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Burnout in undergraduate medical students:

have we reached our limit?

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Editorial

Intercalating medical students: the future is in their hands

Editorial

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Each year around 100 Cardiff medical students do something remarkable: they intercalate. This means they take a year out of the main MBBCh course to study for a bachelor's degree in a medically related subject, achieving something in nine months that normally takes three years.

Our students tell us that one of the highlights of intercalation is the opportunity to experience, in depth, what it is like to conduct a research project from start to finish. Planning, executing and writing up their projects gives them a deeper understanding of research methods, research integrity, laboratory and fieldwork, data analysis, literature searching, and critical appraisal of academic literature. Crucially, they also learn what it's like to work as participating members of Cardiff's world-leading research teams.

This special supplement of The British Student Doctor Journal (BSDJ) showcases some of the outstanding research work done by Cardiff's intercalators during the academic year 2018-19. The 12 articles in this issue give an overview of the scope and high standards of their work. The research questions are important, reflecting current public debates such as sports concussion amongst children; the recruitment crisis in medicine and its effect on junior doctors' career decisions; new approaches to primary care consultations; how clinicians make resuscitations decisions on very premature babies; burnout among undergraduate medical students, and the use of e-cigarettes. As might be expected from student work, some papers have a direct impact on the medical curriculum, where topics such as disability teaching, designing a modern genomic medicine syllabus and the effect of curriculum on how students approach their learning are put under the spotlight. The laboratory-focused work reported is equally important in its potential effect on the way medicine will be understood, learned and practised in the next decade: studies with implications for frontline clinical work include a review of the pharmacokinetics of caffeine intake and a study informing possible new treatments for osteoarthritis of the ankle.

Cardiff's 'C21' curriculum is one of the most modern in the UK, with a renewed focus on equipping our students with the skills, knowledge, professional values and behaviours they will need to carry medicine into the future. We listen to our students. The work that excites them and their concerns for the future of medicine and medical education directly impact how we plan and deliver our curriculum. It is therefore inspiring to read these reports. They reassure us that the future of medicine is in safe hands. As one student author observes:

> *Being involved with "real-life" research and work in government has given me unique first-hand experience and undoubtedly provided me with a skill set that I would otherwise be without – and can now continue to develop. I also have a wider understanding of the ripple effect of research – not just clinically but also on wider policy. (Olivia Parish and Heather Payne, 2019)*

We wish to thank the editorial team of The BSDJ for their fantastic work in co-ordinating and producing this special supplement. The BSDJ is in itself an outstanding initiative created in 2016 and developed by a team of Cardiff medical students. Many are themselves past graduates of our intercalation programme. They started The BSDJ because of their own passion for student research and their belief that it needs a wider audience. The journal has gone from strength to strength thanks to their energy, enthusiasm and leadership. We are delighted to support them all the way, and wish The BSDJ every success as it grows and develops.

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Does C21 prepare medical students for doctoring in foundation? A mixed-methods study

C4ME SUPPLEMENT

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Background

It is essential for Foundation Year 1 (FY1) doctors to be adequately prepared for practice to ensure delivery of safe and high-quality patient-centred care. The transition from student to doctor is known to be challenging due to an increase in responsibility, and working within a pressurised and stressful environment. (1) Preparedness is complicated further by the continual change in healthcare needs and diversity seen within the aging and co-morbid population, (2) which impacts upon the knowledge and skills required by newly qualified doctors.

The standards expected of newly-qualified doctors are outlined in the General Medical Council's 'Tomorrow's Doctors'; (3) a core curriculum by which competency can be measured. This publication generated momentum for curricula reform to address the issues relating to graduate preparedness; smoothing the transition to FY1 through adequate preparation for practice in regards to managing complexity and decision-making. In line with this, the 'Curriculum for the 21st century' (C21) at Cardiff Medical School was introduced in 2013: an integrated case-based learning spiral curriculum with early and continuous patient contact, and an emphasis on independent learning. (4)

Over the past 10 years there has been a large volume of qualitative and quantitative research assessing preparedness to practice, however C21 had not been evaluated in this context as the first cohort graduated in July 2018. Therefore, this study aimed to do so.

Methods

Self-perceptions of preparedness of Cardiff 2018 graduates working as FY1 doctors in the UK were evaluated. An invitation email and link to the online questionnaire based upon 'Tomorrow's Doctors 2009', subdivided into 'Doctor as a Scholar and Scientist', 'Doctor as a Practitioner' and, 'Doctor as a Professional', was distributed through the Alumni network by Medical School administrators. Closed questions required selection of level of preparedness on a 5-point Likert Scale from 'very unprepared' to 'very prepared'. Open questions collected more detail regarding areas in which participants felt prepared and unprepared, and perceived difference between 'prepared' and 'very prepared' to understand subjectivity.

Semi-structured narrative interviews were conducted on a one-to-one basis with those who self-selected to be interviewed via the questionnaire. Interviewees told their personal stories of experience, enabling understanding of 'preparedness' within context, with detailed examples. (5)

Quantitative data underwent descriptive statistics, open-comments and interviews were analysed thematically. Interviews were also analysed narratively from a social constructionist perspective; to understand how interviewees conveyed their stories and why they did so, something influenced by social context. (6)

The Chair of School of Medicine Ethics Committee confirmed that ethical approval was not required and deemed this project a service evaluation. Research was conducted in line with ethical practice: participants received information about the project, their participation and data management. They were informed that confidentiality would be maintained unless an issue compromising patient safety was disclosed.

Results

Of the 24 C21 graduates who responded, 88% agreed they felt prepared to practice resulting from C21. Regarding the 'Doctor as a Scholar and Scientist' 61% felt prepared, 82% regarding 'Doctor as a Practitioner', and 84% regarding 'Doctor as a Professional'. All respondents felt prepared to take a history and perform a physical examination and interpret the results from these.

From interviews (n=7), eight themes were identified with an additional two themes from open-comment survey data: definition of preparedness; being prepared and unprepared for practice; role of the medical degree in preparation; reflection of C21 and how to improve preparedness; assistantships; comparisons with other graduates and top tips. Throughout the narratives, the concept of preparedness was associated with level of knowledge. Most interviewees recognised the difficulty in preparing students to practice, and in fact do not expect to feel fully prepared. Most interviewees discussed the imperative of 'practicing on the job' for preparation, correlating their level of preparedness with level of experience.

Most respondents felt prepared for communicating, team-work and clerking, which was attributed to patient contact and undergraduate placements. Practicalities of the role were prepared for through assistantships, which were valued by participants. However, they felt less prepared for night-shifts and on-calls, and other realities of work (e.g. level of responsibility, workload and working hours). Although 11 questionnaire respondents expressed feeling less prepared regarding scientific knowledge, three interviewees questioned the importance of detailed scientific knowledge within their FY1 role.

Discussion

Most participants felt prepared for practice, following the trend that preparedness amongst graduates in the UK is increasing. (7, 8) However, evidently 'preparedness' is a complex and non-binary concept which develops with 'learning on the job'. (9)

The strengths in preparedness expressed by graduates in this project may reflect the emphasis that C21 places upon communication and team-working, which is reflected in literature concluding problem-based learning graduates felt better prepared than traditional graduates in this respect. (10)

The evaluation of C21 is a longitudinal study, and comparisons of cohort data with larger sample sizes may be used to inform changes to the C21 curriculum. Reflections expressed may be used to create a 'top tips' document or workshop. This could inform future final year students of the realities of practice, something difficult to relay through undergraduate placement.

It is understood this study is the first to analyse suggestions for improvement to medical curricula through narrative interviewing. Caution should be taken when interpreting results with regards responder bias. Nonetheless, this approach has provided insight to context of these FY1s' suggestions for changes to C21, through the provision of experiences for which these individuals felt unprepared, together with reflection of how they could have been better prepared to cope in that scenario.

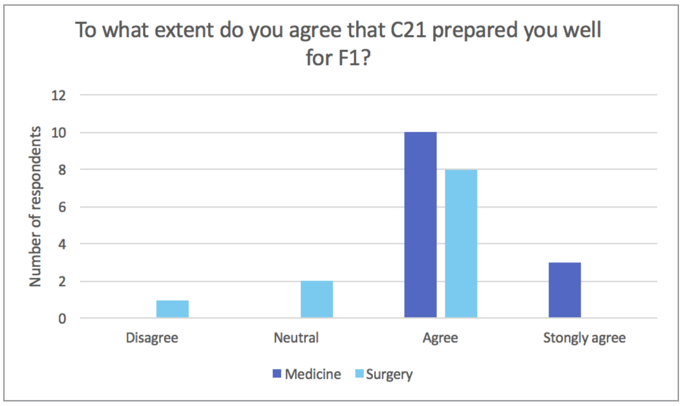

Figure 1: Graph representing agreement that C21 prepared them well for F1 according to their specialty

Lessons Learnt

Designing and conducting a research project during a narrow time frame with minimal previous experience was challenging. Analysis of preparedness amongst medical graduates has been prolific over the past 10 years, hence I initially struggled to specify my literature search and generate research questions unique to my project.

I felt motivated to explore the opinions of Cardiff graduates when designing the questionnaire, and felt it important to unpick the reasons behind feelings of unpreparedness, as this could potentially contribute to easing the transition for future cohorts.

Although design and implementation of the questionnaire were successful, initially the response rate was disappointingly low. It seemed sparking the interest of FY1 doctors was more difficult than I had anticipated; I was concerned about possible impact upon my results and analysis. Upon reflection, low response was in part due to distribution through the Alumni network, as this relied on emails being live, thus we do not know how many were reached rendering it impossible to conduct a reliable response rate. Also, there was lack of awareness of the project and difficulty in attracting the attention of busy and perhaps stressed FY1s. I now recognise the importance of high levels of engagement with the population to ensure higher response rates. Going forwards, we plan to forewarn final year students before graduation and to recruit respondents face-to-face to increase engagement.

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C4ME Supplement

An analysis of the development of self-regulated learning skills in first year medical students: the impact of transition

C4ME SUPPLEMENT

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Background

Self-Regulated Learning (SRL) is the ability to manage one's own learning and identify own learning needs. (1) Since doctors are required to be life-long learners, it is important that medical students develop SRL skills as early as possible. (2) Extensive literature has addressed the elements required of a self-regulated learner; (3,4) however, little has addressed how students can be supported to develop these skills and the impacting factors, particularly the impact of transitioning to university. Medical students are an interesting cohort as they are typically high-achievers at school, have the development of a professional identity forming when they start university, and a clear professional outcome to their studies. It is important that medical schools can support their students through this transition to university, to consequently improve student abilities to self-regulate their learning. (5)

In the medical school being studied, the teaching approach changes between the first and second semester of first year. The first semester being a strongly didactic *'Platform for Clinical Sciences'* (PCS), the second semester adopting a *'Case-Based Learning'* (CBL) approach. The students therefore potentially have to adapt to two different curriculum formats.

Methods

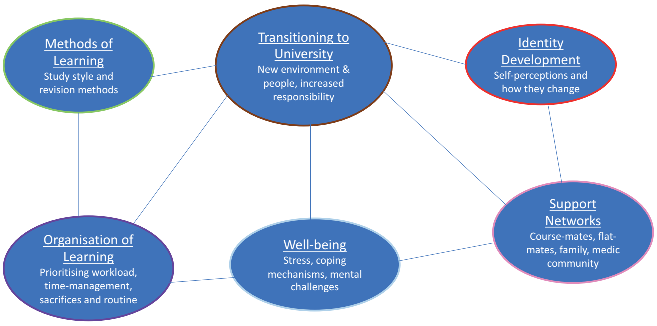
The aim of the project was to investigate participants' lived experiences, so a qualitative approach was adopted using open intensive interviews. The initial interview questions were taken from previous interviews carried out by my supervisor (6) and had been extensively piloted through this process. Participants were recruited from the first-year cohort of the medical school at the beginning of the academic year, and interviewed individually at two points; once during the first semester and again during the second semester. This enabled the development of the participants to be tracked across the year, and compared between the two different teaching approaches.

The data were analysed using a constructivist Grounded Theory approach, meaning that any theories generated were not pre-conceived, but emerged from the data. (7) Analysis of the data by coding using NVivo 11 software began whilst gathering the data (a key tenet of Grounded Theory) and continued as an iterative process of going back and forth between the data and analysis using comparative methods until data saturation was reached. Coding of the first cycle of interviews informed the development of interview questions for the second set of interviews.

Ethical approval was obtained from the local research ethics committee and preparations were made to support students who reported issue of concerns or became distressed during the interview.

Results

Figure 1: The 6 themes derived from the data. The lines between them demonstrate the linkages between themes and those that overlap.



The study followed 15 participants. Approximately 300 codes were derived from analysis of the interviews, focused into 6 main themes (see **Figure 1**).

Efficacy of SRL was not determined empirically, but based on self-report by participants. A key finding was that students were already effective at SRL, but they had to adapt their SRL to the unfamiliar learning environment of university, and then adapt again after PCS changed to CBL. Throughout PCS, there was considerable and widespread uncertainty amongst the participants. Uncertainty led participants to compare themselves to their peers regarding their studies and the social aspects of university. Comparison impacted on student self-assurance and identity, which could then lead to negative emotions driving students to self-regulate, rather than positive emotions. Competition was reported to be higher amongst the participants throughout PCS, and participants noted an unwillingness to share information with their peers.

Conversely throughout the second interviews, participant self-assurance seemed to have increased, alongside a greater ability to identify own learning needs. Most participants displayed an increased willingness to help their peers rather than compete. Collaboration seemed to be a key factor of importance in students adapting their ability to self-regulate, and overall enjoyment seemed to increase whilst stress decreased.

Discussion

Most students were already effective at SRL when starting university, however they struggled to adapt it to their new environment. Some did this successfully, some less so. Students seemed to cope with adapting their SRL in different ways; for example, this project highlighted the significance of transition and identity in student development in their first year of university. SRL effectiveness was not measured, however, the participants' perceptions of efficacy were noted. Uncertainty with regards to what was required of them during their first term led to increased stress and comparison amongst them, this competitive element of the hidden curriculum has been noted in studies previously. (8)

This study showed how medical student identities change across their first year. Lack of confidence in the first semester emphasised the students' novice status within the medical community, whereas the second semester introduced skills associated with 'being a doctor', enabling students to progress towards forming a professional identity and work with others. Developing these relationships with peers is vital if students are to succeed. (9)

Medical schools should be developing curricula that facilitate students' development of professional identity. (10) Not only to assist with SRL skills but to also help promote resilience and coping strategies. It would be beneficial to run a parallel study in a medical school that does not change its curriculum, to compare how much of the development of students was a consequence of the change in course structure.

Lessons Learnt

This study was an interview-based research project, a method new to me before starting my intercalation. I found the project challenging, but it was enjoyable and rewarding talking about student's experiences, and I was glad that participants found sharing their stories beneficial.

I learnt the benefit of using qualitative research in being able to see individual stories and investigating *'lived experiences'* in more detail than possible with a quantitative approach. I learnt the skills of being able to draw out conclusions from similarities between participant data.

Constructivist Grounded Theory was an advanced method of analysis to use, however it allowed me to go down the richest route of the data, teaching me the importance of being adaptable in research. The huge amount of data collected taught me to be concise in my write-up. PCS and CBL posed different challenges to students, with PCS being particularly difficult. Consequently, the work from this project is being sought after from the medical school to inform their review of the curriculum of Year 1.

My experience throughout has encouraged me to become involved in medical education research in the future, as well as improving my communication skills for working with patients and medical students alike. Due to the success of the project we are carrying on the study with the participants into their second year of medical school. I look forward to taking our study onto the next step and continuing my involvement in medical education.

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C4ME Supplement

Designing an undergraduate phase one MBBCh genomic medicine syllabus

C4ME SUPPLEMENT

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Background

Genomic medicine (GeMed) is "an emerging medical discipline that involves using genomic information about an individual as part of their clinical care". (1) In 2009, it was recommended that "use of genomic tools for diagnosis …and choice of treatment should form an important part of the undergraduate medical curriculum". (2) However, 10 years later, GeMed has rapidly advanced but is still not widely integrated into undergraduate medical curricula. A systematic review summarizing the current GeMed curricula for healthcare students contained only two UK-based studies, one from 2001, and one aimed at pharmacy students, (3) demonstrating the lack of current literature. A widening knowledge gap threatens the incorporation of GeMed into clinical medicine, with increasing numbers of clinicians feeling ill-equipped to diagnose genetic disorders. (4) In this precision medicine era, it is vital that tomorrow's doctors are equipped with the skills and knowledge required to utilize GeMed to provide optimal patient care.

Furthermore, with the increasing technological complexities, and ethical and social dilemmas, associated with GeMed, (5) it is important to embrace the medical humanities to motivate ethically intelligent clinicians capable of recognising, communicating and managing sensitive situations. Therefore, when designing a phase one (1st/2nd year) GeMed syllabus, medical humanities should be considered.

Undergraduate medical students must receive GeMed education to adequately prepare them to deal with the challenge of applying the extensive density of knowledge required to deliver on the promise of GeMed. Therefore, this study will recommend key GeMed topics for inclusion in a phase one medical syllabus.

Methods

This study was mixed methods. The online questionnaire, designed using Online Surveys, allowed recruitment of participants from throughout the UK, achieving a more nationally representative view. The sample included curriculum directors/co-directors, researchers, clinicians and/or lecturers working in genomics. Respondents were recruited using convenience sampling through professional contacts and identifying email addresses from NHS and University websites (n=386). Participants ranked a list of 31 genomics topics, derived from existing genomics syllabi, (the APHMG's core curriculum, the AAMC core competencies, and the UK master's curriculum), using a 5-point Likert scale. The results were analysed using IBM SPSS, then ranked to identify the most important topics for inclusion in the phase one GeMed syllabus.

The novel small group consensus building method encouraged comprehensive discussion by utilizing an iterative method that used mini-consensus groups (MCGs) to achieve a consensus between two expert panels. Panel 1=medical humanities (n=3), and panel 2=biomedical researchers and clinicians (n=3). Participants were recruited through convenience sampling and snowballing. Each panel was interviewed twice. The MCGs were audio recorded and transcribed verbatim. In the first round of MCGs, participants brainstormed topics for inclusion and produced a list of ten topics. In the second round, they reduced the other panel's list to 2-5 core topics. The debate and justifications surrounding consensus were analysed and the final list of topics were mapped against the GMC's *Outcomes for Graduates.* (6)

The School Research Ethics Committee approved this study.

Results

The questionnaire received a 22% response rate, n=85. The most popular topics for inclusion in a GeMed syllabus, were 'Mendelian disorders', and 'patterns of inheritance and pedigree analysis', followed by 'molecular pathogenesis/mechanisms of disease', and 'genetic variation and common disease'.

MCGs lasted a mean length of 58 minutes, totaling 231 minutes. The MCGs highlighted seven key topics to include in a GeMed syllabus: 'Fundamentals of Human Genetics', 'Genomics Terminology and Techniques', 'How to use genomic tests', 'Diagnostic Odyssey', 'Pharmacogenomics', 'Sharing, Ownership and Management of Data', and 'Cultural and Religious Viewpoints'. When the topics were mapped to Outcomes for Graduates, most topics mapped to >1 outcomes, with multifaceted topics 'Cultural and religious viewpoints' and 'How to use genomic tests' mapping to ≥6 outcomes across all domains, a reflection of the complex debate occurring within the MCGs.

Discussion

This study informs the future design of the Cardiff Phase 1 syllabus. The findings concur with current literature: the topics raised are included in the HEE GeMed master's curriculum, (7) demonstrating the current move to GeMed, and largely align with the most commonly taught topics in American medical schools. (8)

Additionally, the topics derived from the questionnaire and MCGs overlap considerably. 'Fundamentals of human genetics' is an umbrella term from the MCGs that could include questionnaire topics 'Mendelian disorders', 'patterns of inheritance and pedigree analysis', and 'genetic variation and common disease'.

Currently in genetics education, genetics topics are integrated into other topics, encouraging students to apply pre-existing knowledge to clinical examples. (8) This was confirmed during the MCGs and could be an effective way to incorporate GeMed.

Due to the small, localized MCG sample it would be beneficial to carry out a UK-wide Delphi study to confirm the topics that arose in this study.

The exploration of medical humanities views makes this study unique, to the best of our knowledge, and demonstrates their importance in counteracting the concerning loss of empathy throughout medical education to inspire reflective, empathetic clinicians. (9)

Lessons Learnt

We initially planned to use the Delphi Process as this is a well-recognised approach for reaching consensus on a syllabus. (10) However, GeMed is an emerging field and due to time limitations, it was not possible to recruit sufficient participants. Therefore, we developed a novel small group consensus building method.

I was initially unaware how difficult recruitment would be. When we realised Delphi would not be possible, I was concerned this would be detrimental to my project.

Therefore, we adapted aspects of the Delphi process to develop a novel method that still aimed to reach a consensus but using two smaller groups and this approach produced insightful, meaningful results.

Our approach allowed us to explore the views of medical humanities experts and encouraged thorough discussion of each topic, so we could identify the reasoning and justification behind decisions made when reaching a consensus. Keeping the two panels separate prevented one group deferring to another and having two iterations forced a consensus between the two panels so we could identify the key topics.

Key lesson: It is vital to consider recruitment carefully during method selection.

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C4ME Supplement

Investigating the impact of an inclusive teaching session on medical student attitudes towards patients with intellectual disabilities: a mixed methods study

C4ME SUPPLEMENT

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Background

Patients with intellectual disabilities have complex health needs and are a vulnerable population of society. (1) They have a greater risk of physical and mental health problems yet face countless barriers to accessing healthcare. (1-5) Enquiries into the healthcare system have shown patients with intellectual disabilities experience inequalities in health-care, including access and quality of care received. (2-5) Reports found negative attitudes amongst healthcare professionals, a widespread lack of training and cases of avoidable early mortality. (2-5)

Furthermore, research has shown that undergraduate medical education in intellectual disabilities is inconsistent and inadequate, with students reporting high levels of anxiety about communicating with patients with disabilities. (6-9) The attitudes that medical students hold are critical as they are tomorrow's doctors, and attitudes can have a significant impact on a patient's experience in the health service. (6)

Cardiff University has developed a pioneering partnership with Hijinx, a Welsh theatre company working with professionally trained actors with intellectual disabilities. All fourth-year medical students attend a communication skills teaching session where they role play clinical scenarios with Hijinx actors. This allows inclusive teaching to take place, where individuals with intellectual disabilities have a direct role in the development and delivery of education about them. (9)

This study looked at the effectiveness of this teaching session in changing student attitudes and perceptions about patients with intellectual disabilities.

Methods

A mixed methods approach was chosen for the study. This combination allowed qualitative exploration of quantitative results, so that a greater depth of understanding could be built.

For quantitative data collection, the Attitudes Towards Disabled People questionnaire (ATDP-B) was used to measure student attitudes. (10) This is a validated tool that is in the public domain and was found to be reliable at measuring medical student attitudes in a previous study (Reliability = 0.71). (6) The questionnaire includes thirty statements regarding individuals with disabilities, with a Likert response scale. Higher scores are achieved if the respondent regards someone with a disability as similar to the average person.

66/110 (60%) of year 4 students attending the communication skills session on intellectual disabilities completed the ATDP-B questionnaire, both before and after the teaching. Before and after scores were collated and compared using a paired t-test analysis.

Anonymised ATDP-B questionnaires were used to calculate general student perceptions. For each statement, the overall positive and negative responses were aggregated. This data was used to conduct five semi-structured interviews (1:1) and one focus group with nine students. The common perceptions were discussed, alongside how the teaching session tackled them and suggestions for further improvements.

Ethical approval for this study was granted by the Cardiff University School of Medicine Ethics Committee.

Results

Mean ATDP-B score before the teaching session was 115 (SD = 14.5). Mean ATDP-B score after the teaching session was 122 (SD = 17.2). The teaching session improved scores in the ATDP-B by a mean of 6.92 (4.69, 9.16). A paired t-test found this to be a statistically significant difference, t(65)= 6.20, p <.001.

Qualitative data was thematically analysed and four main themes were identified: student identity, patient contact, equity in healthcare and curriculum content.

Students discussed the impact of a lack of exposure, and how reluctance to communicate with intellectually disabled patients often stems from feeling unprepared and incompetent rather than prejudice, as without prior experience they do not understand how to communicate. Furthermore, exposure is key for building emotional understanding. A critical outcome of the teaching session was students developing empathy and a new understanding of this vulnerable patient group, which are essential for effective communication. The students also identified communication to be the biggest barrier in delivering healthcare to intellectually disabled patients, and thus the strength of this session stems from its focus on effective communication.

Furthermore, students highlighted the pressure as medical students to have egalitarian attitudes, which contrast the needs of intellectually disabled patients, who require special attention and adjustments to be made.

Discussion

The results identified that the teaching session improved student attitudes towards individuals with intellectual disabilities, which is supported by previous studies. This is a significant finding as the attitudes of healthcare professionals are one of the root causes for the health inequalities seen. (2)

This was the first study to investigate the origin of the negative attitudes of medical students, and found they stem from a lack of confidence in their abilities and failure to develop a professional identity. The impact of the teaching session stems from its focus on meaningful patient contact and identifying and overcoming communication barriers. This is significant as it shows students should not be vilified for their uninformed attitudes, and rather it signifies that meaningful clinical exposure is essential at undergraduate level, to adequately prepare students for their professional role.

A potential limitation is the absence of clinical knowledge due to the singular focus on communication. Integration of communication skills and clinical knowledge, as well as repeated teaching throughout the curriculum could further improve this teaching session.

Lessons Learnt

Conducting this research project was a big challenge for me, as I had no experience in research, but an overall gratifying process. I enjoyed learning about a single topic in great detail, particularly one that is given little focus in the medical curriculum.

It was an eye-opening experience as I had little prior knowledge on intellectual disabilities, particularly on the health inequalities faced. The project helped me gain a patient perspective on how our interactions with patients carry more significance than we realise, and how unconscious bias can have a real impact on patient outcomes.

I found it difficult to be impartial when conducting the project, as it is an emotive topic that has a real impact on people's lives. However, on reflection, I think to negate emotions would take away from the heart of this project, which is how human factors such as communication can have an impact on health.

Furthermore, this project has helped prepare me for my professional practice as I have gained knowledge on the clinical and communication needs of this patient group. Understanding the difficulties and inequalities faced will mean I can have meaningful and informed interactions with these individuals.

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C4ME Supplement

Burnout in undergraduate medical students

C4ME SUPPLEMENT

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Background

The increasing prevalence of burnout within the medical profession has been recognised over recent years. However, there is confusion surrounding the definition of burnout defined by Maslach as involving emotional exhaustion, depersonalization or cynicism and weakened sense of personal accomplishment, resulting in its sufferers struggling to identify and accept their feelings delaying necessary support and management. (1, 2) Forty-five percent of medical students' state having suffered with burnout; (3) adverse events may result in later training due to reduced professionalism and engagement. (4, 5) The GMC National Training Survey 2018 revealed the impact of burnout in postgraduates with nearly a quarter of trainees stating that they felt burnt out because of their work. (6) Efforts need to be directed to improving undergraduate burnout prevention allowing medical students to enter a career where they feel comfortable and supported.

Methods

A mixed-methods approach was adopted using an online survey containing open and closed questions and qualitative semi-structured interviews. Four research questions were developed to explore students' perceptions, reasons, prevalence and management strategies surrounding burnout.

All fifth-year medical students studying at Cardiff University were eligible to enrol. An online survey was distributed through medical school administrators, social media pages, emails and snowballing.

Students were given the option to leave their email for a further interview. Fourteen medical students expressed interest in interviews and they all provided written consent. Due to the sensitive nature surrounding burnout, interviewees were provided with contact information for Medic Support.

A semi-structured interview schedule was developed surrounding the research aims. Just under 4-hours of recorded, anonymised data was collected and externally transcribed. Interviewees were asked to share any stories they had witnessed/experienced in relation to the question. These quotes were then narratively analysed to help strengthen the depth of the findings through exploring students' narratives and identity in relation burnout. Thematic analysis was also used; to increase rigour an initial coding framework was developed inductively with supervisors, and 20% of the transcripts were double-coded to check for consensus. Nine major themes and 123 sub-themes were identified including the GIN (general incident narrative) and PIN (personal incident narrative) codes used in the narrative analysis.

Ethical Approval given by Cardiff Medical School Research Ethics Committee prior to commencing the research.

Results

All interviewees mentioned stress when describing their understanding of burnout, 12 mentioned the idea of reaching a limit as burnout causes its sufferers to feel unable to go on. Eleven spoke of tiredness/exhaustion because of burnout, which negatively impacts on their concentration, decreasing students' motivation.

Thirteen students mentioned assessments as a potential source of burnout. Interviewees explained the difficulty in making time for placement and revision, alongside a balanced lifestyle. The pressure medical students place on themselves to succeed was mentioned by 12, some suggested that medical students could be pre-disposed to burnout due to the constant comparisons with others and outside pressure from family and friends.

Nine students expressed that burnout was very prevalent. All interviewees outlined the physical effects of suffering with burnout such as reduced sleep, altered eating habits, sickness and absence. Students emphasised the predominant emotional effects as students become reclusive and isolate themselves from social events and activities they used to enjoy. Some students mentioned that burnout can be misdiagnosed as depression resulting in sufferers taking unnecessary medications.

Both social and academic support was recognised by all as a vital management strategy. However, students mentioned a lack of trust for the Medic Support service, fearing that conversations may appear on their academic record. Hobbies including exercise and university societies allow sufferers the opportunity to take time away from their studies and meet other students.

Discussion

This research is the first of its kind to explore medical student's understanding of burnout and unveil reasons and possible management strategies employed by those suffering. The research identified that medical students have similar perceptions of burnout, with all mentioning stress and the majority providing ideas of 'boundaries being pushed' resulting in exhaustion.

Students described struggling to balance placement and work alongside their social activities and hobbies which mirrors the transition into postgraduate training as junior doctors are expected to work long hours finding little time to socialise and rest. (7) Interviewees discussed the effects of burnout on student's future career, opting to maintain a work-life balance. A recent BMA report found similar problems in junior doctors, with many taking breaks from training due to fear surrounding their mental health and workloads experienced by those working for the NHS. (8)

Three areas for prevention were identified; improved support through promoting Medic Support ensuring it is accessible and educate students of its services. Raising burnout awareness amongst students enabling them to recognise its signs and access necessary support, through the delivery of stress management and the importance of self-care lectures. Reduce stigma surrounding burnout by informing students of its prevalence, granting them confidence to converse freely and access support.

Lessons Learnt

Recruitment of my interview sample proved a challenge during the project. I had limited time to conduct interviews to ensure I had data to code and analyse to write up my research.

The recruitment process was harder than expected and required perseverance and dedication. Despite my initial concern about the quality and quantity of data collected, I was able to deduce strong conclusions from my findings and address my projects aims.

The use of convenience sampling increased my sample through recruiting easily accessible students. (9) However, some students may find burnout uncomfortable to discuss therefore snowball sampling helped to access harder to reach students. (10)

In conclusion, the difficulties faced during this research deepened my understanding of different sampling methods. In future projects, I will adapt my recruitment process to best suit my eligible candidates to ensure I gain an adequate sample size.

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C4ME Supplement

An investigation into the career thinking of foundation doctors in Wales

C4ME SUPPLEMENT

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Background

The training pathway of UK doctors is apparently linear, as trainees typically progress through foundation and specialty training before applying for consultant or GP posts. (1) Despite this, the UK Foundation Programme's 2018 career destinations report stated that just 37.7% of Foundation Year 2 doctors (F2s) progressed directly to specialty training, (2) continuing the annual decline from 71.3% in 2011.

One commonly cited reason for these figures is the opportunity to work abroad. Surman et al. compared home-domiciled graduates' intentions to practice in the UK. Those intending on remaining decreased from 49.6% in 2011 to 25.8% in 2015. (3) Reasons for the increased desire to work abroad include favourable working environments, breaks from UK medicine and the UK's exit from the European Union. (4)

In 2017, a study funded by the Wales Deanery analysed medical trainers' confidence levels when providing careers support. (5) Responses led to a classification of trainees' career thinking states: decided, explorers and rethinkers. The decided had a clear choice, explorers were unsure of options and rethinkers were re-evaluating careers. Consideration of these categories could engender more tailored careers support. This classification was based on trainers' opinions. This study focused on understanding the career thinking of foundation trainees in Wales, testing the classifications, exploring possible associations between specialty intentions and thinking states and assessing trainees' confidence levels when making career decisions.

Methods

Data were collected through an online survey (January 31st to March 29th 2019). The target population was all foundation trainees currently working in Wales (n=678).

The survey was created using Jisc online surveys with all questions optional and participation voluntary. A variety of distribution methods were used, including emailing the survey link to all postgraduate hubs across Wales for circulation to all foundation trainees. In order to further increase response rates, a paper copy of the survey was sent to four of the hubs for distribution during teaching.

Data were analysed descriptively and statistically using SPSS software. Free text comments were manually analysed thematically (by JM) in Microsoft Word, and a sample of the coding was verified with co-authors.

The study was deemed a service evaluation, not requiring ethical approval.

Results

The survey was completed by fifty-eight foundation trainees; 56.9% were F1 and 63.8% were female. The small sample size means that results should be interpreted with caution. However, findings complement other studies, increasing confidence that results are not skewed.

Career thinking states

Participants identified with the suggested thinking states of decided (45.5%), explorer (43.6%) and rethinker (10.9%).

Specialty intentions

Only 30.2% of trainees intended on progressing directly to specialty training. The three most preferred specialty training programmes were general practice (20.8%), internal medicine training (17%) and acute care common stem (11.3%). There was a significant association between thinking state and specialty preference, with GP the most common preference among the decided (20.2%) and general medicine most common among explorers (27.3%) (X2(12)=18.254, p=0.041). Results should be interpreted with caution due to the small proportion of rethinkers (n=6).

Usefulness of resources

Discussions with consultants were considered the most useful resource, with a mean score of 4.31 on a five-point Likert scale. Websites were generally less utilised with 42.8% stating that they were not used.

Career planning and support

Fifty-three percent stated that they had found the process of navigating careers to be unclear and confusing, with a significant association between these feelings and thinking state. The decided were more likely to find the process clear and straightforward (X2(6)=21.820, p<0.001). Trainees felt somewhat supported when making career decisions, with a mean of 3.09 on a five-point Likert scale. This indicated that overall, trainees did not feel strongly either way, demonstrating room for improvement.

Discussion

This study supports findings from the wider literature that fewer trainees are directly progressing to specialty training.

No previous studies have analysed the career thinking states of trainees. These findings confirm that foundation trainees in Wales can be categorised by three thinking states. A significant association was found between specialty intention and thinking state, with GP the most preferred choice among the decided. This result is important given the recognised recruitment ‘crisis’ in this specialty, with the number of GP practitioners in Wales declining annually since 2010. (6) At the time of survey distribution, some specialty programmes had been remodeled following the Shape of Training report, (7) bringing changes to content and duration. This study did not explore the impact of these changes on career thinking state or specialty choice. Further study would be required to fully assess the impact of programme changes on career thinking.

Encouragingly, the resources deemed most useful were discussions with experienced individuals. However, results from the Wales Deanery study (5) suggest that this may not be sufficient in advising explorers and rethinkers. Trainers felt less confident with topics such as working abroad (22%) and flexible training options (37%); areas commonly requiring support from these trainees. Careers support should therefore be tailored to suit varying needs, as well as increasing awareness of other resources.

Over half of respondents found the process of navigating careers to be unclear and confusing, with a significant association ($p<0.001$) between these feelings and thinking state. This is supported by Lachish et al. who suggest that trainees find it difficult to access career guidance. (8) With this in mind, career resources may need adapting to ease navigation.

Lessons Learnt

Description

I conducted a quantitative study, investigating the career thinking of foundation trainees in Wales.

Feelings

I was proud of the work completed and feel that the results will help inform changes to careers support.

Evaluation

I recognise the risk of non-response bias due to the low response rate. My results, however, complement similar studies. Additional findings, not yet considered in literature, means this study adds to the evidence base and suggestions for the development of careers advice are indicated.

Analysis

The low response rates were associated with difficulties in distribution. I did not have access to a single survey distribution point for foundation trainees, meaning I had to be creative in my recruitment strategy.

Conclusion

I thoroughly enjoyed undertaking this rewarding project, developing generic skills which will be useful throughout my career.

Action Plan

In future I will seek to consider potential challenges prior to the project start and develop back-up plans. I will also be more realistic in my expectation of response rates.

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C4ME Supplement

"All young and trendy people using them": An exploration of young adults' perceptions and reasons for using e-cigarettes

C4ME SUPPLEMENT

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Background

E-cigarettes are electronic nicotine delivery devices and were used by 3.2 million UK adults in 2018. (1) Though they are marketed as a cessation tool, they are increasingly being used as a recreational tool by young adults. (2)

The expeditious delivery of nicotine and behavioural similarities to traditional cigarettes are noted by Public Health England as they promote these products as a successful quit tool. (3) However, this stance is contentious amongst institutions such as Public Health Wales who call for greater restrictions of these products due to concerns of adolescent use and their potential to be a *'gateway'* into traditional cigarettes. (4)

Young adults aged 20-25 are of interest, as they are developing autonomy, navigating social media and those within higher education are noted as having a greater proclivity than their peers not in education to engage in risky behaviour such as excess alcohol consumption. (5)

Current literature acknowledges that the ability to customise e-cigarettes allows for self-expression and promotion on social media. (6) However, this research was predominantly based on an American population. Due to the position of e-cigarettes within the socio-political landscape, further qualitative research is required into UK young adults' perceptions and experiences of e-cigarettes in order to inform policy decisions.

Methods

In-depth data collection was facilitated through semi-structured interviews in Cardiff, Wales. Opportunistic and snowball sampling was used to recruit 15 participants who were aged between 20-25 and had used/tried e-cigarettes. Recruitment occurred until data saturation was achieved. All interviews were conducted by the main author, who was trained in interview techniques by a CRUK research fellow. The topic guide was developed by the main author and based on his prior meta-ethnography into young adults' experiences and perspectives of e-cigarettes. Questions explored their use as a cessation tool and their safety. Interviews lasted 20-30 minutes and were audio-recorded.

Along with an information sheet, participants received a full explanation of the study and consent was recorded on the day of the interview. Contact details and links to local cessation services were provided along with a £10 *'Love To* Shop' voucher. Ethical approval was granted by the School of Medicine Research Ethics Committee.

In order to record key themes and important non-verbal cues detailed field notes were completed after each interview. Through listening to interviews and consulting field notes, the main author inductively used Braun and Clarkes' process of thematic analysis to identify key themes known as codes. An interview was independently analysed by a member of the study team to compare codes and generate discussions.

Results

The mean age of participants was 23 and over half of individuals interviewed were female (n=8). Of those interviewed 11 were White British and 12 were in higher education. All participants had used e-cigarettes; 11 were current users and 4 had tried e-cigarettes at least once. Most participants were current (n=7) or former (n=6) traditional cigarette smokers; 2 were never traditional cigarette smokers.

Young adults developed distinct health identities with e-cigarettes, as they found them more aesthetically pleasing and perceived them to contain considerably less harmful chemicals than traditional cigarettes. Users saw them as superior to typical nicotine replacement therapy and associated them with long term cessation. Young adults noted that motivation was required to effectively use e-cigarettes as a cessation tool, and this was often prompted by key events such as graduation, decrease in personal fitness and affiliation to peer groups. Whilst e-cigarettes were perceived as safer than traditional cigarettes, users raised concerns over the lack of longitudinal research and conflicting research available.

E-cigarettes served a social function, as users were able to share their products with their peers and customise them to reflect their personal preferences with respect to flavours and accessories.

Some participants were reluctant to quit traditional cigarettes and had developed distinct patterns of dual use, with e-cigarettes facilitating use inside and traditional cigarettes being used within social environments.

Developing gender roles were recorded, as female users often felt uneasy within e-cigarette stores and male participants concurred that they were typically male dominated space. Female participants aligned themselves with smaller discreet products, whilst noting that men typically had larger, ostentatious devices which allowed them to produce large clouds of vapour. Users noted that e-cigarette stores were a main point of e-cigarette information and facilitated ongoing cessation.

Discussion

E-cigarettes within this study were primarily used as a cessation tool by smokers and this is mirrored at a UK population level as they are currently the most popular tool for quitting. (3) Similar qualitative research including this age group noted their appeal to those who would not typically engage with conventional cessation services. (7) Young adulthood is a critical time for influencing healthy behavioural change, as it is often dictated by their social identity; consumer psychology has shown that young adults may disengage with products which do not align with their perceived group norms. (8) As these young adults are still the main consumers of traditional cigarettes within the UK, health institutions, as demonstrated by Public Health England, should adopt a harm reduction approach to influence behavioural norms. (9)

There has been little research into how e-cigarette stores could potentially play a role in providing smoking cessation information, especially since young adults within this study were often accessing informal channels such as social media to receive health information. Qualitative research into the role of e-cigarette stores found that the provision of bespoke cessation advice and ongoing support was key to successful cessation. (10) E-cigarette stores could be an opportunity to access and engage young adults who may be motivated to quit smoking with cessation support and provide appropriate signposting to conventional cessation services.

Lessons Learnt

Developing the topic guide from my existing meta-ethnography allowed me to develop an in-depth understanding of e-cigarette use within young adults. Conducting the interviews instilled the importance of phrasing questions in an open-ended manner so as to maximise the information received. Furthermore, allowing intentional pauses gave a platform for the participant to collect their thoughts and provide further unprompted thoughts. As I move back into medical training, these skills are translatable within a clinical environment.

It was daunting approaching peers and participants similar in age to discuss their traditional cigarette and e-cigarette use, as it can be a sensitive topic. However, by writing field notes on completion of the interview I was able to maintain good eye contact and remain present within the interaction, which enabled me to build a rapport with participants. The research was limited by the lack of insight from traditional smokers who had never used e-cigarettes. This is a key demographic to examine, as their views may impact whether they see e-cigarettes as a potential cessation tool and subsequently impact the delivery of targeted health information. Due to the sampling process, participants were predominantly White British, so future work should be more representative and include more perspectives from ethnic minorities and low-income groups.

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C4ME Supplement

Public perceptions about non-traditional primary care consultations, back-up prescriptions and point-of-care testing in respiratory tract infections

C4ME SUPPLEMENT

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Background

Respiratory tract infections (RTIs) account for a large proportion of primary care consultations and antibiotic prescriptions in the United Kingdom. Approximately one quarter of the population of England and Wales consult for RTI-related symptoms each year, with 60% of all primary care antibiotics being prescribed for these. (1)

The vast majority of RTIs are self-limiting viral infections, which do not necessarily require face-to-face GP advice or a week-long antibiotic prescription. Such high numbers of consultations increasingly place strain on general practitioners (GPs), who face increased workload and are driven away, resulting in a depleted workforce. (2, 3) Additionally, injudicious antibiotic use feeds the ever-expanding issue of antimicrobial resistance (AMR), which is a well-established threat to health and economies on a global scale. (4)

In order to address these problems, alternatives are needed. These include replacements for traditional GP consultations, such as pharmacist or electronic consultations, alongside novel techniques to reduce rates of prescribing, such as back-up prescriptions (BUPs) and point-of-care testing (POCT). The study we carried out was designed to explore the perceptions of members of the public regarding these interventions. We hope that the results we have obtained will be a valuable contribution to the existing literature on the topic.

Methods

The views of members of the public were collected using HealthWise Wales (HWW), a national online cohort study. HWW consists of a combination of broad sociodemographic surveys and those pertaining to more specific areas of research, in our case the Caring for Coughs and Colds (CCC) module. The study sample was therefore composed of anyone aged 16 or over who was living in Wales who was subscribed to HWW and had completed the CCC module.

As our study aimed to link perceptions to behavior, data were also collected using the Secure Anonymised Information Linkage Databank (SAIL). Read codes were used to identify RTI-related consultations, antibiotic prescriptions and comorbidities, all of which were linked to HWW questionnaire responses on an individual level.

Data analysis was divided into descriptive and analytic phases. Public perceptions on drivers of consulting, perceptions of infection severity, alternatives to traditional consultations and value of the components of a consultation were described. Logistic regression was used in a univariable and multivariable model, implementing a forward stepwise approach for the latter. The aim was to identify associations between a pre-determined list of explanatory variables and specific public perceptions, including the acceptability of alternatives such as pharmacists or video consultations. We also looked at the factors associated with increased confidence in BUPs and POCT.

Results

90% of participants said they would only consult if they believed they had a serious infection, with over 75% driven to visit the GP if they thought they needed antibiotics. A fever of increasing duration was perceived to be the clearest indicator of a serious infection by members of the public. Receiving information and advice from a pharmacist was considered to be a favourable alternative to a traditional GP consultation by over 70% of the study cohort. Video consultations and email correspondence were less popular.

Perceptions of consulting frequency over-estimated consulting behaviour. 6.1% believed they would consult twice or more per year for the symptoms of an RTI, but only 0.4% did across the three-year period identified.

Women and adults without children were more likely to be in favour of visiting a local pharmacist as an alternative to their GP. Participants in the youngest age group were more likely to favour video consultations than those in the oldest. Men were more likely to want to be given a BUP and to be happy with POCT as part of a consultation.

Discussion

In our study, over 90% of participants said they would consult if they believed they had a serious infection. This differed from another similar study in England, in which 51% of participants contacted their GP out of fears of a serious infection. (5) Although perceptions over-estimate behaviour when it comes to consulting for RTIs in a community setting, there is still a significant burden which requires intervention.

Our findings complemented the literature for certain non-traditional consultation alternatives, where email correspondence and video communication have been shown to introduce challenges for both patients and doctors. (6, 7) This was particularly highlighted in the older population, as our study found they would be less willing to accept newer technological forms of seeking advice. It is interesting to see that face-to-face consultations are still favoured by many, although looking at the bigger picture it seems imperative that these alternatives gain momentum.

However, the confidence in pharmacists as alternative sources of advice is very promising. With the appropriate training in assessing RTIs, pharmacists can form an exceptionally valuable part of community management for these infections. 31.8% of participants said they would want a BUP, although 33.8% said they would not feel comfortable in taking one. Measures to increase confidence in BUPs and to educate patients on how to use them would be a useful area to direct futher research into. 92.8% of participants said they would be happy with the finger-prick blood test, a form of POCT, as part of a consultation to help the GP determine need for antibiotics. Exploring the reasons why this is so widely seen as acceptable could help pave the way to increase uptake of BUPs.

Lessons Learnt

Description: This project was predominantly carried out to explore public attitudes on consulting, prescribing and non-traditional alternatives for the management of RTIs in the community. Tying our findings in with the existing literature can be helpful in furthering awareness about the available options from the perspective of members of the public.

Feelings: I thoroughly enjoyed working on this project and getting stuck into the large amounts of data during the analysis. It was rewarding to see some significant results emerge, and bring it all together in the hope of adding something of value to what currently exists in the literature.

Evaluation and Analysis: The main benefits of the study were the huge number of participants and the unique ability we had to link subjective questionnaire item responses to concrete behaviour within primary care records. The drawbacks included ambiguous wording of certain questionnaire items, leading to potential confusion for participant and analyst, and a limited three-year period of consulting and prescribing behaviour (2015-2017). As the data had already been collected previously, I think I would benefit in future from also being exposed to the data collection process.

Conclusion: Overall, I found this project interesting and exciting due to its unique design and exploration of novel ideas. There were certain areas that we could have targeted, in hindsight, to further boost the robustness of the results, such as gathering consulting/prescribing behaviour across a longer time period and cross-checking questionnaire items to ensure clarity. Ultimately it was a very useful project for me to undertake at this stage of my career, helping me gain a new transferrable skillset.

Action plan: I will certainly take the skills I have learnt during this project and implement them in any further research I carry out, whether it be related to the topic in question or not. It has given me a valuable insight into conducting research and it will be useful for future work.

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C4ME Supplement

Attitudes and perspectives of healthcare professionals on resuscitation decisions for infants born at the threshold of survival: a rapid review and reflection

C4ME SUPPLEMENT

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Background

Resuscitation of infants born 22-25-weeks gestational age is one of the major ethical dilemmas in neonatal medicine. (1) Survival rates of these infants have improved in recent decades. (2) However, long-term neurodevelopmental outcomes have not seen the same improvement. Children surviving extreme prematurity remain at a high risk of a wide range of disabilities. (3) Increased survival may come at the cost of long-term disability.

Ambiguity regarding resuscitation decisions is particularly high in the "grey zone" between 22- and 25-weeks gestational age. Neonatal health-care professionals (HCPs) are required to make complex decisions between resuscitation and end-of-life care. (4) Little is known about how these decisions are made. Personal opinions, attitudes and the philosophy of HCPs impact heavily on practice and therefore it is vital to understand what factors influence the resuscitation decisions made by doctors, nurses and midwives. (4, 5) Various studies have explored this but there has been little effort to provide a comprehensive overview of the area. The aim of this study was to provide a review of the attitudes of doctors, nurses and midwives surrounding decisions to resuscitate infants born at the threshold of survival.

Methods

The literature was comprehensively searched using MEDLINE, PsycINFO, Scopus and CINAHL. Three categories of key words were identified: types of HCPs, resuscitation, and gestational age.

Titles and abstracts of papers were screened using pre-defined eligibility criteria. Full texts of selected studies were then screened. Published studies were included if they measured the attitudes of doctors, nurses or midwives pertaining to the decision to resuscitate infants born between 22- and 25-weeks gestational age. Quantitative studies were excluded if they had fewer than 100 respondents or a response rate of less than 60%. Non-English language papers were excluded.

Data were extracted using a standardised piloted form. Due to the heterogeneity of included studies, a narrative synthesis was conducted. To identify key factors influencing resuscitation decision-making, results and discussion sections were analysed for patterns and trends to give a textual summary of the recurring themes.

Quality of cross-sectional studies was assessed using the STROBE checklist. (6) Qualitative studies were assessed using the CASP qualitative checklist. (7)

Results

607 papers were identified, of which 21 papers were eligible.

The main factors identified as influencing decisions were parental wishes, infant outcomes, infant condition, and guidelines and legislation (Figure 1).

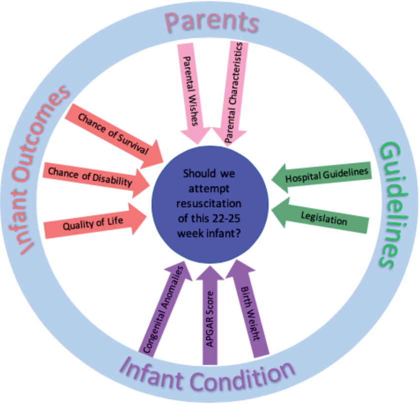

Figure 1: Model of Factors Influencing Resuscitation Decisions

Parental wishes were highly influential. Many studies reported that HCPs would consider parental preferences with regards to resuscitation. However, a few studies reported that parental wishes were not considered during decision-making.

The perceived outcomes of infants – including survival and long-term disability - were considered important when making resuscitation decisions. HCPs were less likely to resuscitate an infant they considered to have a low chance of survival or a high chance of disability.

HCPs were found to underestimate survival rates and overestimate rates of long-term disability. More accurate estimates were associated with a greater willingness to resuscitate.

Lack of guidelines and legislation arose as a key issue leading to uncertainty and inconsistent thresholds for resuscitation between respondents.

Quality of Included Studies

The main quality problems were a lack of thorough descriptions of outcomes and variables, and poor controlling of confounding and bias.

Discussion

This rapid review identified factors influencing resuscitation decisions at the limits of survival. It is significant that a minority of studies reported little consideration of parental wishes. The principle of shared decision-making (SDM) with parents is grounded in the ethical value of acting in the patient's best interests. (8) Barring some exceptions, the complete non-involvement of parents disregards the patient's autonomy.
SDM is a well-known tool in adult medicine but it has additional barriers to implementation in neonatology. (8) More work is needed to identify the specific barriers and facilitators to the implementation of SDM in neonatology.

Many studies found that HCPs poorly estimated outcomes. HCPs may make highly important decisions on the basis of incorrect outcome estimates. Obsolete outcome data and poor accessibility and dissemination of data may explain these misconceptions. (9) More work is needed on how to regularly disseminate up-to-date outcome data directly to clinicians.

Finally, the review highlighted the paucity in formal guidelines. Lack of guidelines leads to inconsistencies in practice and lack of consensus among HCPs. (10) The sheer amount of literature on this subject must be streamlined into concise and evidence-based recommendations for clinicians, by the relevant official bodies.

Lessons Learnt

This project was conducted with the Welsh Government, where my supervisors work. As this was my first project, in hindsight, my expectations of research were very different to the realities. Initially, I struggled to envisage my project. As my supervisor often said, conducting any research can sometimes feel like "wading through treacle" – particularly at the beginning, when the structure is vague, undefined and a little intimidating. Over time, however, I developed my project through reading and discussions with my supervisors, and soon I had a plan. The treacle was feeling much smoother.

However, we later realized that, logistically, I was unable to access the required database and the project needed to be overhauled. This felt frustrating as I had worked hard to develop it. The treacle felt thicker than ever.

Although this was a setback, looking back, the original project was overambitious. The new plan – a review - was more feasible and useful to the field. Also, while at the time, I felt my work had been futile, the reading I had done and notes I had made were still relevant. This particular experience, and the project generally, developed my ability to deal with setbacks – which are common within research. For future projects, I plan to be more prepared and adaptable to changes. Not only is problem-solving useful in research, but it is, of course, highly applicable to clinical practice.
Being involved with "real-life" research and work in government has given me unique firsthand experience and undoubtedly provided me with a skillset that I would otherwise be without – and can now continue to develop. I also have a wider understanding of the ripple effect of research – not just clinically but also on wider policy.

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C4ME Supplement

Management beyond the pitch: a literature review of paediatric sports related concussion

C4ME SUPPLEMENT

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Background

Sports related concussion (SRC) is a growing topic of interest, partly due to media attention and concern for medical negligence towards high-profile athletes. Children and adolescents are at their most vulnerable stage of neurological development and continually at risk of concussive injuries in sporting activities. It is estimated that 1-2 children per team, per season endure a SRC playing rugby in the UK. (1) Despite this, there remains a paucity in the development of clear and objective guidelines for guardians, sports coaches and healthcare professionals to ensure a safer return to sport for the paediatric population.

There is often confusion regarding the precise definition of concussion. The 2017 Concussion in Sport Group define concussion as a direct or transmitted force to the brain which *"results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously."* (2) Concussion *"reflects a functional disturbance rather than a structural injury",* (2) which is echoed in the absence of defect on standard neurological imaging.

This project explores the current practices for managing paediatric SRC in the Emergency Department (ED) by specifically addressing the following questions:

1. *How should we advise families on the rehabilitation of the patient?*
2. *What evidence is there for the value of follow up appointments?*
3. *How should we advise families on the long-term effects on neurocognition?*

Methods

A systematic literature review was conducted using the MEDLINE, Scopus and Web of Science databases. Identification of search terms were formed by breaking down the title into three main themes: paediatrics, sports related concussion and rehabilitation. Possible alternative spellings and synonyms were incorporated.

Initially, 727 records were identified through the database searches and an additional two records through reading other research papers. 135 duplicate abstracts were removed using the citation manager EndNote. The remaining 594 records were screened based on pre-determined inclusion and exclusion criteria.

The resulting articles were critically appraised using verified appraisal tools for risk of bias. 11 papers were included for the final review. Referral to the School of Medicine Research Ethics Committee was not required.

Results

1. How should we advise families on the rehabilitation of the patient?

Comprehensive advice should consist of symptom management including sleep hygiene, nutrition and hydration, graded return-to-play and return-to-school discussions. (3) In the acute phase, a form of exercise before seven days is more beneficial than the complete rest approach. (4) In patients with prolonged symptoms i.e. lasting more than 4 weeks, multiple papers have shown improved outcomes with physiotherapist-supervised exercise. (3, 5) One to two days of cognitive rest followed by a gradual return to activity showed greater symptom resolution versus five or more days of strict cognitive rest. (6) Cognitive behavioural therapy (CBT) programmes in patients with prolonged symptoms showed improvement. (7) Currently, there are no randomised controlled trials using pharmacological therapies for symptom management in paediatric concussion.

2. What evidence is there for the value of follow up appointments?

The paediatric neurorehabilitation service in Wales admits patients who exhibit a change on CT or MRI brain scans, which typically does not include patients with SRC. Therefore, there is a lack of evidence regarding follow-up appointments for patients with prolonged post-concussion symptoms in Wales. However, paediatric concussion clinics are a standard part of long-term care, as seen in Australian and American literature.

3. How should we advise families on the long-term effects on neurocognition?

Early attendance at the ED reduces prolonged symptoms and is therefore advisable. (8) Despite reporting symptom resolution, some patients have continued impairment in neurocognition. (9) Therefore, advice regarding graded return to play should be reinforced.

Research suggests that academic progression favours non-contact sports groups over contact sports groups who have endured an SRC. (10) Therefore, it should be ensured that parents are aware of the seriousness of an SRC and the possibility of suffering long term neurocognitive damage.

Discussion

Evidence suggests taking time to educate both patients and their guardians on recovery and prolonged symptoms is particularly important. Primary and secondary healthcare professionals require further education and training on concussion management, for example through e-learning modules. Potential therapies after discharge from the ED include active rehabilitation with early physiotherapy guided exercises and CBT, which have shown better outcomes than the complete physical rest approach.

Larger randomised controlled trials with prospective monitoring are needed to provide solid evidence on which to base management guidelines. The five to ten-year-old group requires particular focus. There is potential for increasing the use of the 5th Sports Concussion Assessment Tool (SCAT5) proforma in the emergency setting and incorporating it into rehabilitation progression. Pre-season SCAT5 assessments conducted by sports clubs for all amateur players would provide a valuable baseline in the event of an SRC. Safety netting and providing resources for follow-up, including sign-posting sporting body websites, may result in highlighting more patients with prolonged neurocognitive deficits.

Multi-disciplinary neurorehabilitation teams require more funding to expand their outreach. Influence must be taken from other global clinical sources and research continued for progress to be maintained.

Lessons Learnt

On receiving my dissertation title, I was wary of having never undertaken a literature analysis project before and I found the sheer quantity of papers on concussion daunting. However, meeting with the healthcare librarian, who advised me how to use literature databases and how to narrow my search field by using key words, was a valuable experience. The skill of using focused searches to further my background knowledge can be applied to both my further research and to keeping up to date with developments in my future specialty.

The time-consuming nature of critical analysis proved challenging; utilising deadlines for each of the constituent parts helped break the project down into smaller and more surmountable tasks. Critical appraisal frameworks enabled me to evaluate the literature systematically and encouraged me to think more deeply about the provenance and significance of the evidence presented in journal studies.

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C4ME Supplement

Effects of Superoxide Dismutase 1 on cartilage chondrocyte metabolism: a protective mechanism against ankle osteoarthritis?

C4ME SUPPLEMENT

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Background

Osteoarthritis (OA) is a ubiquitous degenerative disease that generates significant global disability and socio-economic burden, forcing more than 8.75 million people aged 45 or over to seek treatment in the UK/annum. (1) OA predominantly affects the lower limbs, however prevalence in the knee is 10-fold higher than in the ankle, with notably differing aetiology between the joints. Knee OA is characteristically a 'wear-and-tear' primary arthritis; in contrast, 90% of ankle OA cases are preceded by trauma-induced joint instability. (2) Hence, ankle cartilage is thought to be relatively protected from the catabolic phenotype that constitutes primary OA pathogenesis. Such protection is likely mediated through biochemical and biomechanical variations including lower concentrations of matrix metalloproteinases (MMPs) - cartilage degrading enzymes, and a reduced sensitivity to pro-inflammatory cytokines. These include Interleukin 1ß (IL-1ß) and Tumour Necrosis Factor-∝ (TNF∝), which potentiate an OA phenotype in cartilage. (3, 4)

Prior RNA sequencing data identified a potential increased expression of the Superoxide Dismutase 1 (SOD1) gene in ankle cartilage relative to the knee; a gene encoding an intracellular antioxidant enzyme that reduces oxidative stress. Oxidative stress is elevated in OA cartilage and is associated with inducing chondrocyte dysfunction, partly through upregulation of OA-linked pro-inflammatory cytokines. (5) Following receipt of the Wolfson Intercalated Award (Royal College of Physicians), I used an *in vitro* model to investigate whether this relative increase in SOD1 was partly responsible for conferring protection against cytokine-induced chondrocyte catabolism.

Methods

Immortalised ATDC5 mouse teratocarcinoma cells were utilised as a chondrocyte source. Cells were seeded within media suspension (100,000/well of a 48-well plate) and subsequently treated (n=6) with 0.31U or 0.63U of bovine erythrocyte SOD1 (25U/mg and 50U/mg of cellular protein respectively). This represented the physiological concentrations of SOD1 reported for knee and ankle articular cartilage in the literature (6). SOD1 treatment occurred in the presence or absence of 5ng/ml IL-1∝ and 10ng/ml Oncostatin M treatment - used to mimic the pro-inflammatory catabolic response observed in OA; untreated cells served as controls. Cells were treated for 1, 2, 3 or 7 days, with media and cell lysates analysed for cytotoxicity, as well as markers of inflammation (nitric oxide (NO), prostaglandin E_2 (PGE_2)) and chondrocyte metabolism (sulphated glycosaminoglycan (sGAG), type II collagen).

Results

Following normalisation to ATDC5 protein content, as a marker of cell metabolic activity, it was observed that both 0.31U ($p \leq 0.001$) and 0.63U ($p \leq 0.01$) of SOD1 treatment blunted cytokine-induced NO synthesis at day 7. Furthermore, 0.31U of SOD1 treatment significantly lowered cytokine-induced PGE_2 media content by day 7 ($p \leq 0.05$). Surprisingly, sGAG content was not affected by cytokine or SOD1 treatment.

Discussion

SOD1 treatment significantly reduced cytokine-induced upregulation of NO and PGE_2 in an ATDC5 chondrocyte-like cell line. Limiting the synthesis of pro-inflammatory molecules, such as NO and PGE_2, potentially reduces the cartilaginous tissue loss characteristic of OA, through decreasing MMP expression and the mitochondrial dysfunction that initiates a chondrocyte apoptotic response. (7) NO and PGE_2 additionally suppress neosynthesis of type II collagen and proteoglycans; (8) therefore, the demonstrated effects of SOD1 may facilitate cartilage regeneration plausibly perturbing OA pathogenesis. Restricting NO and PGE_2 production also disrupts positive feedback-mediated upregulation of pro-inflammatory cytokines, defining an additional mechanism by which SOD1 treatment may reduce joint inflammation. (8) With a potential protective role for SOD1 against a catabolic OA-like phenotype identified, it can be hypothesised that its elevated expression in ankle chondrocytes relative to knee may be partially responsible for the relative susceptibilities of each joint to osteoarthritic degeneration. Nevertheless, future studies are necessary to determine whether these SOD1-mediated reductions in catabolic activities correlate with measurable decreases in human cartilage matrix degradation.

Furthermore, our study may suggest applications for exogenous SOD1 in OA treatment, through attempting to recapitulate innate ankle SOD1 concentrations within OA afflicted joints. This concept is supported by literary evidence for the beneficial effects of Orgotein, a bovine non-specific SOD intra-articular injection, prior to its discontinuation due to adverse effects. (9) Tempol, a SOD mimetic, exhibits a more controlled attenuation of arthritic inflammation due to its biological membrane permeability but has further noxious systemic effects. (10) Therefore, further research into defining mechanisms of SOD1 endocytosis and its extracellular functionality may facilitate a future for recombinant SOD1 as a more effective treatment for OA.

Lessons Learnt

This research project introduced skills such as statistical analysis, tissue culture, and laboratory techniques including pipetting, ELISAs and Western Blotting. With no prior experience of the techniques employed, I found the project a challenging and initially daunting experience, and often frustrating when meticulous time-consuming investigations revealed unusable or anomalous data. This included the data for 3 days of SOD1 treatment, yielding non-significant results and a low metabolic activity that implied compromised cell viability. This highlighted the uncertainty of research, the susceptibility of delicate techniques to error, and the importance of subsequent perseverance and investigation into possible explanations. Learning these challenging techniques and how to systematically approach and resolve problematic situations are skills I will now directly apply to similar future situations in medicine.

Moreover, conducting pioneering research was initially disconcerting, with no information to cross-reference findings. However, analysing novel results taught me a versatility with processing literature evidence, utilising current knowledge in the field to explain my own results. Upon presentation of my work, academic questioning surrounding the methods I employed made me aware of the importance of not only understanding what you are doing, but also why. Whether designing an experiment, explaining novel results or treating patients, I now have an increased appreciation for the importance of literature-based evidence and its skillful handling to guide decision-making. Not only are evidence-based decisions important, but so is an awareness of methodological reasoning and a pliability of your decisions to be in line with the latest evidence.

In conclusion, this project emphasised how pivotal research is to identify biological targets to optimise the treatment of patients. This philosophy has inspired me to integrate research into my future career, as I believe it paramount that doctors are involved in the furthering of medicinal knowledge.

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C4ME Supplement

Development of a competitive ELISA and genotype technique to determine caffeine pharmacokinetics and CYP1A2 status in humans

C4ME SUPPLEMENT

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Background

The cytochrome P-450 1A2 (CYP1A2) enzyme accounts for approximately 13% of the CYP family of enzymes. (1) It metabolises drugs and is important for drug-drug interactions. Interindividual differences in CYP1A2 phenotype and genotype result in variable enzyme expression and functional activity, thus can alter drug plasma concentration. Caffeine is largely metabolised by CYP1A2 and is often used to investigate an individual's CYP1A2 metabolic activity, (2) which may help in drug prescription and dose adjustment to avoid toxicity or inefficacy. (3)

The aim of this project is to develop two protocols:

A) To evaluate CYP1A2 phenotype through determining salivary caffeine pharmacokinetics using a competitive ELISA.

B) To identify the most widely studied single nucleotide polymorphism (SNP) CYP1A2*1F (SNP rs762551 A/C), with polymerase chain reaction-restriction enzyme fragment length polymorphism (PCR-RFLP) assay.

Once protocols have been developed, we would determine if they are appropriate for undergraduate laboratory teaching of pharmacogenomic concepts, i.e. how interindividual differences in CYP1A2 activity can alter the pharmacokinetic parameters of caffeine.

Methods

Ethical approval was sought but not required, as confirmed by the Chair of the School of Medicine Research Ethics Committees.

Development, optimization and validation of ELISA

Competitive ELISA to measure caffeine in saliva is based on a previously described protocol. (4) The concentrations of commercially available antibodies, caffeine conjugated to horse-radish peroxidase and unlabelled caffeine were optimised for the assay. The optimised ELISA was then validated with saliva collected at various time intervals from ten volunteers, after ingestion of 100 mg caffeine in tablet form.

The ELISA standard curve was generated on myassays.com using four-parameter logistic curve fit. Pharmacokinetic parameters of caffeine were determined; coefficient of variation (CV) was calculated to evaluate precision and repeatability of the immunoassay. Data were analysed using GraphPad Prism 7.04 and expressed as mean ± SD.

Development of PCR-RFLP assay to determine a SNP in the CYP1A2 gene

DNA was isolated from buccal cells of three volunteers using two commercially available DNA extraction kits. It was used for identification of CYP1A2*1F through PCR-RFLP, and its association with the fast metaboliser phenotype using two published protocols. (5-6) Two pairs of forward and reverse primers were evaluated to identify and amplify gene segment containing the rs762551 SNP. PCR products were digested using two restriction enzymes specific for the C-allele. Fragments were analysed by agarose gel electrophoresis.

Results

Development, optimization and validation of caffeine competitive ELISA

The optimised ELISA allowed detection of caffeine ranging from 0.169 ng/ml - 20.0 ng/ml in saliva. CV between days was <15%, and <5% between replicates, indicating the ELISA had acceptable precision and repeatability. Saliva was collected before taking the caffeine tablet, then at 0.5, 1, 2, 3, 5, 7, 9, 12 and 24 hours. Levels of caffeine from 1 to 12 hours was statistically different from baseline at 0 hour ($p = <0.05$) and peaked at 1.56 ± 0.98 hours. Large interindividual variations were observed in C_{max} (1215 ± 2927 ng/ml).

PCR-RFLP assay to determine a SNP in the CYP1A2 gene

The PCR-RFLP did not yield any restriction fragments, suggesting all three subjects had two copies of the most common A-allele. Use of a control restriction enzyme, which cuts outside the SNP, yielded fragments within the expected base pair range, demonstrating validity of the assay. Further development of the PCR-RFLP protocol is required to determine CYP1A2*1F genotype.

Discussion

ELISA and CYP1A2 phenotype

Competitive ELISA, optimized and validated, is sensitive enough to quantify salivary caffeine; it is comparable to Carvalho's immunoassay (7) and a commercial ELISA kit using similar antibodies. (8) Large interindividual variations in C_{max} and T_{max} may represent differences in CYP1A2 activity or that caffeine's pharmacokinetic may not accurately represent CYP1A2 metabolic activity. Further study with a larger sample size is required.

PCR-RFLP and CYP1A2 genotype

The PCR-RFLP assay requires further optimization and a larger sample size to identify CYP1A2*1F. In addition to the enzymes specific for C-allele, those specific for A-allele could be used.

Are the protocols appropriate for teaching the concepts of pharmacogenomics to undergraduate students?

The competitive ELISA offers a simple and inexpensive way to quantify salivary caffeine in a standard laboratory, making it suitable for undergraduate laboratory teaching. During the experiments, students can practise laboratory skills, learn the principles of ELISA, understand pharmacokinetics and drug metabolism. Fast metabolisers metabolise drugs quickly, resulting in drug inefficacy; whereas drugs may accumulate in slow metabolisers, leading to toxicity. Through understanding the metaboliser phenotypes, drug dose can be adjusted accordingly for maximum efficacy and to avoid side effect. Many factors affect CYP1A2 phenotype, but their mechanisms and impact are unclear. The significance of different genotypes on its phenotype also has to be confirmed. The current PCR-RFLP protocol is not appropriate for undergraduate laboratory and requires further optimization.

Lessons Learnt

Constant reflection on the experimental process was required to produce an optimised immunoassay for the accurate quantification of salivary caffeine level.

As it was the first time carrying out a laboratory project by myself, I felt quite uncertain initially. However, under the guidance of my supervisors and reading the literature, I quickly understood and became more interested in laboratory research.

I was surprised by the viscosity of saliva and it was hard to pipette. In later experiments, to minimize error in volume of saliva used, a larger volume was pipetted and vortexed after each dilution. In addition, large interindividual differences were observed in caffeine pharmacokinetic. This may be due to saliva collection not being monitored; the duration of saliva collection could be standardised. Moreover, it may be accounted for by differences in gastric emptying. Large volume and high density food are emptied slower, (9) which may affect caffeine absorption rate. Some volunteers fasted before taking caffeine tablets, whereas others did not. This increased my understanding on the interaction between drug pharmacokinetics and consumption of food or liquid. Mealtime and saliva collection times should be standardized in order to minimize interference of food in future experiments. Moreover, pharmacokinetics of caffeine could be affected by differences in body mass, smoking and other drugs, which should be considered in the future.

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