

"I've attached an artwork piece I did for University of Exeter Medical School, showing Edward Jenner's legacy and the contrast to modern day medicine."

Dr Wayne Nishio Ayre FHEA BEng (Hons) PhD FHEA by Gayathri Kannan, Year 3, Cardiff Uni ersity BDS



Dr Nishio Ayre is the lead for the Biomaterials Research Group at Cardiff University and taught me the topic of biomaterials in dentistry as part of the BDS Year 2 programme. As an extremely engaging lecturer who clearly possessed a passion for the topics he was involved in, I thought he would be a perfect fit o explore deeper into the application of biomaterials in dentistry and the concept of research as a part of your career.

What are you currently working on/please describe your latest research in biomaterials relating to dentistry?

I'm currently working on three different projects, all of them are looking at how we can exploit lipids for medical applications. The first project involves developing a metal implant coating made of lipids that responds to bacteria to release an antimicrobial and prevent implant-related infections. The second project is focussed on using lipid nanoparticles to prevent secondary caries by simultaneously releasing antimicrobials and encouraging remineralisation. The third project is a bit different; I'm working with researchers in chemistry, physics and medicine to develop a nanoscale infrared spectroscopy tool that identifies lipids in small cell derived vesicles so we can diagnose diseases in patient blood much earlier.

Picking a specific line of research, please briefly describe more about your project 'Exploiting bacterial virulence for triggered antimicrobial release from orthopaedic implants' and where else you feel exploiting bacterial virulence might come in handy.

Around 200,000 hip and knee replacement surgeries are performed each year in the UK and unfortunately around 3000 of these will experience an infection. This is a major problem as infections are much harder and more costly to treat, and in severe cases can result in amputation or even death. Existing ways of preventing these infections are not very effective and only provide short-term protection. Our research is coating implant surfaces with lipids that encapsulate antimicrobials. What's exciting about this approach is that the lipids can be tailored to release the antimicrobial only in the presence of proteins and enzymes produced by specific bacteria. This means the coating will always have a reservoir of antimicrobial stored and will only use it when needed. Our initial research also shows that the amount of antimicrobial released depends on the level of infection. This will hopefully help prevent any antimicrobial toxicity issues associated with very high antimicrobial concentrations and will also help prevent antimicrobial resistance by ensuring the amount of antimicrobial released is proportional to the amount of bacteria present.

What has been the most rewarding part of being a researcher in your field

As cheesy as it sounds, I think I found supporting the next generation of biomaterials researchers the most rewarding. As you progress through academia, you realise you no longer have the time to do the exciting experiments in the lab. It's great to come up with interesting ideas and get the funding to pursue them, but it's even more rewarding to see early career researchers get excited about the research and see their reaction when things go well in the lab (which believe me is not often!).

What is the most exciting discovery/thought you have come across?

I think it was the discovery that we can incorporate lipid nanoparticles into any type of material. We found that using lipid nanoparticles to release antibiotics from bone cement resulted in much more prolonged levels of release and unexpectedly also improved the mechanical and fatigue properties of the material (something which had not been achieved before). The discovery was patented and also copied by a biotech start-up and we're now exploring how this approach can be used in dental materials.

What novel thing do you hope/expect to see in the future that you believe might be integral in dentistry?

I think the obvious one would be artificial intelligence (AI). In the past, biomaterials development was an iterative, trial and error process that involved making a material, testing it and hoping it would be better than the existing material. Unfortunately, this approach is really slow and expensive (it can take more than 10 years and millions of pounds for a technology to even get tested in a patient!). This results in thousands of exciting new materials being developed but never actually helping any patients. I'm hoping AI will be able to help design new materials, predict properties and also predict how they will behave in the body without the need to physically make and test all the materials one-by-one. This will reduce the time to develop and test materials and hopefully will help accelerate new biomaterials into the clinic.

Anything else you would like to add?

I've really enjoyed being a biomaterials scientist and also teaching undergraduate and postgraduate students about it. I think the one thing that keeps me engaged is that it's a very interdisciplinary field, which means I get to work with lots of interesting people from diverse academic backgrounds on really cool and exciting projects. I hope one day some of my research will benefit patients or at the very least, someone else will use my research for something interesting.

www.profile .cardiff.ac.uk/staff/ yrewn www.cardiff.ac.uk/research/explore/research-units/biomaterials

Pippa Trimble by Moyowa Arenyeka

Year 4, Medicine, University of Plymouth



Pippa Trimble is a solicitor and lecturer in law, with a special interest in medical law and ethics. Although medicine and law may appear quite disparate, there is a lot of valuable overlap to learn from. Therefore, I invited Pippa Trimble to talk to us as I thought it would be interesting to explore the interaction between medicine and law from the perspective of a lawyer; this, in turn, could highlight to healthcare students and professionals the importance of being well versed in the law that encapsulates one's clinical practice.

Can you tell us about your career background and why you were drawn to medical law?

I am a qualified solicitor and spent my early career working as a solicitor in commercial dispute resolution, mostly in big London firms. I joined Plymouth University Law School in 2009 and have taught on a range of undergraduate modules including Tort, Dispute Resolution and Work-Based-Learning (the Innocence Project and MedLaw). Since 2015, I have specialised in medical law and ethics, teaching law undergraduates and healthcare undergraduates and postgraduates with a particular focus on how law and ethics are applied in practice. I currently teach on the Professional Generic Skills Course for Registrars¹, Advancing Professional Practice² for the nursing school and have previously also contributed to the Foundation Training Programme for doctors, Core Surgical trainee programme and HMLI.³

I have always had an interest in medicine; I come from a medical family and for a while I considered a medical rather than a legal career. I am particularly interested in the interaction between patients and clinicians, how this is regulated and how it can be improved for all participants using both legal and ethical frameworks.

Why is it important for medical students to learn about medical law and ethics?

A knowledge and understanding of medical law and ethics enables a medical student to become an effective and safe doctor by understanding the principles underpinning good medical practice, the relationship between clinician and patient, the patients' and clinicians' rights and obligations and understanding and managing risk. It encourages the student to look more broadly at the clinical relationship and consider issues beyond the purely clinical. An understanding of ethics can also be useful in helping analyse and resolve difficult clinical and professional dilemmas, for example, who gets the ICU bed or ventilator, when should active medical interventions be withdrawn and the patient put on a palliative pathway or when should treatment, such as mandatory enteral feeding, be given.

Why did you set up the Medlaw programme at Plymouth University? Was there previously a gap in the curriculum? What makes the programme unique?

Medical Law and Ethics is commonly taught as an academic elective in most undergraduate programmes in law or medicine but this arguably doesn't help the students, legal or medical, learn how to apply it when in practice in their respective professions. MedLaw at Plymouth takes a different, more practice-focused as well as an interdisciplinary approach, with the aim of not only covering the key tenets of medical law and ethics, such as consent, capacity, confidentiality and issues around both the beginning and end of life but also considering the practical application, issues and challenges that arise in clinical scenarios, both from the patient's and clinician's perspective. The interdisciplinary element encourages medical students to focus on the legal and ethical rather than clinical aspects and learn not just the law but also how it is applied and the law students learn about some of the challenges clinicians face trying to put the law into practice in an often busy or pressured situation.

The MedLaw module is a 40-credit, work-based-learning module for final year law students. Unlike healthcare student, law students do not typically acquire legal practice experience during their degree. In MedLaw, law students attend local solicitors' firms and work on real clinical negligence cases as well as attending EBL⁴ scenario-based sessions with 3rd year healthcare students from the medical, dental and nursing schools who volunteer to attend the sessions. The law students therefore experience medical law in practice both from the patient's perspective in the law firms and from the clinician's perspective in the EBL sessions. EBL scenario- based- learning is a particularly useful interdisciplinary tool as it encourages and facilitates discussion and mutual education between the health and law students. There are nine EBL's which broadly cover the life cycle. The medical students join for three sessions, usually held in February/March each year. The healthcare students benefit from the law student's knowledge and understanding of the law, legal practice and legal professional obligations and structures.

Both the legal practice and interdisciplinary elements are unusual in undergraduate medical law teaching and I believe in combination are unique to MedLaw at Plymouth.⁵ There may be further exciting developments bringing in a different practical element next year... watch this space!

What are the advantages of interdisciplinary learning between healthcare and law students?

I have always believed there are lots of synergies between the medical and legal professions, such as our professional and ethical codes of conduct but they often meet at points of conflict, for example in clinical negligence or inquests, which doesn't always foster mutual trust and understanding between the professions! Learning about medical law and ethics together by working through the legal and ethical issues in a clinical scenario provides the opportunity for the law and medical students to learn not only about the law but also about the other profession, how they approach the issues and if and how this differs, and from a clinicians' point of view, de-mystify and reduce anxiety around legal issues and processes.

In the words of the students who participated this year...

'I really enjoyed taking part in the MedLaw sessions, in particular the cross-disciplinary learning aspect of it. I learnt a great deal from the other students and the facilitator and it has given me many useful tools to use as a future doctor.'

'I really enjoyed these sessions, it was something different from my day-to-day life and increased my knowledge on medical law. I was able to consider different aspects of a patient case rather than the just the medical side. This helped me to learn a lot from the case and consolidate my knowledge of ethics.'

What do you think are the greatest legal and ethical challenges faced by doctors? If possible, how can these be mitigated?

Medicine is rarely black and white, nor is the law that regulates it and applying it to, often highly nuanced, situations can be very challenging. Understanding the key legal principles and communicating clearly, effectively and accurately with the patient, their family and clinical colleagues is critical to ensuring not just good clinical care but also that clinicians meet their legal and ethical obligations; for example, the Montgomery case⁶ and Best Interest decisions under the Mental Capacity Act⁷ both clearly require the clinician to consider not just the optimal clinical outcome but also the patient's wishes, preferences and personal context, which can only be obtained with good communication.

The pace of digitalisation is creating considerable challenges for doctors around equality of access to healthcare, confidentiality and digital records and the ease of these being mis-sent/misplaced. The increasing amount of digital data gathered and held on a patient raises a plethora of issues in all specialities but is particularly challenging in genetics and who it could/should be shared with. The law can often be slow to catch up with rapid technological developments and regulation is therefore most likely to be found in practice guidance from the GMC, Royal Colleges, Defence Unions or NICE.

How can doctors and other healthcare professionals try to reduce their chances of encountering medico-legal problems in clinical practice?

Good communication is the key to avoiding medico-legal problems. If there is good communication, for example about risks and/or benefits of treatment and alternative options, with a patient and their family so that they are involved in decisions about their care, they have agency in their treatment pathway and are much less likely to complain/bring a claim if there is less than optimal treatment or outcome. Good and timely communication with the patient and their family is equally important if things have gone wrong and/or errors have been made; this is a legal requirement under the duty of candour but there also is plenty of evidence that shows what motivates patients to bring complaints/claims in the majority of cases is the desire for an explanation of what went wrong, an apology and, if appropriate, reassurance or evidence that systems and processes have been put in place to ensure it doesn't happen again. If these are provided as soon as it is clear something hasn't gone well, the patient and/or their family are far less likely to bring a complaint/claim.

Keeping up-to-date with legal changes in legislation (Acts of Parliament) and case law (decisions made by the Courts) as well

as in professional guidance (such as the GMC) will also reduce the likelihood of encountering medico-legal problems as it ensures a doctor complies with their current legal and ethical obligations as a clinician and protects their patients' rights as well as their own and those of their clinical team. Many areas of law remain unchanged for decades, sometimes even centuries! But medical law is very much an area of law that is changing and/or considering change regularly to keep pace with medical and scientific advances, for example in human fertilisation and genetics, as well as changes in society's values and attitudes, for example the change from paternalistic medicine to shared decision making.8 Recent cases provide good examples of the courts re-considering but not changing the law on adolescent capacity and consent and re-affirming the principles of Gillick competence; this was in the context of modern treatments (puberty blockers)⁹ and an argument that society's attitude to adolescent autonomy had changed sufficiently to allow a 15 year old Jehovah's Witness to refuse top up blood transfusions¹⁰ (she wasn't!). Medicine is advancing rapidly and the law can struggle to keep up with pace of scientific change. Being aware of current medico-legal debates is important in ensuring compliance with legal rights and obligations. An easy way of keeping up to date is to keep your eye out for articles on medico legal updates in the medical press such as the BMJ or and for a more legal perspective subscribe to specialist law firms or barrister's online newsletters.¹¹

What advice would you give healthcare professionals and students that want to learn more about medical law?

Universities provide a range of opportunities to study medical law, from intercalating in law to CPD Certificates and up to an LLM in Medical Law and Ethics as a postgraduate. There are also quite a number of private providers who offer CPD training for healthcare professionals in areas such as consent/capacity, expert witness training or preparation for attending court/coroners court as a witness.

If you think you might be interested and would like to get a feel for some medico-legal issues an easy starter is to listen to some episodes of 'Inside the Ethics Committee' on BBC iplayer https://www.bbc. co.uk/programmes/b007xbtd/episodes/player - it's a few years since they have done new ones but the old ones are still very relevant and useful; look down the list and find the topics you are interested in! The Children Act by Ian McEwan (both a book and a film) is fiction but based on a real case.

To get a bit further into the subject, and thinking about some of the more challenging concepts and arguments have a look at 'Great Debates in Medical Law and Ethics' (2nd Ed) by Imogen Goold and Jonathan Herring. For a quick overview Jonathan Herring's 'Law Express on Medical Law' is useful and for a deeper dive, I would recommend Emily Jackson's 'Medical Law; Text, Cases and Materials' (6th Ed).

If you are interested in how the Coroner's Court works and how to give evidence in legal proceedings more generally, I put together some short films from those with lots of experience - have a look at https://www.plymouth.ac.uk/schools/school-of-society-and-culture/ law/a-guide-to-inquests

Pippa Trimble

Lecturer in Medical Law & Ethics Visiting Specialist, Peninsula Medical, Dental & Nursing Schools Solicitor (non-practising) Fellow of the Higher Education Academy

References

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- 1. https://www.plymouth.ac.uk/about-us/university-structure/faculties/ health/cpd/professional-and-generic-skills-programme
 - https://www.plymouth.ac.uk/courses/postgraduate/msc-advanced-professional-practice-clinical-practitioner

- 3. https://www.plymouth.ac.uk/courses/postgraduate/msc-healthcare-management-leadership-and-innovation
- 4. Enquiry based learning
- If you are interested in reading more about why and how the MedLaw module started see my article in in Vol 10, 2018 of the Plymouth Law Review, found at https://www.plymouthlawreview.org/Issue%2010_contents.html
- Montgomery v Larnarkshire Health Board [2015] UKSC 11 at https://www. supremecourt.uk/cases/uksc-2013-0136.html
- 7. Mental Capacity Act 2005 at https://www.legislation.gov.uk/ukpga/2005/9/ contents
- 8. Montgomery n6
- Bell v Tavistock and Portman NHS Foundation Trust [2021] EWCA Civ 1363 at https://www.judiciary.uk/wp-content/uploads/2022/07/Bell-v-Tavistock-judgment-170921.pdf
- NHS Trust v X (a child) no 2[2021] EWHC 65 (fam) at https://www.bailii.org/ ew/cases/EWHC/Fam/2021/65.html
- 11. Eg https://www.bevanbrittan.com/insights/articles/2023/hc0623/ https:// www.39essex.com/information-hub/mental-capacity-resource-centre



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We are a student-run, student-led journal on Medicine, Dentistry and Veterinary Sciences.

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Senior Editors, Autumn 2023

Moyowa Arenyeka

Year 4, Medicine, University of Plymouth

The INSPIRE scheme has given me multiple opportunities to pursue my interest in medical research. Through this scheme, I became a trained peer reviewer, attended taster days, participated in a residential summer school for research and more. These experiences, as well as becoming an editor for this journal, have exposed me to the different facets of research and have reaffirmed my interest in the field.

I am glad to have been given the opportunity to be on the INSPIRE journal's editorial team. It has been a great learning experience, which has broadened my perspective and has built upon my skillset in different ways. Thank you.

Thomas Butler

Year 4, Medicine, University of Plymouth

I'm a keen rugby player for our medical school and am interested in anaesthetics. Next year I am looking forward to intercalating in psychology and going on my elective to Sri Lanka. I've really enjoyed not only reading all the articles that have been sent my way as an editor but being involved in the process of refining the excellent work that is submitted to us.

Sanay Goyal

Year 4, Medicine, Cardiff University

Hey, I am a fourth-year medical student with an interest in digital health and medical devices. I am currently intercalating at Imperial College London to further my interests in medical management and working in the digital health industry. I am thrilled to have been on the editorial team for the INSPIRE Student Journal this year. It has been a pleasure to read all the submissions and curate another brilliant edition for our readers. Being a part of the editorial team has provided me with the chance to gain academic skills and appreciate how a medical journal functions which will serve me well in my pursuit of a surgical career. I look forward to reading more of your submissions and helping you publish your research!

Caroline Gu

Medicine, University of Exeter

Hi! I am an Exeter medic currently doing an BSc intercalation on Molecular Biology with Translational Haematology at Imperial College London. I am interested in an academic career in surgery and oncology. Working as an editor for INSPIRE, I'm glad to have the opportunity to read your ideas, interact with exciting fellow students and promote research in healthcare.



Kelly Jiayi Gu

Year 2, Medicine, Cardiff University

I feel very honoured to be able to be part of the INSPIRE team during my first and now second year doing medicine as I had the opportunity to read many insightful articles written by my peers about topics I've never linked together or heard about. The journal is filled with good reads! I'm currently interested in neurology and psychiatry, however, I am still exploring! A doubt I had with choosing medicine was the inability to explore niche biological topics in more depth and to write academically, however INSPIRE has given me the chance to do so as well as the chance to critically appraise other's articles. We hope you enjoy the magazine!



Year 4, Medicine, University of Bristol

I spent the last year at the University of Manchester in order to complete an intercalated Masters in Public Health. I am now a research assistant in their Population Health department, working on projects that qualitatively evaluate perceptions of and interactions with existing services and organisations. I am passionate about qualitative research and its ability to uncover the deeper experiences and human stories behind medical conditions, and interactions with healthcare personnel and organisations. My personal interests lie either side of the age spectrum; I care deeply about both dementia care and paediatrics.

This experience has been incredibly enriching, expanding my horizons and teaching me many new skills. I've thoroughly enjoyed every aspect of handling submissions by our talented peers for INSPIRE, and hope that readers find as much delight in reading it as we did in creating it.

Gayathri Kannan

Year 3, BDS, Cardiff University

I have a particular interest in the ever-evolving clinical research world and how it can be incorporated into patient-centered treatment to make life a lot easier for everyone! INSPIRE has helped me hone my critical appraisal skills and has expanded my knowledge of authoring scientific papers, a valuable skill for a profession such as dentistry which involves life-long learning. Aside from INSPIRE, I am involved in DentEazy which is a novel platform aiming to publish free resources for dental students to help them with their education. By being a part of these platforms, I hope to spread the idea of student-led content to others of varying ages, to help young professionals take charge of what they can extract from university life and degrees leading to high levels of self-sufficiency.









Senior Editors, Autumn 2023

Nell Marquess

Year 4, Medicine, University of Exeter

Hi! My interests in medicine include women's health, general practice, oncology and medical education. Being part of the INSPIRE editorial team has been incredibly rewarding and it has been great to be able to get to know the other team members. I have loved reading the work of the talented students that have submitted to INSPIRE and I am very proud of the issue we have created! I hope you readers enjoy it just as much as we enjoyed making it.

Mimi Mostefai

Year 5, Medicine, University of Exeter

Hi! I am currently a final year medical student and I recently completed an intercalated Master's degree in Public Health with a specialism in Global Health. My current clinical medicine and research interests span from general internal medicine, geriatrics and palliative care medicine to global health. Indeed, my Master's degree alongside being an editor of the INSPIRE journal have enabled me to explore fascinating topics outside my interest purview, particularly reinforcing the heterogeneous lenses through which one can consider health and strive to improve it, such as taking a 'One Health' approach. I have thoroughly enjoyed working as part of the INSPIRE team to produce this issue. I feel great pride in it as it is accessible and caters for a diverse audience. I hope that you, as readers, can really immerse yourselves in our great reads produced by myriad talented peers (authors and artists) across the UK.

Ethan Randall

Year 5, BDS, University of Bristol

I initially got into research through a paper that me and a fellow student wrote during our elective project in 2022. Since then I have been involved with INSPIRE and enjoyed helping other students work on and finalise their own work for the journal. It is a unique and rewarding experience to be a part of a student research journal and one that has taught me a great deal at the same time.





Phoebe Sussman

Intercalation onto MSc in Global Wildlife Health and Conservation, Veterinary Sciences, University of Bristol

Hi, I'm Phoebe, I'm a veterinary student from the University of Bristol, currently taking an intercalation year to study for a Masters in Global Wildlife Health and Conservation. have a strong interest in the sustainable use of veterinary medicines, antimicrobial and anthelmintic resistance. This past summer, I carried out a research project working with World Horse Welfare to investigate anthelmintic resistance within working equid populations in Panama. This project really piqued my interest in rural agricultural communities and their access to veterinary care as well as the control of veterinary medicines in different countries. I am also very interested in zoonotic disease and One Health, and I hope to focus my masters project on the impacts of environmental health on the health of wildlife populations and hence the disease risk of communities living adjacent to wildlife. It will be crucial for veterinarians, medics and dentists to work together to begin to tackle some of the large problems affecting humans and animals. Journals such as INSPIRE provides such an incredible platform for vets medics and dentists to come together, and I am very grateful to have been a part of this process and act as an editor.

Amirali Ziaebrahimi

Year 2, BDS, University of Plymouth

Hi. Beyond my studies, I serve as an editor at this INSPIRE student journal and hold the position of President at Dentsoc, where I foster a sense of community among dental students.

My primary passion is dental public health, with a focus on policy design and implementation. I'm dedicated to researching and improving oral healthcare strategies and policies. Additionally, I have a keen interest in dental technologies, recognising their potential to enhance patient care and treatment outcomes.

In both academics and extracurricular activities, I strive to make a positive impact in dentistry. My goal is to grow as a student, researcher, and leader, advancing the dental profession, promoting oral health, and harnessing the potential of dental technologies to benefit patients and practitioners.







Advisory board, Autumn 2023

Anousha Agarwal, Veterinary Sciences, University of Bristol

Zaina Aloul, Medicine, Cardiff University

Elizabeth Brennan, Medicine, University of Bristol

Joshua Erhabor, Medicine, University of Exeter

Liam Fletcher, Dentistry, University of Bristol

Tomas Nicholas, Dentistry, University of Plymouth

List of referees, Autumn 2023

Lispeth Abraham, University of Exeter

Anoushka Agarwal, University of Bristol

Lauren Aldridge, University of Bristol

Aris Alexiadis, University of Exeter

Zaina Aloul, Cardiff University

Lauren Ashley, Kettering General Hospital

Elizabeth Brennan, University of Bristol

Charlotte Burgess, University of Bristol

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Deborah Inyang, King's College London

Viktorija Kaminskaite, University of Exeter

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Virginija Vilkelyte, University of Exeter

Victoria Vincent, University of Plymouth

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Usman Yakubu, University of Bristol

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University of Bristol

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Bristol Medical School Co-Leads: Dr Anu Goenka, Clinical Lecturer in Paediatric Infectious Diseases and Immunology; Dr Becky Foster, Senior Lecturer in Clinical Sciences. Bristol Veterinary School Lead: Professor Linda Wooldridge, Chair in Translational Immunology Bristol Dental School Lead: Mr Mark Gormley, Consultant Senior Lecturer



Cardiff University

www.cures.cardiff.ac.uk/inspire

Cardiff School of Medicine Co-Leads: Dr William Davies, Senior Lecturer (Basic Science), Dr Emma Tallantyre, Clinical Reader Cardiff School of Dentistry Lead: Dr Heather Lundbeck, Clinical Lecturer in Paediatric Dentistry



University of Exeter

www.medicine.exeter.ac.uk/study/ug/medicine/researchopportunities

Leads: Dr Joanna Tarr, Senior Lecturer and Dr Jane Smith, Senior Lecturer, Faculty of Health and Life Sciences



University of Plymouth Peninsula School of Medicine and Dentistry

www.plymouth.ac.uk/about-us/university-structure/faculties/health/inspire

Leads: David Parkinson, Professor of Neuroscience; Vehid Salih, Associate Professor in Oral & Dental Health Research





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