Antibiotic intravenous-to-oral switch guidelines: barriers to adherence and possible solutions

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INTRODUCTION

The increasing use of antibiotics since their discovery is not without its penalties. The dawn of antimicrobial resistance, alongside antibiotic induced super infections, such as *Clostridium difficile* (*C. difficile*) associated diarrhoea, has called for more strict and robust antimicrobial stewardship. Antimicrobial stewardship aims to promote the rational use of antibiotics by ensuring that the most appropriate antibiotic is chosen, at the correct dose by the correct route for the correct time[1].

One aspect of antimicrobial stewardship is the application of antibiotic intravenous to oral switch guidelines[2]. Since the late 1980's there has been a plethora of research into the benefits of employing an early intravenous to oral switch policy for antibiotics. These benefits include the facilitation of early discharge from hospital[3], a reduced risk of cannula associated adverse events[4], reduced spend on medication[5,6], and a shorter time required for administering the medication. These benefits are observed due to a reduction in the course length of intravenous antibiotics. For example, in the studies by Ramirez et al[3] and McLaughlin et al[5], the implementation of antibiotic guidelines facilitating early intravenous to oral switch was associated with a 29-33% reduction in the course lengths of intravenous antibiotics in patients with community acquired pneumonia. The implementation of IV to oral switch antibiotic guidelines has been shown to speed up the time taken from when the patient is first eligible for oral antibiotics to the prescription being changed[7]. Furthermore shorter intravenous courses prior to oral therapy in medical patients, with predominantly respiratory infections, have been shown to reduce the median duration of hospital stay from 13 to 10 days[5]. There has been some speculation that this may decrease the incidence of healthcare associated infections such as *C. difficile*[8] although there is no evidence to directly support this correlation in the literature.

A potential risk of the intravenous to oral switch may include the switch occurring too early, resulting in an inadequate treatment of the infection and thus clinical deterioration. Ramirez et al[3] reported only one treatment failure (following early intravenous to oral switch) out of 118 patients with community acquired pneumonia; however this patient had multiple respiratory pathologies. In this case intravenous therapy was resumed. In another study 7 of 66 patients undergoing early intravenous to oral switch for community acquired pneumonia were readmitted but none were for infectious causes[6].

It is important to acknowledge that the intravenous to oral switch is not appropriate in all patients. For treatment of certain infections, such as endocarditis and osteomyelitis, high antibiotic tissue concentrations are needed and therefore intravenous therapy is essential. An intravenous to oral switch in these infections would likely have a significant negative clinical impact. Alternatively there are some oral antibiotics which have a high bioavailability, thus the equivalent intravenous formulation appears costly to use with no extra clinical benefit. Sequential therapy programs have been undertaken with quinolones for this reason showing that significant cost savings can be made by reducing the usage of intravenous formulations by 60%[9]. In this study the intravenous route was reserved only for the seriously ill or those with intestinal diseases that prevented sufficient oral absorption.

It is therefore essential that antibiotic intravenous to oral switch guidelines include various criteria to ensure that a switch is appropriate. These range from acknowledging clinical improvement to assessing the safety and practicality of the oral route.

Consideration must also be made to which oral antibiotic would be most appropriate as in some cases there are not comparable oral formulations. Pharmacists are well placed to offer advice on available formulations and pharmacokinetic considerations in switching to oral equivalents. They also play roles as antimicrobial specialist pharmacists involved in designing and implementing the guidelines as well as dispensing pharmacists who may be required to enforce the restrictions on antibiotic supply outlined by guidelines[10].

Antibiotic restriction may be one method of regulating the use of intravenous antibiotics however multidisciplinary engagement is likely to be essential for trust-wide guideline adherence. Physician involvement in intravenous to oral switch programmes has previously been thought to be vital in clarifying the legitimacy of the programme to medical colleagues less they believe it to be simply a cost-saving exercise led by pharmacists[10]. Whilst barriers reported by doctors concerning optimal antibiotic use for community acquired pneumonia have included a lack of familiarity with the guideline, belief that intravenous therapy is more efficacious, concern about re-infection and a desire to let senior physicians make the decision[11], the barriers to intravenous to oral switch guideline adherence have received little attention in the literature.

At a large teaching hospital in South West England, a guideline for intravenous to oral switch was developed in 2007, taking into consideration the evidence discussed above. However, a re-audit completed in 2009 demonstrated that there was persistent poor adherence to the guideline[12]. The aim of this study, completed in 2010-2011, was therefore to identify the barriers of doctors, nurses and pharmacists to adhering to the guideline and to explore their possible solutions to overcome these barriers.

Due to the number of healthcare professionals involved in antibiotic therapy, it was decided that a multidisciplinary consensus was required on the prohibitive and enabling contributors to the timely switch of intravenous to oral antibiotics in accordance with local and national guidelines.

METHODS

The study was conducted at University Hospitals Bristol NHS Foundation Trust, a large teaching hospital and tertiary referral centre for cardiology, paediatrics and oncology. The North Somerset and South Bristol Research Ethics Committee deemed the study to be service development and hence ethical approval was not required.

The method comprised a three round Delphi study (one explorative and two iterative rounds) which was initiated in late spring 2010 and semi-structured interviews. The latter were conducted in parallel to the Delphi study as it is generally recognised that the Delphi technique should not be used in isolation[13]. This approach was chosen in order to generate a consensus across disciplines, to allow the participation of various healthcare professionals irrespective of shift-working and to prevent bias and social pressures between profession and grade.

Delphi Study: The Expert Panel

The expert panel was purposively sampled from qualified doctors, nurses and pharmacists who had daily involvement with intravenous antibiotic prescriptions. Ten participants from each profession were invited to participate in line with previous Delphi

studies in the healthcare setting[14]. The participants were selected to evenly represent a variety of grades over the 4 directorates: oncology and haematology, medicine, surgery and cardiology (table 1). Random selection of these staff was not possible due to shift working, incomplete staffing lists, an ever changing work force and in some cases too few staff in certain positions for example pharmacists in cardiology. It was decided not to include microbiologists as, although they have expert knowledge in the field of antibiotics, their role as consultants limits their daily exposure to the practicalities of the intravenous to oral switch guideline at ward level. Including "illusory expertise" in the expert panel has previously been cited as a basic pitfall of the Delphi technique[15].

The expert panel were advised that during the study they should not discuss the intravenous to oral switch guideline with other panel members. They were encouraged to contact the investigator if more time was required to complete each round or if any clarification was needed. All participants were sent correspondence via e-mail outlining information about the study prior to the first round. Completion and return of the study material was taken to imply consent as fully informed consent, in the case of questionnaires, can often only be achieved once the participants have examined the material[16].

Delphi First Round

The correspondence for the first and subsequent rounds was distributed by e-mail with a two week deadline for responses. All rounds were piloted by a pharmacist independent of the expert panel and any ambiguities were resolved prior to distribution.

In round one, free text responses were invited to the following open questions:

1) What barriers prevent a switch from the intravenous to oral route in line with guideline suggestions?
2) What could be done to improve adherence to the antibiotic intravenous to oral switch guideline based on the barriers you have identified?

The resulting comments were anonymised and split into two categories: barriers to adherence and solutions to poor adherence. Each category was thematically analysed by the principal investigator, the senior antimicrobial pharmacist and the clinical pharmacy manager. Identical themes were grouped together and formatted into statements of around 20-25 words which has been shown to encourage optimal consensus in Delphi studies[15].

Delphi Second Round

The Delphi statements resulting from round one were formulated into a questionnaire in which the expert panel were asked to rate the importance of each statement on a five point ordinal scale, from irrelevant to very important, as used by Roos and Weardon[17]. In addition to rating the level of agreement with each statement, the members of the expert panel were invited to justify their response or comment on each statement. They were advised that these would be anonymised and fed back to the expert panel in subsequent rounds.

Delphi Third Round

The purpose of the third round is to allow the members of the panel to re-score each statement based on the comments and group position from the previous round in order to generate greater consensus. The responses to round two were collated and presented in the final questionnaire (Figure 1). A linear scale, which is well described in

previous Delphi studies[18,19], was used to present the results of the second round to the panel in the third round questionnaire. All justifications and comments were anonymised and included without editing. As there were no requests for clarification of any statement and no requests for inclusion of alternative themes, the statements remained unchanged between rounds.

Data Analysis

Data from members of the expert panel who did not complete all three rounds were excluded before analysis. The resulting data from Delphi rounds two and three were analysed using Microsoft® Excel® by quantifying each response (1 equated to irrelevant; 5 to very important). The ordinal nature of the data dictated that the median be used to describe the response of the panel[18-20]. As in previous Delphi studies, the interquartile range (IQR) was used to describe the degree of agreement within the expert panel[17,19] with an IQR of 1 or less representing consensus[17]. Stability between rounds was determined by a change of less than 15% which has been considered the natural level of oscillation between consecutive Delphi rounds[21]. The differences in response between each profession were analysed using IBM SPSS Statistics (SPSS®) Version 16. A Mann Whitney test was used to compare the response of doctors and pharmacists.

Interviews

Semi-structured interviews were conducted with doctors, nurses and pharmacists (who were not invited to participate in the Delphi study) to further explore the barriers to guideline adherence and solutions to poor adherence. The Delphi participants were not interviewed because individual ideas may have been lost to group consensus by nature of the Delphi process. Non-responders were not interviewed as it was presumed that they no longer wished to participate. One participant was purposively sampled from each of the three professions in turnuntil no new themes emerged.

The initial interview schedule was informed by the responses to the first round of the Delphi study, the literature and the aims and objectives of the study. The original interview schedule was piloted on a pharmacist and any points of ambiguity resolved. The interviews were recorded and transcribed verbatim into Microsoft® Word®. The final transcript accuracy was checked by the principal investigator. The interviews were thematically analysed by the principal investigator and a coding tree was developed for each question. The themes identified from the interviews were then compared and contrasted with the Delphi study results.

RESULTS

Delphi

Of the 30 members of the expert panel invited to participate, one declined after the introductory letter. Of the remaining 29 participants, 16 (55%) completed round one and 13 (45%) completed all rounds. The resulting expert panel comprised four doctors and nine pharmacists; no nurses completed all rounds (table 1).

Following round one, 18 statements concerning barriers and 17 statements concerning solutions were formulated and entered into the round two questionnaire template. The

statements remained unchanged throughout rounds two and three as there were no requests for clarification or rewording.

Barriers
Consensus was achieved for 14 statements (78%) following round three (table 2). The highest level of agreement with the median was achieved for statement B1 (76.9%). The level of consensus in round three, determined by a reduced IQR, improved for five statements (B1, B8, B9, B11 and B13) when compared with round two. Stability, less than 15% change between rounds two and three, was reached for all statements except statement B1.

Solutions
Consensus was achieved for 14 statements (82%) following round three (table 3). The highest level of agreement with the median was achieved for statement S12 (76.9%). The level of consensus improved for two statements (S4 and S11) between rounds however there was a divergence of opinion (increase in IQR) for S13. Stability between rounds was reached for all statements.

Interprofessional differences
There was no significant difference ($p>0.05$) between the median ratings of doctors and pharmacists for all but one statement. Statement B10 showed a difference of opinion between doctors and pharmacists ($p=0.023$) with doctors appearing to vote lower (two choosing irrelevant) in the raw data.

Interviews
Seven interviews were conducted including three with doctors, two with pharmacists and two with nurses at which point no new themes emerged. The barriers to guideline adherence were divided into three categories as identified previously in describing interview responses to questions concerning guideline adherence[11]: (1) Internal barriers: knowledge, (2) Internal barriers: attitude and (3) External barriers (table 4). The identified solutions are shown in table 5. The themes identified in the interviews were very similar to those identified by the Delphi study although some more specific solutions emerged.

DISCUSSION
The application of a Delphi study and semi-structured interviews was successful in identifying barriers to the antibiotic intravenous to oral switch guideline and solutions to poor guideline adherence. Within the Delphi study, consensus was achieved for 26 out of 35 statements, with the most important barrier being a lack of appropriate antibiotic review at the weekend and the most important solution to raise guideline awareness.The findings of the Delphi study were in general well supported by those themes identified by the interviews. The combination of the Delphi technique with semi-structured interviews was advantageous, especially with respect to more specific solutions on how to overcome the barriers to guideline adherence were identified in the interviews. The interviews also provided an opportunity for the views of nurses to be represented. It must also be recognised that by the nature of the Delphi technique, specific ideas from a few individuals may have been marginalised in favour of group consensus.

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Participant fatigue is a well recognised limitation of the Delphi study[22]. The lack of nurses in the final Delphi expert panel limits the findings to those of the pharmacy and medical profession although the two nurses interviewed did identify how they could contribute in this area. It is possible that the method of communication by e-mail was not suitable for this group as computer access at ward level is restricted. Whilst the resulting expert panel comprised more pharmacists than doctors, which may have skewed the median, statistically there was no difference between professions except for statement B7. The anonymity of the panel encouraged all participants to judge the comments published between rounds with equal merit. Statement B1 did not achieve stability using the 15% change rule following round three, however it was decided that participant fatigue would be too great to benefit from distributing a fourth round containing only one statement. The use of IQR alone as a method for determining consensus is restrictive as it does not identify the few cases demonstrating bipolar or plural distributions i.e. where there is strong consensus in a particular group of participants[23]. One statement ("the initial indication for the antibiotics was not recorded by the prescribing doctor") has been noticed to show a bipolar distribution during data analysis. Here, equal participants selected important and not important with pharmacists and doctors represented equally in both groups. Using the IQR does not give a robust way to identify all of these alternative distributions.

The most important barrier to antibiotic intravenous to oral switch guideline adherence was perceived to be lack of appropriate review at the weekends. Methods for adequate provision of information with which to inform a switch to oral antibiotics at the weekend should be investigated in the future. Due to limited medical staffing at the weekend it may be necessary to look further afield than simple provision of information to a conditional switch plan which is documented in the medical notes and may be supported in certain areas by a patient group direction.

All of the statements (n=7) where consensus was not reached concerned specific roles for a particular profession. This may be due to differences between the perception of each profession for their own and the other professions responsibilities. Such differences could be a draw-back of the method used but may also highlight that individuals are not aware of the scope of each profession concerning the intravenous to oral switch guideline.

There were no statements (barriers or solutions) pertaining to the involvement of nurses in the antibiotic intravenous to oral switch from the Delphi study. This is possibly due to the lack of nurse respondents to the Delphi which may cast doubt over their perceived role in the switch process. There is little information in the literature concerning nurses attitudes towards the intravenous to oral switch process and so it is difficult to postulate whether the Delphi results would be different with nurse involvement. However the nurses interviewed were clear in their roles of highlighting those patients on intravenous antibiotics for over 48 hours and prompting medical review. Gillespie et al[24] showed that the involvement of nurses in antimicrobial stewardship education sessions and awareness campaigns improved awareness of resistance from 59% to 79% and of line infection due to antibiotic therapy from 38% to 70%. This correlated to a reduction in line days for 3 of the 6 wards studied and a reduction from 3 line-related infections to 2 after the intervention. It is apparent that nurses are well placed to identify intravenous

antibiotic prescriptions that are due for review due to regular medication rounds and patient observation monitoring throughout the day. Engaging the nurses in antimicrobial stewardship using these strategies is likely to be necessary at the study hospital in order to improve adherence to the IV to oral switch guideline.

The interviews alone revealed that doctors are sometimes unaware of which patients are on intravenous antibiotics and therefore those to whom the guideline applies. This view did not emerge through the Delphi study, perhaps through concern that other healthcare professionals would deem this sub-standard practice. The solutions identified through interviews included several point of switch reminders such as stickers affixed to the medication chart, which have been shown to reduce the average course of intravenous antibiotics from over 10 days to 8.4 days[25] if placed on day 7.
The role of pharmacists in the antibiotic intravenous to oral switch has previously ranged from design and implementation of switch guidelines[5] to prompting review by doctors. Over 60% of the expert panel felt that pharmacy staff are not confident to encourage the intravenous to oral switch (statement B10). This is consistent with previous literature which showed that 58% of pharmacists agreed that a 'lack of training/confidence' was a reason for not applying the policy[26]. Out of the four doctors one felt that this was an important barrier whilst the other three chose 'unsure'. This highlights an area where pharmacists may benefit from specific training with support from specialist antibiotic pharmacists.

The proposal that all intravenous antibiotics should be automatically switched from the intravenous to oral route at 48 hours via the Delphi study met with significant opposition. Comments received from a registrar (with an interest in infectious disease) suggest that this approach would compromise patient safety "patients with conditions like endocarditis should not suffer due to doctors poor prescribing habits". This view highlights that guidelines need to balance promoting good prescribing practice and upholding high standards of patient care whilst not letting poor prescribing go un-challenged. The use of antibiotics in less serious infections however has been shown to benefit through the use of a patient group direction (PGD) where nurses can facilitate the switch reducing the median IV antibiotic therapy from 4 to 3 days for uncomplicated cellulitis in an outpatient setting[27]. Whilst the use of a PGD effectively empowers nursing staff to act on the guideline more work is required to determine if this approach would be as successful in secondary care.

Engaging guideline users is an ever growing challenge due to the multitude of clinical guidelines released every year. Recent measures of good antimicrobial stewardship have encouraged the application of around seven different guidelines, one of which is an antibiotic intravenous to oral switch guideline[2]. Methods for engaging guideline users proposed via the Delphi study included education sessions using interactive case studies (statement S7), education on the benefits of intravenous to oral switch (statement S6) and making the guideline more accessible on wards (statement S2). The interview findings mirror these solutions and introduce the additional idea of providing feedback to each consultant team on guideline adherence data and specific benefits such as cost saving. It has been shown that facilities with good clinical guideline adherence have better evidence of timely, individual, non-punitive and customisable audit feedback than lower performing facilities[28]. Doctors have previously agreed that this approach along with encouragement from senior doctors is likely to encourage the adherence to guidelines[29].

CONCLUSIONS

The study has been successful in identifying several barriers to guideline adherence and discovering several solutions that may improve adherence. The most important barrier highlighted was the difference in practice between weekday and weekend working. This should be the focus of effort in attempting to improve adherence to the intravenous to oral switch guideline initially. The most important proposed solution was perceived to be improving guideline awareness through various methods targeting all grades of doctors as well as further engaging nursing staff. Such solutions should be investigated individually in future work to determine which may have a lasting impact on guideline adherence.

Whilst this study concentrated on the intravenous to oral switch guideline, some of the barriers and solutions identified are transferable to increasing adherence to all guidelines. The challenge to increase adherence to guidelines will only increase, as it is clear from the interviews that some healthcare professionals already feel overwhelmed, by the ever emerging barrage of clinical guidelines. This reinforces the need for healthcare professionals to produce concise well sign-posted guidelines which are efficiently disseminated to all professions involved.

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Table 1: Demographics of the final expert panel compared with the initially selected panel

Profession	**Seniority***					**Clinical specialty**			
						Oncology	**Medicine**	**Surgery**	**Cardiology**
Doctor (male=3, female=1)	Foundation training (Year 1-2)		Early specialist training (Years 3-4)		Advanced specialist training (Year 5+)				
	1/7		1/1		2/2	2/2	1/3	1/3	0/2
Nurse (female=10)	Band 5		Band 6	Band 7	Band 8				
	0/5		0/2	0/2	0/1	0/2	0/3	0/3	0/2
Pharmacist (male=2, female=7)	Band 6	Band 7	Band 8a	Band 8b	Band 8c				
	1/2	3/3	3/3	1/1	1/1	1/1	3/3	2/4	2/2

*Doctor seniority based on consecutive years of training since qualifying. Pharmacist and nurse seniority based on the NHS Agenda for Change scale. Nurse seniority ranges from newly qualified registered nurse (band 5) to matron (band 8a). Pharmacist seniority ranges from newly qualified pharmacist (band 6) to the trustwide clinical pharmacy manager (band 8c)

Table 2: Delphi statements concerning barriers where consensus was achieved (IQR ≤ 1)

	Statement	Median	% agreement
B1	Appropriate review dates for IV antibiotics are not documented on the medication chart	4	76.9%
B2	Patients are not always reviewed appropriately at the weekends	5	53.8%
B3	Intravenous antibiotics are not always reviewed daily on ward rounds.	4	53.8%
B4	Staff are not aware of the intravenous to oral switch guidelines.	4	61.5%
B5	Staff are unable to access the necessary guidelines.	4	53.8%
B6	There is no guideline to enable pharmacists to switch intravenous antibiotics to the oral route.	4	53.8%
B7	Prescribers are not aware of how to find information on suitable oral antibiotics following intravenous courses.	4	53.8%
B8	There is insufficient monitoring information available to make an informed decision to switch to oral antibiotics.	3	38.5%
B9	Doubt about the extent of oral absorption prevents an IV to oral switch.	3	30.8%
B10	Pharmacy staff are not confident enough to encourage the IV to oral switch.	4	30.8%
B11	Doubt about the safety of a patient's swallow.	3	53.8%
B12	Clinical staff are worried that oral antibiotics will not treat the infection effectively.	4	69.2%
B13	The criteria for reviewing the suitability of a patient for IV to oral switch are not specific enough	3	61.5%
B14	Variability in clinical judgement in interpreting trends in monitoring parameters.	4	69.2%

B, barrier; 1, irrelevant; 2, unimportant; 3, unsure; 4, important; 5, very important

Table 3: Delphi statements concerning solutions where consensus was achieved (IQR ≤ 1)

	Statement	Median	% agreement
S1	Awareness of the intravenous to oral switch guideline must be improved	5	69.2%
S2	The guideline should be made more accessible on the wards	4	53.8%
S3	Switch criteria complete with tick boxes should be attached to the medication chart to facilitate a decision	3	53.8%
S4	Allow pharmacists to order blood tests to facilitate intravenous to oral switches	3	53.8%
S5	All intravenous antibiotics will be automatically switched to the oral route at 48 hours. Doctors will have to document if they are to continue on IVs past this time	2	61.5%
S6	Education on the benefits of IV to oral switch	4	61.5%
S7	Education sessions using case studies	4	61.5%
S8	Case specific advice from microbiology to include suggestions for a suitable oral option when clinically appropriate	4	69.2%
S9	Encourage speech and language therapy referral if in doubt about the patient's swallow	4	46.2%
S10	Set out minimum monitoring guidelines for patients on intravenous antibiotics to ensure that all information needed to switch from IV to oral is available	4	53.8%
S11	Minimise outliers so that doctors only have to take responsibility for patients on their own ward	4	46.2%
S12	Allow doctors more time to review intravenous antibiotics	4	76.9%
S13	Have guidelines to prevent unnecessary prescribing of IV antibiotics in the first place	4	53.8%
S14	Medical/ surgical teams to document an antibiotics switch plan to facilitate IV to oral switches out of hours	4	46.2%

S, solution; 1, irrelevant; 2, unimportant; 3, unsure; 4, important; 5, very important

Table 4: Barriers to guideline adherence as identified by interviews

Internal barriers: knowledge	Internal barriers: attitude	External barriers
a) Awareness of the guideline: "Well I knew there was one but I have never actually looked at them directly myself." (Dr2S) b) Awareness of patients on intravenous antibiotics: "As long as we [nurses] highlight it to the team if sometimes they forget about it"(N1M) "On a busy ward you just think they're on an antibiotic and you kind of don't look at how it's being given unless the nurses flag it up and say 'do we really need to give it IV?'" (Dr3S) c) Perception that oral antibiotics are inferior: "They're not as effective, the oral antibiotics, that would be the main concern." (Dr 3S)	a) Low priority: "Drugs are often one of the last things they [doctors] look at in a management plan" (Ph2M) b) Seniority of decision: "Must get follow up from above" (Dr3S) c) Reassurance of intravenous antibiotics: "You feel reassured when people are on IV antibiotics" (Dr2S) d) More complex situation than is covered by guideline: e) Attitude towards guidelines in general: "Well obviously guidelines are only guidelines and they are not a rule and they must be taken in clinical context" (Dr2S)	a) Interpatient variability: b) Time: "Occassionally it gets to 72 hours and you think goodness we've missed that." (Dr1M) "The doctors not having time to review the patients appropriately I think is probably the main barrier." (Ph1M) c) Interprofessional communication: "I think they [the doctors] do review at 48 hours but then they don't necessarily document that they have made that review." (Ph1M) "A lack of communication between doctors and nurses." (N2S) d) Current guideline: "The guidance is vague." (Dr3S)

Dr, doctor; Ph, pharmacist; N, nurse; M, medical; S, surgical
Highlighted themes were unique to the interviews

Table 5: Solutions to improve guideline adherence as identified by interviews

Solutions to poor guideline adherence	Sub-themes
Point of switch reminders	*a) Visual* "a nice little IV red stamp on the page..."(Dr1M) "The pharmacist could write 'remember the guidelines or something like that." (Dr2S) *b) Verbal* "We can prompt our seniors..." (Dr2S) "Highlight it to the team if they forget about it"(N1M)
Raising primary guideline awareness	a) *Target audience* "I mean it's just about educating people and talking to the junior doctors, talking to the nursing staff..."(Dr3S) "...maybe have a big push on MAU and on the surgical admissions unit...making the doctors more aware of the 48hour review." (Ph1M) "...the consultants are missed and they are slow to change."(Dr3S) "...teaching to the newly qualified as part of their induction."(N1M) *b) Methods* "...you know mention it at grand rounds..."(Dr3S) "Maybe just send e-mails if there is any [guideline] changes straight away."(N1M)
Change guideline	"It could be encorporated into the [empirical] antibiotic guidelines...you know the protocols"(N2S)
Engage guideline users	"There's so many guidelines for everything" (Dr3S) "Ensure that everyone has read the online guideline" "Presenting audit data to them [doctors] on a regular basis per consultant. I think medics are very competitive..." (Ph2M)
Highlight patients on intravenous antibiotics	"Stick something to the front of the drug chart for those people who are on IV antibiotics...maybe a little thing above the bed even where we say about food intake; IV antibiotics"(Dr1M)

Dr, doctor; Ph, pharmacist; N, nurse; M, medical; S, surgical; MAU, medical admissions unit
Highlighted themes were unique to the interviews

	Irrelevant	Unimportant	Unsure	Important	Very important
Appropriate review dates for IV antibiotics are not documented on the medication chart. *Comments from previous rounds*: The frequency with which antibiotics review dates are omitted is decreasing, so I don't believe it is this that is preventing the IV to oral switch in the majority of cases.	0	2	* 2	7	4
Comments on this round: Please enter comments here					

Figure 1: Example of the format for the third round questionnaire including results from round 2. The view taken by the participant in the previous round is indicated with an asterisk, the median value of the expert panel is shaded.