

Understanding the ward environment: a mixed-methods exploratory study of factors determining medical students' 'ward smarts'.

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Research article

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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': levels of ward smarts vary between students (e.g. based on prior work experience and opportunities offered by placements). However, formal teaching in this area seems to be somewhat neglected, with students being left to 'pick up' this knowledge as they go along, which can have an impact on their clinical education.

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 31% knew what a Waterlow score was. Furthermore, 88% did not know how to read an oxygen flowmeter, and only 57% 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 their understanding of wards would benefit from more ward time and shadowing allied healthcare professionals on the wards.

Conclusions

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.

Background

The GMC (General Medical Council) 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', i.e. being at ease within the ward environment, familiarity with routines, tasks,

and equipment on the ward (e.g. observations), having knowledge of jargon used in hospitals, and an understanding of roles within the multidisciplinary allied health team.² 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 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 'pick up' ward smarts as they go along.³⁻⁵ 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, while those in Queen's Medical Centre for Paediatrics have a 'ward smart day', but no other departments or placements run this session. Both this and the fact that each individual student has their own starting point, having varied levels of previous experience in secondary care, introduces 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.^{3,6} 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 others 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 (see Figure 1):

- Academic year (training stage)
- Course (Graduate Entry Medicine [GEM]/undergrad)
- Previous work experience
 - Healthcare employment
 - Hospital employment
- Teaching:
 - Formal ward introduction
 - Nurse shadowing
- Rating of own understanding
- Gender
- Age

[Figure 1]

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

Methods

Design

We decided to investigate 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 CP2 (Clinical Phase 2) 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).

Procedure

Lacking awareness of prior research in this area, we brainstormed content for the questionnaires based on our concept of being 'ward smart' (see Figure 2). We also used our own perspective as medical students to gauge probable knowledge and limitations, in combination with Professor Sahota's observations from supervising students on their Healthcare of Older People placement during CP2. Key topics were defined related to patient communication, safety and welfare. After a draft version of the questionnaire, we piloted it on five medical students in their CP2 year, who found it easy to navigate and suggested a few minor changes to wording to aid clarity.

[Figure 2]

1. 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 understand the extent to which medical students understand how wards and the staff work. It advised them that it should only take 15 minutes to complete and that all responses were anonymous.

1. Information and consent

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

Materials

We did not use any standard measures for the questionnaire, and so all questions were devised through a brainstorming process by the research team. The questions, which can be seen in full in Appendix 3, covered the following topics:

- Section 1: Demographics (see 'factors')
- Section 2: Knowledge assessment (questions about hospital staff roles and uniforms, communication, paperwork, abbreviations, equipment [oxygen flowmeter, hearing aids, beds], and infection control procedures)

- Used to calculate 'Ward Smart Score' (WSS) out of 27 total points.
- Section 3: Optional open questions:
 - Can you think of any way your understanding of wards could be improved?
 - Would you be interested in attending a practical/teaching session on the topics mentioned in this questionnaire, i.e. how wards function?

Data analysis

1. 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.

1. Multiple regression

We chose multiple regression to analyse our quantitative data as we had a 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, we decided that a backward stepwise approach would be 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 criticised¹⁹ - 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.

1. Qualitative analysis

We also conducted a brief inductive thematic analysis 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.

Following Braun and Clarke’s 6-step process, we first noted down initial themes (e.g. teaching, more time on wards) as they emerged from participants’ answers. Once we had made notes and familiarised ourselves with the data, we went through the open questionnaire item responses and generated initial codes. We repeated this process four times, until we were unable to find any more codes. We then made a list of all the codes and divided them 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) were as follows:

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	12.2%	87.8%
Locating the ‘on’ button on a hearing aid	4.1%	95.9%
Knowing what a Waterlow score is	30.6%	61.2% (8.2% partially correct)
Locating the CPR lever on a hospital bed	57.1%	42.9%

Table 2. Individual question frequencies: oxygen flowmeter, hearing aid, Waterlow score, and resuscitation.

[Figure 3]

It is also worth noting that only 41.5% of students reported having had a ward induction or introduction, and less than 20% had shadowed a nurse.

Multiple regression: diagnostics

An inspection of tolerances and Variance Inflation Factor (VIF) revealed no problems with multicollinearity: the lowest tolerance was .52, well above the .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 also 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

Backward stepwise multiple regression analysis suggested that two predictors (Hospital Experience and Training Stage) explained 28% of the variance in knowledge scores ($R^2=.28$, $F(2,46)=8.95$, $p=.001$).

Participants who had previously worked in a hospital environment scored an average of 3.44 points higher than those who had not ($\beta=.39$, $p=.003$), and knowledge scores increased by 2.53 points ($\beta=.34$, $p=.01$) with every year of training.

The other predictor variables, i.e. being a GEM 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	R ²	Adjusted R ²	Std. Error of the Estimate
1 (Hospital Experience)	.407 ^a	.165	.148	2.68160
2 (Hospital Experience, Training Stage)	.529 ^b	.280	.249	2.51776

Model	Change Statistics					
	R ² Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1 (Hospital Experience)	.165	9.321	1	47	.004	
2 (Hospital Experience, Training Stage)	.115	7.316	1	46	.010	2.221

Table 3. Multiple regression model.

Qualitative analysis

Several key themes emerged from the thematic analysis:

- A need for clinical teaching on and formal induction to the ward environment.
- More time spent on the wards.
- More opportunities for interprofessional learning, e.g. shadowing a range of health care professionals, especially nurses.

Themes	Sub-themes
<i>Teaching</i>	Introductory session
	Practical/clinical skills session
<i>Ward induction</i>	Formal induction process
	Ward tour
<i>Ward time</i>	More ward time scheduled
	Core ward access
<i>Inter-professional learning</i>	Shadowing nurses
	Teaching from nurses
	Learning about MDT roles
	Shadowing various healthcare professionals, including healthcare assistants (HCAs)

Table 4. Thematic analysis findings.

Discussion

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 healthcare professionals on the wards, especially nurses.

However, there is a risk of selection bias: choosing to do and also managing to complete our 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. On a similar note, over 80%

of our participants were in their CP2 year (4th year): it would be good to repeat with a more even year group distribution. As such, our sample is unlikely to be fully representative of medical students' ward smarts as a whole.

We were also lacking in power due to our relatively small sample size, and so may have missed any small or medium effect sizes: recruitment was initially limited (due to a communication error with the Moodle Forum poster) to students already on clinical placement only, and we considered keeping the questionnaire open for longer to enable more students to take part, but this could have blurred the lines between different stages of training: as it is, variation could also have been introduced by the fact that CP2 students do their placements in different orders, so there could be a benefit to a specific placement which we would have been unable to identify. We would like to repeat the study with an entire cohort at the start or end of a clinical phase, to ensure experience levels as controlled as possible.

In addition, it would be ideal if we could create a validated 'Ward Smart Score' measure: our questionnaire items were the result of brainstorming between medical students and one consultant, and for 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 healthcare professionals (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 reliable, validated measure would be more robust.

Finally, there is a concern with backward stepwise regression: the large number of independent variables could have increased the risk of the model being influenced by random variation and intercorrelation in the data.²⁰ For a future study, it would be beneficial to focus on fewer independent variables grounded in background research.

We could also use background research to inform our planned interventions combined with these preliminary findings: interprofessional ward placements have been demonstrated as effective in improving elements of ward smarts such as teamwork and communication, and would be an ideal and common-sense 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.^{2,3,12,15} 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, healthcare assistants (HCAs), and perhaps some specialised ward-based teachers could all collaborate on such a project.²⁴ However, on a practical level, an additional placement would be extremely difficult

to incorporate into the existing curriculum: a more watered-down version involving an interprofessional ward-based training day at the start of the clinical phase would be a more achievable goal.

Conclusions

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. However, the quality and content of any teaching deemed by participants to be on the ward environment was not measured, and so the fact that students were generally keen on the idea of a teaching or clinical skills session dedicated to the ward environment suggests that the introduction of additional teaching should nevertheless be considered.

Declarations

Ethics approval and consent to participate

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 (see Appendix I) and a consent form - in order to continue with the study, participants had to complete this written form:

- 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.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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No funding was necessary for this project.

Authors' contributions

EPS and OS decided on the research question. EPS, EC, and OS all contributed to questionnaire design (including images) and publicised the questionnaire online. EPS and EC coded the data according to whether participants' answers were correct. EC was a major contributor in terms of theoretical background to the study, while EPS analysed the data (multiple regression and thematic analysis) and wrote the methods section. All authors read and approved the final manuscript.

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Authors' information

EPS and EC are both Graduate Entry Medical Students at the University of Nottingham. OS is a Consultant in general and geriatric medicine who supervises students in their placement during their penultimate year of medical school.

List of abbreviations

- GMC – General Medical Council
- GEM – Graduate Entry Medicine
- CP – Clinical Phase (1-3)
- WSS – Ward Smart Score
- VIF – Variance Inflation Factor
- HCP – Healthcare Professional
- HCA – Healthcare Assistant

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Figures

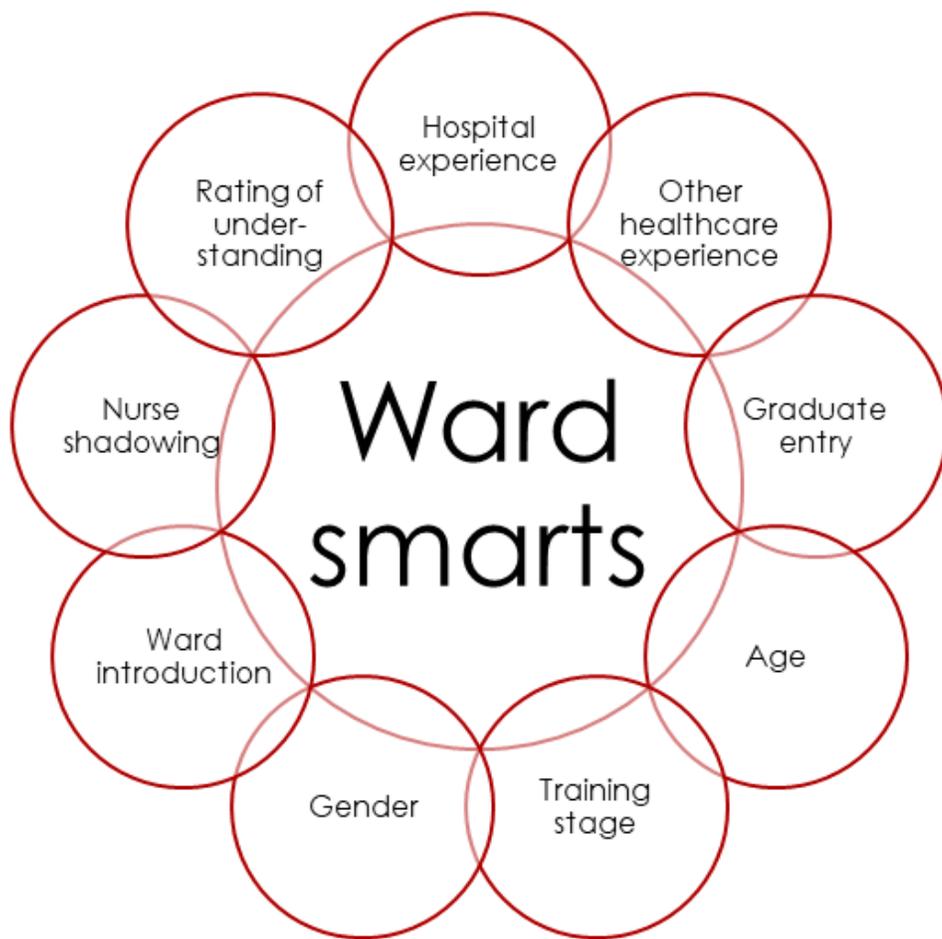


Figure 1

Factors investigated as potentially affecting whether medical students are 'ward smart'.

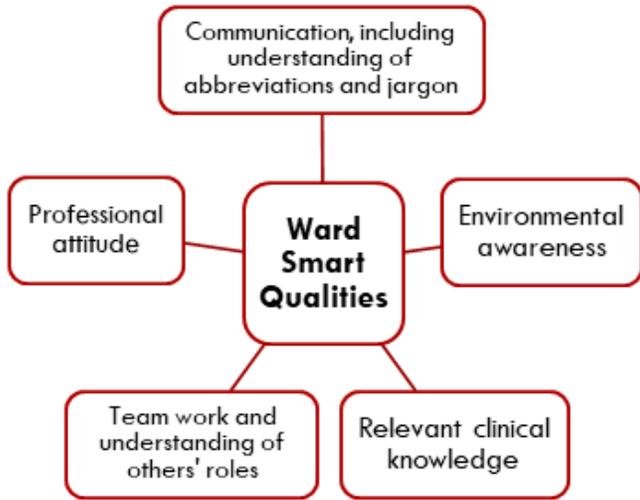


Figure 2

Our interpretation of factors contributing to being 'ward smart'.

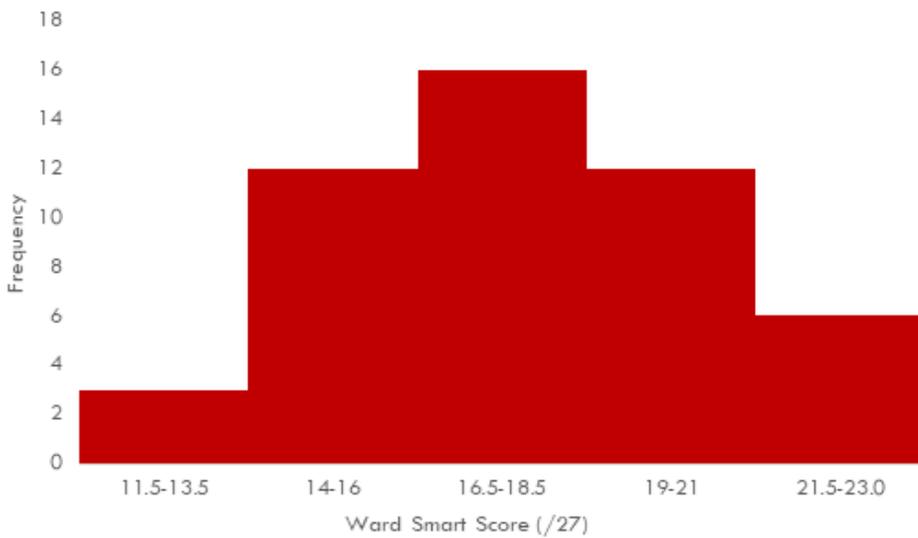


Figure 3

Histogram showing variation in Ward Smart Scores.

Supplementary Files

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