Beat bad microbes: raising public awareness of antibiotic resistance in Rwanda

Article

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Beat Bad Microbes: raising public awareness of antibiotic resistance in Rwanda

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Abstract

Health-related information design has made a difference to people's lives through clear explanation of procedures, processes, disease prevention and maintenance. This paper provides an example of user-centered design being applied to engage people with the prevention of drug-resistant infection. In particular, we focus on antibiotic resistance in the specific location of a community pharmacy in Rwanda. We describe an information campaign, Beat Bad Microbes, and summarize the challenges and opportunities of working in Rwanda on a cross-disciplinary project in which design research and practice are closely integrated.

1. Introduction

Health-related information design has made a difference to people's lives through clear explanation of procedures, processes, disease prevention and maintenance. There is historical precedence for this, for example, in the work of Otto and Marie Neurath and their application of Isotype principles to health concerns, such as TB and leprosy (Walker, 2019); as well as many excellent examples of contemporary relevance (e.g., Noel et al., 2017; van der Waarde, 2014) and in related design specialisms including human factors and ergonomics (e.g., Hignett et al., 2017), and service design (e.g., Chamberlain et al., 2017).

This paper provides an example of user-centered design being applied to engage people with the prevention of drug-resistant infection, in particular, antibiotic resistance, in the specific location of a community pharmacies in Rwanda. As well as describing an information campaign, Beat Bad Microbes, it summarizes the challenges and opportunities of working in Rwanda on a cross-disciplinary project in which design research and practice are closely integrated. The user-centered design methods here included co-design, making of prototypes, the application of information design good practice, and evaluation of materials by intended users in context.

2. An 'equitable partnership'

The Beat Bad Microbes project was underpinned by partnership working that enabled contributions of cross- and inter-disciplinary expertise, research and professional in information design and pharmacy; and institutional collaboration between universities (University of Reading and University of Rwanda), and with professional organizations (Rwanda Community Pharmacists Union (RCPU) and the Commonwealth Pharmacists Association (CPA)). This was driven to some extent by the requirements of the funding for the work -- the University of Reading's Global Challenges Research Fund (GCRF) allocation for equitable partnerships. The funding defined that we work with partners and distribute the funding to benefit researchers and research users in an LMIC country. However, our commitment to involving information stakeholders and users in developing ideas for effective use of language and images was inherently well-aligned with the notion of 'equitable partnership'. For communication in community pharmacies to be effective we needed to find out about how Rwandan pharmacies operated and how pharmacists worked: we wanted to gauge current levels of understanding amongst pharmacists about antibiotic resistance; we were keen to know how prescriptions were dispensed and what kind of interaction there was between pharmacists and their patients. We wanted to understand why people visit pharmacies and whether or not they expected to receive advice about their health. These issues underpinned co-design workshops with the expectation that researchers, project

partners and intended users worked together to consider ways of using community pharmacies to raise public awareness of antibiotic resistance.

Our academic project partner, the School of Pharmacy, University of Rwanda, provided information about perceptions of antimicrobial resistance in Rwanda and contributions to workshops, practical support through locations for workshops and advice and support for ethics, and ideas for project legacy including future collaborations. The CPA played a key role in the project through providing a summary overview of the extent of AMR awareness in Rwanda and neighboring countries in Africa (Tuck et al., 2018). RCPU was fundamental to the success of the work through engaging its member network to become involved in the workshops as co-researchers; and providing locations for and people to undertake the testing of materials in our pilot study. We worked with RCPU president, Flandrie Habyarimana, to organize a meeting with teachers, children and others in his home village.

3. The origins of Beat Bad Microbes

BBM derived from a previous cross-disciplinary project 'Information Design and Architecture in Persuasive Pharmacy Space: combating AMR' (IDAPPS) which considered how the socially inclusive and convenient environment of community pharmacies could be used to raise awareness of antimicrobial resistance and specifically misuse of antibiotics. IDAPPS brought together academics and practitioners in information design, architecture, behavioral psychology and pharmacy. The project affirmed the relevance of partnership working, co-design and prototype review as key ingredients in successful and innovative communication design (Walker et al., 2020).

One aim of the IDAPPS project was to draw attention to the role of design -- information design, user-centered design, architecture and interior design -- in communicating information about anti-microbial resistance in community pharmacies. We were aware that for many people involved in public health communication, design is something that is considered at the end of a project to make materials or products look good, or to align with particular brand guidelines (see Black & Stanbridge, 2012). We wanted to demonstrate that design can be a catalyst for innovative thinking – and the IDAPPS method included a competition (supported by a 2-day 'Ideas Lab') where cross-disciplinary teams worked to design ways to help people understand the threat of anti-microbial resistance. One outcome from the IDAPPS competition was an installation and materials for use in a community pharmacy in Reading, UK. Under the slogan 'Beat Bad Bugs', life-size characters – the 'persuaders' – offered a perspective on antibiotic usage. These messages were reinforced through leaflets, worksheets, and badges for distribution by pharmacy staff. Initial feedback to the prototype installation suggested that, with some adaptions, this

approach worked well to engage people with issues around AMR and antibiotic misuse. (Figure 1)

Figure 1. Prototype materials for 'Beat Bad Bugs' on display for user evaluation in a pharmacy in Reading, UK.

The 'Beat Bad Bugs' materials were seen by the CPA who thought this solution and way of working could be of value in their work in Africa. This stimulated discussion and led to a proposal for funding from Reading's GCRF allocation, introduced above. The research in Rwanda set out to:

- assess current initiatives/schemes and state of AMR and antimicrobial stewardship in Rwanda through interviews with pharmacists in Rwanda to identify factors unique to the Rwanda environment which can influence the delivery of AMR interventions;
- conduct co-design workshops (along the lines of the IDAPPS Ideas Lab) to develop approaches to the design of the materials for use in a Rwandan context;
- evaluate pharmacist, pharmacy worker and pharmacy visitor reactions to the materials developed in the workshops, using the qualitative measures used in the IDAPPS project.

4. Workshops: developing Beat Bad Bugs for Rwanda

The research comprised two user-centered, co-design workshops at the University of Rwanda, and a meeting with members of a local community. The aim of the workshops was first, to produce a design brief, and secondly, to gather feedback on prototype designs. Participants included pharmacists, pharmacy academics and business owners, CPA representatives, design and communication specialists and researchers. We used co-design methods to engage all participants.

The rationale for the workshops derived from the IDAPPS project in the UK. The evaluation of the Beat Bad Bugs installation in the Reading pharmacy suggested that many pharmacy users were 'passive' in relation to the display, responding only to parts of the intervention that they happened to encounter. Beyond reading the texts on some of the standing figures, there was little engagement with, for example, leaflets, badges and feedback forms. Many of the pharmacy users affirmed that clear action points in simple, straightforward language was important. This and other feedback reported by Walker et al., 2020, informed questions for consideration in the workshops in Rwanda, including:

- What kinds of intervention might gain attention in a Rwandan pharmacy setting?
- To what extent might life-size characters (as used in Beat Bad Bugs) resonate with Rwandan pharmacy users? If the response to this is favourable, what characters are likely to be relevant? What names, what appearance, what 'antibiotic message' should they carry?
- How much information in any one message can people take in? How do people perceive text presented as a) continuous text; b) list structures with bullets etc
- Should messages be explanatory or directive?
- How should characters (or other interventions) be positioned in pharmacy space? Is there typically a waiting area? Is this a good place to position material that needs to be read?
- How can related elements be drawn together (if that is relevant)?
- What is likely to be the baseline understanding of AMR, specifically antibiotic resistance?
- What other health-related campaigns are people aware of?
- Is it good/ helpful to have a name for a set of interventions? Does 'getting the message across' to individuals benefit from a campaign name, or do people respond better to a message they can relate to individually?

4.1. First workshop: producing a design brief

The prototype materials were developed in collaboration with pharmacists and pharmacy users at the first workshop. After being shown the outcomes of the IDAPPS project, small groups considered the kind of intervention that might work in pharmacies in Rwanda, the messages that could be usefully conveyed and how they might be expressed in words and pictures. Participants sketched and drew their ideas, which included ways in which antibiotic resistance might be explained, or images that might represent microbes. We used role play to anticipate pharmacist/patient interaction in a pharmacy. As with the IDAPPS work in the

UK, workshop participants visited pharmacies in Kigali to gain understanding of the environment in which the materials would be used. Working with a design consultancy, Design Science (who had also facilitated the first workshop in Rwanda), we produced first prototypes for the visual identity for the campaign and for a set of materials. Materials were drafted first in English, taking account of guidance on clear writing summarized in Kools (2012), and translated into Kinyarwanda by members of RCPU to ensure pharmacy practitioner accuracy in meaning. This work comprised:

Visual identity. Members of the first workshop wanted to take forward the Beat Bad Bugs identity from the IDAPPS project. It was thought to be distinctive, appropriate and would be highly visible among the visual clutter in Rwandan community pharmacies. (Figure 2)

Figure 2. Part of the visual identity for 'Beat Bad Bugs' as supported by participants at workshop 1 in Rwanda.

Antibiotic record card. An 'antibiotic record card' was proposed by workshop participants for patients to keep track of the antibiotics they take, and to help dispensing pharmacists (and/or prescribers) to be aware of the antibiotics a patient has taken in the past, and any reactions they may have had to particular antibiotics. (Figure 3)
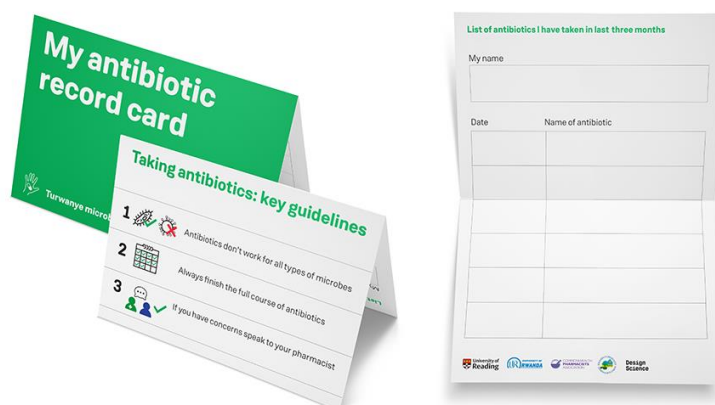
Figure 3. First iteration of the Antibiotic Record Card. 99 x 148 mm

Information about antibiotics. Influenced by the information cards from the IDAPPS project, a set of laminated cards was made. The set was divided into two. Blue-banded cards were to remind pharmacists about AMR including 'What is antibiotic resistance' and ' Antibiotics don't work for a virus'; and, for patients, green-banded cards to provide information about taking antibiotics: 'Do you need antibiotics?', 'Concerns about side effects', 'Completing the course' and 'Taking antibiotics with or without food'. (Figure 4)
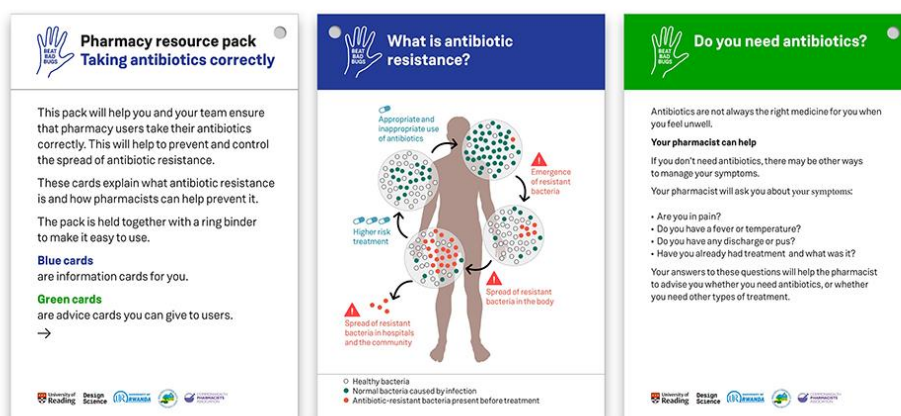

Figure 4. Examples from the pack of laminated information cards for use in community pharmacies in Rwanda. Blue-banded cards with information for pharmacists, green-banded cards with information for patients. 210 x 148 mm

4.2. Second workshop: feedback from stakeholders

The first set of materials was reviewed by pharmacists and members of the public as part of a second workshop in Rwanda, and by community members at a village meeting. Interest was high, the pharmacists commenting that this was the first time they had been part of a project where their views played a substantive role. They acknowledged that consideration of circumstances of use, and the needs of users were important components of design and that

they had the skills and expertise to contribute. A meeting with members of a local community in a village school affirmed the need for raising public awareness of AMR. As a result of feedback from both meetings:

- 'Beat Bad Bugs' became 'Beat Bad Microbes' because despite the alliterative appeal of the former, the word 'bugs' was not widely used in Rwanda. It was revealing to see how the word 'microbes' was used by adults and children alike by attendees at our village workshop, and affirmed the value of being aware of local terminology;
- the symbol of a hand and the colour green were thought by pharmacists and members of the public to be distinctive and appropriate; there was a suggestion that visual representation of some form of pill would enhance the message. The shape of the pill to be used was drawn and discussed in the workshop where it was agreed that a capsule shape was widely used for antibiotic dispersal in Rwanda;
- the antibiotic card stimulated much discussion and while thought to be a positive intervention, the A6 format was too big to store and handle. The purpose of the card was agreed to be: for patients, to keep track of the antibiotic they take; for dispensing pharmacists (and prescribers), to be aware of the antibiotics a patient has taken in the past, and any reactions they may have had to particular antibiotics;
- pharmacists thought that the set of laminated information cards was confusing to use but they agreed that the information for patients would be useful;
- it was agreed that having the materials available in Kinyarwanda and in English was essential to reach as wide and audience as possible. While Kinyarwanda is the first language, project partner RCPU advised that pharmacists used English professionally as well as being widely used in the community. There was also support for a French version (but no funding is available for this currently).

Taking account of this feedback, a revised set of materials in English and Kinyarwanda was produced by the research team.

Visual identity. The Beat Bad Bugs identity was revised to become Beat Bad Microbes and the device changed so that the open hand contains a pill capsule. Green continued to be used as the overall campaign color, with blue used to differentiate pharmacist-facing information as appropriate. (Figure 5)
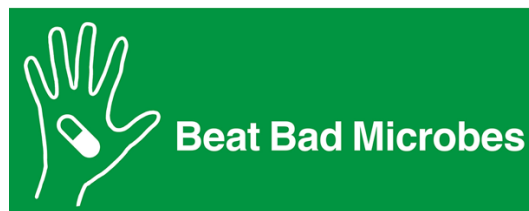
Figure 5. Device for 'Beat Bad Microbes' modified from 'Beat Bad Bugs' taking account of feedback from Rwandan users.

Antibiotic record card. Workshop discussions confirmed that the antibiotic record card was the key component of Beat Bad Microbes. The participants proposed what should be recorded on the cards (for adults):

Information about the card holder

- Name
- ID
- Have you taken antibiotics in the last 3 months?
- Are you pregnant?
- Are you breast feeding?
- How old are you?
- Are you allergic to any medicines? If yes, write down what they are or tell your pharmacist
- Pharmacy contact details
- Doctor contact details

Information about each 'antibiotic encounter'

- Date
- Condition
- Name and brand of antibiotic
- Did you have any side effects?
- How long did it take you to feel better?
- Did you complete the course?

The antibiotic record card was redesigned in a smaller format that would be easy to carry around. In the card, a short text and an illustration were developed to explain the purpose of the card and to provide context for the reader. Color was used to distinguish the information to be filled-in by pharmacists (in blue), and by patients (in green). (Figure 6)
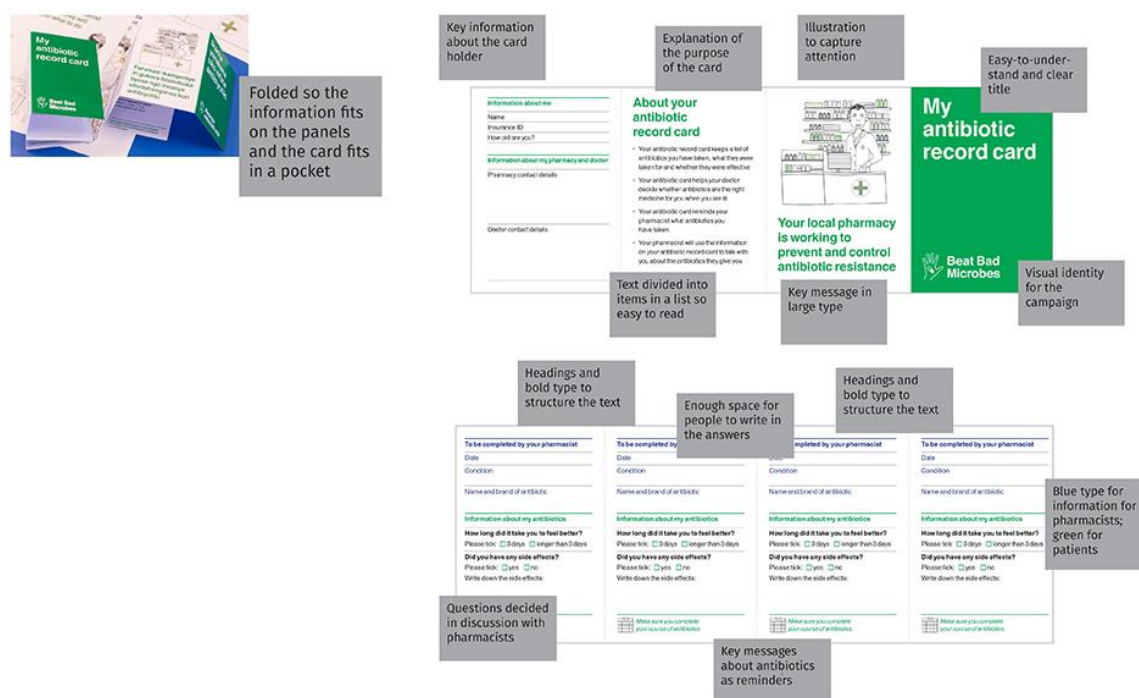

Figure 6. The antibiotic record card redesigned in a smaller format, with new content. Show here with labels used to explain to workshop participants the design decisions taken to make the information clear and accessible. Folded size 105 x 94 mm

Information cards. To replace the set of laminated cards and in discussion with pharmacists, we identified four topics for information cards to be handed out by pharmacists to patients: 'Completing your antibiotic course', 'Do you need antibiotics?', 'Concerns about side effects' and 'Taking antibiotics with or without food'. These were designed as one-third A4 cards, with English on one side, and Kinyarwanda on the other. (Figure 7)
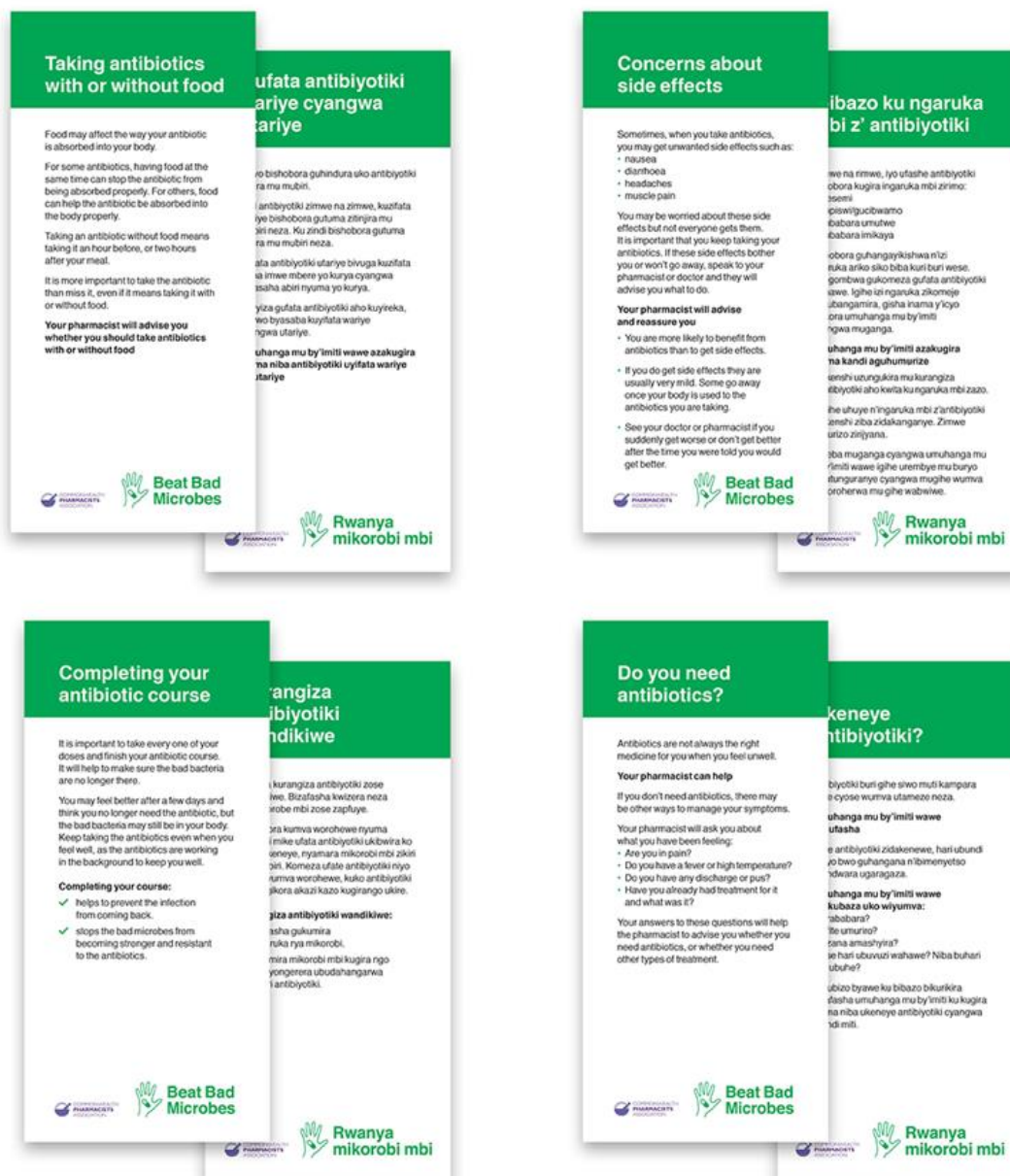
Figure 7. Information leaflets for patients with English on one side and Kinyarwanda on the other. 210 x 99 mm

Set of posters. At the request of workshop participants, keen to promote BBM, a series of posters with key messages was introduced to the campaign. As part of the discussion at the workshop, participants were shown a range of illustrative styles: photographs, schematic images and drawings. A style of drawing used in one of the IDAPPS winning entries, Good Bugs, Bad Bugs, was picked out by the workshop participants as being appropriate in terms of level of formality and visual interest. As a result, a set of illustrations was commissioned and the illustrator was asked to work from a series of photographs supplied by RCPU to ensure authenticity in people's appearance and dress, and context of use. The posters had

messages for pharmacists: 'Your pharmacist can advise you about whether you need antibiotics or not'; 'Your pharmacists will advise whether you should take antibiotics with or without food' and 'Pharmacists in Rwanda are working to prevent and control antibiotic resistance'; and for patients, 'Make sure you complete your course of antibiotics; 'If side effects bother you or won't go away, speak to your pharmacist or doctor and they will advise you what to do'. The posters were designed in A4 format, and as with the information cards, has Kinyarwanda on one side and English on the other. (Figure 8)
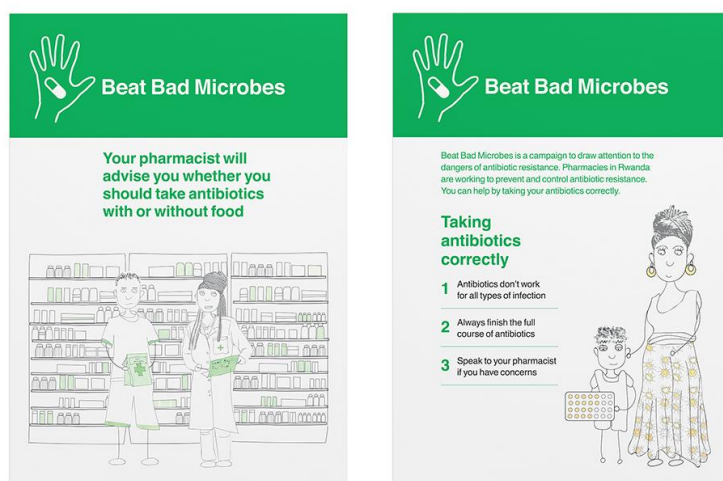

Figure 8. Two of the series of posters. English on one side, Kinyarwanda on the other. 297 x 210 mm

Information for pharmacists. To accompany the antibiotic record card, the information cards and the posters, an 'Information for pharmacists' leaflet explained the purpose of these materials and how to use them. It also contained a clear explanation, 'What is antibiotic resistance? for pharmacists to share with their patients.

All the materials were included in a pack (Figure 9) for distribution by RCPU to 20 pharmacies in Kigali for user evaluation. To support their conversations, each pilot pharmacy was provided with 280 antibiotic record cards and 560 information leaflets. The pharmacists were briefed through an introductory video that explained what the materials were for and how the data should be captured. Pharmacists were asked to record via a simple tally the number of antibiotic prescriptions they issued each day of the 10-day pilot study. They were asked to record the length of time they spent speaking with patients about antibiotics: less that 5 minutes; between 5 and 10 minutes; and more than 10 minutes. The pharmacists were also asked for feedback about their experience of using the materials.

Fourteen of the 20 pharmacies took part in the pilot study. Three pharmacies used all the record cards they had been given, and on average 65% of the antibiotic record cards were used during the pilot, and 74% of the information leaflets. This usage suggests that the materials made a significant contribution to the conversation to raise awareness of AMR. All the pharmacists agreed that it was helpful to have materials about antibiotics to give to customers. Eleven out of 14 pharmacies found that more than half the time it was easy to have a conversation about AMR with their patients. Thirteen participants said that they discussed AMR during the pilot more than they usually did.
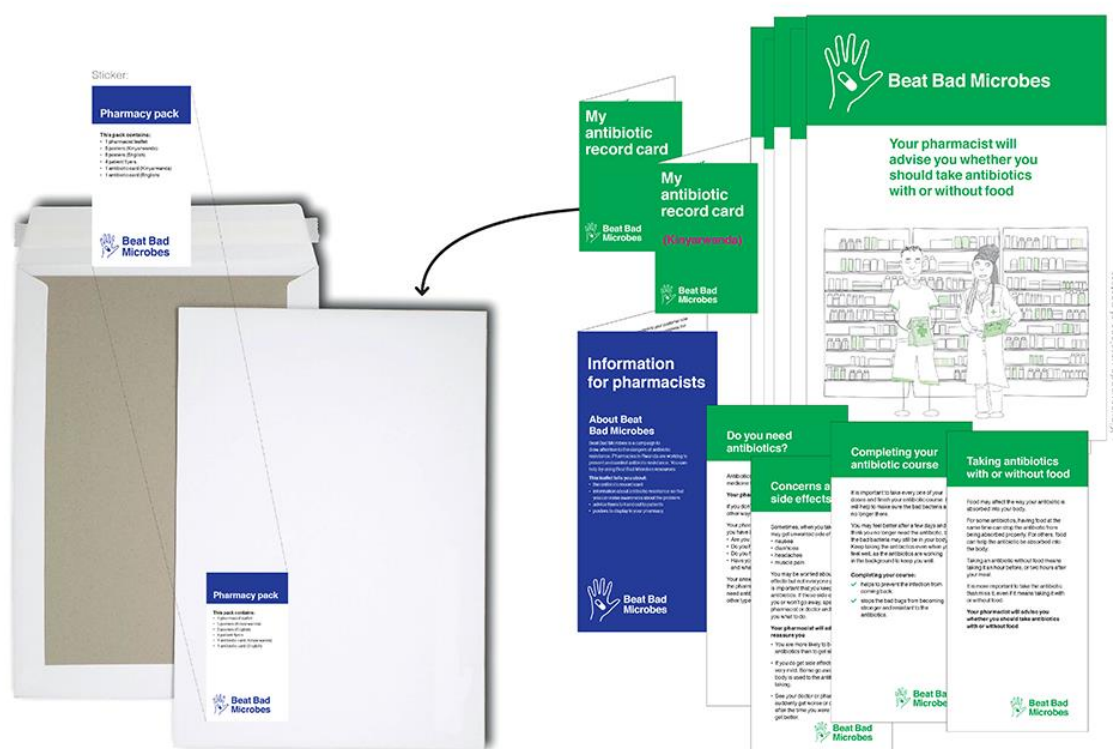

Figure 9. Components of the pack of materials for evaluation for distribution to pharmacies in Kigali.

The materials were praised by pharmacists as a way of starting conversations about antibiotic resistance. They welcomed time efficiencies by being able to convey messages about using antibiotics through clearly presented cards that fitted inside prescription bags. One pharmacist remarked: "All pharmacies should get these cards so that more patients can get them" and "I did realize that most of my clients are interested in respecting the instructions we gave after being aware of the effect of not taking antibiotics correctly. I would recommend this pilot to be expanded to up country pharmacies where there is also a large number of people who lack information about effective use of antibiotics." Feedback from RCPU was that their involvement in BBM has raised the status of community pharmacists

and that it helped to "empower our members and pharmacy professionals to provide our clients (patients) high-quality service and keep antibiotics working."

The success of the pilot led to requests by CPA and RCPU for more widespread distribution in Rwanda and in other CPA membership countries. This introduced another design challenge. The pilot materials had been professionally printed in the UK and had been designed to take advantage of, for example, ability to bleed off color at the edges of the paper or card. The printing had been funded as part of the research project, with recognition that sources of funding would need to be found for future production. Given that we could not assume that any professional printing would be funded to enable widespread use in Rwanda, we produced a new set of BBM materials for printing on desktop printers and assumed that paper (rather than card) would be used. This was done in consultation with pharmacists most of whom said they had access to a desktop printer. To keep costs low, therefore, the antibiotic card was revised to fit on one side of A4 (with no bleed) so it could be folded as a 'two sheets of paper thick' object that same size as the original; the information cards were designed to fit on A4 sheets concertina folded. Step-by-step instructions for printing and folding the antibiotic record card and patient information cards were included (Figure 10). These revised materials were made available via the CPA website, and RCPU also used their website and an instructional webinar for dissemination.
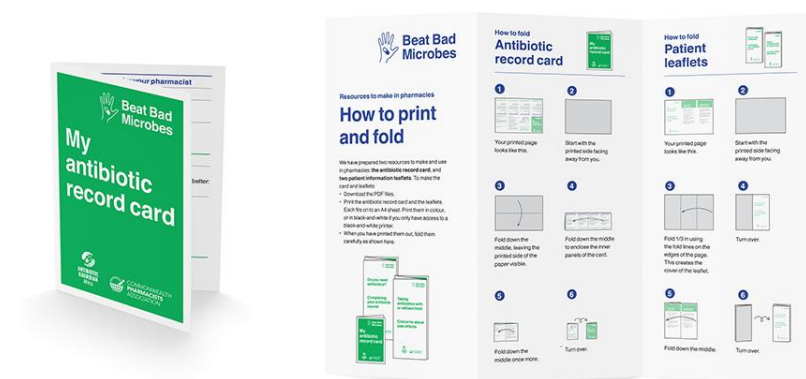

Figure 10. The antibiotic card designed for printing on a desktop printer and instructions for folding.

5. Challenges, benefits and opportunities

The project brought operational challenges that might be expected, such as distribution of funding, and timeliness of producing funder requirements such as Memoranda of Understanding. There were unanticipated expectations, such as that of pharmacists collaborating in the project workshops wanting a certificate from the University of Reading to affirm their attendance, of the Rwandan researchers that funding would continue beyond

the end of the project, and of the UK team that it would be straightforward to send funding and print research materials to Rwanda.

However, such challenges were far outweighed by the mutual benefits of collaboration across disciplines and international borders. The value of participatory design (or co-design) in relation to health communication has been well-evidenced in the information design literature (e.g. Zender et al., 2017; Black et al., 2017; Waller & VandenBerg, 2017), as well as in design for health more broadly (see Donetto et al., 2015). In this project, our partners CPA and RCPU had never been engaged in the process of designing -- or indeed thought that they were relevant to it. To realize that design is about solving a problem without a predetermined outcome was a revelation -- the more so because they became aware of the value and power of design to enable action, and to work towards solutions that are relevant for stakeholders and users. A positive outcome of the kind of partnership working in this project was that those with no experience of design process or practice were convinced of the value of designing, of what design could do, and ambition to make a difference.

However, one of the project challenges was eliciting feedback. While the pharmacists in our pilot were keen to use the materials, only 14/20 pharmacies responded to our questionnaire despite written and video protocols. In future work, therefore, we will be mindful of the need to explain the importance and relevance of feedback. More informal feedback, such as comments from workshop participants and project team members was easier to capture.

For the BBM materials, the design brief was compiled in the participatory design workshops. In the workshops, stakeholders worked with the research team to determine the messages and modes of information about AMR and its distribution and use in community pharmacies. Our non-design colleagues contributed to the work in many ways. An early decision was to produce material in single language rather than dual-language form for reasons of clarity and ease of use, and translation from English to Kinyarwanda was undertaken by pharmacists. The illustrator (drawing was preferred to photographs or schematic images after discussions in a workshop) worked from source material collated by attendees at one of the workshops in Rwanda. The design brief was taken by professional designers and transformed into materials/artefacts taking account of production and distribution issues, and the application of research-informed practice with regard to legibility and structure of information. We were therefore able to introduce non-designers to the details of visual organization that contribute to ease of reading, such as use of headings and lists to structure the text, typographic differentiation of key messages, and use of color to differentiate information for different kinds of use by identifying these in relation to the antibiotic record card. We used the workshops and discussions about the materials to draw

attention to usefulness of list structures, of highlighting key messages, easy-to-understand headings and other features as shown, for example, in the antibiotic record card illustrated in Figure 6.

In this project, design practice and design research were inter-related. Designing the artefacts was iterative, demonstrated by the different versions shown in this paper through changes in wording (as 'microbes' instead of 'bugs'), and in the format and folding of the materials. The project also highlighted that compromise to optimal visual quality is sometime necessary to ensure that important messages reach as large an audience as possible. The version of the antibiotic record card for widespread distribution (via CPA and RCPU website) was redesigned with a surrounding white border (for ease of printing) which is arguably less visually strong than the version bled off on all sides. However, such pragmatic solutions can secure user-engagement that might not otherwise occur. To ensure wide dissemination of this resource, it was important to have a version that could be printed on a home printer, with instructions for folding the paper so that it could function in the way that the original printed card did.

Moving forward, colleagues in Rwanda and other LMICs are keen to continue the work and to extend the approach to other health concerns. They are keen for advice both on design process and on the 'look and feel' of artefacts. There has been mention of 'toolkits', 'guidelines' and 'templates', and we are still considering an appropriate way forward. We are more inclined towards principles (e.g. Lentz et al., 2014) rather than detailed recommendations (e.g. Lonsdale et al., 2019), but a key message will be to engage with all stakeholders and users, involve designers at the beginning of any communication project, and consider carefully how to act on any feedback. As information designers we would not be inclined to compromise on clarity of language and legibility, but we recognize that less than optimal solutions may be necessary to make sure access to information is as wide as possible.

One next step for any successful pilot project is to think about ways of upscaling. To this end we have worked with the CPA, which has made the downloadable BBM materials available on its website. In Rwanda, we have had interest from pharmaceutical wholesale distributors in sponsoring printing; and given the widespread use of mobile phones in Rwanda, and in response to feedback, we are considering an on-line version of the antibiotic record card, and subject to the availability of screens in pharmacies, a video of key messages about antibiotics, using the BBM 'brand'.

An unexpected BBM legacy has been continued cross-disciplinary collaboration between the members of the project team. Project partner Design Science subsequently collaborated with a bio-medical scientist (workshop attendee) on an Innovate UK funded project in India, 'Milk Guard' (https://milk-guard.com/) to help treat mastitis and reduce AMR in cows and buffalo. Design-led collaboration between IDAPPS team members (bio-

science and information design) has stimulated a new project about instructional text for COVID home- and community- testing kits, recently funded by the UK Research and Innovation (see https://research.reading.ac.uk/design-research-for-testing-diagnostics).

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