BMJ open

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Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2011-000398
Article Type:	Research
Date Submitted by the Author:	21-Sep-2011
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Primary Subject Heading:	Qualitative research
Keywords:	GENERAL MEDICINE (see Internal Medicine), INFECTIOUS DISEASES, Infection control < INFECTIOUS DISEASES, CHEMOTHERAPY

Submission format for BMJ Open: Qualitative Research Article

Eliciting views on antibiotic prescribing and resistance from hospital and outpatient care physicians with focus groups

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The authors assure that all authors included on this paper fulfil the criteria of authorship. In addition we assure that there is no one else who fulfils the criteria but has not been included as an author.

Short title: Physicians views on antibiotic prescribing and resistance

ABSTRACT

Objective To provide a current assessment of physicians' views on factors of influence for the prescribing of antibiotics and on antibiotic resistance

Design Qualitative study with focus groups of 7 GPs, 2 urologists, 1 paediatrician from outpatient care; 8 internists, 2 paediatricians, 2 ENTs, 1 urologist from hospital care, all within the German health care system

Results Physicians showed differential interest in topics related to antibiotic prescribing and antibiotic resistance. Outpatient care physicians were interested in topics around their own prescribing, such as being able to diagnose and prescribe precisely, and topics about patient demand and noncompliance. Hospital care physicians were interested in hygiene challenges, limited consult time and multi-resistant pathogens. A major topic in both groups was the development of antibiotics for specific indications.

Conclusions Physicians in this sample considered the development of resistance to be more in the domain of clinical treatment than that of the patient. Major challenges that play a role in the context of antimicrobial resistance for physicians are access to and clarity of treatment recommendations, implementation of hygienic measures, as well as increased outsourcing of laboratory services. Results suggest that in Germany physicians may be the key target group for intervention that aims to influence antimicrobial resistance. This is remarkable because in other countries intervention to reduce antimicrobial resistance has often been targeted at the patient directly. There is a need to revisit current approaches to intervention methods so that they are sensitive to evolving socio-behavioural factors for physician antibiotic prescribing.

Keywords antibiotic prescribing, antibiotic resistance, hospital care, outpatient care, social factors, qualitative research

Word counts Abstract (247); Manuscript (3755)

ARTICLE SUMMARY

Article Focus

- Overuse of antibiotics across many specialities and in some of the most common diagnoses remains a driving force for antibiotic resistance
- While much attention has focused on limiting use and addressing clinical concerns like improving point-of-care diagnostic tests, prior literature has largely left out the consideration of socio-behavioural factors that influence physicians in their choice to prescribe antibiotics
- Physicians' views on factors that influence their prescribing of antibiotics and antibiotic resistance were assessed with focus group discussions

Key Messages

- Physicians are interested in help for making the right decisions on the appropriate measures for mitigating patient discomfort and risk
- Well-informed prescribing practice is influenced by structural (e.g. overcrowding in hospitals) as well as non-structural factors (e.g. access to feedback from microbiologists or patient consult time)
- Physicians desire intervention activities that address their own skills, like assessment of patient needs, time management for consult and navigation of pharmaceutical consulting

Strengths and Limitations

- Participants were recruited from diverse physician specialities from both the hospital and outpatient care setting, from different age groups and those treating diverse patient populations
- The study utilised up-to-date methodologies for focus group analysis, including a comprehensive plan for ensuring validity in data making and data reduction
- A replicable model was provided; showing how to use an open-source, free software that can be applied to similar research efforts
- Focus group participants are all from the Berlin metropolitan area and physicians from other regions, particularly rural areas, may present different experiences and views.

INTRODUCTION

Antimicrobial use has remained a major concern in medicine and epidemiology over the last years. Surveillance initiatives have been implemented in order to monitor antimicrobial consumption and usage patterns and resistance data for selected pathogens in order to present trends over time and comparisons between countries and regions. [1;2] The results provide evidence that antimicrobial resistance has continued to persist across all specialities and in some of the most common diagnoses. Efforts to combat resistance have focused on limiting antimicrobial use, providing patient education about appropriate use, and developing better point of care tests. But there are other factors of antimicrobial use and resistance, which should also be a core part of campaigns that attempt to monitor resistance in both hospital and outpatient care settings.[3,4;5 6]

In 2007 the Robert Koch Institute (RKI), the federal public health institution in Germany, initiated a number of different studies to investigate factors to be considered when designing a national strategy to prevent the spread of antimicrobial resistance. The aim was to use different methodological approaches to describe prescribing behaviours for antimicrobials as well as factors of influence for antibiotic prescribing and antibiotic resistance in Germany. To complement a nationally representative, quantitative cross-sectional survey with 10,600 physicians on the same topic [7] we conducted a qualitative study to generate in-depth exploratory information on this topic. Combining quantitative and qualitative approaches can help to better explore hard-to-gauge socio-behavioural factors of prescribing, especially social and cultural factors of epidemiology like aging, gender, geography, attitude, knowledge and behavioural factors.[8,9]

METHODS

Focus group conceptual structure

We conducted a literature review to identify previous work on socio-behavioural factors of influence for antimicrobial prescribing and to guide all further research. A conceptual structure was created to serve as the basis for designing further research studies on this topic, the first of which being focus group discussions. The five conceptual areas encompassed influence factors for: 1. General impressions of antibiotic resistance (e.g. How is the development of antibiotic-resistance perceived? How generally relevant is the topic of rising antibiotic-resistance?), 2. Prescribing in outpatient care (e.g. which influence factors are relevant for prescribing antibiotics? Which factors are relevant for prescribing in outpatient care?), 3. Prescribing in hospital care (e.g. which influence factors are relevant for prescribing antibiotics? Which factors are relevant for prescribing in hospital care?), 4. Information and knowledge about antibiotic treatment (e.g. what are sources of knowledge about antibiotics? How do physicians generally get informed about medical areas related to antibiotics?), 5. Impressions on problematic areas of concern (e.g. Where are problem areas in antibiotics and antibiotic resistance addressed? Which factors should be addressed by potential interventions to combat antibiotic resistance?). Please see tables 1 and 2.

Focus group participants

Purposive sampling was used to recruit physicians from diverse backgrounds with respect to sex, age, specialty, practice type, the number of patients seen quarterly, and location of practice (former East or West Germany). All physicians were recruited from Berlin metropolitan area. Physicians were offered monetary compensation of 200 Euros. A qualitative research agency (H,T,P, Concept[10]) was employed to draw a sample of physicians, moderate and transcribe the group discussion sessions.

We conducted four focus group sessions of 5-7 physicians each: Group one, “Outpatient setting: less experience:” practice-experience from 5-12 years; a mix of single and group practice; 3 GPs, 1 paediatrician, 1 urologist; 2 women, 3 men. Group two, “Outpatient setting: more experience:” practice-experience from 12 years; a mix of single and group practice; 4 GPs, 1 urologist; 3 women, 2 men. Group three, “Hospital setting: less experience:” practice-experience from 3-10 years; 4 internists, 1 paediatrician, 1 ENT, 1 urologist; 2 women, 5 men. Group four, “Hospital setting: more experience:” practice-experience from 10 years, 4 internists, 1 paediatrician, 1 ENT; 1 woman, 6 men. Please see table 1 and 2 for details on focus group participants.

Interview methodology

The focus groups were held between December 4 and 6, 2007 in Berlin, and were facilitated in 4 sessions of 2 hours each. All sessions were held separately and conducted by a trained moderator. For each discussion, moderators used a semi-structured framework based on the topics from the five conceptual areas, but allowed participants in each group to explore topics differentially. Interviews were transcribed in real-time, and each session was video-recorded. To selectively check for accuracy of the text in each transcription, 6 random samples of 5-7 minutes were chosen from the video-footage of each focus group, and then checked against the corresponding text.

Data Analysis

A preliminary analysis of transcribed data was completed. This firstly consisted of examining the data based on the five conceptual areas and the respective study questions set out before beginning this research. We were able to draw key relationships between conceptual areas, so called "code-categories" under which were assigned individual topics arising from the content of the focus group discussions. The resulting framework was used to guide all subsequent data-making and analysis tasks.

A pre-analysis code map was developed from the framework, showing a hierarchy from the five code-categories to each topic and sub-topic. (The code map is provided online as supplementary data.) The code map was then created, to be used later for constant comparative analysis—an iterative method of content analysis where each category is searched and constantly revised, popularly used to allow so called "emergent codes" to be applied at all points in the analysis. [11;12] Before beginning the analysis, we validated our code map by performing a code check, looking for duplicates and comparing codes to the topics within the aforementioned framework. Revisions were made and a resulting code map was used for subsequent data making. Please see Figure 1: Plan for data-making, data reduction and analysis.

All text from transcripts was subjected to constant comparative analysis, as described above. The frequencies of codes were used as a measure of significance. Additionally, quotations were collected from all transcripts when a specific topic involved multiple sentences, when the comment provided was provocative or when it involved more than 2 individuals in dialog. All data making and content analyses were done using TAMS Analyzer for Macintosh OS X, an open-source, computer-assisted qualitative research tool (version 4.13).[13]

RESULTS

Table 3 provides a detailed overview of the highest incident emergent codes and code-categories from constant comparison analysis for all focus groups combined. Those results stratified by each focus group are presented in the following section.

Outpatient care physicians with fewer years of practice experience (focus group 1) discussed topics within the category of outpatient-specific influences on prescribing 146 times. Subsequent categories discussed by this group were: general impressions on rising resistance (115), sources of information on antibiotics (64), and physician-oriented interventions (17).

The most frequently discussed topics in this focus group were difficulties in dealing with complicated patient histories (12), patient compliance (9) and patient perception of treatment (8). Participants frequently discussed the development of antibiotic substances (11) and showed concern with showing responsibility in their own practice and prescribing of therapy (4). Participants also focused on specific diagnoses that are perceived to be driving resistance, with major discussion occurring around the topic of uncomplicated urinary tract infections (UTIs) (5).

Conferences (9) and pharmaceutical companies (4) were discussed most when it came to common sources of information on antibiotics. A large amount of time was spent talking about the nature of pharmaceutical representatives. This was described as a persistent, aggressive – yet specialty-specific approach:

> 'They come often and always have antibiotics on hand. You get a bag of them every day. And high doses of drugs. It all stacks up in the cabinet. For me there are 4 to 5 representatives each day.' (1-3: i.e. Focus Group 1-Participant 3; please see tables 2 and 3 for participant details.)
>
> 'I notice that they approach me, too. But I do not accept them all. I would estimate that there are about 5-7 every day, and they do bring whole bags full (of giveaways).' (1-2)

'The representatives come into my practice. And you do listen to them. You even take the information they offer, even if with a critical eye. But you do learn something as well. ' (1-5)

'The pharmaceutical industry is very aggressive.' (1-3)

'For urology I can not remember in recent months receiving a visit on this issue. But that is certainly very different than in the primary care sector.' (1-4)

Participants from outpatient care with less experience most frequently saw feedback on their resistance situation and cooperation with laboratories (5) as ways to address the problem of rising antibiotic resistance.

Outpatient physicians with more years of practice experience (focus group 2) discussed those topics within the category of general impressions on rising resistance 150 times. Other categories in order of most to least frequent included: sources of information on antibiotics (126), outpatient-specific influences on prescribing (105), and physician-oriented interventions (28). In this group there was also some discussion around the category of hospital-specific influences on prescribing and mostly focused on problems specific to the hospital setting (8) and multi-resistance pathogens (6).

The topic of hygiene arose in each of the two outpatient focus groups, who agreed that antibiotic resistance was largely a problem of the hospital setting, "In hospitals resistance plays a bigger role because there one finds hospital specific germs." (1-4) Incidentally, the topic of resistance was often quickly averted when brought up, instead being commented as a problem specific to the hospital care setting:

'I think the development of resistance is more the domain of clinical treatment and not the patient.' (2-5)
'Exactly.' (2-3)
'Yeah, especially in intensive care.' (2-4)

They also frequently discussed the effectiveness antibiotic substances and drug development (6). This group also talked about social factors that may be driving the situation, like increased foreign travel (6), over-the-counter availability of drugs abroad (4), and migration (4). The topic of UTIs also arose as a specific concern driving resistance (4).

Physicians in this group valued information that is concise and available to them in a way that complements their work without taking up too much time:

'Is there a new antibiotic? What is the resistance situation? Which organisms are being affected? What are the indications, what are the side effects? The interactions with other drugs? Are there alternatives? If this information could be given to us in a short and sweet way, then we would be happy. Something like this is not currently available to us.' (2-1)

Participants discussed most frequently that patient demand (11) is a major driver for prescribing in the outpatient setting, followed by doctor experience (9) and specific diagnoses (6). The role of the patient, including patient non-compliance and self-medication also emerged. Physicians discussed two types of patients: those concerned with getting an antibiotic, and those concerned with avoiding what they think is harmful:

'Pressure from patients is not insignificant…the worst are the mothers where the children are really very sick and the mothers say: I don't want any chemotherapy. The lymph nodes are thick with pus, almost hanging out, and then the mother says no, no antibiotics for us. That's bad.' (2-1)

Participants in focus group 2 found treatment guidelines (8), pharmaceutical based materials (5) and conferences (4) to be main sources of information on antibiotics. This group found information from pharmaceuticals to be concise, and readily available:

'There's been a big change from the expertise of representatives who come in. These are all clinicians and they do not give a bad impression at all. They bring me a lot of information although, of course, you have to make sense of it all. But I do admit that I feel as though I am getting good

> consulting. Because I don't have the time to do my own research nor to sit down on the Internet every evening. I am very grateful for the very specific information they offer me.' (2-2)

Increased surveillance (9), including information on their regional resistance situation (5), constraints on their consulting time (3), and consulting (2) were found to be the most often discussed recommendations for intervention. There was discussion that patient outreach is not needed in Germany (2), but they discussed the need to have more access to surveillance of their local resistance situation:

> 'I think we need what there was in (the former) East Germany, a short, independent information sheet that shows the current epidemiological situation in the country or the region where I live.' (2-5)

Hospital physicians with fewer years of experience (focus group 3) most frequently discussed their general impressions on rising resistance (70), hospital-specific influences on prescribing (40), sources of information on antibiotics (15), and physician-oriented interventions (12). Patient non-compliance (8), correct prescribing and antibiotic dosing (5), hospital care (3) and hygiene (3) were the most frequently addressed topics.
The Internet (3), pharmaceutical advertising (2) and conferences (2) were listed as the most frequent physician-oriented interventions mentioned by this group. The visibility of pharmaceutical advertising was also discussed, and this group found it on the whole easy to access and useful for learning. (3-7) Participants overwhelmingly stayed with the topic of hospital workplace concerns, like hygiene (7) and time for patient-consult (4) as the most needed intervention to combat resistance in their setting. Non-structural demands on the hospital, such as advances in treatment possibilities for more complex indications, might necessitate more antibiotics consumption in the hospital setting, which may in turn itself be a driver for resistance.

The hospital itself was viewed as having structural aspects that might contribute to increased antibiotic use and resistance (7). One such aspect, maintaining hygiene, was a perceived danger of interrelated issues of increased patient load (3), patient-patient contact (1) and infectiousness (2). One physician noted that the pressure to treat more patients has led to a related need for a faster consult time, which may put strain on the thoroughness of hospital hygiene measures (4-1). Hospital physicians also pointed out that they would prefer to pursue intervention through new programs for hygiene, although they also recognise it to be a challenging method of improvement (3-7).

Hospital physicians with more years of experience (focus group 4) discussed most frequently about their general impressions on rising resistance (66), followed by hospital-specific influences on prescribing (29), sources of information on antibiotics (27), and physician-oriented interventions (21). The most frequent topics brought up by this group were diagnostics possibilities (5), patient history/epidemiology (increasingly acute cases in care) (4) and social factors like aging (4). When talking about the influence on prescribing in hospital care, the following topics were most frequent: indication and disease (2), risk assessment in acute cases (2), specificity of guidelines (2) and time constraints during patient consultation (2).

Specialty journals (9), clinical handbooks (3) and the Internet (3) were the most frequent topics to emerge under the category of hospital-specific influences on prescribing. Discussion points on hospital feedback on the resistance situation (5) and continuing education (2), especially in the area of hygiene (2) and infectious diseases (2) emerged most frequently in discussions regarding intervention for antibiotic resistance.

Collegial exchange with microbiologists/ laboratories (5) emerged as the most frequent topics under the category of hospital-specific influences on prescribing. All hospital physicians in our sample spoke about opportunities to closely collaborate with laboratories and microbiologists, who can be helpful in navigating antibiotics treatments:

> The micro-biologists that we have are top. We mostly get reports via the doctor calling us before anything is published on our intranet. It is then also discussed, what underlying disease does the patient have, which antibiotic was given, and the provisional findings will be communicated first. Short, quick ways; you have to communicate well with people.(4-1)

Throughout the discussion of this category arose the topic of outsourcing of laboratories, which physicians perceived as prohibiting close communication and producing too much bureaucracy, “For us, it is unfortunately not the case. The laboratory has been outsourced. A service provider is at the other end of town; they can't communicate with us much.” (4-5) Other dominant topics that emerged in the category were the role of the hospital pharmacist in influencing prescribing choices (4), followed by how often and appropriately internal/hospital antibiotic treatment guidelines are updated (4), and subsequently by multi-resistant pathogens (3).

DISCUSSION

In similar studies throughout the past decade, research had underlined the importance of patient-oriented factors of influence for prescribing.[14-16] The focus has primarily been on patient demand and noncompliance. This is consistent with the historical data on the subject showing that antibiotics are more likely to be prescribed when the patient expects them, and that they may be even more likely to be prescribed when the doctor may perceive that the patient wants a prescription, when in fact the demands of patient are unclear.[17] Physicians in this sample showed differential interest in those topics related to their antibiotics prescribing and resistance.

A major topic in both groups with outpatient physicians was their experience of increasingly difficult diagnoses in practice. The concern in our sample for the prevalence of UTIs and the related development of antibiotics for specific indications is important. UTIs are the dominant topic which emerged in the discussions among outpatient care physicians, which makes sense: the trend in many European studies of antimicrobial resistance show UTIs to be accountable for a large amount of antibiotics consumption.[1] Indeed, the cross-sectional survey component of this study showed UTI to be the overall most frequent diagnosis for which physicians chose to begin antibiotic treatment in patients.[7] Many of the common pathogens leading to UTIs such as E. coli (one of the most frequent), P. mirabilis and K. pneumoniae are increasingly becoming resistant to standard treatments, leading to higher use of wide-spectrum antibiotics.[18;19]

Outpatient physicians frequently commented that resistance is primarily a problem of the hospital setting, related to the presence of different multi-resistant pathogens and challenges with hygiene. Not surprisingly, this was a major topic among hospital physicians in this sample. The increasing prevalence of multi-resistant pathogens is of particular concern, especially given the views that the hospital ward is increasingly faced with more patients at any single time, and that patients—many of whom are carrying more complex indications—are also expected to be seen in shorter consult times.[20;21]

Some hospital care physicians were familiar with regular and easy collaboration with microbiologists when discussing indications and possibilities for therapy. Laboratories also enabled the provision of information on the resistance situation for their hospital via regular communication channels, such as staff meetings and Intranet services. Other physicians, however, complained that increased outsourcing of diagnostics and other laboratory services from hospitals prohibited them from close collaboration and from having an overview of their local resistance situation. For the outpatient care setting, this was more problematic, where participants described needing better access to their local resistance situation.

It has remained unclear how large the current influence of the pharmaceutical industry is on physicians in Germany. In this sample, we learned that the pharmaceutical industry plays a large role in outpatient care practice. Visits to doctor’s offices by the industry and free samples of antibiotics are ubiquitous; their informational

materials are generally perceived as attractive. This may be associated with the fact that information from the industry presents information in ways that is more convenient than scientific literature on the same topics.[22] Despite some caution about the persistence of the industry, most outpatient care physicians welcome their assistance, and view them as another resource among many other sources of information on antibiotics. [7] There was differential discussion about treatment guidelines, which may also be an important influence factor on physician prescribing practice. Participants from the outpatient care setting viewed clinical recommendations to be difficult to access quickly and use. For the hospital setting, this was significantly different. There was more discussion about whether guidelines are up-to-date, and about their relevance, specificity and availability to clinical practice. There are many guidelines with varying degrees of quality available to physicians. Hospital care physicians have an array of in-house developed guidelines, differentially taking into account local resistance data.[23] But, as also evidenced by other studies availability is differential and should be addressed separately for each setting. [4,24]

CONCLUSION

Our findings show that outpatient care physicians in our sample were interested in topics around their own prescribing, like physician-sensitivity to patient need, time management for patient consult, access to guidelines and their perception of the pharmaceutical industry. These socio-behavioural factors, when coupled with intervention for the hospital care setting (e.g. improving hygiene measures, easing diagnostics and cooperation with laboratories) are markedly different from past factors: they are physician-oriented. New intervention strategies that comprise these factors can thus inform innovative approaches in the field that complement years of prevention work among to educate patient populations.

STUDY LIMITATIONS

Although the same moderator conducted all focus group discussions based on a conceptual framework drawn before the sessions, there could be issues of reliability due to its application to 4 different groups of physicians. But, since we intended for the moderator to allow for participants in each group to explore topics differentially around this framework, so that any new or previously unanticipated topics could come up, we believe that this provided a major strength that is unique to this qualitative approach.

To address the challenges of validity in our data making and analysis, we employed a comprehensive plan for data-making, data reduction and analysis that allowed for cyclical and repeated checks. This included a cope map, which was reviewed by 2 epidemiologists. (Please see figure 1.)

Acknowledgements We thank the following individuals for cooperating on this research effort: Werner Espelage, Kirsten Heckenbach, Jürgen Hoffmann, Michael Kramer and Ines Noll.

Funding This research was funded by a departmental grant from the Federal Ministry of Health. The study sponsors had no role in the study design or in the collection, analysis, and interpretation of data; in the writing of the report, nor in the decision to submit the article for publication.

Competing interests None

Ethical approval This study was approved by the institutional commission for data protection of the Robert Koch Institute. All participants gave informed consent before taking part in focus group discussions.

Data access all authors had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Contributors EV completed all analysis and drafted the manuscript. AZ, TE and GK conceived of the study and obtained funding. All authors contributed to the study design, the carrying out of the study, and provided critical feedback to the manuscript.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data available.

[Figure 1 Plan for data-making, data reduction and analysis]

Table 1 Focus group participant details: outpatient care

Focus Group	Participant ID	Sex	Age	Specialty	Practice type	Years in Practice	Location	Patients per quarter
1	1	F	46	Paediatrics	Group	12	East	ca. 900
	2	F	35	GP	Group	5	West	ca. 200
	3	M	48	GP	Single	9	East	ca. 1000
	4	M	54	Urology	Single	11	West	ca. 1200
	5	M	40	GP	Group	10	West	ca. 800
2	3	F	55	GP	Group	16	East	ca. 150
	4	F	42	GP	Group	15	East	ca. 180
	2	F	53	Urology	Group	15	West	ca. 800-900
	1	M	62	GP	Group	25	West	ca. 2000
	5	M	57	GP	Single	15	East	ca. 800-900

Table 2 Focus group participant details: hospital care

Focus Group	Participant ID	Sex	Age	Specialty/ Position	Number of beds	Years in Practice	Location	Patients per quarter
3	1	F	40	Paediatrics/Consultant	1200	8	West	ca. 600-700
	2	M	34	Internal/Resident	620	5	West	ca. 400
	3	M	43	Internal/ Consultant	538	9	East	ca. 500
	4	M	42	Internal/ Resident	626	4	West	ca. 300-400
	5	F	34	Internal/ Resident	363	3.5	West	ca. 400
	6	M	30	ENT/ Resident	1200	3	East	ca. 350
	7	M	43	Urology/ Consultant	220	12	West	ca. 500
4	1	M	51	Internal/ Consultant	538	16	West	ca. 500
	2	F	40	Internal/ Consultant	1200	14	East	ca. 1000
	3	M	56	Internal/ Consultant	276	31	West	ca. 500
	4	M	48	ENT/Consultant	1000	10	West	ca. 1400
	5	M	41	Internal/ Consultant	1200	10	West	ca. 1000
	6	M	44	Paediatrics/ Consultant	542	16	West	ca. 300-500
	7	F	63	Urology/ Consultant	1200	37	East	ca. 4000

Table 3 Top 5 highest incident emergent codes and categories from constant comparison analysis (All groups combined; total codes n=1035)

Code-Category	5 most frequent code-topics	Frequency
General impressions on rising resistance		401
	Patient noncompliance	15
	Antibiotics development	13
	Hospital specific issues, e.g. hygiene, labs	11
	Antibiotic dosing	10
	Urinary tract infections	10
Outpatient-specific influences on prescribing		251
	Patient history	18
	Patient demand	18
	Physician experience	14
	Patient self-educated	11
	Patient compliance	11
Sources of information on antibiotics		234
	Practice guidelines	10
	Continuing medical education	8
	Specialty journals	8
	Internet	8
	Quality of conferences	7
Physician-oriented interventions		84
	Surveillance	9
	Laboratory feedback	7
	Information on local resistance situation	7
	Hospital	4
	Hygiene	4
Hospital-specific influences on prescribing		65
	Up-to-date internal guidelines	4
	Laboratory/microbiologists exchange	4
	Specificity of Internal guidelines	4
	Experience with infectious diseases	3
	Problematic diagnoses	3

Reference List

(1) Ferech M, Coenen S, Malhotra-Kumar S, et al. European Surveillance of Antimicrobial Consumption (ESAC): outpatient antibiotic use in Europe. J Antimicrob Chemother 2006;58:401-407.

(2) Vander Stichele RH, Elseviers MM, Ferech M, et al. Hospital consumption of antibiotics in 15 European countries: results of the ESAC Retrospective Data Collection (1997-2002). J Antimicrob Chemother 2006;58:159-167.

(3) Cotter M, Daly L. Antibiotic prescription practices of general practitioners. Ir Med J 2007;100:598-601.

(4) Guerra CM, Pereira CA, Neves Neto AR, et al. Physicians' perceptions, beliefs, attitudes, and knowledge concerning antimicrobial resistance in a Brazilian teaching hospital. Infect Control Hosp Epidemiol 2007; 28:1411-1414.

(5) Hulscher ME, Grol RP, Van der Meer JW. Antibiotic prescribing in hospitals: a social and behavioural scientific approach. Lancet Infectious Diseases 2010;10:167-175.

(6) Harbarth S, Monnet DL. Cultural and socioeconomic determinants of antibiotic use. In: Gould IM, van der Meer J, eds. Antibiotic Policies - Fighting Resistance. Berlin: Springer 2007:39-40.

(7) Velasco E, Espelage W, Faber M, et al. A national cross-sectional study on socio-behavioural factors that influence physicians' decisions to begin antimicrobial therapy. Infection 2011;39:289-297.

(8) O'Donnel A, Luftey K, Marceau L, et al. Using focus groups to improve the validity of cross-national survey research: A study of physician decision making. Qual Manag Health Care 2007;:971.

(9) Kuper A, Reeves S, Levinson W. An introduction to reading and appraising qualitative research. BMJ 2008;337:288.

(10) H,T,P, Concept website: http://www.inspirationformarketing.com/; Access date: 21.09.2011.

(11) Leech N, Onwuegbuzie A. An array of qualitative data analysis tools: A call for data analysis triangulation. Sch Psychol Q 2007;22:557-584.

(12) Pope C, Van Royen P, Baker R. Qualitative methods in research on healthcare quality. Qual Saf Health Care 2002:148-152.

(13) TAMS website: http://tamsys.sourceforge.net/; Access date: 21.09.2011.

(14) Butler CC, Rollnick S, Pill R, et al. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. BMJ 1998;317:637-642.

(15) Cockburn J, Pit S. Prescribing behaviour in clinical practice: patients' expectations and doctors' perceptions of patients' expectations--a questionnaire study. BMJ 1997;315:520-523.

(16) Harbarth S, Albrich W, Brun-Buisson C. Outpatient antibiotic use and prevalence of antibiotic-resistant pneumococci in France and Germany: a sociocultural perspective. Emerg Infect Dis 2002;8:1460-1467.

(17) Faber MS, Heckenbach K, Velasco E, et al. Antibiotics for the common cold: expectations of Germany's general population. Euro Surveill 2010;15:19655.

(18) Vasquez GA, Siu HR, Luna EM, et al. Risk factors for Quinolone-resistant Escherichia coli urinary tract infections. Infect Dis Clin Pract 2011;17:09-313.

(19) Hooper DC. Emerging mechanisms of fluoroquinolone resistance. Emerg Infect Dis 2001;7:337-341.

(20) Kern WV, Nink K, Steib-Bauert M, et al. Regional variation in outpatient antibiotic prescribing in Germany. Infection 2006;34:269-273.

(21) Goossens H, Ferech M, Vander SR, et al. Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. Lancet 2005; 365:579-587.

(22) Avorn J, Solomon DH. Cultural and economic factors that (mis)shape antibiotic use: the nonpharmacologic basis of therapeutics. Ann Intern Med 2000;133:128-135.

(23) Deja M, Nachtigall I, Halle E, et al. Antibiotikatherapie - Strategien für die Verordnung von Antibiotika in der Intensivmedizin [Strategies in the treatment of infections with antibiotics in intensive care medicine]. Anasthesiol Intensivmed Notfallmed Schmerzther 2007;42:108-115.

(24) Srinivasan A, Song X, Richards A, et al. A survey of knowledge, attitudes, and beliefs of house staff physicians from various specialties concerning antimicrobial use and resistance. Arch Intern Med 2004; 164:1451-1456.

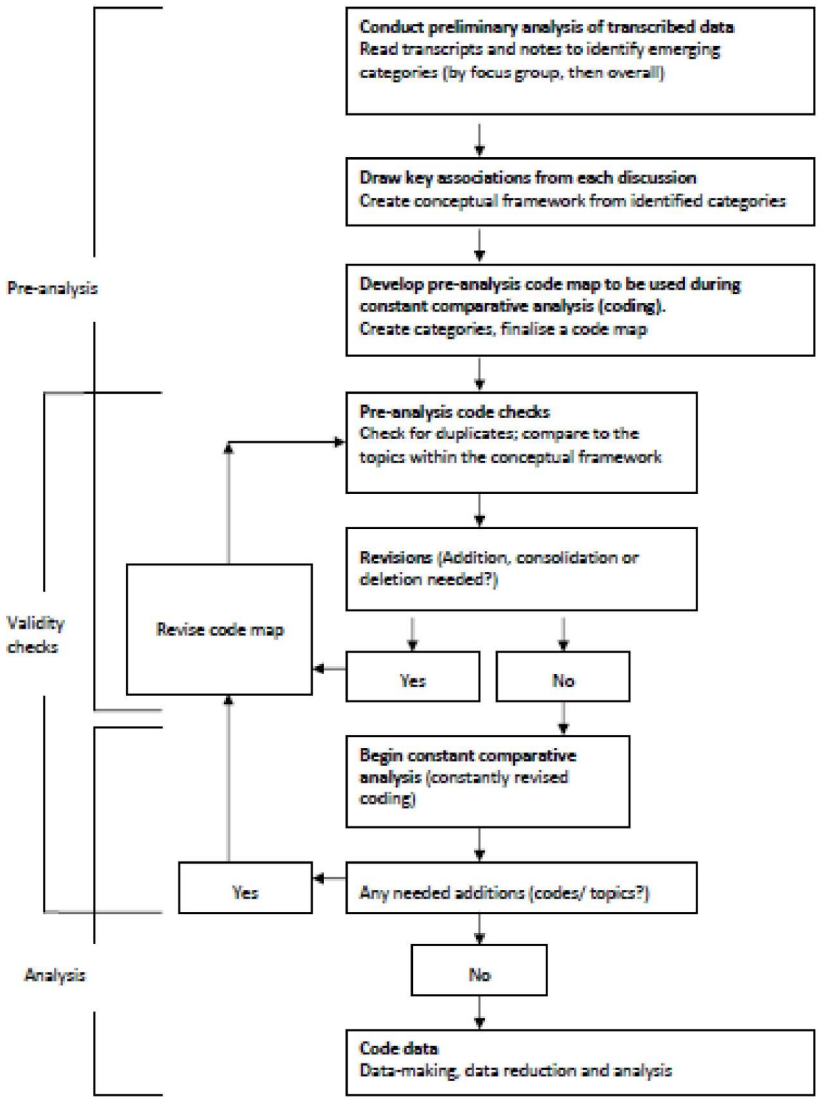

Figure 1 Plan for data-making, data reduction and analysis
194x264mm (300 x 300 DPI)

Qualitative research

These are the questions that BMJ editors should consider when appraising papers presenting original qualitative research (although we don't routinely use a checklist for this):

- Was the research question clearly defined? **YES**
- Overall, did the researcher make explicit in the account the theoretical framework and methods used at every stage or the research? **YES**
- Was the context clearly described? **YES**
- Was the sampling strategy clearly described and justified? **YES**
- Was the sampling strategy theoretically comprehensive to ensure the generalisability of the conceptual analysis (diverse range of individuals and settings, for example)? **YES**
- How was the fieldwork undertaken? Was it described in detail? **YES**
- Could the evidence (fieldwork notes, interview transcripts, recordings, documentary analysis, etc) could be inspected independently by others: if relevant, could the process of transcription be independently inspected? **YES**
- Were the procedures for data analysis clearly described and theoretically justified? Did they relate to the original research questions? **YES** How were themes and concepts identified from the data?
- Was the analysis repeated by more than one researcher to ensure reliability? **YES – at different phases**
- Did the investigator make use of quantitative evidence to test qualitative conclusions where appropriate? **YES – reference to a separate cross-sectional component conducted by the author**
- Did the investigator give evidence of seeking out observations that might have contradicted or modified the analysis? **YES**
- Was sufficient of the original evidence presented systematically in the written account to satisfy the sceptical reader of the relation between the interpretation and the evidence (for example, were quotations numbered and sources given)? **YES**

BMJ open

Eliciting views on antibiotic prescribing and resistance among hospital and outpatient care physicians in Berlin, Germany: results of a qualitative study

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2011-000398.R1
Article Type:	Research
Date Submitted by the Author:	07-Dec-2011
Complete List of Authors:	Velasco, Edward; Robert Koch Institute , Department for Infectious Disease Epidemiology Ziegelmann, Antina; Federal Ministry of Health, Division for Communicable Diseases, AIDS, Prevention of Epidemics Eckmanns, Tim; Robert Koch Institute, Department for Infectious Disease Epidemiology Berlin, Germany Krause, Gérard; Robert Koch Institute, Department for Infectious Disease Epidemiology Berlin, Germany
Primary Subject Heading:	Qualitative research
Secondary Subject Heading:	Infectious diseases, Epidemiology
Keywords:	antimicrobial prescribing, antibiotic resistance, inpatient care, outpatient care, social factors, focus group research

Submission format for BMJ Open: Qualitative Research Article

Eliciting views on antibiotic prescribing and resistance among hospital and outpatient care physicians in Berlin, Germany: results of a qualitative study

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The authors assure that all authors included on this paper fulfil the criteria of authorship. In addition we assure that there is no one else who fulfils the criteria but has not been included as an author.

Short title: Physicians' views on antibiotic prescribing and resistance

ABSTRACT

Objective To better understand physicians' views on factors of influence for the prescribing of antibiotics and on antibiotic resistance in the Berlin region, Germany

Design Qualitative study with focus groups

Setting Outpatient care and hospital care practice in the Berlin region, Germany

Participants 7 General practitioners, 2 urologists, 1 paediatrician from outpatient care; 8 internists, 2 paediatricians, 2 ear, nose and threat specialists, 2 urologists from hospital care

Results Physicians showed differential interest in topics related to antibiotic prescribing and antibiotic resistance. Outpatient care physicians were interested in topics around their own prescribing, such as being able to diagnose and prescribe precisely, and topics about patient demand and noncompliance. Hospital care physicians were interested in hygiene challenges, limited consult time and multi-resistant pathogens.

Conclusions Physicians considered the development of resistance to be more in the domain of clinical treatment than that of the patient. Major challenges related to antibiotic resistance for this group of physicians are access to and clarity of treatment recommendations, implementation of hygienic measures, as well as increased outsourcing of laboratory services. Results raise questions about whether meeting physicians' expectations should be a focus when developing intervention that aims to influence antibiotic resistance in this and other areas of Germany.

Keywords antimicrobial prescribing, antibiotic resistance, inpatient care, outpatient care, social factors, focus group research

Word counts Abstract (203); Manuscript (3987)

ARTICLE SUMMARY

Article Focus

- Overuse of antibiotics across many specialities and in some of the most common diagnoses remains a driving force for antibiotic resistance
- While much attention has focused on limiting use and addressing clinical concerns like improving point-of-care diagnostic tests, prior literature has largely left out the consideration of socio-behavioural factors that influence physicians' decisions to prescribe antibiotics
- Focus group discussions were used to show physicians' views on factors that influence their prescribing of antibiotics and antibiotic resistance

Key Messages

- Berlin area physicians are interested in receiving help to make informed decisions on the appropriate measures for mitigating patient discomfort and risk
- In this group, well informed prescribing practice appears to be influenced by non-patient oriented factors that are both structural (e.g. overcrowding in hospitals) as well as non-structural in nature (e.g. access to feedback from microbiologists or time allowed for patient consult)
- Physicians desire intervention activities that address their own skills, like assessment of patient needs, time management for consult and navigation of pharmaceutical consulting

Strengths and Limitations

- Modern methodologies for focus group data analysis, including a comprehensive plan for ensuring validity in data making and data reduction were used in the study
- Presented study methodology allows replication by other research groups
- The number of participating physicians was limited, however they were recruited from diverse backgrounds with respect to age, sex, size of practice, care setting and number of years in practice

INTRODUCTION

Antimicrobial use has remained a major concern in medicine and epidemiology over the last years. Surveillance initiatives have been implemented in order to monitor antimicrobial consumption and usage patterns and resistance data for selected pathogens in order to present trends over time and comparisons between countries and regions.[1;2] The results provide evidence that antimicrobial resistance has continued to persist across all specialities and in some of the most common diagnoses. Efforts to combat resistance have focused on limiting antimicrobial use, providing patient education about appropriate use, and developing better point of care tests. There are also other socio-behavioural factors of antibiotic use and resistance, which should also be a core part of campaigns that attempt to monitor resistance in both hospital and outpatient care settings.[3,4;5 6]

In 2007 the Robert Koch Institute (RKI), the federal public health institution in Germany, initiated a number of different studies to investigate factors to be considered when designing a national strategy to prevent the spread of antimicrobial resistance. The aim was to use different methodological approaches to describe factors of influence for antibiotic prescribing and antibiotic resistance in Germany. As a preliminary study, a literature review was conducted to identify previous work on factors of influence for antimicrobial prescribing and to guide further research. The aim of this study using focus groups was to elicit physicians' views on factors that influence their prescribing of antibiotics and antibiotic resistance. As a mixed-methods research approach can help to explore research findings in greater detail,[7,8] a further aim was to generate exploratory information as the basis to develop a nationally representative, cross-sectional survey on the same topic, conducted in 2008.[9]

METHODS

Focus group conceptual structure

A conceptual structure was created to serve as the basis for the focus group discussions. Five conceptual areas encompassed influence factors for: 1. General impressions of antibiotic resistance (e.g. How is the development of antibiotic-resistance perceived? How generally relevant is the topic of rising antibiotic-resistance?), 2. Prescribing in outpatient care (e.g. Which influence factors are relevant for prescribing antibiotics? Which factors are relevant for prescribing in outpatient care?), 3. Prescribing in hospital care (e.g. Which influence factors are relevant for prescribing antibiotics? Which factors are relevant for prescribing in hospital care?), 4. Information and knowledge about antibiotic treatment (e.g. what are sources of knowledge about antibiotics? How are physicians generally informed about medical areas related to antibiotics?) and 5. Impressions on problematic areas of concern (e.g. How are problem areas in antibiotics and antibiotic resistance addressed? Which factors should be addressed by potential interventions to combat antibiotic resistance?).

Focus group participants

We recruited physicians from the Berlin region, Germany, with diverse backgrounds with respect to age, sex, specialty, practice type, the number of patients seen quarterly, and location of practice. Physicians were offered monetary compensation of 200 Euros. We conducted four focus group sessions of 5-7 physicians each: 1. Outpatient setting, less experience; 2. Outpatient setting, more experience; and 3. Hospital setting, less experience; 4. Hospital setting, more experience (Table 1 and 2). A qualitative research agency (H,T,P, Concept[10]) was employed to draw a sample of physicians, moderate and transcribe the group discussion sessions.

Interview methodology

The focus groups were held between December 4 and 6, 2007 in Berlin, and were facilitated in 4 sessions of 2 hours each. All sessions were held separately and conducted by a trained moderator. Moderators used a semi-structured framework, a method which has been found to enable participants to share and confirm their views, or construct new views based on interactions in a peer context, and build knowledge together.[11,12] For each discussion, the framework was based on the topics from the five conceptual areas, but allowed participants in each group to explore topics differentially. Interviews were transcribed in real-time, and each session was video-recorded for later in-depth review. To check for accuracy of the text in

each transcription, 6 random samples of 5-7 minutes were chosen from the video-footage of each focus group, and then checked against the corresponding text. Video footage was also later reviewed in greater detail in order to explore group dynamics.

Data Analysis

A semi-quantitative approach was used to analyse the results of the focus group discussions. This firstly consisted of examining the data based on the five conceptual areas and the respective study questions. We were able to draw key relationships between conceptual areas, so called "code-categories" under which were assigned individual topics arising from the content of the focus group discussions. The resulting framework was used to guide all subsequent data-making and analysis tasks.

A pre-analysis code map was developed from the framework, showing a hierarchy from the five code-categories to each topic and sub-topic. (Supplementary data table.) The code map was then created, to be used later for constant comparative analysis—an iterative method of content analysis where each category is searched and constantly revised, popularly used to allow so called "emergent codes" to be applied at all points in the analysis. [13;14] Before beginning the analysis, we validated our code map by performing a code check, looking for duplicates and comparing codes to the topics within the aforementioned framework. Revisions were made and a resulting code map was used for subsequent data making (Figure 1).

All text from transcripts was subjected to constant comparative analysis, and the frequencies of codes were used as a measure of significance. All data making and content analyses were done using TAMS Analyzer for Macintosh OS X (version 4.13), an open-source, computer-assisted qualitative research tool.[15]

We extracted quotes from all transcripts when a specific topic involved multiple sentences, when the comment provided was observed to be provocative and/or when it generated lively discussion among more than 2 individuals. We extracted relevant quotes from each focus group interview in order to further establish an in-depth look at each topic. An epidemiologist who is fluent in German and a native English speaker completed German-English translations. We assigned each participant a quote-identifier based on the focus group in which they belonged and their demographic information (Shown in Table 1 and 2). The identifier is presented in the results section as a two numbers (focus group number - ID number).

RESULTS

Table 3 provides a detailed overview of the highest incident emergent codes and code-categories from constant comparison analysis for all focus groups combined. Emergent codes served as a way to begin further critical analysis of the main insights reflected in this group of physicians, which we present in the following segments stratified by each focus group. Additional in depth-responses on several determinants of antibiotic prescribing and antibiotic resistance that cut across all focus groups, such as non-patient factors, hygiene, the pharmaceutical industry and antibiotic costs are also presented (Table 4).

Focus Group 1: Outpatient care physicians with fewer years of practice experience

Physicians focused on themes that are related to prescribing in the outpatient care setting (*frequency*: 146). Discussion focused on general impressions of rising resistance (115), sources of information on antibiotics (64), and physician-oriented interventions (17). They expressed concern about difficulties dealing with complicated patient histories (12), patient compliance (9) and patient perception of treatment (8). Participants frequently discussed the development of antibiotic substances (11) and about responsibility in their own practice (4). Participants also focused on specific diagnoses that are perceived to be driving resistance, with major discussion occurring around the topic of uncomplicated urinary tract infections (UTIs) (5). Cost was also discussed as a factor influencing antimicrobial prescribing, specifically, the effects of health regulations on the accessibility of medications.

Conferences (9) and pharmaceutical companies (4) were discussed most when it came to common sources of information on antibiotics. A large amount of time was spent discussing pharmaceutical representatives, who participants found to be persistent and aggressive:

> 'They come often and always have antibiotics on hand. You get a bag of them every day. And high doses of drugs. It all stacks up in the cabinet. For me there are 4 to 5 representatives each day' (*Participant* 1-3: Table 1-2).
>
> 'I notice that they approach me, too. But I do not accept them all. I would estimate that there are about 5-7 every day, and they do bring whole bags full (of giveaways).' (1-2)
>
> 'The representatives come into my practice. And you do listen to them. You even take the information they offer, even if with a critical eye. But you do learn something as well. ' (1-5)
>
> 'The pharmaceutical industry is very aggressive.' (1-3)

'For urology I cannot remember in recent months receiving a visit on this issue. But that is certainly very different than in the primary care sector.' (1-4)

There was no single participant dominating the discussion, and comments readily came from each; however, the paediatrician did mention that there is less pharmaceutical presence in her practice. This group most frequently saw feedback on their resistance situation and cooperation with laboratories (5) as ways to address the problem of rising antibiotic resistance.

Focus Group 2: Outpatient care physicians with more years of practice experience

Unlike the first outpatient group, this group veered away from a dominant focus on outpatient-specific topics and discussed most frequently those topics within the category of general impressions on rising resistance (150). The group was also concerned with having adequate sources of information on antibiotics (126), outpatient-specific influences on prescribing (105) and other physician-oriented interventions (28).

Physicians frequently discussed the effectiveness of antibiotic substances and drug development (6). As in the previous outpatient care group; cost was seen as a factor of influence on antimicrobial prescribing. In this group, participants agreed that they are less wary of the cost of antibiotics because the nature of predominantly short treatments makes it affordable, compared with longer-term treatments, like those prescribed for high blood pressure. This group also talked about social factors that may be driving the situation, like increased foreign travel (6), over-the-counter availability of drugs abroad (4), and migration (4). The topic of UTIs arose as a specific concern driving resistance.

This group discussed the category of hospital-specific influences on prescribing (8), like multi-resistant pathogens (6). The topic of hospital hygiene arose in each of the two outpatient focus groups, which agreed that antibiotic resistance was largely a problem of the hospital setting, "In hospitals resistance plays a bigger role because there one finds hospital specific germs." (1-4) Incidentally, the topic of resistance was often quickly averted when brought up, instead being commented as a problem specific to the hospital care setting:

'I think the development of resistance is more the domain of clinical treatment and not the patient.' (2-5)
'Exactly.' (2-3)
'Yeah, especially in intensive care.' (2-4)

Participants discussed most frequently that patient demand (11) is a major driver for prescribing in the outpatient setting, followed by doctor experience (9) and specific diagnoses

(6). The role of the patient, including patient non-compliance and self-medication also emerged. Physicians discussed two types of patients: those concerned with getting an antibiotic, and those concerned with avoiding what they think is harmful:

> 'Pressure from patients is not insignificant…the worst are the mothers where the children are really very sick and the mothers say: I don't want any chemotherapy. The lymph nodes are thick with pus, almost hanging out, and then the mother says no, no antibiotics for us. That's bad.' (2-1)

Physicians in this group valued information that is concise and available to them in a way that complements their work without taking up too much time:

> 'Is there a new antibiotic? What is the resistance situation? Which organisms are being affected? What are the indications, what are the side effects? The interactions with other drugs? Are there alternatives? If this information could be given to us in a short and sweet way, then we would be happy. Something like this is not currently available to us.' (2-1)

Participants in focus group 2 found treatment guidelines (8), pharmaceutical based materials (5) and conferences (4) to be main sources of information on antibiotics. This group found information from pharmaceuticals to be concise and readily available:

> 'There's been a big change from the expertise of representatives who come in. These are all clinicians and they do not give a bad impression at all. They bring me a lot of information although, of course, you have to make sense of it all. But I do admit that I feel as though I am getting good consulting. Because I don't have the time to do my own research nor to sit down on the Internet every evening. I am very grateful for the very specific information they offer me.' (2-2)

As evidenced above, most other comments about the pharmaceutical industry also remained positive in this group. There were comments that patient outreach is not needed in Germany (2), and this focused largely on the belief that the patient population is well informed and, if at all, opposed to antibiotics, sometimes opting for alternative therapies.

They discussed the need to have more access to surveillance of their local resistance situation: "I think we need what there was in (the former) East Germany, a short, independent information sheet that shows the current epidemiological situation in the country or the region where I live." (2-5) The group seems to have agreed, since they mostly discussed interest the following intervention options: increased surveillance (9), including information on their regional resistance situation (5), constraints on their patient-consult time (3), and consulting (2).

Focus Group 3: Hospital physicians with fewer years of experience

Physicians most frequently discussed their general impressions on rising resistance (70), hospital-specific influences on prescribing (40), sources of information on antibiotics (15), and physician-oriented interventions (12). Patient non-compliance (8), correct prescribing and antibiotic dosing (5), hospital care (3) and hygiene (3) were the most frequently addressed topics.

The Internet (3), pharmaceutical advertising (2) and conferences (2) were listed as the most frequent physician-oriented interventions mentioned by this group. The visibility of pharmaceutical advertising was also discussed, and this group found it easy to access and useful for learning. Participants were in agreement about how pharmaceutical advertising is more accessible than other traditional forms of information dissemination, such as medical journals.

Participants overwhelmingly stayed with the topic of hospital workplace concerns, like hygiene (7) and time for patient-consult (4) as the most needed intervention to combat resistance in their setting. They discussed non-structural demands on the hospital, such as advances in treatment possibilities for more complex indications, which might necessitate more antibiotics consumption in the hospital setting, which may in turn itself be a driver for resistance.

The hospital itself was viewed as having structural aspects that might contribute to increased antibiotic use and resistance (7). One such aspect, maintaining hygiene, was a perceived danger of interrelated issues of increased patient load (3), patient-patient contact (1) and infectiousness (2). One physician noted that the pressure to treat more patients has led to a related need for a faster consult time, which may put strain on the thoroughness of hospital hygiene measures. Hospital physicians also pointed out that they would prefer to pursue intervention through new programs for hygiene, although they also recognise it to be a challenging method of improvement. Participants also discussed the benefits of transparency and feedback on antibiotic consumption, costs and trends in the hospital setting.

Focus Group 4: Hospital physicians with more years of experience

Participants discussed most frequently about their general impressions on rising resistance (66), followed by hospital-specific influences on prescribing (29), sources of information on

antibiotics (27), and physician-oriented interventions (21). The most frequent topics brought up by this group were diagnostics possibilities (5), patient history/epidemiology (increasingly acute cases in care) (4) and social factors like aging (4). When talking about the influence on prescribing in hospital care, the following topics were most frequent: indication and disease (2), risk assessment in acute cases (2), specificity of guidelines (2) and time constraints during patient consultation (2). This group of physicians made relatively long commentaries at a higher level of detail than was observed in participants during the other focus group sessions. The group spoke at such detail about non-patient factors of antibiotic prescribing and antibiotic resistance, including patient stays in non-intensive wards of hospitals as increasing risk, minimised hygiene routines in hospital due to increased patient intake.

Physicians frequently consulted specialty journals (9), clinical handbooks (3) and the Internet (3) as sources of information on antibiotics. Discussion points on hospital feedback on the resistance situation (5) and continuing education (2), especially in the area of hygiene (2) and infectious diseases (2) emerged most frequently in discussions regarding intervention for antibiotic resistance.

Collegial exchange with microbiologists/ laboratories (5) emerged as the most frequent topic under the category of hospital-specific influences on prescribing, something that was also observed in focus group 3. Physicians in this group spoke about opportunities to closely collaborate with laboratories and microbiologists, which they saw as helpful in navigating antibiotic treatments:

> The microbiologists that we have are top. We mostly get reports via the doctor calling us before anything is published on our intranet. It is then also discussed, what underlying disease does the patient have, which antibiotic was given, and the provisional findings will be communicated first. Short, quick ways; you have to communicate well with people. (4-1)

The topic of outsourcing of laboratories arose throughout this discussion. Physicians perceived this as prohibiting close communication and producing too much bureaucracy, “For us, it is unfortunately not the case. The laboratory has been outsourced. A service provider is at the other end of town; they can't communicate with us much.” (4-5) Other emerging themes were the role of the hospital pharmacist in influencing prescribing choices (4), followed by how often and appropriately internal/hospital antibiotic treatment guidelines are updated (4), and subsequently by multi-resistant pathogens (3).

DISCUSSION

Past research has underlined the importance of patient-oriented factors of influence for prescribing and the focus has primarily been on patient demand and noncompliance.[16-18] This is consistent with the historical data on the subject showing that antibiotics are more likely to be prescribed when the patient expects them, and that they may be even more likely to be prescribed when the doctor may perceive that the patient wants a prescription, when in fact the demands of patient are unclear.[19] Responses from physicians in these groups indicated something different: an overwhelming interest in non-patient factors that influence antibiotic prescribing and resistance.

A major topic in both groups of participating physicians from outpatient care was their experience of increasingly difficult diagnoses that are complicated by resistance patterns. A good example is the increasing prevalence of antibiotic resistant UTIs. Many participants are involved in the management of UTIs, a finding supported by the cross-sectional study component of this research (survey).[9] Indeed, the trends in many European studies of antimicrobial resistance show UTIs to be accountable for a large amount of antibiotics consumption.[1] Many of the common pathogens leading to UTIs such as *E. coli, P. mirabilis* and *K. pneumoniae* are increasingly becoming resistant to standard treatments, which affects antibiotic treatment choices;[20;21] however, physicians showed differential interest topics related to their antibiotics prescribing and resistance, based on their care setting.

Outpatient care physicians found resistance primarily a problem of the hospital care setting, related to the presence of different multi-resistant pathogens and challenges with hygiene. This was also a major topic discussed by hospital physicians. The increasing prevalence of multi-resistant pathogens is of particular concern, especially given the views that the hospital ward is increasingly faced with more patients at any single time, and that patients—many of whom are carrying more complex indications—are also seen during shorter consult times.[22;23] In fact, data from the survey identified that status as a hospital physician was a predictor for deciding to start antimicrobial therapy on a patient.[9] This could be attributed to the fact that, generally, hospital physicians attend more acute cases than their outpatient care counterparts.

Hospital care physicians were accustomed to regular and easy collaboration with microbiologists when discussing indications and possibilities for therapy. This was also found in the study sample of the survey, which showed that hospital physicians found it either important or very important that they receive data on regional antimicrobial resistance and appropriate feedback for prescribing.[9] This opinion was also shared in the focus group

discussions among physicians who want laboratories to provide feedback on the resistance situation for their hospitals. Participants expressed frustration and concern around outsourcing of laboratories. It was not only a matter of having less contact with helpful microbiologists, but also a described a need: that even in a hospital setting with outsourced laboratory services, it is important to offer chances to dialog with microbiologists. While this finding does seem to match the views shown by the national survey, more qualitative research on other groups could help to show whether or not there is a need to enhance access to their local resistance situation in the hospital setting in other areas of Germany.

There was differential discussion about treatment guidelines, which may also be an important influence factor on physician prescribing practice. Participants from the outpatient care setting found clinical recommendations to be difficult to access quickly and use. For the hospital setting, this was significantly different. There was more discussion about whether guidelines are up-to-date, and about their relevance, specificity and availability in clinical practice. There are many guidelines with varying degrees of quality available to physicians. Hospital care physicians have an array of in-house developed guidelines, differentially taking into account local resistance data.[24] But, as also evidenced by other studies, availability is differential and may warrant addressing this separately for each practice setting. [4,25;26]

The pharmaceutical industry was often a major topic of discussion, but it remains unclear how large the current influence of the pharmaceutical industry is on physicians in Germany. Physicians indicated that the pharmaceutical industry plays a large role in outpatient care practice. Visits to doctors' offices by the industry and free samples of antibiotics are ubiquitous; their informational materials are generally perceived as attractive. This may have to do with the fact that information from the industry presents information in ways that are more convenient than scientific literature on the same topics.[27] These important findings about the presence of the pharmaceutical industry also showed up among the participants of the survey: despite some caution about the persistence of the industry, most outpatient care physicians welcome their assistance, and view them as another resource among many other sources of information on antibiotics. Results from these focus groups and the survey indicate that the pharmaceutical industry has a large presence among physicians in Germany.

CONCLUSION

Our findings show that outpatient care physicians in Berlin are interested in topics around their own prescribing, like physician-sensitivity to patient need, time management for patient consult, access to guidelines and their perception of the pharmaceutical industry. These non-patient determinants, when coupled with intervention ideas for the hospital care setting (e.g. improving hygiene measures, easing diagnostics and cooperation with laboratories) are different from factors of antibiotic prescribing and resistance that have been previously observed in similar contexts: they are physician-oriented. Furthermore, focus group discussions provided more details about some of the determinants that were also found relevant by physicians participating in the survey component of this research. Together these study components raise questions about whether targeting other physicians may be a better approach for intervention that aims to influence antibiotic resistance in this and other areas of Germany. This could be a remarkable finding for Germany: in other countries intervention to reduce antimicrobial resistance has often been targeted at the patient directly, but more qualitative research and similar focus groups in other areas of Germany could show whether or not this trend is nationally relevant.

STUDY LIMITATIONS

Participants were all from the Berlin region, and included physicians from diverse backgrounds with respect to age, sex, size of practice, care setting and number of years in practice. Additionally, we recruited physicians from the former east and west areas of Berlin, and from outer city areas to reflect greater diversity specific to this setting in Germany. We used a relatively small, purposive, convenience sample of physicians from specialties known to prescribe most often, thus there may have been some degree of representational bias. Although many findings from the focus groups align well with findings from our nationally representative, survey, which was conducted to further explore influence factors on this topic, other focus groups in other regions or large metropolitan areas in Germany could strengthen these results and are critical before determining national relevance.

The same moderator conducted all focus group discussions based on a conceptual framework drawn before the sessions, so there could be issues of reliability due to its application to 4 different groups of physicians. But, since we intended for the moderator to allow for participants in each group to explore topics differentially around this framework, so that any new or previously unanticipated topics could come up, we believe that this provided a strength that is unique to this qualitative approach.

Acknowledgements We thank the following individuals for cooperating on this research effort: Werner Espelage, Kirsten Heckenbach, Jürgen Hoffmann, Michael Kramer and Ines Noll.

Funding This research was funded by a departmental grant from the Federal Ministry of Health. The study sponsors had no role in the study design or in the collection, analysis, and interpretation of data, in the writing of the report, nor in the decision to submit the article for publication.

Competing interests None

Ethical approval This study was approved by the institutional commission for data protection of the Robert Koch Institute. All participants gave informed consent before taking part in focus group discussions.

Data access all authors had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Contributors EV completed all analysis and drafted the manuscript. AZ, TE and GK conceived of the study and obtained funding. All authors contributed to the study design, the carrying out of the study, and provided critical feedback to the manuscript.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data available.

[Figure 1 Plan for data-making, data reduction and analysis]

Table 1 Focus group participant details: outpatient care

Focus Group	Participant ID	Sex	Age	Specialty	Practice type	Years in Practice	Location	Patients per quarter
1	1	F	46	Paediatrics	Group	12	East	~ 900
	2	F	35	GP	Group	5	West	~ 200
	3	M	48	GP	Single	9	East	~ 1000
	4	M	54	Urology	Single	11	West	~ 1200
	5	M	40	GP	Group	10	West	~ 800
2	3	F	55	GP	Group	16	East	~ 150
	4	F	42	GP	Group	15	East	~ 180
	2	F	53	Urology	Group	15	West	~ 800-900
	1	M	62	GP	Group	25	West	~ 2000
	5	M	57	GP	Single	15	East	~ 800-900

Table 2 Focus group participant details: hospital care

Focus Group	Participant ID	Sex	Age	Specialty/ Position	Number of beds	Years in Practice	Location	Patients per quarter
3	1	F	40	Paediatrics/Consultant	1200	8	West	~ 600-700
	2	M	34	Internal/Resident	620	5	West	~ 400
	3	M	43	Internal/ Consultant	538	9	East	~ 500
	4	M	42	Internal/ Resident	626	4	West	~ 300-400
	5	F	34	Internal/ Resident	363	3.5	West	~ 400
	6	M	30	ENT/ Resident	1200	3	East	~ 350
	7	M	43	Urology/ Consultant	220	12	West	~ 500
4	1	M	51	Internal/ Consultant	538	16	West	~ 500
	2	F	40	Internal/ Consultant	1200	14	East	~ 1000
	3	M	56	Internal/ Consultant	276	31	West	~ 500
	4	M	48	ENT/Consultant	1000	10	West	~ 1400
	5	M	41	Internal/ Consultant	1200	10	West	~ 1000
	6	M	44	Paediatrics/ Consultant	542	16	West	~ 300-500
	7	F	63	Urology/ Consultant	1200	37	East	~ 4000

Table 3 Top 5 highest incident emergent codes and categories from constant comparison analysis (All groups combined; total codes n=1035)

Code-Category	5 most frequent code-topics	Frequency
General impressions on rising resistance		401
	Patient noncompliance	15
	Antibiotics development	13
	Hospital specific issues, e.g. hygiene, labs	11
	Antibiotic dosing	10
	Urinary tract infections	10
Outpatient-specific influences on prescribing		251
	Patient history	18
	Patient demand	18
	Physician experience	14
	Patient self-educated	11
	Patient compliance	11
Sources of information on antibiotics		234
	Practice guidelines	10
	Continuing medical education	8
	Specialty journals	8
	Internet	8
	Quality of conferences	7
Physician-oriented interventions		84
	Surveillance	9
	Laboratory feedback	7
	Information on local resistance situation	7
	Hospital	4
	Hygiene	4
Hospital-specific influences on prescribing		65
	Up-to-date internal guidelines	4
	Laboratory/microbiologists exchange	4
	Specificity of Internal guidelines	4
	Experience with infectious diseases	3
	Problematic diagnoses	3

Table 4 Selected in depth-responses from focus group discussions

Category	Quotes
Hygiene	'Have a look what is happening in the operating rooms. Time for cleaning up is getting shorter every day. Before we had around 100 beds in a normal ward, now its cut down to 40-50 beds, but we are still treating as many patients as they were 10 years ago. Get in and get out. A bed is never empty. And I have my doubts as to whether these disinfectant wipes are an ideal solution. I think the time pressure is there already a problem.' (4-7) 'The highest infection rates are in intensive care units, but it is certainly always clean. In the OR smears are made at regular intervals. I think this is still the safest. Unless they have very septic cases and those cases where the pus runs from the abdomen. On the hospital ward that is where I think it is not very hygienic. In intensive care so they can get almost all antibiotics, and that is where the transmission of nosocomial infections at the highest, and where there are more immunosuppressed patients.' (4-1) 'From our end in the clinic, it is the hospital-acquired infections that are acquired in the hospital and last for 2-3 days, possibly even later. They are often preventable through effective hygiene measures and can be much better than they would be with antibiotics.' (4-3)
Laboratory and resistance data	'Our laboratory is outsourced, but once we had also invited a microbiologist to provide training, and he made a comparison of the germs in hospital with those generally presented in the other hospitals. It was good information.' (4-3) 'Many things change as well over the years, procedures change. Too often, there is a deficit in this information.' (4-3) 'Guidelines vary and are specific to each hospital. We have a very committed leader in this area, who takes a lot of trouble to log and actually follow information from each recommending commission, which often revise their information. We have a commission that discusses and revises information which is then put online for reference and so that all staff can gain insight. We also have disclosure on which department prescribe show much and how expensive it is. This is useful in individual cases, and to follow the development of resistance and hygiene. So, it is all kept very transparent.' (3-3)
Pharmaceutical industry	'Pharmaceutical advertising is very important. There are at least two variants. There are those that visually present with more or less exciting images and colours. And these accordingly make you curious so that you might read some fine print and look more closely to find out what the stuff is. I find this to be the more pleasant variant. Because you immediately recognize it as such and may or may have to look closer. Medical journals on the other hand may contain interesting content, but there it's hard for you to determine what the content is. Is it a short conference report? Is it a topic that interests me? A professor on a topic I am interested in? Is it really is objective? And that's the annoying thing, because then it is difficult to distinguish.' (3-7) 'They also know as who is receptive. Then they just leave the bag there and just want a signature and a seal. Much is given at each and every day, many just want a short word. I've been doing this at the counter. Very rarely do I give them an appointment. For me there are 4 to 5 representatives each day.' (1-1) 'Pharmaceutical representatives give me bags full (of antibiotic samples)!' (1-P1) 'In the moment when the pressure in the outpatient setting is relatively high, even from marketing, then certain things are pushed. Something has changed in prescribing in the outpatient setting; this is what will notice from practice in the clinic. Prescribing practice, what is the underlying it, this is often not transparent.' (4-6)
Cost	'Until three years ago, I was still prescribing Cotrim in the urology setting. It was still cheap, at about €3. Back then, gyrase-inhibitors had a starting price of about 12 €. Then health regulations led to compulsory levies, which introduced a fixed fee of 8€. Since then, Cotrim increased from 3€ to 12€ -- the same as the gyrase-inhibitors. Until then, the threshold for prescribing gyrase-inhibitors for UTIs was relatively high, and I prefered to prescribe Cotrim. But since the price drop, I prescribe Cotrim less and more quickly look to prescribing gyrase-inhibitors.' (1-4) 'Yes, I would think that costs are different for antibiotics than for other treatments. Simply because the duration of (antibiotic) treatment is short. When I prescribe an antibiotic, and even if it is an expensive one, then I know it takes 10 days or 2 weeks, so the treatment is limited from the outset. When I prescribe someone a drug for its high blood pressure, which in the quarter costs 150€, then I am affected each quarter. Thus, the antibiotics - treatment when it comes to price, is certainly not as problematic as the high blood pressure treatment or other therapies I am prescribing.' (2-1)
Other non-patient determinants	'We have experienced changes: like short stays in hospital. Hospitals are simply the most dangerous places for patients. The sooner the patient is out of the hospital the better. The more minimal invasive interventions are, the lower the probability for wound infections.' (FG3-P7) 'Recent medical interventions are indeed more complex and daring; cardio-haematology, oncology. We are also treating acute myelogenous leukaemia, which accounts for a lot of consumption of antibiotics. You also can't ignore that in certain areas treatments are simply too complex. The result is also that inappropriate consumption is higher. This is the price for medical progress. Bypasses for 80 year olds, do an ACVB and then they still catch pneumonia, lie for weeks in intensive care. This is the reality now. We believe in all sorts of advances; but we'll see the resulting effects soon enough.' (4-1)

Reference List

(1) Ferech M, Coenen S, Malhotra-Kumar S, Dvorakova K, Hendrickx E, Suetens C et al. European Surveillance of Antimicrobial Consumption (ESAC): outpatient antibiotic use in Europe. J Antimicrob Chemother 2006; 58(2): 401-407.

(2) Vander Stichele RH, Elseviers MM, Ferech M, Blot S, Goossens H. Hospital consumption of antibiotics in 15 European countries: results of the ESAC Retrospective Data Collection (1997-2002). J Antimicrob Chemother 2006; 58(1):159-167.

(3) Cotter M, Daly L. Antibiotic prescription practices of general practitioners. Ir Med J 2007; 100(9):598-601.

(4) Guerra CM, Pereira CA, Neves Neto AR, Cardo DM, Correa L. Physicians' perceptions, beliefs, attitudes, and knowledge concerning antimicrobial resistance in a Brazilian teaching hospital. Infect Control Hosp Epidemiol 2007; 28(12):1411-1414.

(5) Hulscher MEJL, Grol RPTM, Van der Meer JWM. Antibiotic prescribing in hospitals: a social and behavioural scientific approach. Lancet Infectious Diseases 2010;(10):167-175.

(6) Harbarth S, Monnet DL. Cultural and socioeconomic determinants of antibiotic use. In: Gould IM, van der Meer J, editors. Antibiotic Policies - Fighting Resistance. Berlin: Springer; 2007. 29-40.

(7) O'Donnel A, Luftey K, Marceau L, McKinlay J. Using focus groups to improve the validity of cross-national survey research: A study of physician decision making. Qual Manag Health Care 2007;(17):971.

(8) Kuper A, reeves S, Levinson W. An introduction to reading and appraising qualitative research. BMJ 2008; 337(10):288.

(9) Velasco E, Espelage W, Faber M, Noll I, Ziegelmann A, Krause G et al. A national cross-sectional study on socio-behavioural factors that influence physicians' decisions to begin antimicrobial therapy. Infection 2011.

(10) H,T,P, Concept website: http://www.inspirationformarketing.com/

(11) Lehoux P, Poland B, Daudelin G. Focus group research and "the patient's view". Soc Sci Med 2006; 63(8):2091-2104.

(12) Lehoux P, Poland B, Daudelin G. Focus group research and "the patient's view". Soc Sci Med 2006; 63(8):2091-2104.

(13) Leech N, Onwuegbuzie A. An array of qualitative data analysis tools: A call for data analysis triangulation. School Psychology Quarterly 2007; 22(4):557-584.

(14) Pope C, Van Royen P, Baker R. Qualitative methods in research on healthcare quality. Qual Saf Health Care 2002;(11):148-152.

(15) TAMS website: http://tamsys.sourceforge.net/

(16) Butler CC, Rollnick S, Pill R, Maggs-Rapport F, Stott N. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. BMJ 1998; 317(7159):637-642.

(17) Cockburn J, Pit S. Prescribing behaviour in clinical practice: patients' expectations and doctors' perceptions of patients' expectations--a questionnaire study. BMJ 1997; 315(7107):520-523.

(18) Harbarth S, Albrich W, Brun-Buisson C. Outpatient antibiotic use and prevalence of antibiotic-resistant pneumococci in France and Germany: a sociocultural perspective. Emerg Infect Dis 2002; 8(12):1460-1467.

(19) Faber MS, Heckenbach K, Velasco E, Eckmanns T. Antibiotics for the common cold: expectations of Germany's general population. Euro Surveill 2010; 15(35):pii=19655.

(20) Vasquez GA, Siu HR, Luna EM, Eduardo M, Reyes KC, Zervos MJ. Risk factors for Quinolone-resistant Escherichia coli urinary tract infection. Infect Dis Clin Pract 2011; 17(5):309-313.

(21) Hooper DC. Emerging mechanisms of fluoroquinolone resistance. Emerg Infect Dis 2001; 7(2):337-341.

(22) Kern WV, Nink K, Steib-Bauert M, Schröder H. Regional variation in outpatient antibiotic prescribing in Germany. Infection 2006; 34(5):269-273.

(23) Goossens H, Ferech M, Vander SR, Elseviers M. Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. Lancet 2005; 365(9459):579-587.

(24) Deja M, Nachtigall I, Halle E, Kastrup M, Guill MM, Spies CD. Antibiotikatherapie - Strategien für die Verordnung von Antibiotika in der Intensivmedizin [Strategies in the treatment of infections with antibiotics in intensive care medicine]. Anasthesiol Intensivmed Notfallmed Schmerzther 2007; 42(2):108-115.

(25) Guerra CM, Pereira CA, Neves Neto AR, Cardo DM, Correa L. Physicians' perceptions, beliefs, attitudes, and knowledge concerning antimicrobial resistance in a Brazilian teaching hospital. Infect Control Hosp Epidemiol 2007; 28(12):1411-1414.

(26) Srinivasan A, Song X, Richards A, Sinkowitz-Cochran R, Cardo D, Rand C. A survey of knowledge, attitudes, and beliefs of house staff physicians from various specialties concerning antimicrobial use and resistance. Arch Intern Med 2004; 164(13):1451-1456.

(27) Avorn J, Solomon DH. Cultural and economic factors that (mis)shape antibiotic use: the nonpharmacologic basis of therapeutics. Ann Intern Med 2000; 133(2):128-135.

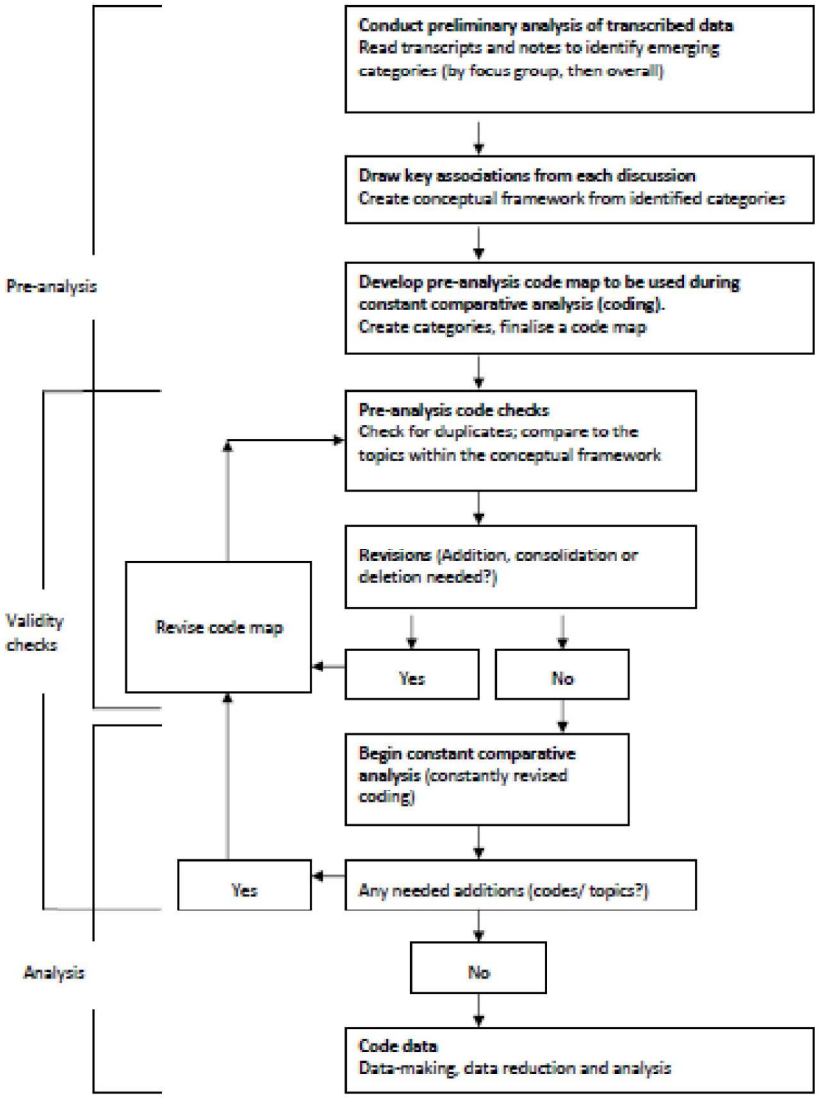

Figure 1 Plan for data-making, data reduction and analysis
194x264mm (300 x 300 DPI)

Qualitative research

These are the questions that BMJ editors should consider when appraising papers presenting original qualitative research (although we don't routinely use a checklist for this):

- Was the research question clearly defined? **YES**
- Overall, did the researcher make explicit in the account the theoretical framework and methods used at every stage or the research? **YES**
- Was the context clearly described? **YES**
- Was the sampling strategy clearly described and justified? **YES**
- Was the sampling strategy theoretically comprehensive to ensure the generalisability of the conceptual analysis (diverse range of individuals and settings, for example)? **YES**
- How was the fieldwork undertaken? Was it described in detail? **YES**
- Could the evidence (fieldwork notes, interview transcripts, recordings, documentary analysis, etc) could be inspected independently by others: if relevant, could the process of transcription be independently inspected? **YES**
- Were the procedures for data analysis clearly described and theoretically justified? Did they relate to the original research questions? **YES** How were themes and concepts identified from the data?
- Was the analysis repeated by more than one researcher to ensure reliability? **YES – at different phases**
- Did the investigator make use of quantitative evidence to test qualitative conclusions where appropriate? **YES – reference to a separate cross-sectional component conducted by the author**
- Did the investigator give evidence of seeking out observations that might have contradicted or modified the analysis? **YES**
- Was sufficient of the original evidence presented systematically in the written account to satisfy the sceptical reader of the relation between the interpretation and the evidence (for example, were quotations numbered and sources given)? **YES**