

SUPPLEMENTARY

Supplementary Table 1. CwPAMS Grant selection criteria as informed by a scoping study.

<ul style="list-style-type: none">● The current status of antimicrobial use, stewardship, resistance and IPCinfection prevention control● Inclusion of antimicrobial use, stewardship in national AMR strategies and the status of their implementation● Status of AMS, surveillance IPC activities● Principal stakeholders with a current or potential interest/role in addressing AMR and stewardship● The coverage of AMR in health worker training (both pre-service and in-service)● Potential for digital health initiatives● The number and role of pharmacists.

Supplementary Table 2. List of the awarded CwPAMS partnerships for the period of February 2019- to April 2020 (The partnerships are listed in no particular order).

To aid with the application process, THET and CPA hosted a series of launch events across the UK in November 2018. These events were open to any individual who had been involved in or was willing to participate in a global health partnership with an interest in applying for a grant to improve antimicrobial stewardship in Ghana, Tanzania, Uganda, or Zambia. Topics covered during the event were: an introduction to the grants scheme and the Fleming Fund, an overview of health partnerships and principles, the application process, including eligibility criteria, project planning, and monitoring and evaluation. There was also an opportunity for questions and answers and networking.¹³ The partnerships were categorised into new and established partnerships. In the context of the CwPAMS programme, an established health partnership was defined as one that has been working together for over 6 months, is formalised and institutionalised, and can clearly demonstrate adherence to [THET's Principles of Partnership](#). A new partnership was defined as one that has either been working together for less than 6 months or has not yet started working together but has intentions to do so. It did not need to demonstrate adherence to all of THET's Principles of Partnership but must have demonstrated a commitment to do so and had a clear strategy of how the partnership would become formalised and institutionalised.

We selected seven established partnerships and these were awarded a funding allocation of upto £60,000 and the five new partnerships were allocated upto £30,000.

ID	New/Established Partnership	UK Lead Partner	LMIC Lead Partner	Country	Project Title
A02	New	Norfolk and Suffolk NHS Foundation Trust *	The Assemblies of God Hospital, Saboba	Ghana	Optimising the use of antibiotics and increasing knowledge of antimicrobial resistance in a rural healthcare setting in Northern Ghana and wider community
A04	New	UK Faculty of Public Health *	Ghana Public Health Association	Ghana	To strengthen Antimicrobial Stewardship through improving surveillance and building sustainable capacity in Ledzokuku Krowor Municipal Assembly [LEKMA] Hospital, Ghana.
A05	New	North Middlesex University Hospital NHS Trust *	Korle-Bu Teaching Hospital	Ghana	Building Professional Capacity and Sustainability to Deliver Effective Antimicrobial Stewardship and IPC Programmes in Accra, Ghana.
A07	New	University College London Hospitals NHS Foundation Trust *	University of Health and Allied Sciences	Ghana	Enhancing Hospital Pharmacists Roles to support the Delivery of Antimicrobial Stewardship programmes in Volta Regional Hospital, Ho, Ghana
A11	New	Healthcare Improvement Scotland *	Ghana Police Hospital	Ghana	Utilising a Scottish triad approach to developing and implementing antimicrobial stewardship in Ghana and Zambia: Information, Education, Quality Improvement
B01	Established	Cambridge University Hospitals NHS Foundation Trust #	Makerere University and Mulago National Referral and Teaching Hospital	Uganda	Kampala Cambridge Antimicrobial Stewardship and Infection Prevention and Control project
B02	Established	University of Sussex; Brighton and Sussex Medical School #	University Teaching Hospital, Lusaka	Zambia	Championing Pharmacists as Antibiotic Guardians in Zambia; the Brighton-Lusaka Pharmacy Link Initiative.
B03	Established	University of Salford	Pharmaceutical	Uganda	Anti-Microbial Resistance

		#	Society of Uganda		and Maternal Sepsis in a Ugandan Regional Referral Hospital
B08	Established	Health Education England #	Gulu Regional Referral Hospital	Uganda	Establishing Effective Antibiotic Stewardship in Gulu Regional Referral Hospital (GRRH), Northern Uganda
B09	Established	Northumbria Healthcare NHS Foundation Trust #	Kilimanjaro Christian Medical Centre	Tanzania	Interventions that are designed to change antimicrobial use for better patient outcomes and avoiding AMR
B10	Established	Nottingham Trent University #	Makerere University School of Public Health	Uganda	Strengthening antimicrobial stewardship in Wakiso district, Uganda
B12	Established	London School of Hygiene and Tropical Medicine #	Makerere University College of Health Sciences and Infectious Diseases Research Collaboration (IDRC)	Uganda	Capacity Sharing for AntiMicrobial Stewardship (CaSAMS) through the medicines and therapeutic committee at Jinja hospital.

Supplementary Table 3. Support offered by the Commonwealth Pharmacists Association and the number of partnerships that reported using the support.

SUPPORT OFFERED BY THE COMMONWEALTH PHARMACISTS ASSOCIATION	NUMBER OF PARTNERSHIPS
Pre-deployment training which included training on AMS initiatives and good practices in the LMIC context and data collection training for the GPPS.	12
Reported receiving sufficient bespoke training or materials from CPA during the course of their Project.	8
Reported that CPA had aided them in establishing relationships within CPA's network, including other HPs involved in the CwPAMS programme.	10
Partnerships who had a CPhOGH Fellow or Fellows appointed to them.	11

Supplementary Table 4. The extent to which partnership objectives were achieved.

PARTNERSHIP OUTCOME	OUTCOME INDICATOR	FREQUENCY
LMIC healthcare Institutions and LMIC health workforce demonstrate improved practice related to AMS and prescribing practice.	Number of partnerships who have measured and reported changes to prescribing practices particularly the reduction in use of broad spectrum (WA and RE of AWaRe) antibiotics.	1
	Percentage of LMIC healthcare institutions with: established AMS team; pharmacist included on AMS team; regular meetings held and minuted; national/WHO AMS protocols ratified at health institution level; training programme articulated for all staff working with AMR.	100%
	Number of health partnerships that reported improved prescribing practice demonstrated by the increase of biological samples being sent to the lab for testing to confirm diagnosis, as well as an improved feedback process between the lab and prescribers.	1
AMS strategies, guidelines and tools are in place in each LMIC healthcare institution.	Percentage of LMIC healthcare institutions with AMS guidelines, tools and protocols.	100%
	Percentage of LMIC healthcare institutions who have introduced the principles of WHO AWaRE antibiotic categories	71.4%
NHS staff demonstrate improved leadership skills and understanding of the global context of AMR in their work.	Number of UK health institutions actively including returned volunteers' skills and experiences in their NHS institution.	16
	Number of partnerships which reported that UK institutions have actively included these new skills or experiences into their practice	10
	Number of healthcare partnerships who reported that UK volunteers (NHS staff) had demonstrated improved competencies in implementing AMS in LMIC settings.	9
LMIC healthcare workforce strengthened in areas of AMS and antimicrobial prescribing practice.	Number of LMIC healthcare staff trained in AMS, antimicrobial prescribing practise and consumption surveillance (based on WHO competency framework).	670
	Number of LMIC healthcare staff demonstrating improved knowledge after training.	379
	Number of LMIC healthcare staff able to demonstrate how to practise their new knowledge.	2
LMIC healthcare institutes	Number of new or revised documents related to AMS and antibiotic prescribing developed.	15

develop/implement AMS policies and protocols in line with international or national guidelines/frameworks.	Number of guidelines and protocols rolled out in the LMIC healthcare institutes through awareness campaign, training, printing and sharing.	7
	Number of institutions collecting and feeding back antimicrobial consumption data through the global PPS.	10
NHS volunteers demonstrate improved knowledge and understanding of AMS in LMIC contexts.	Number of volunteers who can name 5 barriers to functional AMS in LMICs.	17
	Number of health partnerships who reported that NHS volunteers had demonstrated improved knowledge and understanding of AMS in the LMIC contexts	9
	Total number of volunteering days contributed by NHS staff to strengthen AMS in LMIC healthcare institutions.	815

Supplementary Table 5. Extent to which CwPAMS has influenced AMS policy.

ACHIEVEMENT	NUMBER OF PARTNERSHIPS
Health partnership projects which aimed to address local priorities and contribute to the implementation of AMR NAPs.	12
Health partnerships which reported having published peer-reviewed articles or other relevant publications as a result of the CwPAMS Programme	9
Health partnerships who presented posters of their work at national and international events namely; the UK Clinical Pharmacy Association Pharmacy Infection Network Masterclass, the International Pharmaceutical Federation (FIP) World Congress of Pharmacy and Pharmaceutical Sciences, and internal and external presentations as part of the Health Education England Global NHS Programme.	3
Health Partnerships that successfully established new MTCs and accompanying AMS committees	6
Health Partnerships that ensured that AMS was prioritised in already existing MTCs by way of either including it as a recurring agenda topic or involving specific personnel with understanding of AMS	4
Health Partnerships that were working towards establishing AMS committees beyond Q3.	2
All projects have established links with government, civil society actors or other groups active in the AMS policy domain, mostly at local and district/regional levels through the facilitation of CPA and THET country directors.	All projects (12 partnerships)

Supplementary Table 6. Range of avenues via which CwPAMS activities were publicised.

- Publications, blogs and peer reviewed manuscripts (supplementary table 4)
- Programme dissemination events
- Dissemination at local hospital sites and community groups
- Presentations at external workshops, conferences and ministerial meetings
- Dissemination to National AMR Meetings
- Social media with health partnerships, CPA and THET using the #CwPAMS consistently
- Organising webinars- The CPA held a webinar series focused on COVID-19, often highlighting or using CwPAMS as a case study and inviting CwPAMS members to present at the webinars.
- CwPAMS was also showcased at the fifth Antibiotic Guardian Awards where the Programme won an award for 'Multi-Country collaboration'. Several HPs from the Partnerships were given commendations.¹⁶
- The work undertaken by the Programme was also showcased during World Antibiotic Awareness Weeks.

Supplementary Table 7. Dissemination of CwPAMS activities: peer review publications.

1. Olaoye O, Tuck C, Khor WP, McMenamin R, Hudson L, Northall M, Panford-Quainoo E, Asima DM, Ashiru-Oredope D. Improving Access to Antimicrobial Prescribing Guidelines in 4 African Countries: Development and Pilot Implementation of an App and Cross-Sectional Assessment of Attitudes and Behaviour Survey of Healthcare Workers and Patients. *Antibiotics*. 2020; 9(9):555. <https://doi.org/10.3390/antibiotics9090555>
2. Ashiru-Oredope, Diane, Amy Hai Yan Chan, Omotayo Olaoye, Victoria Rutter, Zaheer ud Din Babar, Claire Anderson, Ayodeji Matuluko, Chloe Tuck, Manjula Halai, Hayley Wickens, Winnie Nambatya, Rao Vadlamudi and Raymond Anderson. "COVID-19: Needs assessment of the pharmacy profession and contributions so far across the Commonwealth." (2020). DOI: 10.21203/rs.3.rs-64723/v1
3. Chan, A.H.Y., Rutter, V., Ashiru-Oredope, D. *et al.* Together we unite: the role of the Commonwealth in achieving universal health coverage through pharmaceutical care amidst the COVID-19 pandemic. *J of Pharm Policy and Pract* **13**, 13 (2020). <https://doi.org/10.1186/s40545-020-00214-6>
4. Khor WP, Olaoye O, D'Arcy N, Krockow EM, Elshenawy RA, Rutter V, Ashiru-Oredope D. The Need for Ongoing Antimicrobial Stewardship during the COVID-19 Pandemic and Actionable Recommendations. *Antibiotics* (Basel). 2020 Dec 14;9(12):904. doi: 10.3390/antibiotics9120904. PMID: 33327430; PMCID: PMC7764884.
5. Sneddon J, Cooper L, Afriyie DK, Sefah IA, Cockburn A, Kerr F, Cameron E, Goldthorpe J, Kurdi A, Seaton RA. Supporting antimicrobial stewardship in Ghana: evaluation of the impact of training on knowledge and attitudes of healthcare professionals in two hospitals. *JAC Antimicrob Resist*. 2020 Oct 22;2(4):dlaa092. doi: 10.1093/jacamr/dlaa092. PMID: 34223045; PMCID: PMC8210265.

6. Ackers, L., Ackers-Johnson, G., Seekles, M., Odur, J., & Opio, S. (2020). Opportunities and Challenges for Improving Anti-Microbial Stewardship in Low- and Middle-Income Countries; Lessons Learnt from the Maternal Sepsis Intervention in Western Uganda. *Antibiotics (Basel, Switzerland)*, 9(6), 315. <https://doi.org/10.3390/antibiotics9060315>
7. Sneddon J, Afriyie D, Sefah I, Cockburn A, Kerr F, Byrne-Davis L, Cameron E. Developing a Sustainable Antimicrobial Stewardship (AMS) Programme in Ghana: Replicating the Scottish Triad Model of Information, Education and Quality Improvement. *Antibiotics (Basel)*. 2020 Sep 23;9(10):636. doi: 10.3390/antibiotics9100636. PMID: 32977691; PMCID: PMC7598579.
8. Daniel Kwame Afriyie, Israel A Sefah, Jacqueline Sneddon, William Malcolm, Rachel McKinney, Lesley Cooper, Amanj Kurdi, Brian Godman, R Andrew Seaton, Antimicrobial point prevalence surveys in two Ghanaian hospitals: opportunities for antimicrobial stewardship, *JAC-Antimicrobial Resistance*, Volume 2, Issue 1, March 2020, dlaa001, <https://doi.org/10.1093/jacamr/dlaa001>
9. Musoke D, Kitutu FE, Mugisha L, Amir S, Brandish C, Ikhile D, Kajumbula H, Kizito IM, Lubega GB, Niyongabo F, Ng BY, O'Driscoll J, Russell-Hobbs K, Winter J, Gibson L. A One Health Approach to Strengthening Antimicrobial Stewardship in Wakiso District, Uganda. *Antibiotics (Basel)*. 2020 Oct 31;9(11):764. doi: 10.3390/antibiotics9110764. PMID: 33142711; PMCID: PMC7692373.
10. Kerr F, Sefah IA, Essah DO, Cockburn A, Afriyie D, Mahungu J, Mirfenderesky M, Ankrah D, Aggor A, Barrett S, Brayson J, Muro E, Benedict P, Santos R, Kanturegye R, Onegwa R, Sekikubo M, Rees F, Banda D, Kalungia AC, Alutuli L, Chikatula E, Ashiru-Oredope D. Practical Pharmacist-Led Interventions to Improve Antimicrobial Stewardship in Ghana, Tanzania, Uganda and Zambia. *Pharmacy*. 2021; 9(3):124. <https://doi.org/10.3390/pharmacy9030124>
11. Brandish C, Garraghan F, Ng BY, Russell-Hobbs K, Olaoye O, Ashiru-Oredope D. Assessing the Impact of a Global Health Fellowship on Pharmacists' Leadership Skills and Consideration of Benefits to the National Health Service (NHS) in the United Kingdom. *Healthcare (Basel)*. 2021 Jul 15;9(7):890. doi: 10.3390/healthcare9070890. PMID: 34356268; PMCID: PMC8304379.
12. Ankrah D, Owusu H, Aggor A, Osei A, Ampomah A, Harrison M, Nelson F, Aboagye GO, Ekpale P, Laryea J, Selby J, Amoah S, Lartey L, Addison O, Bruce E, Mahungu J, Mirfenderesky M. Point Prevalence Survey of Antimicrobial Utilization in Ghana's Premier Hospital: Implications for Antimicrobial Stewardship. *Antibiotics (Basel)*. 2021 Dec 14;10(12):1528. doi: 10.3390/antibiotics10121528. PMID: 34943740; PMCID: PMC8698913.
13. Kpokiri EE, Ladva M, Dodoo CC, Orman E, Aku TA, Mensah A, Jato J, Mfoafo KA, Folitse I, Hutton-Nyameaye A, Okon-Ben I, Mensah-Kane P, Sarkodie E, Awadzi B, Jani YH. Knowledge, Awareness and Practice with Antimicrobial Stewardship Programmes among Healthcare Providers in a Ghanaian Tertiary Hospital. *Antibiotics (Basel)*. 2021 Dec 22;11(1):6. doi: 10.3390/antibiotics11010006. PMID: 35052883; PMCID: PMC8773036.
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15. Ashiru-Oredope D, Nabiryo M, Yeoman A, Bell M, Cavanagh S, D'Arcy N, Townsend W, Demenciukas D, Yadav S, Garraghan F, Carter V, Rutter V, Skone-James R. Development of and User Feedback on a Board and Online Game to Educate on Antimicrobial Resistance and Stewardship. *Antibiotics*. 2022; 11(5):611. <https://doi.org/10.3390/antibiotics11050611>

16. Ogunnigbo O, Nabiryo M, Atteh M, Muringu E, Olaitan OJ, Rutter V, Ashiru-Oredope D. Exploring the Antimicrobial Stewardship Educational Needs of Healthcare Students and the Potential of an Antimicrobial Prescribing App as an Educational Tool in Selected African Countries. *Antibiotics*. 2022; 11(5):691. <https://doi.org/10.3390/antibiotics11050691>