

Supporting antimicrobial stewardship in Ghana: evaluation of the impact of training on knowledge and attitudes of healthcare professionals in two hospitals

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Background: A Commonwealth Partnership for Antimicrobial Stewardship was created between the Scottish Antimicrobial Prescribing Group (SAPG), Ghana Police Hospital and Keta Municipal Hospital. During a scoping visit, requirements for implementing antimicrobial stewardship (AMS), areas for improvement and training needs were identified.

Methods: A multidisciplinary team from SAPG and health psychologists from The Change Exchange developed and delivered multi-professional evidence-based teaching incorporating behavioural science, supported by partner pharmacists in each hospital. Four sessions were delivered over 2 days to 60 participants across both sites. Before and after the sessions, participants were asked to complete a knowledge quiz and a behaviours survey. Results were analysed using *t*-tests.

Results: Comparison of the participants' pre- and post-test quiz scores (Keta Municipal Hospital 9.4 and 10.9, Ghana Police Hospital 9.2 and 11.1, respectively) demonstrated statistically significant improvement in knowledge of antimicrobial resistance and appropriate use of antibiotics. Comparison of survey responses before and after the education sessions indicated that the education had a positive impact on participants' attitudes towards the issue of antimicrobial resistance, their role in AMS and confidence in using the Ghana Standard Treatment Guidelines. Participants were also more likely to question colleagues about compliance with guidelines. Forty-eight participants (80%) completed a training evaluation and all responded positively.

Conclusions: The education sessions appeared to be successful in improving knowledge and behaviours of hospital staff. Cascade of an abbreviated version of the training by partner pharmacists and AMS teams in Ghana will ensure that all staff have the opportunity to develop skills and knowledge to support AMS.

Introduction

The Scottish Antimicrobial Prescribing Group (SAPG)¹ were awarded a global volunteering grant from the Fleming Fund's Commonwealth Partnerships for Antimicrobial Stewardship (AMS) initiative led by the Tropical Health and Education Trust (THET) in partnership with the Commonwealth Pharmacists Association (CPA).² This work to support implementation of National Action

Plans to tackle the threat of antimicrobial resistance (AMR) involved supporting the development of AMS in two hospitals in Ghana: Keta Municipal Hospital (KMH), a rural community hospital in the Volta region, and Ghana Police Hospital (GPH), an urban hospital in Accra. The lead partners in both hospitals were the lead pharmacists and were therefore at a senior level with links into hospital management structures. This supported establishment of

stewardship teams with responsibility for delivery of the project and management support for interventions.

Education has been identified as a core intervention for hospital stewardship programmes and is most successful when combined in a multifaceted approach to improve prescribing practice.³ Competencies for AMS have been developed by the WHO⁴ and these have formed the basis of our training programme along with those developed by ESCMID⁵ and the UK Department of Health.⁶

Education provides individuals with the required knowledge but when used alone does not change entrenched and habitual behaviours.^{7,8} There is increasing awareness of the need for behaviour change approaches to support clinicians to perform the behaviours associated with best practice and various models have been suggested that should be considered when planning education and embedding behaviour change within interactive sessions. Evidence suggests that the capability, opportunity, motivation = behaviour (COM-B) model has the potential to support behaviour change interventions that are acceptable to clinicians.^{9,10} Techniques based on this approach were applied in the design of the SAPG education programme. A 'train the trainer' approach was used with the lead pharmacists and other members of the stewardship teams delivering an abbreviated version of the SAPG programme to support sustainable and ongoing education for all clinical staff groups.

Methods

General approach

The project utilized the successful SAPG triad approach to developing and implementing AMS using information, education and quality improvement to optimize the use of antimicrobials. SAPG volunteers included antimicrobial pharmacists, infectious diseases clinicians, antimicrobial nurses and academic colleagues with experience of medicines utilization work in low- and middle-income countries (LMICs). The work was also supported by health psychologists from The Change Exchange at the University of Manchester,¹¹ who tailored training to embed behaviour change ensuring sustainability of the project with benefits for both Ghanaian partners and the SAPG volunteers.

An initial scoping visit in each hospital included an introductory meeting with the management team, tour of hospital wards and departments, discussions with front-line clinical staff and collection of baseline data for the Global Point Prevalence Survey (GPPS)¹² on antimicrobial use. The findings from this visit were utilized to inform development of a multi-professional training programme as a key component of our stewardship project. At this point senior managers in each hospital had committed to supporting an AMS programme and AMS team members had been convened but a self-assessment using an AMS audit tool from the CPA showed that the majority of elements required were not yet in place.

Ethics

There was no requirement for either ethics committee approval or written informed consent from the participants for this work.

Development of the training programme

The scoping visit findings informed the development of a training programme to meet the specific needs within each hospital, focusing on areas for improvement identified by hospital staff and from the GPPS data.¹³ An iterative process was used by the SAPG team to agree the content and

format of the training programme (Appendix S1, available as [Supplementary data](#) at [JAC-AMR Online](#)) working in collaboration with Ghana partners and The Change Exchange. The training programme comprised a mix of lectures and interactive case/scenario-based sessions to engage participants in discussion of current practice and explore behaviours and attitudes to using antibiotics. The programme was delivered twice in each hospital on consecutive days by a multi-professional team from SAPG with some elements around overcoming potential barriers to complying with the guidance facilitated by health psychologists from The Change Exchange. Healthcare staff across all professions involved in managing infections within each hospital were identified to participate in the training. At the end of the training session all participants were given a certificate of completion signed by the lead partners.

Instruments and data collection

To evaluate the success of the training programme a knowledge quiz (Appendix S2) and an attitudes and behaviours survey (Appendix S3) were used to gather data before and after the training session.

A system for anonymized coding was used to allow matching of pre- and post-training responses at the individual level. Where participants left a question blank we added a 'don't know' category. Pre- and post-education surveys were analysed for participants with complete data only.

A training evaluation form (Appendix S4) was used to seek feedback from participants on the training session, including how they would apply their learning and suggestions for improvement.

To evaluate the success of the 'train the trainer' approach to cascade training to other clinical staff in GPH, the knowledge quiz was used before and after a session delivered by the hospital antimicrobial team.

To evaluate whether the knowledge gained during the training delivered by the UK team was retained, the knowledge quiz was employed during a follow-up visit by the UK team 6 months after the training session, aiming to target staff in both hospitals who had attended the original training but also capturing responses from staff who had attended cascade training or had not yet received training. The attitudes and behaviours survey was also repeated to assess whether positive behaviours had been retained.

Data from all forms were collated within an Excel spreadsheet and analysed using a predetermined analysis plan.

Data from the knowledge quiz were exported into the Minitab[®] 18 statistical package. Descriptive statistics were produced for means, standard deviations and verification of the assumption of data normality. Student's *t*-tests (unilateral, paired) were used to verify the significance of the findings. Analyses were conducted at the 95% confidence level, considering 5% significance.

Results

Training session participants

Hospital management actively supported staff participation in the training and ensured that as many staff as possible could be released from their duties to attend one of the sessions while also ensuring appropriate clinical cover across all departments. A total of 60 staff (KMH 32, GPH 28) participated in a 1 day training session held across 2 days in each hospital. This represented 29% of staff in KMH and 28% of staff in GPH. The majority of participants were nurses ($n = 22$, 36.7%) followed by medical doctors ($n = 10$, 16.7%) and pharmacists ($n = 10$, 16.7%). The remaining 18 staff (30%) consisted of laboratory scientists, hospital managers, midwives and a public health practitioner.

Knowledge quiz

Analyses of pre- and post-test scores are presented below. Participants from both hospitals demonstrated improved knowledge of AMR and use of antibiotics after the training session.

Keta Municipal Hospital

On day 1, the pre-test score was missing for one participant and the post-test score was missing for one participant. On day 2, post-test scores were missing for two participants. The available scores were normally distributed and used to calculate the mean and standard deviation. The mean scores were: pre-test 9.4 (SD 1.8, range 5–13) and post-test 10.9 (SD 1.4, range 8–13).

Pre- and post-test scores could be matched for participants who had completed both the pre- and post-training tests ($n = 28$). The mean difference between the scores was 1.57 (95% CI 0.93–2.21, $P = 0.00001$).

Ghana Police Hospital

All participants completed the pre-test quiz; however, on day 1 one participant did not complete the post-test and on day 2 four participants did not complete the post-test. Pre- and post-test scores could not be matched for participants, therefore post-test scores were compared with the average of all pre-test scores. The mean scores were: pre-test 9.2 (SD 2.2, range 5–13) and post-test 11.1 (SD 1.8, range 8–13). The mean difference between scores was 1.88 (95% CI 0.753–3.008, $P = 0.002$).

Further analysis of knowledge quiz responses Further analysis was carried out using responses from 28 KMH participants and 19 GPH participants. Question 1 asked respondents to identify causes of AMR. Before the education 13 respondents (27%) correctly identified all three causes and after the education 30 (63%) correctly identified all three causes. Pre-education 42 (90%) were aware that overuse of antibiotics contributes to resistance and this increased to 46 (98%) after the training. However, both pre- and post-education 25 (54%) and 30 (63%), respectively, incorrectly thought that underuse of antibiotics was a cause of AMR. Knowledge was most improved, from 14 (29%) to 30 (63%), in relation to the impact of inadequate hand hygiene in the development of AMR.

Question 2 asked respondents to identify interventions that could prevent infection. Forty-two respondents (90%) both pre- and post-education correctly chose hand washing, indicating a good understanding of infection prevention. Before the education two respondents (7%) thought that a 7 day course of antibiotics after surgery would prevent infection. Following the sessions, no respondent chose this option.

Questions that showed the weakest knowledge related to understanding of the pneumonia CURB65 score,¹⁴ the benefit of point prevalence surveys (PPS) and the meaning of stewardship. Knowledge in all these areas improved following the education, particularly the question related to CURB65 score, which increased from 18 (39%) to 44 (94%). Understanding that stewardship means taking care of antibiotics increased from 26 (56%) to 40 (85%). Less improvement was seen regarding the question related to the benefit of PPS: 15 (31%) versus 24 (50%).

Table 1. Pre- and post-education responses to survey questions—Keta Municipal Hospital

Statement		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know
Antimicrobial resistance is a serious problem	pre	2			4	21	1
	post					28	
I am worried that antibiotics will soon become ineffective	pre	1	1		11	14	1
	post		1		1	26	
I am worried patients will develop antibiotic-resistant infections	pre	2	1		13	12	
	post				4	23	1
Following national or local antibiotic prescribing guidelines will help to prevent the development of antimicrobial resistance	pre	2	1	1	10	14	
	post				3	25	
It is part of my professional role to reduce the risks of antibiotic resistance	pre	2			10	15	1
	post				1	27	
I am able to access the GSTG easily	pre	3	6	4	12	2	1
	post		3	1	10	14	
I find it easy to adhere to GSTG whenever I prescribe or administer antimicrobials	pre	1	2	10	14	1	
	post		1	4	7	16	
My peers support adherence to GSTG when prescribing or administering antimicrobials	pre		6	14	6	2	
	post		2	5	13	8	
I feel confident about questioning a colleague about an antibiotic prescription not in line with the GSTG	pre	2	4	11	9	2	
	post	1		1	9	17	
I plan to adhere to GSTG whenever I prescribe or administer an antibiotic	pre	2		3	16	7	
	post			1	2	25	

GSTG, Ghana Standard Treatment Guidelines.

All other questions in the quiz achieved a score of 80%–90% before the education; however, most scores improved to $\geq 90\%$ post-education.

Evaluation of the ‘train the trainer’ approach Eighteen participants completed a knowledge quiz before a session delivered by the GPH antimicrobial team. Only eight participants fully completed the post-training knowledge quiz. The mean pre-training score was 8.5/13 (range 6–12) and the mean post-training score was 9.3/13 (range 8–11).

Evaluation of sustained knowledge of AMS In GPH two of the original training participants completed a further knowledge quiz 4 months after the training session, scoring 10 and 13 points. A total of eight staff (including an additional six people trained by the GPH team) completed the knowledge quiz and scored a mean of 10/13 (range 8–13).

In KMH two of the original training participants completed a further knowledge quiz 4 months after the training session, scoring 9 and 13 points. A total of 12 staff (who completed UK or Ghana team training) completed the knowledge quiz and scored a mean of 10.5/13 (range 6–13).

Attitudes and behaviours survey

Participants from both hospitals demonstrated improved attitudes and behaviours around the use of antibiotics after the training session. No particular professional group demonstrated an

attitude or behaviour that differed from members of other professional groups and there was uncertainty across all groups in various aspects of the attitudes and behaviours questioned.

Keta Municipal Hospital

On day 1, the pre-education survey was missing for one participant and the post-education survey was missing from one participant. On day 2 post-education surveys were missing from two participants ($n = 28$). Results of pre- and post-test scores are presented in Table 1.

Ghana Police Hospital

On day 1, the post-education survey was missing for five participants. On day 2 the pre-education survey was missing for one participant and post-education surveys were missing for three participants. Pre- and post-education surveys were analysed for participants with complete data only ($n = 19$). Results of pre- and post-test scores are presented in Table 2.

Comparison of responses to the survey before and after the education sessions showed that positive responses to all statements increased post-education.

The pattern of responses in GPH was similar to that in KMH, with most participants choosing positive responses following the education sessions. The main difference between the sites was that participants in GPH were more likely to provide a positive response before the education than those in KMH. Note that the number of pharmacists in GPH was eight compared with two in KMH.

Table 2. Pre- and post-education responses to survey questions—Ghana Police Hospital

Statement		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know
Antimicrobial resistance is a serious problem	pre				4	15	
	post	1			4	14	
I am worried that antibiotics will soon become ineffective	pre	1	1	1	7	8	1
	post	1			4	13	1
I am worried patients will develop antibiotic-resistant infections	pre	1		1	7	10	
	post	2			6	11	
Following national or local antibiotic prescribing guidelines will help to prevent the development of antimicrobial resistance	pre			2	8	9	
	post	1			5	13	
It is part of my professional role to reduce the risks of antibiotic resistance	pre	1			5	13	
	post				5	13	1
I am able to access the GSTG easily	pre	1			6	12	
	post			6	6	6	1
I find it easy to adhere to GSTG whenever I prescribe or administer antimicrobials	pre	1			9	9	
	post		1	5	8	4	1
My peers support adherence to GSTG when prescribing or administering antimicrobials	pre	1		2	10	5	1
	post			7	11		1
I feel confident about questioning a colleague about an antibiotic prescription not in line with the GSTG	pre	1		4	11	3	
	post		2	4	11	1	1
I plan to adhere to GSTG whenever I prescribe or administer an antibiotic	pre	1			10	7	1
	post			1	10	7	1

GSTG, Ghana Standard Treatment Guidelines.

Table 3. Selected feedback comments from participants

Question	Feedback
What is your key learning from the training?	<ul style="list-style-type: none"> • Ensure standard treatment guidelines are adhered to. • Working together with colleagues and supporting them to make informed decisions. • Antimicrobial stewardship is a multidiscipline approach. • Judicious antimicrobial use is necessary. • Good collaboration between doctors, pharmacists and nurses is important in AM stewardship. • Antimicrobial resistance is a serious global problem which needs all hands on deck. • How to educate my patients and relatives on medications (antibiotics). • We should respect each other's view in the management of patients. • Need to classify pneumonia diagnosis well to give appropriate treatment.
How will you apply this learning to your practice?	<ul style="list-style-type: none"> • Adhering to national treatment guidelines and also encouraging colleagues to do so. • Increasing awareness with colleagues and public. • Listen to others and understand their viewpoint. • I would develop an approachable attitude. • To always check the 6Rs when administering antibiotic to my patient. • By reviewing my indications for IV antibiotics and antibiotics in general. • Monitor the administration and dosage of antibiotics prescribed for patients in my department. • Develop protocol for my unit and ensure stewardship. • Be a steward and a custodian to antibiotic use. • Use the micro guide app for antibiotic treatment. • Will disseminate the information to my colleagues. The micro guide app will be installed for my colleagues.
How can future sessions be improved?	<ul style="list-style-type: none"> • More practical/interactive sessions should be used to help us digest the information acquired. • More participant engagement in role play; role play should be demonstrated. • Discussing more case studies and involving physician assistants since they also prescribe. • Extend number of days (at least 2 days). • By involving all prescribers and developing strategies to include community outreach programmes. • To increase the number of participants. • Intersperse the interactive sessions with the lectures.

Evaluation of sustained attitudes and behaviours During a follow-up visit in GPH staff agreed or strongly agreed with all but two of the positive stewardship behaviours. Those where some staff did not agree or offered a neutral opinion were that it was easy to adhere to guidelines and that peers support adherence to guidelines. One person responded that they could not access the guidelines. In KMH a larger number of staff did not agree with these attitudes towards the guidelines and more staff could not access the guidelines.

Participant feedback on training

Participants were asked to complete an evaluation form on the training provided. Forty-eight of the 60 participants (80%) completed a feedback form. Responses were positive, with 39 (65%) participants rating it very good and 9 (35%) rating it good.

The final three questions were free text and Table 3 shows selected comments by participants.

Discussion

Comparison of responses to the survey before and after the education sessions indicates that the education had a positive impact on

participants' attitudes to the issue of antimicrobial resistance, their role in prevention of development of resistance and ease of access and adherence to Ghana Standard Treatment Guidelines. Prior to the education sessions there had been one exchange programme visit by the UK team which might have contributed subtly to AMR awareness and hospital management focus on AMS. Before the education sessions, most participants were aware of problems related to antimicrobial resistance and their role in reducing risk, but they were less sure regarding their ability to access and adhere to the guidelines. Peer support for adherence to guidelines was also of concern and only 11 (40%) participants in KMH indicated that they were confident about questioning a colleague. Following the education programme, positive responses to all statements increased, suggesting the education influenced an overall positive change in attitudes and behaviours. Training scores for the sessions delivered by the Ghana team compared favourably with the UK-delivered training mean scores, suggesting the 'train the trainer' approach was successful.

The health psychologists from The Change Exchange tailored their training based on the initial scoping visit and opportunistic observations and conversations involving staff at the hospital. They were able to identify target behaviours for compliance with guidelines (e.g. checking local guidance) and overcoming barriers

to change (e.g. having difficult conversations with senior staff and peers about non-compliance). This may have contributed to the initial positive change in scores for the attitudes and behaviours survey and adds to the existing evidence base that supports the use of theory and evidence from psychology in producing effective training for health professionals. The lack of sustained positive change in attitudes and behaviours in comparison with the sustained levels of knowledge reported may indicate that barriers to compliance with local guidelines may change over time. Local monitoring and the development of strategies to overcome these barriers may be beneficial.

The educational sessions delivered by the UK and Ghana teams were part of a partnership project, delivered between May 2019 and February 2020, which included reciprocal visits to Scotland and ongoing regular virtual meetings. It is therefore likely that the sustained engagement and collaboration between the Ghana and SAPG teams contributed to the learning and positive effect on behaviours. We acknowledge that this work has several limitations. The training was delivered in two small hospitals, each by a different multi-professional team. We also accept that evaluation of a single training session may not be a good indicator of sustainable knowledge transfer and behaviour change and further cascade and repetition of training on a regular basis will be required. Some data from both the quiz and the survey were incomplete. However, we suggest that the model employed has been successful in raising awareness and building capacity for stewardship.

Conclusions

Our approach of developing training collaboratively and having the sessions delivered by a multi-professional team of experts in AMS and behaviour change appears to be successful in imparting knowledge, skills and positive behaviours to support improved use of antibiotics in these two hospitals. The use of lectures and interactive sessions was well received by participants and they rated the training highly. The training materials have been made available via the CPA website and can be used by others to support similar work. The 'train the trainer' approach has built capacity locally and could be used to spread capacity and good practice within other hospitals in Ghana. Ongoing remote discussion will allow teams to continue to work together to support and sustain these local stewardship programmes. This model of experienced stewardship teams supporting hospital multi-professional teams to establish AMS could be utilized in other LMICs.

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Transparency declarations

None to declare.

Disclaimer

The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the Fleming Fund, the Department of Health and Social Care, THET or CPA.

Supplementary data

Appendices S1 to S4 are available as [Supplementary data](#) at JAC-AMR Online.

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