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Original Article

Medical Student Perspectives on Undergraduate Oncology Education in the UK



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Abstract

Aims: The British Oncology Network for Undergraduate Societies (BONUS) surveyed students who attended an oncology revision day to determine their views on the current quantity, quality and type of curriculum-based oncology teaching they have experienced.

Materials and methods: Students attending two BONUS revision days received a questionnaire assessing their experience of oncology teaching within the medical curriculum and interest in pursuing a future career in oncology using a 10-point Likert scale. Data were collected with informed consent to be anonymised and used for research. Student demographics and qualitative and quantitative data about experiences of oncology education were analysed.

Results: In total, 451 students registered to attend the revision days. After removal of duplicates, non-responders and non-UK participants, responses from 153 students studying across years 1–6 at 22 UK medical schools were analysed. The mean quantity of oncology lectures students reported receiving was 8.9 hours and the mean quantity of clinic/ward-based oncology teaching was 7.5 hours. Ninety (62.1%) of the 145 students who responded to the relevant question reported that they had received dedicated teaching in oncology. Students who had received dedicated oncology teaching reported a statistically significantly higher mean quality 6.1 (95% confidence interval 5.6–6.5) versus 5.0 (95% confidence interval 4.3–5.5; $P = 0.003$) and quantity 5.2 (95% confidence interval 4.7–5.6) versus 4.3 (95% confidence interval 3.7–4.9; $P = 0.03$) of oncology teaching compared with those who had not received this.

Conclusion: Appropriate oncology education is essential for all medical students due to the high prevalence of cancer. All future doctors need the appropriate knowledge and communication skills to care for cancer patients. Our analysis provides quantitative evidence to support the value of specialist oncology teaching within the medical school curriculum in improving student-reported experience. National student-led revision days and events may widen interest in a future career in oncology and aid collaboration between oncology societies. It is important for the general undergraduate medical curriculum to integrate specialty content. An integrated curriculum should facilitate a holistic approach that spans prevention, screening, treatment and palliation rather than being split by subspecialty.

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Key words: Feedback; Medical education; Medical students; Peer-learning; Teaching; Undergraduate curriculum

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Introduction

One in two people in the UK will develop cancer during their lifetime, with the cancer incidence expected to double over the next twenty years [1]. Newly qualified doctors often look after cancer patients and therefore require the skills to care for and communicate with patients and their families. It is vital that medical students are adequately prepared for managing the unique psychosocial challenges faced by cancer patients [2,3].

Medical school education in the UK is overseen centrally by professional bodies such as the General Medical Council and Medical Schools Council [4,5]. In 2014, the Royal College of Radiologists (RCR) and the Royal College of Physicians (RCP) compiled a UK undergraduate (non-surgical) oncology curriculum, which has subsequently provided the basis for medical school teaching [6]. This was updated in 2020 to incorporate elements of the General Medical Council's 'Outcomes for Graduates' and the Medical Licensing Assessment that all UK medical students graduating in 2025 will need to pass in order to join the medical register [6–8]. These regulatory bodies ensure that students are not disadvantaged by geographical location. However, the 'Outcomes for Graduates' guidelines are generic and there is not a unified undergraduate curriculum in the UK at present [7,9]. Various medical specialties in addition to oncology have expressed concerns about being under-represented in medical school curricula and have developed specialty-specific core curricula that are utilised in UK medical school teaching [9]. Nonetheless, there is a significant amount of overlap between these subspecialties with core basic and clinical components of courses, such as pathology, pharmacology, anatomy, molecular biology and public health/epidemiology [10]. Therefore, there is scope for further integration of specialist knowledge from subspecialties into the core subjects, instead of different subspecialties receiving more individual emphasis. Subspecialty curricula also need to be updated over time to take into consideration innovative discoveries.

Despite this, medical schools typically offer limited exposure to oncology within their curriculum, often limited to a couple of weeks throughout the entire course [10,11]. Oncology is usually taught in the context of common cancer subtypes and rarely are the different treatment modalities in oncology explored in any detail [12]. Previous studies have shown that one teaching event in radiation oncology increased student confidence during oncology placements, which highlights that greater explanation of cancer care allows students to benefit from clinical attachments in oncology [13]. A recent RCR workforce report indicates that there is a shortage of oncologists in the UK, with many oncologists reporting that this is negatively impacting patient care [14]. Therefore, it is paramount that medical students are well-educated about oncology to inspire the next generation of oncologists early on in their training.

The British Oncology Network of Undergraduate Societies (BONUS) aims to promote medical, clinical, surgical and interventional oncology to students and junior doctors. By involving representatives from individual UK university oncology societies, BONUS is able to advertise events

nationwide, while also offering societies the opportunity to advertise local events nationally through BONUS' social media platforms. Utilising this unique structure, BONUS successfully organised a national research day to champion student-led projects and national education days to support students preparing for their end of year examinations. We surveyed undergraduate students who attended BONUS' oncology revision day to determine the current quantity, quality and type of oncology teaching that current medical students experience and whether this impacts their interest in oncology as a future career.

This paper aims to outline student perceptions of the quantity and quality of oncology teaching at their respective medical schools and to highlight the importance of high-quality oncology teaching events for medical students.

Materials and Methods

National revision days were organised by BONUS with oncology, haematology and palliative care themed lectures delivered by junior doctors, registrars and consultants in these specialties. These were aimed at preparing undergraduate medical students for examinations and were advertised through BONUS university representatives across the UK, as well as on BONUS' social media platforms.

Students were asked to fill out an electronically distributed post-attendance questionnaire in order to receive access to the delivered PowerPoints (even if they could not attend all of the lectures). This feedback form also contained an optional second section asking questions used in this project. Participants were informed about the aims of our study, given the opportunity to consent and informed about our intention of using their anonymised answers in research/publication. It was indicated to participants that the second part of the form was entirely optional and would not influence their rights to access the revision PowerPoints. Answers returned were anonymised and interpreted on a spreadsheet.

The survey evaluated the quality and quantity of oncology teaching that students had received to date. The questionnaire collected student demographic data (year of study, name of medical school). A 10-point Likert scale was used to evaluate interest in pursuing a future career in oncology. Additionally, qualitative data were collected asking about the quality and quantity of oncology teaching at their medical school and free text data regarding recommendations on what would optimise their learning were analysed by thematic analysis.

Data were grouped by geographical location and year of study so that comparisons could be drawn based on students undergoing similar stages of training.

A descriptive statistical analysis was undertaken, including chi-squared and two-tailed t-testing, as indicated in the respective figure legends (*P* critical value <0.05).

Results

In total, 451 students registered to attend BONUS' revision days. After the removal of duplicates, non-responders,

missing data, non-medical students and non-UK participants, responses from 153 students, studying across years 1–6 (Table 1) at 22 UK medical schools (Supplementary Table S1) were included in the analysis. Participants who did not provide enough demographic information to enable classification were excluded from the analysis. Of these 22 medical schools, 18 had a university oncology society with a BONUS undergraduate representative.

Quantitative Analysis

The most reported oncology experience was sitting in on an oncology clinic (58.8% of students) and the second most reported was attending a ward round (38.6% of medical students) (Table 2). Notably, 24.8% of medical students had not experienced any of these oncology experiences so far at their medical school. The results of this data were stratified based on whether the medical students indicated they wanted to pursue a career in oncology, to see whether this correlated with the number of oncology experiences they had had to date (Figure 1A).

Figure 1B shows the total number of oncology experiences (out of those listed in Table 2/Figure 1A) that each student had experienced. The greater the number of oncology experiences, the more likely a student was to be interested in a career in oncology (Figure 1C; no–yes 1.9 versus 3.3 $P = 0.00286$; not sure–yes 2.0 versus 3.3 $P = 0.00884$). However, we cannot conclude a causal relationship and we do not know the temporal relationship between the interest and the experience. It is also likely that this association between experience and interest would be seen for any speciality/subspeciality, not just oncology, so this is not an unexpected finding.

The mean quantity of oncology lectures students had received across all six year groups was 8.9 hours, ranging from a mean of 6 hours in year 1 students to 12 hours in year 6 students. The mean quantity of clinic and ward round-based oncology teaching was 7.5 hours, ranging from 0 hours in years 1 and 2 students to 12.8 hours in year 4 students. The mean rating of the quality of oncology teaching was 5.6/10, ranging from 4.4/10 in year 3 students to 6.3/10 in year 1 students. The mean rating of the quantity of oncology teaching was 4.9/10, ranging from 4.0/10 in year 3 students to 6.3/10 in year 1 students (Table 3).

Of the 145 students who responded to a question regarding receipt of specialist teaching, 90 students (62.1%)

had received dedicated oncology teaching by the point of data collection: 33.3% of year 1 students, 37.5% of year 2 students, 13.8% of year 3 students, 59.3% of year 4 students, 88.5% of year 5 students and 50.0% of year 6 students (Table 3).

Students who had received dedicated oncology teaching reported a statistically significant higher mean quality [6.1 (95% confidence interval 5.6–6.5) versus 5.0 (95% confidence interval 4.3–5.5); $P = 0.003$] (Figure 2A) and quantity [5.2 (95% confidence interval 4.7–5.6) versus 4.3 (95% confidence interval 3.7–4.9); $P = 0.03$] (Figure 2B) of oncology teaching compared with those who had not received dedicated oncology teaching.

Students were asked if they were ‘hoping to pursue a career in oncology’: 38% responded ‘no’, 42% responded ‘not sure’ and 20% responded ‘yes’ (Figure 3A). Of the 43 students who responded ‘yes’ or ‘not sure’ and reported knowing which speciality within oncology they were most interested in, 37% responded medical oncology, 35% clinical oncology, 21% surgical oncology, 5% research and 2% interventional oncology (Figure 3B).

Students who reported wanting to pursue a career in oncology also reported experiencing a higher median quality [6.1 (95% confidence interval 5.2–7.1) versus 5.4 (95% confidence interval 4.8–6.0); $P = 0.18$] (Figure 2C) and quantity [5.0 (95% confidence interval 4.2–5.9) versus 4.9 (95% confidence interval 4.4–5.5); $P = 0.81$] (Figure 2D) of specialist teaching at medical school. However, this difference was not statistically significant ($P > 0.05$).

Qualitative Analysis

Oncology Teaching Recommendations

In response to suggested improvements to oncology teaching at their medical school, four main themes were identified (Figure 4). These themes include: quantity of teaching received, translation to clinical practice, time of exposure and the impact of COVID-19 on oncology teaching.

Regarding the quantity of teaching, students unanimously suggested that oncology teaching/clinical placements should be longer in order to cover the breadth of the specialty. No students suggested less oncology teaching. Earlier exposure to the specialty was also a recurring desire, with many students reporting that their oncology teaching occurred over a single week in their fifth or sixth year.

Participants also often commented on the nature of teaching in terms of translatability to clinical practice. Students frequently suggested that the focus was too heavily weighted towards underpinning science and that more case-based teaching around how to manage common oncology presentations would be preferred.

The impact of the COVID-19 pandemic was also commented on extensively, with many students reporting that their learning experiences had been interrupted, resulting in fewer in-person teaching opportunities due to concerns over immunosuppressed cancer patients being exposed to unnecessary risk.

In response to topics that students believed were taught well at their medical school, oncological emergencies,

Table 1
Year groups of medical students included in the analysis

Medical school year group (1–6)	Number of medical students	Percentage of 153 students (%)
1	3	1.9
2	8	5.2
3	29	19.0
4	59	38.6
5	52	34.0
6	2	1.3

Table 2

The number and percentage of medical students who reported oncology educational experiences

Type of oncology experience	Number of medical students who reported they had had this experience	Percentage of total 153 students (%)
Sitting in on a clinic	90	58.8
Attending a ward round	59	38.6
Attending a chemotherapy day unit	41	26.8
Attending a multidisciplinary team	56	36.6
Having a tour of a radiotherapy department	26	17.0
Witnessing an oncology surgical procedure	42	27.5
Taking part in an audit/case report/systematic review/similar	10	6.5
Doing a student-selected placement in oncology	13	8.5
Doing an elective in oncology	4	2.6
None of the above	38	24.8

histopathology and palliative care were repeatedly mentioned. Some students also described that management of oncology patients was generally not taught well at their medical school.

Extracurricular Oncology Revision Days

Of the students who attended the BONUS oncology revision day, 101 UK medical students also provided feedback on this event and how it contributed to their learning. Students were asked how useful they found the lectures overall on a 10-point Likert scale. 81% of students rated them $\geq 8/10$, with only 2% of students rating them $\leq 6/10$.

79% of students 'agreed' or 'strongly agreed' that the length of the revision day was appropriate (lasting 5 hours) and 94% 'agreed' or 'strongly agreed' that the student-run revision day was well organised. 99% of students 'agreed' or 'strongly agreed' that the revision day covered an appropriate range of oncology topics and 97% of students 'agreed' or 'strongly agreed' that the day was relevant for their learning.

From the qualitative questions, students expressed that they found it helpful to have case-based questions at the end of each talk to illustrate the key learning points. Students stated that it would be helpful to signpost to the most

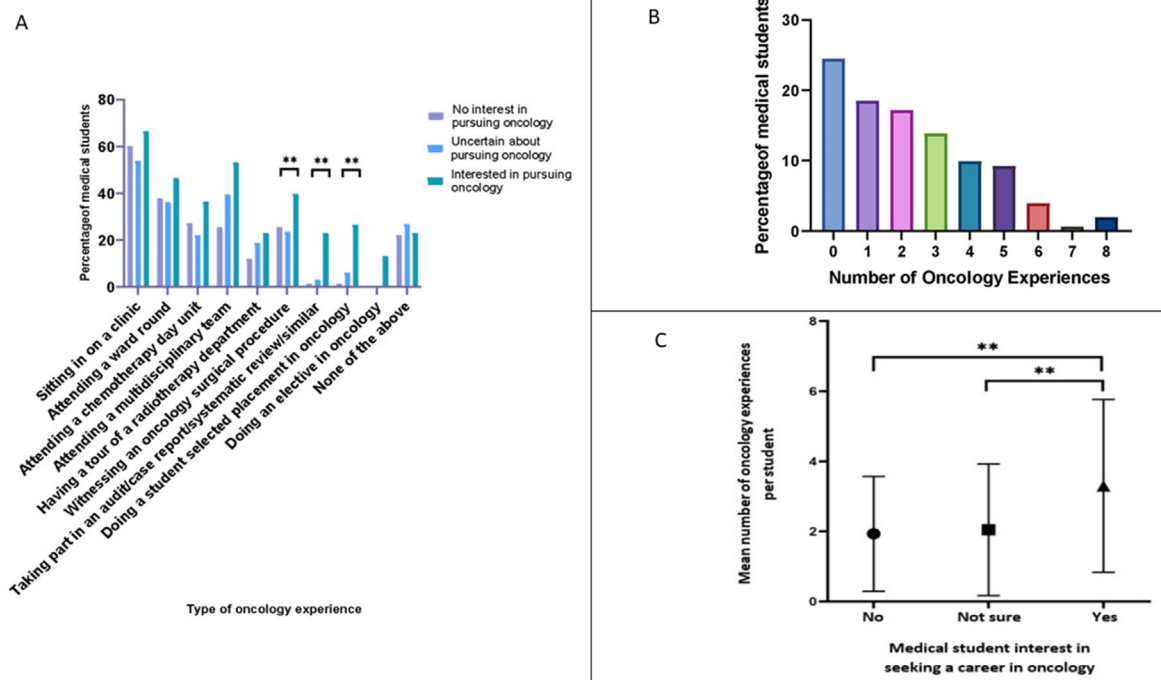


Fig 1. (A) The number and percentage of medical students who reported undertaking curricular or extracurricular oncology experiences, grouped by whether they expressed interest in oncology as a career. **Statistical significance between those who expressed an interest in oncology as a career and those who did not ($P < 0.01$, chi-squared testing; $P = 0.0004$ for audit; $P = 0.006$ for SSC (student selected component/ placement); $P = 0.0003$ for elective). (B) Total number of oncology experiences from (A) that each medical student reported. (C) The mean number (± 1 standard deviation) of oncology experiences, stratified by student interest in seeking a career in oncology (** $P < 0.01$, $P = 0.00286$ and $P = 0.00884$, two-tailed statistical analysis).

Table 3

The median quantity of oncology-themed lectures, ward round/clinic experience, student-reported quality and quantity of oncology teaching and percentage of students who reported having received specialist teaching in each year group

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Mean quantity of oncology-themed lectures (h)	6.0	6.8	6.3	9.9	9.1	12.0
Mean quantity of ward round/clinic experience (h)	0.0	0.0	1.0	12.8	6.6	3.0
Mean student-reported quality of teaching (0–10)	6.3	6.0	4.4	6.1	5.7	5.0
Mean student-reported quantity of teaching (0–10)	6.3	5.7	4.0	5.3	4.6	5.0
Students who have received specialist teaching (%)	33.3	37.5	13.8	59.3	88.5	50.0

relevant information for medical students and junior doctors. They were also asked if there were any topics that were not covered in the revision lectures that they thought would be relevant to their learning (noting that haematology and palliative care were covered in a second day of revision lectures). They stated that it would be useful to discuss national screening programmes and cancer therapeutics, for example drug interactions, side-effects and immunotherapy in greater depth.

Finally, students who provided feedback on the oncology revision lectures were asked to rate their confidence in their knowledge of oncology prior to and after the revision day. Prior to the revision day, 86% of students rated their confidence as 4–7/10. After the oncology revision lectures run by BONUS, 87% of students rated their confidence as >7/10.

The full questionnaire can be found in the [Supplementary Material](#).

Discussion

This paper aimed to analyse the oncology teaching experiences of UK-based medical students. Responses from 153 students were included, which confirmed the value and benefit of specialist oncology teaching within medical school curricula to help improve student-reported experiences.

Doctors will inevitably encounter patients with cancer regardless of which speciality they work in. Therefore it is essential that they develop the knowledge and skills to care for cancer patients [3]. According to the undergraduate non-surgical oncology curriculum published by the RCR and the RCP, graduates should be able to undertake a focused oncological history and show core communication skills, such as breaking bad news [15]. Increased exposure to oncology during medical school has been shown to increase

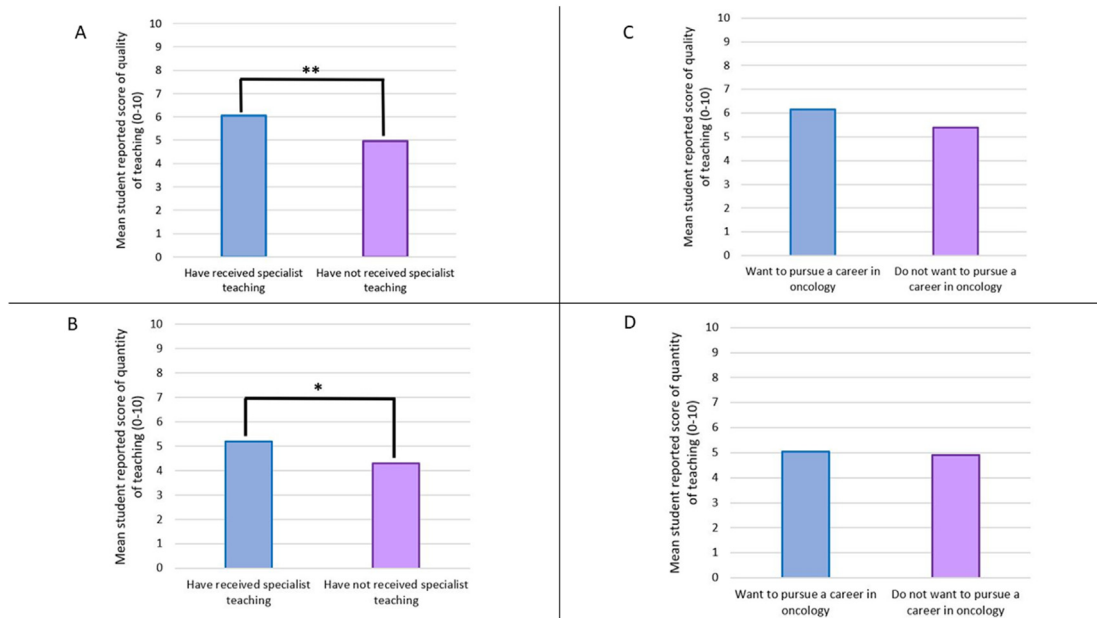


Fig 2. (A) Student rating of quality of oncology teaching using 10-point Likert scale, depending on whether or not they had received specialist oncology teaching. (** $P < 0.01$, $P = 0.003$, t -test, two-sample assuming unequal variances). (B) Student rating of quantity of oncology teaching using 10-point Likert scale, depending on whether or not they had received specialist oncology teaching (* $P < 0.05$; $P = 0.03$, t -test, two-sample assuming unequal variances). (C) Student rating of quality of oncology teaching using 10-point Likert scale, depending on whether or not they wanted to pursue a career in oncology ($P > 0.05$, t -test: two-sample assuming unequal variances). (D) Student rating of quantity of oncology teaching using 10-point Likert scale, depending on whether or not they wanted to pursue a career in oncology ($P > 0.05$, t -test: two-sample assuming unequal variances).

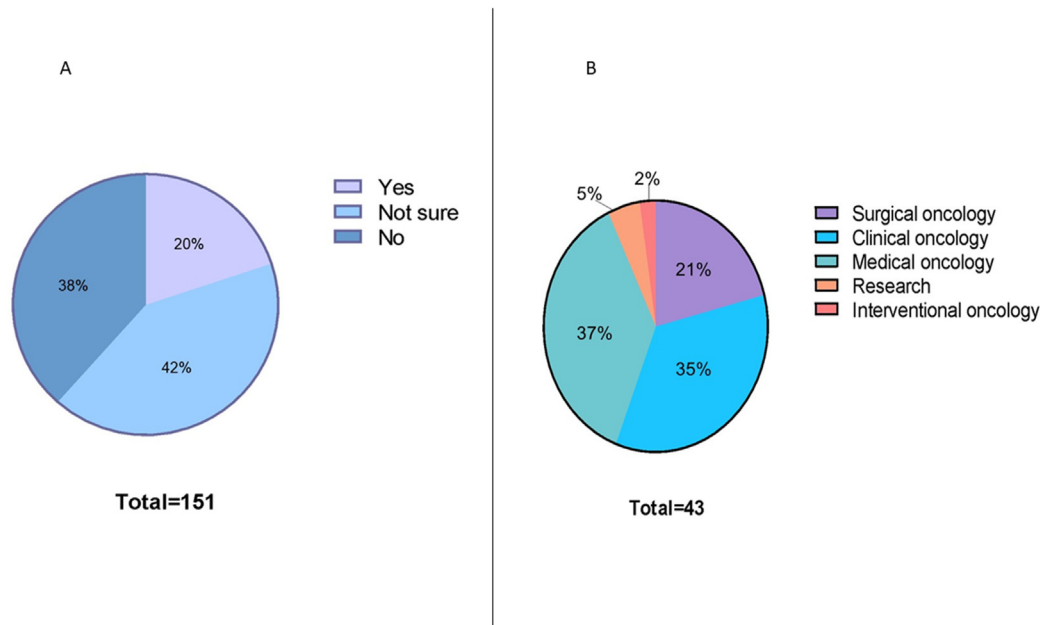


Fig 3. (A) Responses of medical students to 'Are you hoping to pursue a career in oncology?' (B) Preferred subspecialty of medical students interested in pursuing oncology as a career and who know which subspecialty is of most interest to them.

interest in a career in oncology [16], which is especially important given the current shortfall of oncologists demonstrated in the latest RCR UK workforce census in 2020 [14]. However, deficits in the quality and quantity of oncology teaching during medical school have been reported both in the UK [10,11] and internationally [17–21]. In a survey of final-year medical students in Australia and New Zealand, less than half of students felt confident in assessing patients with a malignancy by history taking and examination [17]. In a Canadian study, oncology was ranked as the worst-taught speciality in medical school, both by medical students and faculty members [20]. Few studies have assessed the state of oncology teaching in the UK [10,11]. According to a UK-wide survey, students reported limited knowledge of or interest in oncology [10]. A survey of FY1 doctors reported similar dissatisfaction with oncology teaching during medical school [11]. Our study corroborates these findings.

The present study aimed to: (i) ascertain students' perception of oncology teaching at their respective medical schools and (ii) evaluate the impact of a national oncology revision day on student learning. Overall, students expressed low levels of satisfaction with the quality and quantity of oncology teaching during medical school, which supports global findings [10,11,17,18,20,21]. In a recent UK-wide study, students reported receiving 1–2 weeks of oncology teaching during medical school [10]. We found that students received a mean of 6 hours of oncology lectures and a mean of 4 hours of ward/clinic time. Some students had also gained additional experiences in oncology, such as observing surgical procedures or participating in research. It is interesting that one of the oncology topics that some students felt was taught well at their medical school was oncological emergencies, as prior

studies have reported that medical students felt least confident in their abilities to deal with oncological emergencies [22].

Students who had received specialist teaching were more satisfied with the quality and quantity of oncology teaching than those who had not. Some students reported that their medical school did not have a specific oncology block and that this would be helpful, alongside more exposure to oncology earlier on in their degree. This is supported by prior research that suggests a pre-clinical oncology block was effective in helping students to understand the basics of cancer therapeutics and that this enhanced their subsequent clinical training [23]. Exposure to oncology during pre-clinical years was also shown to increase student confidence in breaking bad news [16]. Furthermore, a dedicated oncology programme for clinical-year medical students has been shown to significantly improve examination results and increase confidence in managing cancer patients [19].

Our data support that clinical communication skills training is something that medical students would appreciate to aid their oncology placements, in situations such as breaking bad news [22]. These findings are consistent internationally, where students have expressed low levels of confidence in key oncology skills, such as history taking, examination and discussing death and dying with patients [17,20].

Less than half of students were interested in pursuing a career in oncology. Of those who were interested in a career in oncology, medical oncology was the most popular subspecialty of choice. In a survey of students attending European medical schools, the majority of students were also more interested in medical oncology compared with other oncology subspecialties [21]. Student-led oncology

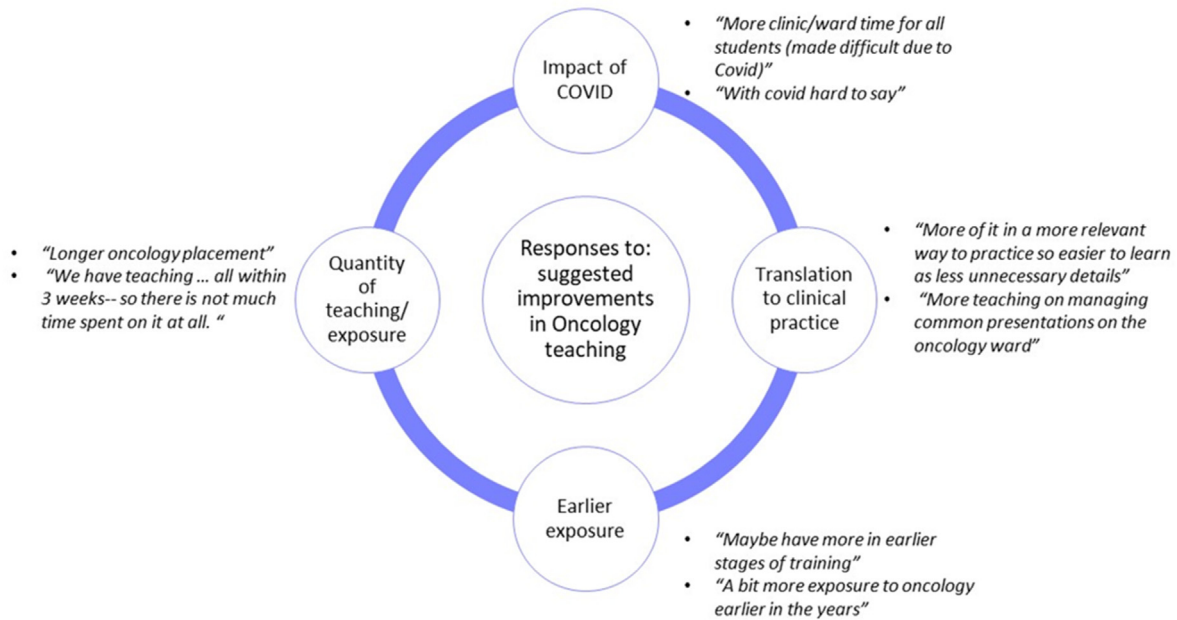


Fig 4. Qualitative answers to suggested improvements in medical school oncology teaching.

societies often play a key role in providing additional oncology opportunities, especially in medical schools where clinical experiences in oncology are limited [24]. However, it has been shown that most student-led oncology societies have a focus on medical oncology and this depends on factors such as access to mentors and educational resources [25]. Exposure to oncology subspecialties may influence career choice [26]. According to a survey of graduating medical students in the US, most students had had no exposure to radiotherapy during medical school. This resulted in a lack of knowledge of or interest in pursuing a career in radiation oncology [26]. BONUS has run events dedicated to subspecialties that are not always covered in medical school, such as surgical oncology and interventional oncology.

Certain European and US regions split oncology education by the modality of treatment – medical oncology (drug treatment) and radiation oncology (radiotherapy) – whereas in the UK the undergraduate curriculum split is based on surgical and non-surgical arms [6,21,26]. Furthermore, during the post-MRCP training programme for specialising in oncology, the RCR and RCP in the UK have a merged 'oncology common stem' curriculum before subspecialising in medical or clinical oncology [27,28]. This aims to facilitate a more holistic approach, which spans prevention, screening, treatment and palliation instead of skewing subspecialists towards certain treatment modalities [27–29]. Historically, clinical oncology focussed on a holistic approach to systemic anticancer treatment and radiotherapy, whereas medical oncology focussed largely on research [29]. This has evolved over time, with both working holistically and collaboratively with other multidisciplinary team members. The new approach of merged subspeciality training in the first few years helps ensure holistic clinical competency where oncologists are trained to support patients at all stages, including supporting

newly diagnosed patients, supporting palliative patients, providing systemic or targeted anticancer treatments and pursuing research [27,28].

Students were satisfied with the quality and structure of the national oncology revision days and found them relevant to their learning. Students reported higher levels of confidence in oncology topics following the revision days. A national undergraduate oncology conference has also been found to increase medical student knowledge of and interest in oncology [10]. This highlights the importance of student-led national events to supplement oncology teaching. Pharmacology students have also reported deficits in the quality of their haematology teaching and expressed that they would attend an e-learning module or evening session on these topics [30]. Thus, other healthcare students may also benefit from similar revision sessions on haematology and oncology.

Strengths and Limitations

This national study gathered data from students attending 22 UK medical schools. It assesses the role that free-access national revision days could hold in supplementing oncology education. It also compares student perception of quality and quantity of oncology teaching depending on the year of study. Furthermore, it is beneficial that the data collected are both quantitative and qualitative so that it can be statistically interpreted and students' experiences can be more fully explored.

We acknowledge that there may be a selection bias in our study as the medical students used in the data analysis were students who voluntarily chose to attend a national revision day that was not a compulsory part of their medical training. This might mean that it is more likely to select for students who are interested in a career in oncology. On the other hand, it may mean that it selects students who feel

that oncology has not been taught adequately at their medical school, meaning that they feel they have to search for alternative sources of teaching in order to best prepare them for their examinations. Additionally, as indicated in [Supplementary Table S1](#), the 22 UK medical schools were not equally represented because it depended on which participants decided to complete the post-event questionnaire. This might mean that some medical schools are under-represented and some are over-represented and this could skew our analysis towards the opinions of students at just a small number of UK medical schools. In an ideal situation, we would have been able to ask equal numbers of students from each represented medical school to fill out the questionnaire.

Ideally this is a preliminary study that indicates that it would be appropriate for oncology teaching to be reviewed or improved nationally. Future studies would ideally be prospective studies whereby questionnaires are sent to all students at UK medical schools, preferably in a comparable year of study once they have received their specialist oncology teaching. This will ensure that it reaches students in a less-exclusive manner.

Although analysis of oncology teaching for other multidisciplinary team members, junior doctors and students from non-UK medical schools is important, it was beyond the scope of this study and the number of participants that fitted this criteria was too small to draw any meaningful conclusions. The demographics of these participants are indicated in [Supplementary Table S2](#).

Additionally, students who completed the questionnaire attended all or some of the revision days, meaning that some people who completed the online questionnaire had not been able to attend any of the oncology revision talks, only the haematology/palliative care ones held at a later date, so their responses may not encompass the full extent of what was covered in the revision sessions. To improve data reliability and ensure valid consent, giving consent and responding to questions used in this study were not required in order for students to receive the PowerPoint slides.

Recommendations and Conclusions

One way that BONUS aims to improve access to clinical opportunities is through launching a national mentorship scheme in oncology. The results of this scheme will be published at a later date. Mentorship schemes such as this have been shown to be a strong motivating factor in encouraging students to pursue a career in oncology [31]. BONUS is also creating educational resources in the form of videos that can be accessed online free of charge. Similar online lectures and quizzes have been shown to be beneficial in supplementing oncology teaching [4,32].

It is important to highlight to students the need for holistic care in oncology where all subspecialties work together to provide care as part of a wider multidisciplinary team. Sometimes oncology teaching is split by subspeciality, but a more holistic approach to the general undergraduate

medical curriculum may facilitate a broader understanding and competency that spans prevention, screening, treatment and palliation [27–29]. It is therefore important to have integrated speciality teaching, especially in the undergraduate curriculum and early stages of speciality training instead of splitting training by subspeciality at early stages of education.

Our study reveals that students perceive that the COVID-19 pandemic has negatively impacted their clinical experiences in oncology. This is probably not unique to oncology and so future recommendations would be for other specialities in medicine to assess the lasting impact that the pandemic may have had on medical students' experiences and knowledge and put forward recommendations based on these assessments. It would also be useful to conduct a repeat study after the pandemic to see if the data captured (obtained in March 2021) were influenced primarily by the pandemic's impact on medical education.

Our study also emphasises the benefit of student-organised revision days and of national student-run societies, such as BONUS. By having undergraduate representatives in multiple medical schools, this allows for easy distribution of information across the UK and also gives opportunities for collaborative work across the country.

Given that caring for oncology patients is an essential part of work for junior doctors, it is paramount that medical students complete their degree feeling well-equipped in this regard. This includes not just the academic knowledge involved in diagnosing, investigating and treating patients with cancer, but also an awareness of how best to communicate with oncology patients in an effective manner and manage their symptoms with optimal palliative care.

Conflicts of interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clon.2022.04.011>.

References

- [1] Cancer Research UK. Worldwide cancer incidence statistics. Available at: <https://www.cancerresearchuk.org/health->

- professional/cancer-statistics/worldwide-cancer/incidence#heading-One 2021. [Accessed 11 November 2021].
- [2] Kiernan G, Meyler E, Guerin S. Psychosocial issues and care in pediatric oncology: medical and nursing professionals' perceptions. *Cancer Nurs* 2010;33:e12–e20. <https://doi.org/10.1097/NCC.0b013e3181d5c476>.
 - [3] Oktay E, Levent M, Gelincik H, Aktaş G, Yumuk F, Koral L, et al. Perspective of Turkish medicine students on cancer, cancer treatments, palliative care, and oncologists (ARES study): a study of the palliative care working committee of the Turkish Oncology Group (TOG). *J Cancer Educ* 2020;35:69–75. <https://doi.org/10.1007/s13187-018-1441-6>.
 - [4] Shi G, Kong T, Tran W, Wang L, Ingledew P. Learning oncology online: patterns of use of an expanding online resource for medical students. *Radiother Oncol* 2019;139:S21–S22. [https://doi.org/10.1016/S0167-8140\(19\)33331-6](https://doi.org/10.1016/S0167-8140(19)33331-6).
 - [5] Medical Schools Council. <https://www.medschools.ac.uk/2018>. [Accessed 15 March 2022].
 - [6] Royal College of Radiologists. Undergraduate non-surgical oncology curriculum. Available at: https://www.rcr.ac.uk/sites/default/files/undergraduate_non-surgical_oncology_curriculum.pdf 2020. [Accessed 15 March 2022].
 - [7] General Medical Council. Outcomes for graduates. Available at: <https://www.gmc-uk.org/education/standards-guidance-and-curricula/standards-and-outcomes/outcomes-for-graduates> 2022. [Accessed 15 March 2022].
 - [8] General Medical Council. Medical licensing assessment. Available at: <https://www.gmc-uk.org/education/medical-licensing-assessment> 2022. [Accessed 15 March 2022].
 - [9] Sharma M, Murphy R, Doody GA. Do we need a core curriculum for medical students? A scoping review. *BMJ Open* 2019;9:e027369. <https://doi.org/10.1136/bmjopen-2018-027369>.
 - [10] Rallis KS, Wozniak AM, Hui S, Nicolaidis M, Shah N, Subba B, et al. Inspiring the future generation of oncologists: a UK-wide study of medical students' views towards oncology. *BMC Med Educ* 2021;21:82. <https://doi.org/10.1186/s12909-021-02506-0>.
 - [11] Cave J, Woolf K, Dacre J, Potts HW, Jones A. Medical student teaching in the UK: how well are newly qualified doctors prepared for their role caring for patients with cancer in hospital? *Br J Cancer* 2007;97:472–478. <https://doi.org/10.1038/sj.bjc.6603888>.
 - [12] George M, Mandaliya H, Prawira A. A survey of medical oncology training in Australian medical schools: pilot study. *JMIR Med Educ* 2017;3:e23. <https://doi.org/10.2196/mededu.7903>.
 - [13] Oskvarek JJ, Brower JV, Mohindra P, Raleigh DR, Chmura SJ, Golden DW. Educational impact of a structured radiation oncology clerkship curriculum: an interinstitutional comparison. *J Am Coll Radiol* 2017;14:96–102. <https://doi.org/10.1016/j.jacr.2016.07.017>.
 - [14] The Royal College of Radiologists. Clinical oncology UK workforce census report 2020 executive summary Available at: <https://www.rcr.ac.uk/sites/default/files/documents/clinical-oncology-uk-workforce-census-2020-executive-summary.pdf> 2020. [Accessed 11 November 2021].
 - [15] The Royal College of Radiologists. Undergraduate non-surgical oncology curriculum 2020. Available at: <https://www.rcr.ac.uk/clinical-oncology/careers-and-recruitment/undergraduate-oncology/undergraduate-non-surgical-oncology> 2020. [Accessed 11 November 2021].
 - [16] Granek L, Lazarev I, Birenstock-Cohen S, Geffen DB, Riesenber K, Ariad S. Early exposure to a clinical oncology course during the preclinical second year of medical school. *Acad Med* 2015;90:454–457. <https://doi.org/10.1097/ACM.0000000000000521>.
 - [17] Bravery BD, Shi K, Nicholls L, Chelvarajah R, Tieu MT, Turner S, et al. Oncology and radiation oncology awareness in final year medical students in Australia and New Zealand. *J Cancer Educ* 2020;35:1227–1236. <https://doi.org/10.1007/s13187-019-01586-3>.
 - [18] Mattes MD, Patel KR, Burt LM, Hirsch AE. A nationwide medical student assessment of oncology education. *J Cancer Educ* 2016;31:679–686. <https://doi.org/10.1007/s13187-015-0872-6>.
 - [19] Agarwal A, DeNunzio N, Handal RC, Hirsch AE. Medical student education in radiation oncology: a multi-year analysis of the oncology education initiative. *Int J Radiat Oncol Biol Phys* 2012;84:S664. <https://doi.org/10.1016/j.ijrobp.2012.07.1772>.
 - [20] Tam VC, Berry S, Hsu T, North S, Neville A, Chan K, et al. Oncology education in Canadian undergraduate and post-graduate medical programs: a survey of educators and learners. *Curr Oncol* 2014;21:e75–e88. <https://doi.org/10.3747/co.21.1667>.
 - [21] Pavlidis N, Vermorken JB, Stahel R, Bernier J, Cervantes A, Pentheroudakis G, et al. Undergraduate training in oncology: an ESO continuing challenge for medical students. *Surg Oncol* 2012;21:15–21. <https://doi.org/10.1016/j.suronc.2010.07.003>.
 - [22] Al Suwayri SM. Feasibility and outcomes of oncology teaching for 5th year medical students. *J Cancer Educ* 2018;33:83–88. <https://doi.org/10.1007/s13187-016-1031-4>.
 - [23] Agarwal A, Koottappillil B, Shah B, Ahuja D, Hirsch AE. Medical student-reported outcomes of a radiation oncologist-led preclinical course in oncology: a five-year analysis. *Int J Radiat Oncol Biol Phys* 2015;92:735–739. <https://doi.org/10.1016/j.ijrobp.2015.03.008>.
 - [24] Agarwal A, Shah A, Byler S, Hirsch AE. Cultivating interest in oncology through a medical student oncology society. *J Cancer Educ* 2017;32:31–34. <https://doi.org/10.1007/s13187-015-0902-4>.
 - [25] Malik NH, Li GJ, Giuliani M, Brundage M, Caissie A, Cao JQ, et al. Mapping the current state of Canadian medical school oncology interest groups. *J Cancer Educ* 2022;37:203–209. <https://doi.org/10.1007/s13187-020-01803-4>.
 - [26] Wu TC, McCloskey SA, Wallner PE, Steinberg ML, Raldow AC. The declining residency applicant pool: a multi-institutional medical student survey to identify precipitating factors. *Adv Radiat Oncol* 2021;6:e100597. <https://doi.org/10.1016/j.adro.2020.10.010>.
 - [27] Royal College of Radiologists. Clinical oncology speciality training curriculum. Available at: https://www.rcr.ac.uk/sites/default/files/clinical_oncology_curriculum_2021.pdf 2021. [Accessed 15 March 2022].
 - [28] Joint Royal Colleges of Physicians Training Board. Curriculum for medical oncology training. Available at: https://www.gmc-uk.org/-/media/documents/medical-oncology-2021-curriculum-final_pdf-86966310.pdf 2021. [Accessed 15 March 2022].
 - [29] Popescu RA, Schafer R, Califano R, Eckert R, Coleman R, Douillard JY, et al. The current and future role of the medical oncologist in the professional care for cancer patients: a position paper by the European Society for Medical Oncology (ESMO). *Ann Oncol* 2014;25:9–15. <https://doi.org/10.1093/annonc/mdt522>.
 - [30] Bauters T, Boussery K, Commeyne S, Laureys G. Pharmaceutical care for pediatric oncology and hematopoietic stem cell transplantation patients: need for education and training. *Biol Blood Marrow Transplant* 2015;21:S365–S366. <https://doi.org/10.1016/j.bbmt.2014.11.588>.
 - [31] Dosani M, Giuliani M, Golden D, Jimenez R, Hirsch A, Caissie A, et al. 42 factors that promote medical student

- interest in radiation oncology: a survey of Canadian radiation oncology residents. *Radiother Oncol* 2020;150:S21–S22. [https://doi.org/10.1016/S0167-8140\(20\)30934-8](https://doi.org/10.1016/S0167-8140(20)30934-8).
- [32] Matkowski R, Szlachowska J, Szewczyk K, Staszek-Szewczyk U, Kornafel J. Improvements in undergraduate oncology education introduced at Polish medical universities between 2004 and 2010 under Poland's "National Program for Combating Neoplastic Diseases. *J Cancer Educ* 2014;29:428–433. <https://doi.org/10.1007/s13187-014-0633-y>.