What influences the implementation and sustainability of antibiotic stewardship programmes in hospitals? A qualitative study of antibiotic pharmacists' perspectives across South West England

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ABSTRACT

Objectives Antibiotic stewardship programmes (ASPs) are needed at every hospital as they can improve antibiotic use and address antibiotic resistance. Pharmacists are key agents and specialists in these programmes. This study explored antibiotic pharmacists' perceptions of factors that influence the implementation and sustainability of hospital-based ASPs.

Methods Semistructured interviews were conducted with hospital antibiotic pharmacists face-to-face or by telephone. NVivo V.12 software was used to collate and organise the data grouped within codes. Thematic analysis was undertaken using inductive and deductive approaches to produce overarching themes.

Results Thirteen pharmacists from 13 hospitals were interviewed. Four main themes were identified: (1) 'organisational culture' which highlighted the importance of strong local clinical leadership to help achieve organisational buy-in and address resistance among physicians or clinical hierarchies; (2) 'national influences' including networks, guidance and incentive schemes which were considered to be a driver to bring about changes across organisation; (3) 'continuous monitoring with feedback ASP data, preferably through direct communication' to demonstrate the impact of the programmes which then facilitated ongoing support from local leadership and improved engagement across organisation; and (4) 'resources' which indicated the need of information technology and dedicated personnel with protected time to support ASP activities.

Conclusions Interventions and strategies should operate at different levels—individual, team, organisational and national—to help implement and sustain ASPs in hospital. This is also the first study to identify and highlight the importance of national initiatives in contributing to the implementation and sustainability of hospital-based ASPs.

INTRODUCTION

Despite evidence of the clear benefits of antibiotic stewardship programmes (ASPs),[1] a global ASP survey including 660 hospitals in 67 countries found that only half of these hospitals had ASPs.[2] While perceived challenges of ASP implementation include lack of resources and lack of prioritisation within governance,[3 4] there are increasing calls to identify factors that influence ASP success, including the most effective methods of implementation.[1 5]

The implementation and national strategies to support ASPs in hospitals in England

The UK is one of the countries which has shown great efforts in reducing antibiotic use and tackling antibiotic resistance.[6] The first national action plan on tackling antibiotic resistance was established in the country with a strategy in place as early as 2000.[6] An increased focus on ASPs as an important element of the UK's 5-year antibiotic resistance strategy has been accelerated and embedded in hospitals in the UK since 2013.[7] To respond and in line with the national strategy, Public Health England published the guidance called 'Start Smart Then Focus' (SSTF) which aims to help guide and drive the implementation of ASPs across English hospitals.[8]

The SSTF recommends that, as a minimum, all healthcare providers should develop an action plan and monitor adherence to ASP principles regularly in all clinical areas at least annually. The SSTF comprises several actions and indicators that need to be acted on and documented.[8] These include documentation of evidence of indication and treatment duration, review antibiotics at 48–72 hours after initiation and documentation of prescribing decision.[8] Since then, the role of antibiotic pharmacists in ASPs has become well established across English hospitals alongside their formal recognition as part of multidisciplinary ASP teams.[9]

More recently, the National Health Service (England) launched the Commissioning for Quality and Innovation (CQUIN) initiative, highlighting the need for further improvement of ASPs and reduction of antibiotic resistance.[10] CQUIN is a national payment framework in England which enables commissioners to reward healthcare providers by linking a proportion of the provider's income to the achievement of quality improvement goals.[10] In secondary care, CQUIN provides financial incentives to hospitals for gathering and sharing data on antibiotic consumption and further incentive for demonstrating reduction in antibiotic use of specific agents.[10]

Antibiotic pharmacist and hospital-based ASPs

Antibiotic pharmacists have an established role in ASPs in many countries, including England.[9] Their major and unique roles in ASPs include introducing and delivering several strategies to optimise antibiotic use, as well as monitoring and reporting ASP performance to achieve programme goals.[11 12] A national survey in 153 acute hospitals in England

found that all hospitals had at least one specialist antibiotic pharmacist who enabled hospital to deliver ASPs.[9]

The involvement of antibiotic pharmacists in ASPs has been shown to be associated with enhanced implementation success, improved patient outcomes, as well as reduced antibiotic consumption and expenditure.[13 14] However, there has been limited exploration of antibiotic pharmacists' perceptions regarding how hospital ASPs should be developed and improved. As such, the aim of this study was to explore antibiotic pharmacists' perceptions of factors that influence the implementation and sustainability of hospital-based ASPs.

METHODS

Study design and setting

Semistructured interviews were conducted with hospital antibiotic pharmacists who were members of the South West Antibiotic Pharmacy (SWAP) group, an antibiotic resistance network in England.[15] The members of this group comprise specialist antibiotic pharmacists from 13 acute hospitals and community pharmacists who have a special interest in antibiotic utilisation across the region. The group meets quarterly to discuss good practice in promoting appropriate antibiotic use, share resources in operating ASPs, as well as support their members in delivering national ASP strategies.

Participants and recruitment

Potential participants were identified by a researcher (TM) during a SWAP group meeting during which the study was presented to attendees who were then invited to participate if: they had been involved with the implementation of ASP interventions; and their hospital had an antibiotic or ASP policy in place. Following the meeting, all eligible participants (n=13) from 13 individual hospitals agreed to participate. A study information sheet was emailed to these individuals.

Data collection

The interviews were conducted face-to-face or by telephone using a topic guide (online supplemental file) informed by the literature[3 4] and reviewed for content validity by the research team. The guide was piloted with two non-participating hospital antibiotic pharmacists and refined on their suggestions. The interviews explored pharmacists' views and experience of factors that influence the implementation and sustainability of ASPs in their settings. All interviews were conducted by one researcher (TM) and were audio-recorded with permission. The sample size was primarily based on the adequacy of data in terms of data richness and complexity[16] around factors influencing hospital ASPs which were compared with the existing literature and new additional insights from the interviews. Data collection and analysis were conducted concurrently to modify the interview guide if necessary and to determine the final sample size. After the adequacy of data had been achieved, the interviews were continued with all eligible participants which aimed to provide more rich and in-depth contextualised understanding of ASPs across the region and to enhance the diversity of experiences included in the analysis.

Analysis

All interviews were transcribed verbatim and accuracy checked against original audio-recordings. The interviews were analysed thematically using inductive and deductive approaches to produce the codes and the themes.[17] The codes were informed by the literature and interview content. The first transcript was reviewed and coded independently (TM, JS and MCW). Similarities and differences in coding were discussed and the initial coding framework was agreed for single coding (by TM) of the remaining transcripts. NVivo V.12 software was used to aid data management. The development and refinement of codes within the coding framework was regularly discussed by the research team until the end of the coding process. A thematic map was used to draw out main themes and subthemes.[18] In the final analysis, all researchers reviewed and agreed the findings. This study is reported to reflect the Consolidated Criteria for Reporting Qualitative Research (online supplemental file).[19]

RESULTS

Thirteen interviews were completed between June and September 2019. Eleven interviews were face-to-face, and two were conducted by telephone. Each interview lasted approximately 1 hour. Most participants (n=11) worked in teaching hospitals and had ≥15 years of post-registration experience (range: 7–30 years). The participants had a wide range of experience working in ASP roles, ranging between 2 and 19 years, and spent between 15 and 37.5 hours per week on ASP activities.

Four main themes were identified, including organisational culture, national influences, communication and resources. The following sections provide a detailed description of each theme in hierarchical order as perceived and mentioned by participants.

Organisational culture

This theme was cited as being necessary and considered as a foundation when implementing or maintaining hospital-based ASPs. In the context of this study, organisational culture includes shared beliefs, values, and ways of interacting that influence individual or group behaviour of healthcare personnel to engage, support, or hinder the development or maintenance of ASPs. The theme was divided into three subthemes, including organisational buy-in, relationships and teamwork, and managing conflict of inconsistency between antibiotic prescribing and local guideline.

Organisational buy-in

Achieving organisational buy-in was described as an important aspect in the initial development, long-term sustainability and driving improvement of ASPs. It could enhance engagement across the whole organisation with the programmes. Participants emphasised the importance of support from strong influential clinical leaders in achieving acceptance across organisation. Clinical leadership involvement was also important in achieving engagement with junior doctors who prescribed most antibiotics, resulting in improved appropriate antibiotic use.

> Some areas in our hospital that are really good in [antibiotic] prescribing…the seniors in that area are keen on ASPs…they sit on our stewardship governance group…[their] junior doctors are more engaged…that makes all the differences to how the junior doctors prescribe. (PT005)

Participants also emphasised the importance of leadership to help address concerns about challenging clinical hierarchies and physician resistance.

> Without the high-level sponsorship…the consultants are going to say "if I don't do it, what's going to happen to me?"…I think without that…you are fighting uphill all the time. (PD012)

Education was perceived to help promote awareness of the importance of optimising antibiotic use, creating a foundation for buy-in and multidisciplinary engagement with ASPs. Conversely, lack of regular education sessions for healthcare workers was

considered to be a major barrier to multidisciplinary involvement in these programmes.

> We do need more on the ground education to keep it [ASPs] in people's minds …if we could do that…it would improve engagement of people [with ASPs] here. (PT010)

Relationships and teamwork

While core ASP teams included infectious disease physicians, medical microbiologists and antibiotic pharmacists, participants believed that close relationships with leaders in other specialties and professions could send a strong signal about the importance of responsible antibiotic use. In addition, the importance of building relationships with non-ASP ward staff, including physicians, nurses and pharmacists, was emphasised. Participants described the value of multidisciplinary working to promote ownership of ASPs, ensure a multidisciplinary approach and improve engagement across the organisation.

> The key success to me is to get people from various areas to work with you as a team…everybody has different views on how you can improve things and how you can get things embedded in practice… (PT009)

Participants explained strategies for developing relationships and teamwork including demonstrating the clinical impact of ASPs.

> We showed the surgeons that we could get patients from intravenous to oral [antibiotics] sooner…we could get patients out [from hospital] sooner…they are now very keen and engaged to do a ward round with us. (PT009)

Participants considered multiple, direct interactions between ASP team members and ward staff to be more effective in relationship-building than remote interactions. Clinical ward rounds, team meetings, and regular ward visits by ASP staff acted as reminders to colleagues about ASP-related activities and were perceived to contribute to the sustainability of ASPs.

> Being a high visual presence [of ASP team] where people are making decisions [about treatment] is one of the most important things… that's all sort of maintaining and reminding people that guidelines exist, review [antibiotics] is required. (PD006)

Managing conflict of inconsistency between antibiotic prescribing and local guideline

Participants confirmed that antibiotics were not always prescribed in accordance with hospital guidelines. These inconsistencies were sometimes attributed to the influence of senior medical staff.

> The consultants who had a lot more experience and sometimes they go off guidelines as they feel that something, they don't like to do it…they want to treat it a different way. (PT008)

To address the conflict between using hospital guidelines and senior medical staff's experience, participants identified reasons why those guidelines did not apply to their patient as there were some clinical situations when alternative antibiotics could be used instead of recommendations in the guidelines. Participants were sometimes able to engage with the ASP lead (a medical microbiologist or an infectious disease physician) to approach senior medical staff about their non-compliance with the guidelines and use evidence-based medicine or local antibiotic resistance data to inform and change their practice in prescribing.

> I did have locum consultants…they gave Tazocin [board spectrum antibiotic] for everybody…our lead [microbiologist] and I had a meeting with them…we explained and talked about evidence-based medicine…it doesn't happen anymore. (PT005)

Participants also mentioned the value of coalition building to develop local ownership of using hospital guidelines.

> We had our own plastic surgeons and they just liked to do their own thing…they didn't follow the guidelines…we asked them to join us to make those guidelines…we met them several times and finally had guidelines that they were comfortable with. (PT003)

National influences

The importance of national influences was perceived by participants as an external driver that enabled them to implement, operate and maintain ASPs in their setting. These included supports from national networks, national guidance which was integrated with regulatory systems and national incentive schemes.

The establishment of national ASP or antimicrobial resistance networks such as the SWAP group allowed individuals to share experiences in managing ASPs and included several dedicated open-access platforms which were able to help other different healthcare settings to learn and improve ASP activities.

> Having [the] national antimicrobial resistance network is really useful…it keeps you informed…we share ideas and resources…we communicate national data…it's very collaborative and supportive. (PT010)

National guidance such as the SSTF was considered an effective tool to give participants authority to convince other healthcare personnel in their settings of the necessity to comply with recommendations. The integration of the SSTF guidance within reporting systems requiring monitoring guidance adherence through several ASP indicators to be submitted and published as national data helped to raise awareness of ASPs among hospital leadership. These individuals were perceived to be key local champions who enabled programmes to be continuously improved as a result of local performance data being benchmarked against national figures. In addition, participants emphasised the need for a national strategy to standardise the operation of hospital ASPs.

> I think national guidance does make a difference… it gives us clout and authority to say [with hospital leaders] that we have to do this [ASPs]… it sits very high on the Trust's agenda…I don't have trouble getting people involved because of this. (PT009)

National quality improvement schemes were also considered to be important in prioritising and maintaining ASPs, with the success of programmes deemed more likely if linked to financial incentives. Participants cited 'CQUIN' initiative to be a positive influence as it brought the attention of ASP activities to hospital leaders. In addition, CQUIN was considered to help provide an opportunity for their organisation to focus on and expand ASP activities as a result of incentive rewards.

> CQUIN gives you the priorities and makes more noticeable amongst the Trust Board essentially…it does work from that point of view of getting support from senior management…if there's any country that is struggling [to implement ASPs]…I think it [CQUIN] would certainly help. (PT003)

Communication

Communication, including type and route for disseminating ASP information, was cited as an important factor, contributing the implementation, operation and sustainability of ASPs. While providing antibiotic recommendations was part of daily ASP

activities, participants perceived that the use of 'audit and feed-back' was more effective to help implement and maintain ASPs. ASP team members (usually a pharmacist) typically collected audit results regarding antibiotic prescribing (process and clinical) outcomes over a specified period of time and disseminated them to prescribers, senior clinicians and the hospital administrative board. Aggregated data were considered as an effective tool to inform improved antibiotic prescribing and to demonstrate ASP impact which then facilitated ongoing leadership support and improved engagement across organisation.

> You need outcomes to show to have some teeth…so those men [Trust Board] can see this [ASPs] is useful…this is worth investing in definitely…and once you've got the data and people can see there's an impact…you can then go onto the next area. (PT010)

Route of communication was deemed necessary to disseminate ASP data, preferably through direct contact. Participants distinguished the effectiveness of communicating ASP information between intraorganisational networks (email) and direct contact. The latter included face-to-face communication in the prescriber group meeting or during daily round. Face-to-face communication was perceived to enable participants and prescribers to facilitate interactive discussion which then improved the acceptance of recommendations and engagement with ASP activities.

> I find it's very useful for me is to go out and communicate with their own [each prescriber group] meeting…you can discuss and tell them how they're performing against the metrics…I've got lots of feedback from them which is absolutely invaluable. (PT013)

Resources
The fourth key theme identified in this study was resources. Resources in the form of information technology and personnel were cited to be important to effective ASPs.

Information technology
Electronic or e-prescribing was considered to facilitate the implementation of ASPs in terms of patient identification and prescription checking (indication and duration) of restricted antibiotics, however, only few participants had access to this technology. Access to e-prescribing was also perceived to save time for ASP team members which would help them to focus more on physical ASP activities, such as clinical ward round.

> If we had e-prescribing systems…we could spend the time on the wards with the clinical teams without having to spend all this time looking through notes and going around collecting that sort of data…it's the one that I'm looking for to see changed. (PD012)

Personnel
Insufficient staff and lack of dedicated time for ASP duties were identified as personnel-related barriers to delivering ASPs. Participants suggested that this lack of resource meant tasks such as 'audit and feedback' could not be undertaken, thus impeding the continuous development of ASPs.

> We do need more antibiotic pharmacists and microbiologists… whereas we get asked to do more and more with fewer and fewer resources…so things fail and stop happening…if you stop doing audits to [present with] the [antibiotic] governance meeting…that's the main problem to maintain ASPs. (PT008)

Strategies to address these challenges included having protected time for specific ASP activities which required active support from hospital leadership, engaging with ward pharmacists or identifying ward 'champions' such as nurses. Engagement with ward staff meant that ASPs could become embedded into daily patient care and thus enhancing the sustainability of these programmes.

> Our pharmacists on the ground are the ones who review drug charts everyday… our compliance [with guideline] is always above 90%…they're key drivers for pushing this. (PD007)

DISCUSSION
This study provides insights into the experiences of specialist antibiotic pharmacists regarding factors that influence the implementation and sustainability of hospital-based ASPs in England. The results illustrate that the development and maintenance of ASPs in hospitals depends on a range of factors. At an organisational level, the findings indicate the need for support from local clinical leadership, as well as effective mechanisms of monitoring and reporting ASP performance. The participants in this study suggested that leadership engagement and the provision of feedback to reflect the necessity or the impact of initiatives were essential for achieving organisational buy-in, the foundation of sustainable ASPs.[3 20]

These findings are consistent with other studies which investigated factors related to the implementation of infection prevention practices.[21 22] Studies have shown that participation in collaborative efforts which align clinical leadership and provision of feedback data concerning local infection rates helped to address resistance to change among staff.[21 22] Strong clinical leaders are perceived as locally respected change agents and experts in the subject matter.[11 22] Their involvement has been shown to be related to the success of several hospital initiatives.[21 23] It was also evident from our study that in addition to using evidence-based practice, strong influential clinical leadership is considered by pharmacists to help manage conflict of inconsistency between prescribers' experiences and local guidelines. However, recent studies have suggested that recommendations endorsed by strong clinical leaders should be delivered in a collegial manner which does not judge prescriber competence.[23 24] This is also likely to be more effective in fostering and maintaining long-term interprofessional relationships.[23 24]

There are opportunities to drive development and improvement of ASPs beyond institutional levels. The establishment of national guidance that links with regulatory systems, such as quality indicators, illustrates a promising strategy for maintaining ASPs. Using such regulators to reflect performance against standards provides an increased sense of accountability to initiatives among staff and organisations.[25] The participants in the current study also suggested that the use of financial incentives that reward quality improvement can be an effective strategy to encourage engagement with ASPs. The achievement of quality-related targets provides additional resources and thus enhances the capacity of healthcare settings to initiate other ASP strategies which improve the quality of care. Our finding that ASPs need to be adequately resourced to be implemented and maintained has been reported elsewhere.[2–4 20] There is evidence that countries which combine quality improvement with financial incentives have the highest rates of ASP implementation.[2 26] Furthermore, the introduction of financial rewards has been successful in reducing antibiotic use for uncomplicated self-limiting infections in primary care.[27] A positive influence of rewards on performance has been reported as a motivational driver to overcome organisational inertia, and to help change local practice and organisational culture by shifting priorities and over time influencing values and norms.[28 29]

This study concurs with previous research which has found that resource constraints remain a universal barrier to ASPs.[2–4 20] There are strategies which may help overcome this challenge. Provision of feedback to leadership about ASP performance can be an effective strategy for receiving regular support and possibly compensating for a lack of resources.[11 30] From our findings, it appears that demonstrating outcomes which links with externally driven targets (eg, CQUIN goals), along with other patient-related measures, is likely to increase leaders' attention and buy-in. The results in this study also suggest that multidisciplinary collaborations can address some of resource limitations, such as a lack of personnel. To promote sustained engagement with the wider healthcare workforce, our findings demonstrate the need for direct communication using audit and feedback. This technique is a recognised educational tool and a way to demonstrate the credibility of the programmes.[11 30]

Implications and recommendations for practice

Hospitals should engage with and incorporate national initiatives to ensure effective support and scale-up ASP interventions. In addition, we recommend that hospitals seek support from strong, influential, clinical leaders as key local champions and provide feedback regarding the impact of ASP initiatives. These two elements are likely to influence and facilitate the success in implementing, improving and sustaining hospital-based ASPs. ASPs may take time to derive noticeable improvements and require substantial resources to achieve their desired effect.[20 30] Local clinical leadership can be an effective driver in enacting more immediate and sustainable changes which result in successful programmes even where government-led ASPs are absent.

LIMITATIONS

There are limitations to the methods and interpretation of this study. Antibiotic pharmacists from one region were interviewed; professional, cultural and healthcare contexts may differ across regions. As with any qualitative study, our findings are not meant to be generalisable but rather to provide perspectives of specialist antibiotic pharmacists from different hospitals. Other non-pharmacist ASP members or healthcare professionals may also hold different opinions. Most participants worked in teaching hospitals; therefore, their opinions may not reflect those of personnel from non-teaching institutions which may have different challenges in building and maintaining ASPs. Further

exploration of factors which influence the success of ASPs would benefit from the inclusion of additional geographical regions and the inclusion of other healthcare professionals' perspectives.

CONCLUSIONS

Several factors influence the implementation and sustainability of hospital-based ASPs and involve individual, team, organisational and national levels. The importance of national initiatives was also a novel finding of the study. This suggests that national initiatives should be used and aligned together with support from local clinical leadership, effective mechanisms for monitoring and feedback, as well as adequate resources, to help implement and maintain these programmes.

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What this paper adds

What is already known on this subject

► Antibiotic stewardship programmes (ASPs) in secondary care are multifaceted and their success is dependent on several factors.
► Barriers to the adoption of hospital ASPs include lack of financial and human resources, and a lack of prioritisation within organisations.

What this study adds

► National influences facilitate the implementation and sustainability of hospital-based ASPs.
► Support from strong local clinical leadership and provision of feedback through direct communication are essential components at an organisational level to help implement and maintain the programmes.

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SUPPLEMENTARY DATA

TITLE:

What influences the implementation and sustainability of antibiotic stewardship programmes in hospitals? A qualitative study of antibiotic pharmacists' perspectives across South West England

Pharmacists' perspectives in ASPs

Monmaturapoj T et al

Table of Contents   **Page**

Pharmacists' perspectives in ASPs   Monmaturapoj T et al

Interview Topic Guide

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The following questions were used as a topic guide during the interviews with the pharmacists. As part of introduction, the pharmacists were reminded regarding the research aim and to express their views freely as there is no right or wrong answer. A consent form including permission to record the interview was obtained before the interview commenced. The pharmacists who chose to be interviewed by telephone, a consent form was sent by post with a reply-paid envelop.

○ **Introduction and welcome**

○ **Questions**

1. Please tell me about your role or involvement in the ASPs in your hospital.

2. Please tell me about the current operation of the ASPs in your hospital.

("As you may have heard that hospitals in some countries still face challenges with the implementation of ASPs.")

3. In your experience, what are the barriers and facilitators that influence the implementation of the ASPs in your hospital?
    ● And why?

("When ASPs have already been in place, maintenance of successful ASPs is also important but it can be challenging in many hospitals.")

4. So far, what are the barriers and facilitators that influence the sustainability of the ASPs in your hospital?
    ● And why?

5. In your views, please tell me about what can be improved around the ASPs in your hospital?
    ● And why?

6. Are there any relevant issues to the topic that I haven't covered and you would like to mention?

7. Do you have any questions for me?

○ **Thank you for participating and closure**

Pharmacists' perspectives in ASPs   Monmaturapoj T et al

Consolidated criteria for reporting qualitative research (COREQ) 32-item checklist

	Guide questions/description	Comment	Location in the manuscript (section)
Domain 1: Research team and reflexivity			
Personal Characteristics			
1. Interviewer/ facilitator	Which author/s conducted the interview or focus group?	Teerapong Monmaturapoj (TM) conducted the interviews.	Methods (*Data collection*)
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	TM obtained bachelor degree in Pharmacy and master degree in Clinical Pharmacy.	N/A
3. Occupation	What was their occupation at the time of the study?	TM is a PhD student at Department of Pharmacy and Pharmacology, The University of Bath.	N/A
4. Gender	Was the researcher male or female?	Male	N/A
5. Experience and training	What experience or training did the researcher have?	TM had undertaken several courses related to advanced qualitative health research before the study was conducted. The other authors have extensive experience in qualitative health research.	N/A
Relationship with participants			
6. Relationship established	Was a relationship established prior to study commencement?	TM had no relationships with participants prior to the study.	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	TM attended the South West Antibiotic Pharmacy (SWAP) group meeting and presented details of the study to attendees who were then invited to participate if: they were hospital antibiotic pharmacist, they had been involved in ASP implementation, and their hospital had an antibiotic or ASP policy in place.

Prior the interviews, TM introduced himself again to eligible participants stating he is a PhD student, etc. as well as describing the purpose of the | Methods (*Participants and recruitment*) |

		project and answering any questions that participants may have had about the project.	
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	TM is a clinical pharmacist and his research interests lie in infectious diseases, antibiotic resistance, and antibiotic utilization. TM has a special interest in antibiotic stewardship as it helps optimize antibiotic use and thus address antibiotic resistance.	N/A
Domain 2: Study design			
Theoretical framework			
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	A reflexive thematic analysis using inductive and deductive approaches.	Methods *(Analysis)*
Participant selection			
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	TM recruited participants through their professional group of the South West Antibiotic Pharmacy.	Methods *(Participants and recruitment)*
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	TM attended the South West Antibiotic Pharmacy Group meeting and presented details of the study to attendees who were then invited to participate if: they were hospital antibiotic pharmacist, they had been involved in ASP implementation, and their hospital had an antibiotic or ASP policy in place. A study information sheet was emailed to these individuals who agreed to take part.	Methods *(Participants and recruitment)*
12. Sample size	How many participants were in the study?	Thirteen	Results

13. Non-participation	How many people refused to participate or dropped out? Reasons?	Following the presentation and discussion of the study in the meeting, all eligible participants (n=13) from 13 individual hospitals across South West England agreed to participate. During data collection (interviews), there were no eligible participants who refused to participate or withdrew interview data from the study. Thirteen interviews were completed with all specialist hospital antibiotic pharmacists who were members of the South West Antibiotic Pharmacy Group.	Methods (*Participants and recruitment*) & Results
Setting			
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Participants could determine whether they preferred to be interviewed face-to-face or by telephone. All face-to-face interviews took place in non-clinical professional area.	Methods (*Data collection*)
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	No	N/A
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Fully presented in results section	Results
Data collection			
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Yes, the research team developed a semi-structured topic guide which was then piloted with two non-participating hospital antibiotic pharmacists. TM used a semi-structured topic guide to facilitate the interviews, however questions may vary depending on participants' response.	Methods (*Data collection*) & Supplementary file

Pharmacists' perspectives in ASPs   Monmaturapoj T et al

18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	No	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	All interviews were audio-recorded (with permission) and later transcribed.	Methods *(Data collection)*
20. Field notes	Were field notes made during and/or after the interview or focus group?	Yes, TM wrote brief field notes after each interview regarding the nature of the interview and his perceptions of participant's responses.	N/A
21. Duration	What was the duration of the interviews or focus group?	Interview times varied but were generally around 60 minutes.	Results
22. Data saturation	Was data saturation discussed?	Details and method of sample size determination were fully described in method section.	Methods *(Data collection)*
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	N/A
Domain 3: Analysis and findings			
Data analysis			
24. Number of data coders	How many data coders coded the data?	Three independent coders (TM, JS, and MW) reviewed and coded the first transcript. Similarities and differences in coding were discussed and the initial coding framework was agreed for single coding (by TM) of the remaining transcripts. The development and refinement of codes within the coding framework was regularly discussed by the research team until the end of the coding process.	Methods *(Analysis)*
25. Description of the coding tree	Did authors provide a description of the coding tree?	Each code had description within the software. The description of each potential theme and sub-theme was	Methods *(Analysis)*

		also defined to help draw out and finalize main themes and sub-themes.	
26. Derivation of themes	Were themes identified in advance or derived from the data?	This study used inductive and deductive approaches. The codes and the themes were informed by literature and interview content.	Methods *(Analysis)*
27. Software	What software, if applicable, was used to manage the data?	Nvivo12® software was used.	Methods *(Analysis)*
28. Participant checking	Did participants provide feedback on the findings?	No	N/A
Reporting			
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Yes, quotations were presented and identified in a manner protecting participant confidentiality.	Results
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes, there was consistency between the data and the findings.	Results
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes, major themes were clearly identified.	Results
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Yes, minor themes were clearly identified and related to major themes.	Results
N/A; not applicable Tong A, Sainsbury P, and Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349–57.			