Understanding the ward environment: factors determining medical students' 'ward smarts'

ORIGINAL RESEARCH

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ABSTRACT

Background: Medical students are expected to know how to function on hospital wards and to be at ease within the ward environment. Such ward-based knowledge indicates that a student is 'ward smart'. However, formal teaching in this area seems to be somewhat neglected, with students being left to gather this knowledge through experience.

Methods: Data were collected via an online questionnaire comprising both closed and open questions designed to assess students' ward smarts, focusing on knowledge of the ward environment (routines, equipment, and terminology used), relevant clinical knowledge, and communication/roles of other members of the multi-disciplinary team.
Multiple regression was used to identify factors influencing students' scores (i.e. demographics, work experience). Thematic analysis was used to explore medical students' opinions on how their ward understanding could be improved.

Results: In our sample of 53 medical students, 96% did not know how to turn on a hearing aid and only 30% knew what a Waterlow score was. Furthermore, 89% did not know how to read an oxygen flowmeter, and only 55% knew where the CPR lever on the bed was situated.
Multiple regression showed that ward smarts can be predicted by previous hospital-based work and year group, both of which may represent time spent on wards. Thematic analysis suggested that students felt they would benefit from more ward time and shadowing healthcare professionals on the wards.

Discussion: This suggests that students may not be prepared to work in a ward environment. We propose, based on training implemented in other medical schools, that a specific ward-based interprofessional learning placement or experience should be added to the medical curriculum. As an initial step, specific teaching and/or practical sessions for students centred around patient communication and understanding the ward environment would be beneficial.

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BACKGROUND

The General Medical Council (GMC) requires that all medical school graduates have an understanding of the multidisciplinary team and are able to work efficiently within a secondary care setting. (1) These requirements should be met through 'clinical phase' education, whereby students learn whilst being in the clinical environment alongside qualified medical staff. This ward-based knowledge indicates that a student is 'ward smart', which encompasses being at ease within the ward environment, familiarity with routines, tasks, and equipment on the ward, having knowledge of jargon used in hospitals, and an understanding of roles within the multidisciplinary allied health team. (2, 3) Such knowledge is not only important for patient care, but also helps medical students feel less 'alien' or 'in the way' on the ward: students who feel as though they are a useful part of the team are more able to take advantage of situated (clinical) learning opportunities and their educational outcomes tend to reflect this. (2, 4, 5)

This raises the question of when and where students should acquire 'ward smarts'; formal teaching on ward environments is often neglected, with students feeling unprepared for clinical placement and being left to acquire ward smarts as they progress. (4-6) Furthermore, ward opportunities and quality of teaching can vary greatly between individual placements and hospital trusts. For example, at Nottingham Medical School, undergraduate students have a ward simulation day, but this opportunity is not offered to graduate entry students. Furthermore, those at Queen's Medical Centre for Paediatrics have a 'ward smart day', but no other departments or placements run this session. This variation and the fact that each individual student has their own starting point, having varied levels of previous experience in secondary care, introduce significant variation into students' understanding of the ward environment. (2)

Being ward smart is key for many aspects of medicine; it can be the difference between having a smooth transition to new placements or taking weeks trying to familiarise oneself, and could therefore lead to reduced time for effective learning. (3, 4) As being ward smart has only recently been defined, there is a gap in the literature related to this specific term, but many of the aspects of ward smarts have been studied in isolation or as part of professionalism: for example, there is evidence to suggest that there are deficits in medical students' ward smarts in specific areas such as paperwork and documentation, (7) teamwork and interprofessional communication, (8) awareness of other healthcare professionals' roles, (9) understanding of terminology or jargon used in hospitals, (10) and managing common ward environment distractions. (11)

One way to improve students' ward smarts could be through interprofessional learning experiences; (12) various medical schools run specialised placements on 'interprofessional training wards' or 'clinical education wards' for both medical and nursing students (as well as physiotherapy and occupational therapy students), and have found it beneficial in terms of understanding different professionals' roles in the team, (13-15) awareness of ward-based communication skills, (16) and professional role development. (17) This emphasis on assessing 'non-medical' skills shows significant overlaps with aspects of ward smarts, implying that such learning experiences could make medical students more ward smart. (18)

Research questions

This study aims to develop this area by exploring medical students' ward smarts, and thereby identifying any areas in which there are deficits (or relative strengths), as well as a short qualitative analysis exploring how medical students believe any gaps in their ward-based knowledge could be filled. As such, our key questions were as follows:

1. How much do students know about the ward environment?

• Are there any specific patterns of weaknesses/strengths?

2. Does this vary by the following factors:

• Academic year (training stage)

• Course (graduate entry [GEM]/undergraduate)

• Previous work experience

    o Healthcare employment

    o Hospital employment

• Teaching:

    o Formal ward introduction

    o Nurse shadowing

• Rating of own understanding

• Gender

• Age

3. How students feel their ward understanding could be improved.

METHODS

Database Design

We investigated these questions using an online questionnaire. This allowed us to recruit a relatively large number of medical students across different demographics and year groups and to quantitatively analyse their responses.

Participants

Questionnaire participants were medical students in any year of study at the University of Nottingham. They were identified and recruited online through posts on Medical School Facebook Groups and the official Moodle Forum, as well as some students being told about the questionnaire by fellow students and clinical supervisors.

In total, 53 students took part in the questionnaire, but 4 were excluded from our regression analysis due to incomplete data. Of the 49 remaining participants, 29 identified as female and 20 as male. They had an average age of 22.8 (SE = 2.04). They varied from third year to final year students (though 84% were in their penultimate year).

Ethics

Nottingham LREC (Local Research Ethics Committee) did not wish to undertake ethical review – as a questionnaire study requiring no confidential information and with no patient involvement, we did not meet criteria for research ethics committee

review. We had informed consent from participants and conducted the study in line with Helsinki guidelines.

At the start of the online questionnaire, participants were presented with some information about the study and a consent form – in order to continue with the study, participants had to confirm that they had read and understood the information, were participating voluntarily, and that data would be stored in a confidential manner.

Procedure

Research in this area was lacking; therefore, we developed content for the questionnaires based on our own concept of being 'ward smart'. This involved a combination of the previous research and our own perspective as medical students to gauge probable knowledge and limitations. In conjunction with Professor Sahota's observations from supervising students, several key topics were defined. These related to:

• Communication, including understanding of abbreviations and jargon

• Environmental awareness (e.g. ward equipment and procedures)

• Relevant clinical knowledge (e.g. relevance of Waterlow scores)

• Teamwork and understanding of others' roles (including their uniforms and key responsibilities)

• Professional attitude

We piloted a draft version of the questionnaire on five medical students in their fourth year, who found it easy to navigate and suggested a few minor changes to wording to aid clarity.

Recruitment

The medical student forum (new posts emailed to all students weekly) had a post entitled 'Medical Student Awareness of the Ward Environment Survey' with a link to the Google Form, while Facebook advertisements on relevant groups and pages invited students to fill in a quick survey to help us to understand the extent to which medical students understand how wards work. It advised them that it should only take 15 minutes to complete and that all responses were anonymous.

Information and consent

Once potential participants followed the Google Form link, they were presented with some information about the study (see Appendix II) and a consent form (Appendix III) which had to be completed in order to continue with the study.

Materials

We did not use any standard measures for the questionnaire; all questions were devised by the research team. The questions covered the following topics:

• Section 1: Demographics (training stage, course, work experience, teaching, gender, age, rating of understanding)

• Section 2: Knowledge assessment; based on the key topics listed above, used to calculate a 'Ward Smart Score' out of 27 total points

(see Appendix I)

• Section 3: Optional open questions:

o Can you think of any way your understanding of wards could be improved?

o Would you be interested in attending a practical/teaching session on the topics mentioned in this questionnaire, i.e. how wards function?

Data analysis

Scoring

Participants' responses to the questionnaire items were scored according to the marking criteria in Appendix III: each answer was scored from either 0-1 or 0-2, with half marks available on some questions for answers deemed to be partially correct. Each question was scored independently and agreed upon by two researchers to demonstrate reliability and ensure validity, and these scores were then combined to form an overall knowledge score for each participant.

Multiple regression

Multiple regression was used to analyse the quantitative data due to the single outcome variable (knowledge score) and a number of potential categorical predictor variables which could impact on the score. Multiple linear regression not only enabled us to identify which factors were most strongly predictive, but also to control for the effects of other variables ('nuisance covariates') and to test for multicollinearity.

The only concerns with this choice of method were the increased risk of Type I errors and the fact that, lacking prior similar studies, we could not use a hierarchical or block approach. We considered forced entry and backward stepwise approaches: both are atheoretical and data-led and are thus particularly suitable when there is no logical or theoretical basis for considering any variable to be prior to any other, as in this case. (19, 20)

Given the large number of independent variables involved, a backward stepwise approach was deemed more appropriate; adding all variables to the model might improve its predictive value, but potentially not to a significant extent, and so simplifying the model by narrowing down variables produces more useful information. Furthermore, a backward stepwise approach avoids the issue of suppression effects for which forward stepwise models can be criticised (19) – i.e. that two variables could be significant if entered together, but not alone, in which case their effects would be missed by the model.

Qualitative analysis

A brief inductive thematic analysis was conducted on the longer text answers with participants' suggestions regarding improving medical students' ward awareness. This had the advantages of being quick, flexible, and not tied to a theoretical framework, making it ideal for exploratory analysis. The only downsides of thematic analysis are that it can produce overwhelming quantities of data, but this is mitigated by the sample size and short question style.

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Following Braun and Clarke's six-step process, initial themes were noted (e.g. teaching, more time on wards) as they emerged from participants' answers. The open questionnaire item responses were then reviewed, generating initial codes. This process was repeated four times until no further codes were generated. These codes were then divided into themes and sub-themes. (21)

RESULTS

Data were analysed using SPSS 22. For full results, please see SPSS output in Appendix IV.

Descriptive statistics

Descriptive statistics for the participants (n=49 for multiple regression analysis, n=53 for descriptive and qualitative analysis) are shown in Table 1 and 2. Figure 1 shows the variation in Ward Smart Scores.

It is also worth noting that only 41.5% of students reported having had a ward induction or introduction.

Gender			Year group	
Male	41%		3	2%
Female	59%		4	84%
Age			5	14%
Mean (SD)	22.8 (2.0)		Healthcare employment	
Range	21-33		None	71%
Course			Non-hospital	17%
Graduate Entry	31%		Hospital	12%
Undergraduate	69%			

Table 1

Participant descriptive statistics

	Correct	Incorrect
Reading an oxygen flowmeter	11.3%	88.7%
Locating the 'on' button on a hearing aid	3.8%	96.2%
Knowing what a Waterlow score is	30.2%	62.3% (7.5% partially correct)
Locating the CPR lever on a hospital bed	54.7%	45.3%

Table 2

Individual question response frequencies (NB: full results in Appendix I)
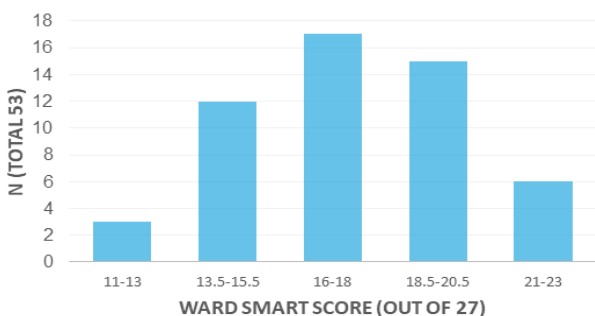
Figure 1

Bar chart showing variation in Ward Smart Scores

Multiple regression: diagnostics

An inspection of tolerances and Variance Inflation Factor (VIF) revealed no problems with multicollinearity: the lowest tolerance was 0.52, well above the 0.10 threshold, (22) and VIF values ranged from 1.02 to 1.93, far below the limit of 10.19 Plotting the residuals against predicted values demonstrated that the data met the assumption of homoscedasticity, and independence of errors was demonstrated by the Durbin-Watson statistic, which was 2.22. (19)

Casewise diagnostics highlighted 3 cases above the limit of 2; (19) we did not consider this of particular concern, as it represents only just over 5% of our total cases and the values ranged from 2.008 to 2.206: still far from approaching the more lenient limit of 3. Cook's distance statistics revealed no outliers, and all Mahalanobis distance values were below the critical values. (23) Overall, this suggests that there were no significant outliers and no cases with undue leverage.

Multiple regression: report

Table 3 shows the Multiple Regression Model. Backward stepwise multiple regression analysis suggested that two predictors (Hospital Experience and Training Stage) explained 28% of the variance in knowledge scores ($R2=0.28$, $F(2,46)=8.95$, $p=0.001$).

Participants who had previously worked in a hospital environment scored an average of 3.44 points higher than those who had not ($\beta=0.39$, $p=0.003$), and knowledge scores increased by 2.53 points ($\beta=0.34$, $p=0.01$) with every year of training.

The other predictor variables, i.e. being a graduate-entry student, age, gender, healthcare (non-hospital) employment, having had a ward introduction or the opportunity to shadow a nurse, and participants' rating of their own understanding, did not contribute significantly to the model.

Model	R	R²	Adjusted R²	Std. Error of the Estimate
1 (Hospital Experience)	0.407ª	0.165	0.148	2.68160
2 (Hospital Experience, Training Stage)	0.529ᵇ	0.280	0.249	2.51776

Model	Change Statistics					
	R² Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1 (Hospital Experience)	0.165	9.321	1	47	0.004	
2 (Hospital Experience, Training Stage)	0.115	7.316	1	46	0.010	2.221

Table 3

Multiple regression model

Qualitative analysis

Several key themes emerged from the thematic analysis, (21) mostly demonstrating a need for clinical teaching on and formal induction to the ward environment, as well as more time spent on the wards and more opportunities for interprofessional learning. Our themes and subthemes were as follows:

- Teaching
    - o Introductory session
    - o Practical/clinical skills session
- Ward induction
    - o Formal induction process
    - o Ward tour
- Ward time
    - o More ward time scheduled
    - o Core ward access
- Interprofessional learning/other healthcare professionals (HCPs)
    - o Shadowing nurses
    - o Teaching from nurses
    - o Learning about multidisciplinary team roles
    - o Shadowing various HCPs

DISCUSSION

Our data suggest that medical students are not as 'ward smart' as they may be presumed to be – there are key gaps in their knowledge, including, for example, the ability to read an oxygen flowmeter. The regression analysis suggested that key factors in determining medical students' ward smarts were previous employment in a hospital and stage of training, both of which are likely to represent the amount of time spent on wards; this was also a key theme in the qualitative data. Students also felt that teaching would be helpful, whereas the quantitative data suggest that having attended such sessions did not improve Ward Smart Scores. Students also felt they would benefit from ward inductions and shadowing HCPs on the wards, especially nurses.

However, there is a risk of selection bias: choosing to do and also managing to complete the questionnaire may have screened out potential participants who would not have scored so well, especially as the Ward Smart Score questions feel like a test – people who felt they were not performing well might have dropped out or decided not to participate in the first place. Statistical power was low due to the small sample size, and any small or medium effect sizes may have been missed. This may be due to the methods used for participant recruitment, which was initially limited (due to a communication error with the Moodle Forum poster) to students already on clinical placement. On a similar note, over 80% of the participants were in their fourth year; a more evenly distributed sample would likely be more fully representative of medical students' ward smarts as a whole. We would like to repeat the study with an entire cohort at the start or end of a clinical phase, to ensure experience levels are as controlled as possible.

There is also some debate around the use of our 'Ward Smart Score' (WSS) to assess participants, both in terms of measure validation and what could be considered an 'acceptable' WSS; students' scores should be proportional to the training they have received and which placements they have completed. For example, a student who has completed a health care of later life placement should be better equipped to answer questions about Waterlow scores. There should also be a baseline of 'essential' knowledge expected of all clinical phase (CP) students, ensuring they are safe in the ward environment – this should be conveyed to all students during pre-clinical teaching. 'Further' ward smart knowledge should accumulate throughout clinical phase, as students spend more time in the ward environment.

If we were to divide our questionnaire items into 'essential' and 'further' knowledge, the 'essential' themes could include infection prevention and control, staff roles, key medical knowledge, information governance, and emergency procedures. By this standard, our questionnaire contained ten 'essential' questions (highlighted in Appendix 1), three of which were to do with staff roles, two related to infection prevention and control, one related to information governance, three questions were on key medical knowledge, and one on emergency procedures. Across these ten questions, the mean percentage correct was 74%, with correct responses varying greatly between questions: the most correct answers related to knowing where medical notes are stored (97.6%) and the least for reading an oxygen flow meter (12.2%). However, it is worth noting that some of the questions were 'leading' (e.g. "Should medical notes be kept in a locked trolley?") and that we have retroactively applied this 'essential vs. further' knowledge distinction: it would improve validity if this was considered in terms of questionnaire items and score weighting during the design phase.

Furthermore, as our questionnaire items were the result of brainstorming between medical students and one consultant, in future it would be ideal if we could use a consensus method (e.g. the Nominal Group Technique and Delphi Technique) for idea generation with a variety of HCPs in contact with students. We have since noticed some potential issues with some of our questions – those focused on beds and staff uniforms may not have applied equally to all trusts. Findings using a standardised, reliable, validated measure would be more robust.

These preliminary findings have face validity and merit further research, as well as indicating that an intervention to aid medical students' ward smarts could be beneficial. Prior research has found that interprofessional ward placements have been effective in improving various elements of ward smarts. This would be an ideal intervention in terms of involving students as participating members of an interprofessional team in a ward environment, thereby enhancing their ward smarts through situated learning. (2, 4, 12, 15) The desire for more interprofessional learning opportunities was a strong theme in our thematic analysis, and this would therefore be ideal to implement: medical students, nursing students, HCAs, and perhaps some specialised ward-based teachers could all collaborate on such a project. (24)

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CONCLUSION

Medical students' ward smarts can, to some extent, be explained by whether they have worked in a hospital environment and their year group, with increased experience reflected in knowledge scores. These could both be considered proxy measures for time spent on wards. Students also felt they would benefit from more ward time (particularly longer sessions), ward inductions, and shadowing healthcare professionals on the wards, especially nurses. This could be encouraged by adding a ward-based interprofessional learning placement or experience to the medical curriculum.

Ward Smart Scores were not significantly predicted by non-hospital work experience, age, gender, being a graduate entry student, relevant teaching and shadowing, or students' rating of their own understanding. The quality and content of any teaching deemed by participants to be on the ward environment was not measured. The fact that students were generally keen on the idea of a teaching or clinical skills session dedicated to the ward environment, however, suggests that the introduction of additional situated learning experiences, ideally in the form of interprofessional ward training, should nevertheless be considered.

APPENDIX A
WARD SMART
KNOWLEDGE QUESTIONS

The knowledge section was prefaced by the following:

This section will try to quantify how well you understand the ward environment. We are not "testing" you, and we do not expect you to know everything there is to know about wards: we are simply trying to highlight areas which have not been sufficiently covered in the curriculum so far. If you do not know an answer, you can always guess/select or write 'don't know'.

Communication	What does NBM stand for? [Open] What does TTO stand for and what does it refer to? [Open] Scenarios: toilet assistance/pain relief: to which staff member would you refer the issue? [Multiple choice; NB also relevant to 'Teamwork']
Environmental awareness	What do the nursing notes contain? [Open; NB also relevant to 'Teamwork'] How many visitors are typically allowed at the patient bedside? [Multiple choice] How much oxygen is the patient attached to this flow meter on? [Image] Where would you look to find out about a patient's fluid balance? [Multiple choice] Which lever do you press to make the bed go flat in an acute cardiac arrest? [Image] Where is the 'on' button for the hearing aid? [Image] A patient has a blue infection control sign on their door and your consultant goes straight in. What should you do? [Multiple choice] Which colour bin should gowns and gloves go in? [Multiple choice] What is this device? [Image: bladder ultrasound scanner, multiple choice]
Relevant clinical knowledge	What does a red wristband on a patient indicate? [Open] What is a Waterlow score and who calculates it? [Open] How many categories are there on the Bristol Stool Chart? [Multiple choice] Approximately how long do hearing aid batteries last for? [Multiple choice]
Teamwork and others' roles	What colour uniforms do the following HCPs wear? [Multiple choice] Which of the following professions is a healthcare assistant (HCA) linked with? [Multiple choice] Who is responsible for the controlled drugs cabinet on the ward? [Multiple choice] Who routinely checks patients' observations (BP, HR, SPO2)? [Multiple choice]
Professional attitude	Are students on clinical placement able to log in and view patient observations/notes? [Yes/No] Should medical notes be kept in a locked trolley when not in use? [Yes/No]

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APPENDIX B
RAW FREQUENCY DATA

Question	Incorrect %	Partially correct %
What colour uniforms do the following HCPs wear? [Ward sister/matron]	7.3	
What colour uniforms do the following HCPs wear? [Staff nurse]	9.8	
What colour uniforms do the following HCPs wear? [ACP]	36.6	
What colour uniforms do the following HCPs wear? [Occupational therapist/physiotherapist]	19.5	
Please read the scenarios and select the most appropriate person on the ward to whom you would refer the issue: [A patient stops you to tell you that they need assistance to go to the toilet.]	2.4	
Please read the scenarios and select the most appropriate person on the ward to whom you would refer the issue: [A patient tells you that they are in pain and urgently need more pain relief.]	41.5	
Which of the following professions is a healthcare assistant (HCA) linked with?	24.4	
What do the nursing notes contain? Please list as many elements/pages as you can think of.	26.8	22.0
Who is responsible for the controlled drugs cabinet on the ward?	29.3	9.8
Who routinely checks patients' observations (BP, HR, SPO2)? (You can select more than one option.)	36.6	
Are students on clinical placement able to log in and view patient observations/notes?	14.6	
What does a red wristband on a patient indicate?	17.1	
Should medical notes be kept in a locked trolley when not in use?	2.4	
How many visitors are typically allowed at the patient bedside?	12.2	
What does NBM stand for?	4.9	
How much oxygen is the patient attached to this flow meter on?	87.8	
Where would you look to find out about a patient's fluid balance?	31.7	
What does TTO stand for and what does it refer to?	46.3	9.8
What is a Waterlow score and who calculates it?	65.9	9.8
How many categories are there on the Bristol Stool Chart?	36.6	
Which lever do you press to make the bed go flat in an acute cardiac arrest?	41.5	
A patient can't hear you – where is the 'on' button for the hearing aid?	97.6	
Approximately how long do hearing aid batteries last for?	90.2	
A patient has a blue infection control sign on their door and your consultant goes straight in. What should you do?	17.1	31.7
Which colour bin should gowns and gloves go in?	4.9	
What is this device?	51.2	

NB: Highlighted rows indicate the ten questions deemed 'essential'.

Bold text indicates >70% correct or >30% incorrect.

APPENDIX C
QUESTIONNAIRE
INFORMATION

Placement/ward awareness questionnaire

I would like to invite you to take part in our research study investigating whether medical students and doctors have a thorough understanding of how wards operate and what factors are related to their level of awareness.

Main researchers: Emma Poynton-Smith (mzyep7@nottingham.ac.uk), Erica Colwill (mzyec13@nottingham.ac.uk)

Supervisor: Professor Opinder Sahota (Opinder.Sahota@nuh.nhs.uk)

It is up to you to decide whether or not to take part: you can give your consent by checking the appropriate boxes on the consent form below. You are free to withdraw at any time and without giving a reason, and withdrawing would not affect your legal rights. However, please note that it is not possible for your information to be extracted and destroyed once you complete and submit the full survey.

If you choose to give your consent to participate using the form below, you will be able to access the next section, which contains questions about your understanding and awareness of hospital wards. It usually takes about 15 minutes to complete.

We will follow ethical and legal practice and all information about you will be handled in confidence: it will be kept anonymous and only viewed by the researchers and authorised persons. It will be stored securely and deleted after 7 years.

The results of the research may be written up with the aim of producing an article or poster for journal presentation. Please be assured that you will not be identified in any report or publication.

If there is anything that is not clear or if you have any concerns, please do not hesitate to contact us using the details provided.

APPENDIX D
CONSENT FORM

Consent to take part

• I confirm that I have read and understand the information above and have had the opportunity to ask questions.

• I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

• I understand that relevant sections of my information collected in the study may be looked at by the research group and regulatory authorities where it is relevant to my taking part in this study. I give permission for these individuals to have access to these records and to collect, store, analyse and publish information obtained from my participation in this study. I understand that my personal details will be kept confidential.

• I understand that information about me recorded during the study will be kept in a secure database. If the information is transferred, it will be made anonymous. Information will be kept for 7 years after the study has ended.

• I agree to take part in the above study.

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