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How are junior doctors managing patients with self-limiting illnesses at their first presentation? A video vignette study

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TITLE PAGE

Title: How are junior doctors managing patients with self-limiting illnesses at their first presentation? A video vignette study.

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ABSTRACT

Purpose

To conduct a video vignette survey of medical students and doctors investigating test ordering for patients presenting with self-limiting or minor illness.

Methods

Participants were shown six video vignettes of common self-limiting illnesses and invited to devise investigation and management plans for the patients' current presentation. The number of tests ordered was compared to those recommended by an expert panel. A Theory of Planned Behaviour questionnaire explored participants' beliefs and attitudes about ordering tests in the context of self-limiting illness.

Results

Participants (n=61) were recruited from across Australia. All participants ordered at least 1 test that was not recommended by the experts in most cases. Presentations that focused mainly on symptoms (e.g. in cases with bowel habit disturbance and fatigue) resulted in more tests being ordered. A test not recommended by experts was ordered on 54.9% of occasions. With regard to attitudes to test ordering junior doctors were strongly influenced by social norms. The number of questionable tests ordered in this survey of 366 consultations has a projected cost of $17,000.

Conclusions

This study suggests there is some evidence of questionable test ordering by these participants with significant implications for costs to the health system. Further research is needed to explore the extent and reasons for test ordering by junior doctors across a range of clinical settings.

Key issues

- Health care costs are rising with significant costs attributed to waste including unnecessary laboratory or radiological testing.
- The cost of managing patients is rising disproportionately to the complexity of their presentation
- Junior doctors make up a large portion of doctors in the public Australian hospital setting where they have access to so-called basic investigations.

Main messages

- There is evidence that junior doctors need guidance on appropriate testing, particularly for self-limiting illnesses.
- Participants ordered tests not recommended by experts on 55% of occasions.
- Junior doctors have questionable test ordering in presentations that rely on symptom assessment.
- Further research is needed involving junior doctors in contexts where they are working autonomously.

BACKGROUND/INTRODUCTION

Upon graduating from medical school, junior doctors in Australia are allowed to order tests with or without reference to a supervisor. In this country junior doctors form part of the 9000 hospital non-specialist doctors, many of whom work in publically funded hospitals[1]. Junior doctors employed by teaching hospitals have relative ease of access to so-called basic investigations. Recent studies have shown a dramatic increase in the number and cost of investigations[2] and junior doctors are at the front of this trend. Information regarding the testing patterns of junior doctors is limited, despite junior medical officers and registrars making up a large portion of doctors in the public Australian hospital setting.

Pathology, imaging and other investigations play a critical role in the diagnosis, monitoring and screening for disease in medical practice[3]. However, the overuse of many common biochemical and imaging investigations is an ongoing concern[3-6]. A 15-year US-based meta-analysis of 1.6 million laboratory results found that on average, 30 per cent of all laboratory tests are probably unnecessary[7]. Australian studies have also highlighted rising health care costs. People of all ages are receiving more tests per person on average which indicates a potential waste of resources[2 8 9].

A number of studies have sought to identify the issues and challenges facing clinicians in ordering laboratory tests [10 11]. A low tolerance to uncertainty has been described as a causative factor in over-testing and may be a factor for doctors who are relatively inexperienced and unfamiliar with managing undifferentiated illness[12]. A fear of litigation may also result in the practice of defensive medicine[6]. Other known factors that drive over-testing include the need to reassure the patientor pressure put on by patients with specific expectations[6 12].

This study used video vignettes to assess the levels of inappropriate testing amongst junior doctors. The video vignettes presented participants with a hypothetical clinical scenario and characters, providing enough context and information to have an understanding of the presentation being depicted[13]. Video vignettes previously used in Australian health research were found to have advantages over other data collection methods. Vignettes provide realism and a means to standardise clinical scenarios that is not possible with other methodologies. Medical practitioners report confidence in their ability to conduct video consultations[14-17]. The video scenarios provide valid data by simulating clinicians' usual working environments, which generate more detailed responses from participants in a way that text-based scenarios do not [14].

The objective of this study was to conduct a video vignette survey of medical students and junior doctors' test ordering patterns for patients presenting with self-limiting or minor illness.

METHODS

Study Design

A prospective observational study was conducted examining the decision making and test ordering patterns undertaken by junior doctors when presented with general common conditions in the primary care setting. Participants were sent a link to the secure website hosting the survey and video vignettes. Once consent was obtained, participants commenced the survey and had access to the video vignettes and relevant materials. At the conclusion of the video vignette, the participant was prompted with web-based questions requesting their provisional diagnosis, their first line investigations (if any), their differential diagnoses and management plan. Participants

repeated this process with each of the six video vignettes, outlining different case scenarios. At the conclusion of watching all six video vignettes, participants were then asked to complete a survey based on the Theory of Planned Behaviour (TPB) to ascertain their beliefs and attitudes towards investigations in these cases.

Method

Snowball sampling was used to recruit participants. Medical students and doctors were invited to participate in the study via email, direct contact and professional network connections. Participants were then asked to nominate colleagues suitable for participation in the study. An outline of the study and its purpose was provided to all candidates without reference to the focus on test ordering. In order to minimise expectation bias, outcome measures of the study were not discussed in detail with the participants prior to the intervention.

Eligible participants were allocated to four groups:
Group 1: Final year medical students at Australian universities.
Group 2: Intern doctors.
Group 3: Resident Medical Officers (RMOs), Postgraduate years 2-4.
Group 4: Registrars – Physician, general practice or emergency medicine.

We hypothesised that there will be differences in investigation patterns between these groups. All participants were Australian medical school graduates. A total sample size of 89 participants would allow us to confirm if most participants (98%) would order at least one test not recommended by experts in most cases. This is based on a 95% confidence level and 9% margin of error.

Materials

Vignettes

Six video vignettes were developed depicting what may be seen typically in general practice[18]. These were developed with the aid of an experienced general practitioner and tested with other clinicians. The scenarios depicted were:

1. Irritable bowel syndrome
2. Post-Viral Cough
3. Migraine
4. Musculoskeletal back pain
5. Fatigue
6. Ganglion cyst

Participants were presented with a video scenario of a patient explaining their symptoms. Physical examination findings were then read out in the video. A table outlining the history and examination findings were provided to the participant at the end of each vignette and they could replay the video if required. Each video ran for approximately two minutes. An outline of the cases are presented in Table 1.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a validated survey instrument that examines influencing factors for a particular behaviour.[19] The behaviour in this instance is the ordering of tests. The TPB therefore offers a recognised framework to explore participants' intentions, attitudes, subjective norms, and control beliefs for test ordering behaviour. The TBP survey is comprised of multiple questions related to each of these domains of the survey. For this study, control beliefs were

further divided into two sub-domains of self-efficacy and controllability resulting in six domains in total for the TPB survey. The TPB survey was developed with reference to previous studies utilising video vignettes and tested with a representative cohort of medical practitioners not included in the study [14 15 20].

Analysis

Standard descriptive analysis was used to summarise the profile of the participants using SPSS (version 23).

Vignettes

The primary outcome measure was the number of tests ordered at first presentation compared to an expert panel. The expert panel consisted of a total of five specialists from emergency medicine, internal medicine and general practice. Appropriate investigations were based on current available evidence based guidelines or best practice as deemed by the panel. Recommended appropriate tests were determined by selecting tests that the majority of expert clinicians independently rated as 'important' or 'essential'. Table 1 outlines the tests recommended by the expert panel in each case. The recommended tests from the expert panel served as the baseline for "appropriate investigations" for each video vignette.

The number of investigations ordered by the participants were analysed with reference to the expert panel recommendations. Participant responses were scored relative to this baseline. Multivariable logistic regression was used to determine any significant difference between sub-groups of participants according to demographic criteria (registrars vs. JMOs vs. Medical Students). P-values less than 0.05 were considered statistically significant.

Theory of Planned Behaviour

Participant responses to each TPB domain were scored and group results reported. The domains were measured on a 7-point ordinal scale. Averages were used to determine a score for each domain of intention, attitudes, subjective norms and control beliefs as well as the sub-domains of self-efficacy and controllability. Higher values in a domain correlate strongly with the behaviour being observed. The higher the TPB score, the more likely this domain has an influence on the choice to order tests.

Group TPB scores were reported as means and standard deviation (SD), and the group differences were assessed using a linear regression model. When there was an overall group difference (Wald's test $p<0.05$ after the regression), the comparison between four groups was estimated with Bonferroni adjustment for multiple comparisons. TPB scores are on a Likert scale, and although conventionally mean and SD are used for analysis, we also used Kruskal-Wallis rank test and tested their median and found that results were similar. All analyses were performed using Stata MP 14.1 (StataCorp, Texas, USA). All tests are two-sided and a p value <0.05 was regarded as statistically significant. Cronbach α (Crα) measures the internal consistency of participants' scores in each domain. Crα scores greater than 0.7 and less than 0.95 demonstrate good reliability within that domain. Crα is a measure of the correlation of scores between related survey items of a domain[21]. Where there is good internal consistency, participant responses to related survey items will generate similar scores.

Ethics

Ethics approval was obtained from the University of Notre Dame Australia Human Research Ethics Committee. (approval number: 015065S).

RESULTS

Participant demographics

A total of 61 participants consented and completed the study. These included medical students (21), Interns (18), Residents (12) and Registrars (10). Residents' clinical experience ranged from 2-3 years and Registrars' had 3-8 years of clinical experience. The male and female proportion was 43% and 57% respectively. Participants were located predominantly in Victoria (69%) and New South Wales (21%).

Vignettes

Expert Recommendations

Table 1 outlines the scenarios constructed by the expert panel and presented to participants. The panel also recommended tests at first presentation. In all but Case 5, no tests were indicated by the majority of expert clinicians to the standardised simulated cases.

	History	Examination Findings	Expert Recommended Tests
Case 1 Irritable Bowel Syndrome	23yo woman with abdominal pain Long history of irregular bowel habits (constipation & diarrhoea) Anxious No nausea or vomiting, Feels bloated Appetite & weight is normal Last GP diagnosed as Irritable Bowel Syndrome	Appears well, afebrile, normotensive Nil jaundice or pallor Soft, non-tender abdomen, nil guarding No abdominal masses Abdomen distended DRE - No abnormalities	0
Case 2 Post-Viral Cough	35yo woman presenting with cough. Married with 2 children. Non-smoker, nil asthma Bad cold 2 weeks ago, cough still persisting Dry non-productive cough, sore throat Feels generally well	Appears well, afebrile Nil shortness of breath Mouth dry, Inflamed oropharynx, Tonsils normal size Chest clear on auscultation	0
Case 3 Migraine	28yo woman presenting with right sided headache Unable to work last two days Taking paracetamol and ibuprofen with no relief History of headaches – aggravated by wine & stress Stressed at work, not able to sleep Nauseated, no vomiting Aura – 'zig zag' lines in periphery at onset Nil other issues. Not on any medications.	Tired Blood pressure and heart rate normal Fundoscopy - No abnormalities No focal neurological signs	0
Case 4 Musculoskeletal Back Pain	41yo male production worker presenting with acute lower back pain 5 day history, constant, worse in morning Mechanism: picking up box at work Nil pins & needles, numbness, leg pain Nil changes to urine or bowel patterns	Overweight Appears well Local spasm in left lower lumbar region Nil radiculopathy Nil neurological signs	0
Case 5 Fatigue	25yo woman presenting with generalised fatigue Feels 'run down' for 1 month Busy marking exams at work – teacher Nil previous episodes Eating well, nil change to weight Nil changes to bowel and bladder Periods are light and normal LMP last week – not pregnant	Looks well, slightly tired Normotensive, afebrile, normal heart rate Nil pallor Heart and lung sounds are normal Abdomen: soft, non-tender, no masses Nil lymphadenopathy	Full Blood Examination (FBE), Thyroid Function Tests (TFT)
Case 6 Ganglion Cyst	45yo woman presenting with lump on right hand. Lump on back of hand for few weeks Feels rubbery, moves with finger movements Non-tender, no recent trauma or insect bites Nil other medical history. Not on any medications	Looks well Nil neurological signs, nil wasting of hand muscles No other deformities or nodules Nil lymphadenopathy *Lump*: 2cm wide, firm, not inflamed/warm, skin above moves freely.	0

Table 1: Summary of clinical scenarios and consensus expert opinion of recommended tests.

Participant agreement with expert panel

Participants who ordered more tests than those recommended by the expert panel were deemed as not in agreement. Table 2 outlines the number of participants in agreement with the expert panel on tests ordered in each case. Cases one (8%) and five (13%) had the lowest agreement with the expert panel.

Participant Agreement with Experts		**% Agreement**				
	Tests recommended by expert	**Medical Student n = 21 (%)**	**Intern n = 18 (%)**	**Resident n = 12 (%)**	**Registrar n = 10 (%)**	**Total n = 61**
Case 1: Irritable Bowel Syndrome	**0**	4 (19%)	1 (6%)	0 (0%)	0 (0%)	5 (8%)
Case 2: Post-Viral Cough	**0**	14 (67%)	12 (67%)	6 (50%)	6 (60%)	38 (62%)
Case 3: Migraine	**0**	16 (76%)	13 (72%)	10 (83%)	8 (80%)	47 (77%)
Case 4: Musculoskeletal Back Pain	**0**	14 (67%)	11 (61%)	9 (75%)	8 (80%)	42 (69%)
Case 5: Fatigue	**FBE, TFT**	3 (14%)	2 (11%)	2 (17%)	1 (10%)	8 (13%)
Case 6: Ganglion Cyst	**0**	9 (43%)	9 (50%)	5 (42%)	3 (30%)	26 (43%)

Table 2: Participant agreement with expert clinicians. FBE (Full Blood Examination), TFT (Thyroid Function Test).

Rate of inappropriate test ordering

Each participant had six opportunities to order tests (six simulated scenarios). When analysing the whole participant group, the rate at which at least one inappropriate test was ordered was 54.9% (Table 3). A similar rate of test ordering was observed across all participant groups, however this was not statistically significant (p=0.89).

Occasions where an inappropriate test was ordered		**n (%)**
By group		
Students (n=126)		62 (52.4)
Interns (n=108)		60 (55.6)
Residents (n=72)		40 (55.6)
Registrars (n=60)		35 (58.3)
	Total (n=366)	201 (54.9)

Table 3: Occasions on which inappropriate tests were ordered. n = opportunities for a test to be ordered.

Test ordering pattern

Participants ordered a variety of tests in each case. The number of tests ordered in each case is presented in Table 4. Cases one and five had the largest number of tests ordered with a median of 5 and 4 tests respectively. The most common tests ordered in each case are presented in table 5. Cases one and five had the largest range and quantity of tests ordered by participants.

Number of tests ordered	Recommended by expert consensus	Medical Student n = 21	Intern n = 18	Resident n = 12	Registrar n = 10	Total n = 61
Case 1: Irritable Bowel Syndrome	**0**	3 (2,5)	5 (3,6)	5 (5,6)	4 (2,5)	5 (2,6)
Case 2: Post-Viral Cough	**0**	0 (0,1)	0 (0,1)	1 (0,2)	0 (0,1)	0 (0,1)
Case 3: Migraine	**0**	0 (0,0)	0 (0,1)	0 (0,0)	0 (0,0)	0 (0,0)
Case 4: Musculoskeletal Back Pain	**0**	0 (0,1)	0 (0,1)	0 (0,1)	0 (0,1)	0 (0,1)
Case 5: Fatigue	**2**	4 (3,5)	4 (3,4)	4 (4,5)	4 (2,5)	4 (3,5)
Case 6: Ganglion Cyst	**0**	1 (0,1)	4 (3,6)	1 (0,1)	0 (0,1)	1 (0,1)

Table 4: Number of tests ordered by participants; Median (1st quartile, 3rd quartile).

Common tests ordered	Recommended by expert consensus	Top 5 most common tests ordered in each case
Case 1: Irritable Bowel Syndrome	**0**	⇒ FBE, UEC, Coeliac Serology, LFT, Stool Study
Case 2: Post-Viral Cough	**0**	⇒ Nose & throat swab, FBE, CRP, UEC, CXR
Case 3: Migraine	**0**	⇒ FBE, UEC, CRP, ESR, Iron studies
Case 4: Musculoskeletal Back Pain	**0**	⇒ Lumbar X-ray, Lumbar MRI, Lumbar CT, FBE, UEC
Case 5: Fatigue	**2 (FBE, TFT)**	⇒ FBE, TFT, Iron studies, UEC, LFT
Case 6: Ganglion Cyst	**0**	⇒ Ultrasound, X-ray hand/wrist, Fine Needle Aspiration, FBE, UEC

Table 5: Top 5 most common tests ordered for each case by all participants.

Theory of Planned Behaviour (TPB)

TPB data is presented in Table 6. Domains with a Cronbach α score greater than 0.7 are considered to have good internal consistency of the entire group within the domain. The subjective norm and attitude domains demonstrated good internal consistency with Cronbach α scores of 0.72 and 0.78 respectively.

The higher the TPB values the greater the influence of that domain on test ordering behaviour. The subjective norm domain had the largest influence on whether a test is likely to be ordered. This effect was largest in the intern group. There was group difference in the subjective norm domain (p=0.036), with interns having a significantly higher subjective norm score than medical students (mean difference=0.8, 95% CI=0.03, 1.43, p=0.04). There were no statistically significant group differences in all other measurements.

Theory of Planned Behaviour Scores

Domain	Cronbach alpha	Students (n=21)	Interns (n=18)	Residents (n=12)	Registrars (n=10)	Total (n=61)	P value[1]
		mean (SD)	mean (SD)	mean (SD)	mean (SD)	mean (SD)	
Intention	0.43	4.3 (0.8)	4.2 (0.8)	4.5 (0.9)	4.9 (1.1)	4.4 (0.9)	0.24
Attitude	**0.78**	4.4 (0.7)	4.4 (0.9)	4.4 (1.0)	4.0 (0.8)	4.3 (0.8)	0.67
Self-efficacy	0.14	3.9 (1.0)	3.6 (1.0)	3.8 (1.4)	3.8 (1.0)	3.7 (1.1)	0.85
Controllability	0.52	4.4 (1.1)	4.1 (0.9)	4.2 (1.5)	4.4 (0.9)	4.3 (1.1)	0.83
Overall perceived controllability	0.62	4.2 (0.9)	3.9 (0.8)	4.0 (1.2)	4.1 (0.8)	4.0 (0.9)	0.78
Subjective norm	**0.72**	4.3 (1.0)[a]	5.1 (0.5)[b]	4.7 (0.9)	4.4 (0.9)	4.6 (0.9)	**0.04**

Table 6: Theory of Planned Behaviour survey results. Mean (Standard Deviation) scores for each domain. Likert scale from 1-7; Higher scores are more favourable towards ordering tests. Cronbach alpha scores of 0.70 and above have good internal consistency.

[1] p values were derived with Wald's test after 6 linear regression models, in which study group is the only dependent variable. [a,b] group with different superscript are significantly different from each other at p<0.05 level.

DISCUSSION

This study aimed to identify test ordering patterns in junior doctors and final year medical students at the first presentation of self-limiting and minor illnesses. The data provides evidence of test ordering that is not in keeping with expert opinion amongst the participant groups.

Expert panel assessment of the vignettes deemed in all but one case that no essential tests were recommended. In contrast only in Case 3 (Migraine) did participants show high levels of concordance with the expert panel with 77% agreeing no test was necessary. The tests ordered in cases depicting Irritable Bowel Syndrome (Case 1) and Fatigue (Case 5) showed the least correlation with the expert panel; 8% and 13% respectively. The cases of Irritable Bowel Syndrome and Fatigue provide doctors with a range of differential diagnoses and thus diagnostic uncertainty. However despite depicting non-acutely unwell patients in these vignettes, data from this study suggests that junior doctors were more likely to order at least one test which is not recommended.

In addition, given the opportunity, on 55% of occasions the sample of junior doctors ordered a test that was not recommended. It might be expected that increased experience may result in fewer unnecessary tests being ordered. However, the data suggests that the rate of questionable test ordering was similar across all participant groups. It was surprising to find that medical students were just as likely to order a questionable test (52%) as residents (56%) and registrars (58%). However, we did not record a significant trend in the comparison between groups ($p=0.889$).

The TPB survey investigated possible influencing factors on test ordering by junior doctors. The average subjective norm rating of 4.6 supports the hypothesis that social and professional drivers favourably impact a doctor's decision to order a test. The TPB scores for this domain indicate that junior doctors are influenced by their peers, colleagues and supervisors in test ordering behaviour. Junior doctors may take their lead on test ordering from senior clinicians. In addition, social pressure, particularly from patient expectation, is likely to influence the decision to order tests. A significant difference was found between students and interns ($p=0.036$) in this domain. Medical students reported the lowest average rating of subjective norm (4.3), however interns rated highest of the four groups (5.1). This may reflect a greater willingness to order tests during internship in response to the perceived attitudes of senior colleagues and patients. Participants also scored an average of 4.3 in the attitude domain indicating a favourable inclination towards ordering tests, noting that tests were 'good, beneficial, useful and convenient'.

The data suggests that personal attitudes towards testing and external sources positively influence the likelihood and number of tests ordered by junior doctors. This resonates with existing medical literature which has highlighted defensive medicine and established "routine" practice as justification for inappropriate test ordering[5 10] and further supports the importance of educating doctors on approaches to diagnostic testing.[22]

These behaviours may arise due to junior doctors' low tolerance for uncertainty and inability to manage undifferentiated illnesses.[12] Recent literature has also suggested that the overuse of diagnostic testing is a result of lack of confidence in history taking and the physical examination.[22] Other contributing factors in this regard include for a focus on early detection of life limiting disease in the absence of symptoms, concerns about litigation, failure to appreciate the limited value of testing, ease of test ordering and the perception that greater deployment of technology is a prerequisite to best care. There are recommendations that the ultimate goal for diagnostic testing should be to optimise decision-making.[22-24]

Drivers of overuse include psychological, social, economic and political factors.[25] Overuse of testing appears to be a common issue across the globe, driven by availability, apparent objectiveness and increasing sensitivity to detect disease.[26 27] A recent study has outlined various cognitive biases in decision making which may make it difficult for clinicians to balance evidence of overuse with prior ingrained beliefs.[28] Commonly encountered biases include commission bias, attribution bias, impact bias and ambiguity bias. Such biases may lead to tests that are not indicated.[22 28 29]

CLINICAL IMPLICATIONS

High rates of overuse of diagnostic and screening tests are an unnecessary drain on resources.[26 30] In the context of minor illness, tests have high sensitivity but low specificity. Therefore with the high risk of a false positive, further tests may then be ordered. The over-investigation of self-limiting illness can lead to diagnostic and therapeutic errors.[26] In addition the projected cost of questionable tests in this simulation was calculated to exceed $17,000.

LIMITATIONS

The modest sample size, based on snowball sampling, limits external validity therefore extrapolating these results to the wider junior doctor population may not be appropriate. The topic draws attention to clinical acumen and would be considered challenging. In this respect video vignettes, were an effective way to present clinical scenarios. However videos do not offer participants the opportunity to clarify history and examination findings, which may impact on the decision to order a test. The study aimed to blind participants from the aims of the study (number of investigations ordered) and varied the complexity of the scenarios to minimise issues of responder bias. The study relied on a small expert panel to make recommendations about which tests were indicated for each case. This is also a limitation of this study.

CONCLUSIONS

This study suggests that there is some evidence that junior doctors need further guidance on appropriate test ordering. The participants demonstrated questionable test ordering most notably in presentations that rely on symptom assessment. Junior doctors may need education and support to develop their clinical skills so as to determine when investigations will not add to the assessment. In this way investigations may be used more judiciously to optimise decision making in cases of diagnostic uncertainty.[22 24] The questionable tests ordered in this simulation were projected to cost an additional $46 per consultation. Further research is needed involving junior doctors working in the context of specialties where minor illness present most commonly or where they are working autonomously.

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Further Research Questions

- To what extent are junior doctors and final year medical students consistent with evidence based guidelines on test ordering?
- Are there significant differences between junior doctors and senior colleagues on the question of test ordering?
- What is the scope to reduce costs in healthcare without compromising clinical care with reference to test ordering by doctors?

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