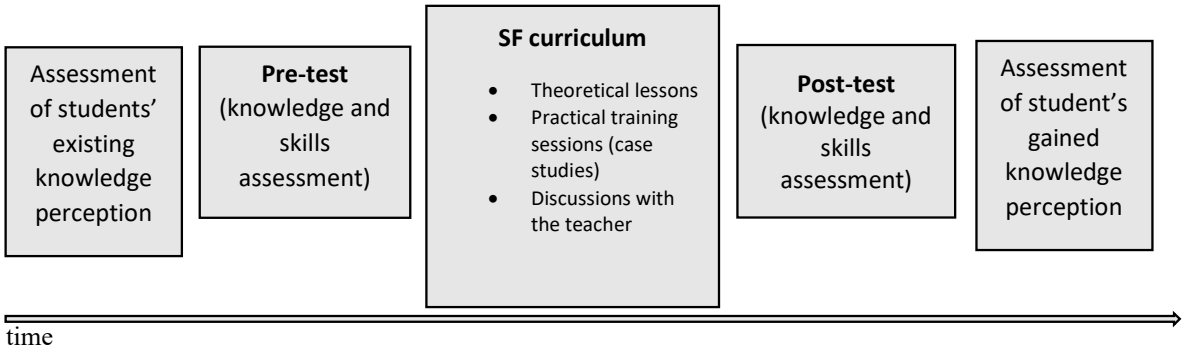
SUPPLEMENTARY APPENDIX

Visualization of the timeline of the methodology

Figure 1. Visualization of the timeline of the methodology



Prior knowledge of SF products, self-assessed by students

A total number of 246 students filled out this open question (Cameroon n=51, Senegal n=167, Tanzania n=28, response rate 69.3% from 355 total participants) to describe their prior knowledge of SF medical products. There were no students who completed only part of the assessment, the assessment was either fully completed or not completed. A total number of 36 students (14.6% from total of 246 students who filled out the open question in the survey) indicated no previous knowledge (Cameroon n=18, Senegal n=13, Tanzania n=5). If any knowledge was indicated, students (n=144, 58.5% from total of 246 students who filled out the open question in the survey) in all three countries indicated that they mostly had some prior knowledge of the general aspects about SF medical products (Cameroon n=24, Senegal n=102, Tanzania n=18). No students in Cameroon and Tanzania indicated any prior knowledge about identification of medical products most at risk being falsified (module B), reporting SF medical products (module E) and counseling of patients exposed to falsified medical products (module F). The latter two were similar in Senegal, with no student indicating prior knowledge in these.

Pre-test: The distribution of the coded answers is presented in Table 1 and Figure 2.

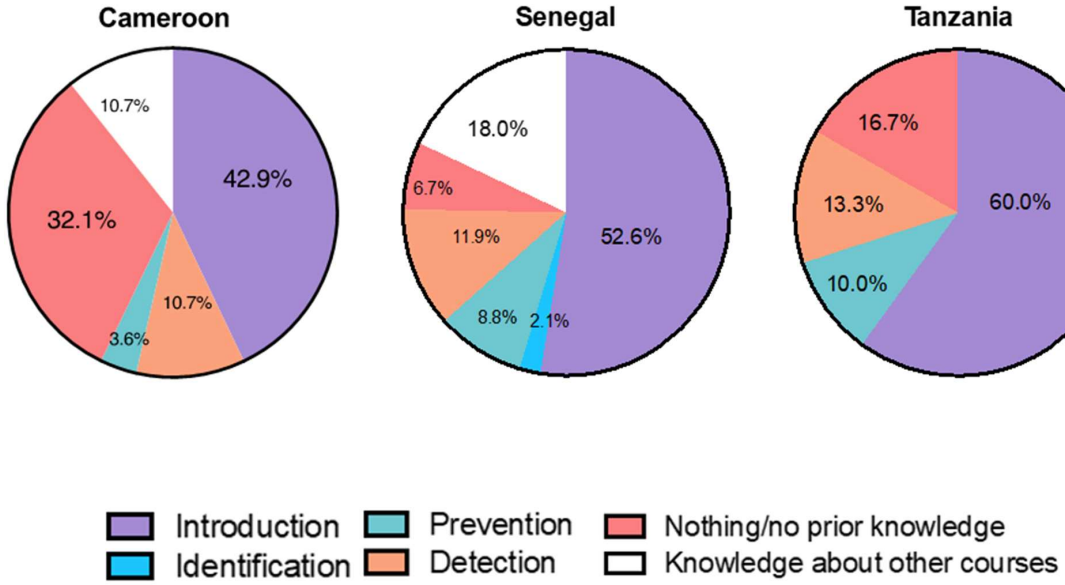
Table 1. Distribution of coded responses to the question about prior knowledge of SF medication as self-assessed by students, stratified by country

	Percentage (%) of responses		
	Cameroon	**Senegal**	**Tanzania**
Introducing the problem /general information about SF medical products (module A)	42.9	52.6	60.0

Identification (module B)	0.0	2.1	0.0
Prevention (module C)	3.6	8.8	10.0
Detection (module D)	10.7	11.9	13.3
Report (module E)	0.0	0.0	0.0
Advisement (module F)	0.0	0.0	0.0
Nothing/no prior knowledge	32.1	6.7	16.7
Knowledge about other courses	10.7	18.0	0.0

Caption: The sum of the percentages as presented may not be 100 due to rounding.

Figure 2. Distribution of coded responses (%) on question about prior knowledge among students from Cameroon, Senegal and Tanzania



The number of responses is higher compared to the number of students who completed this open question, because multiple modules (i.e., codes) could correlate to the given answer.

Areas of improvement: self-assessment

A total number of 281 students (response rate 79.2% from total of 355 participants) answered the question on self-assessment per module (Cameroon: $n_{students}$=8, $n_{responses}$=36; Senegal $n_{students}$=215, $n_{responses}$=998; Tanzania $n_{students}$=57, $n_{responses}$=291). Students overall declared a similar improvement in all modules, approximately around 20% per module.

Specifically, students from Senegal indicated that they improved the most in module A ($n_{responses}$=197; 19.7% out of 998), which gives a general introduction to SF medical products. The students indicated that they improved the least in module F ($n_{responses}$=111; 11.1% out of 998), which is about interventions after encountering SF medical products.

In Cameroon, a different distribution was observed, with students reporting an equal amount of knowledge improvement related to the content of modules A, B and C ($n_{responses}$=8; 22.2% each out of 36). For module D, E and F students reported less knowledge improvement ($n_{responses}$=6; 16.7%, $n_{responses}$=2; 5.6% and $n_{responses}$=4; 11.1%, respectively, thus, n responses divided over total of 36 responses).

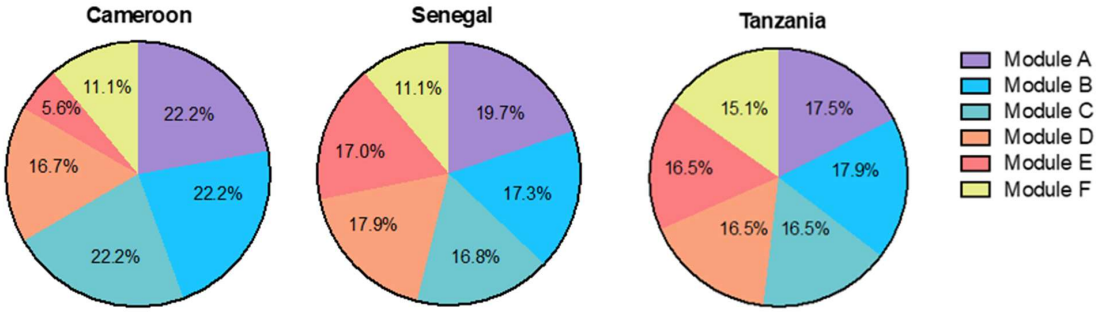
In Tanzania, students indicated that they improved the most in module B ($n_{responses}$=52; 17.9% out of 291), which is about identification of medical products at risk. Comparable to the results in Senegal, the students from Tanzanian students self-assessed that they improved the least in module F ($n_{responses}$=44; 15.1% out of 291). Table 2 and Figure 3 summarizes the distribution.

Table 2. Distribution of responses to the question about gained knowledge of SF medical products as self-assessed by students, stratified by country

	Percentage (%) of responses		
	Cameroon	**Senegal**	**Tanzania**
Introducing the problem of SF medical products/general information (module A)	22.2	19.7	17.5
Identification (module B)	22.2	17.3	17.9
Prevention (module C)	22.2	16.8	16.5
Detection (module D)	16.7	17.9	16.5
Report (module E)	5.6	17.0	16.5
Advisement (module F)	11.1	11.1	15.1

Caption: The sum of the percentages as presented may not be 100 due to rounding.

Figure 3. Distribution of responses to the question about gained knowledge of SF medical products as self-assessed by students, stratified by country



The assessment questionnaire

The assessment questionnaire can be requested by contacting the corresponding author on confidential basis. Given the programme is ongoing in other African universities, it is important that students who may read the published article are not aware in advance of the questions they will be asked.

The list of open-ended questions used in the semi-structured interview

The following open-ended questions were used for the semi-structured interview and shared with the teachers beforehand in the interview guide:

Question 1 – Preparation
Were you adequately prepared for the teaching of the course (1) and what feedback would you give for improvement of the preparation? (2)
What tools were helpful in your teaching preparation?
- Was the Train the Trainers useful in your preparation?
- Was the Curriculum Guide useful in your preparation?
- Was the Competency Framework useful in your preparation?
- Was the Moodle platform useful in your preparation?

Question 2 – Time investment
How long did the course last?
- Did you think this was enough time to properly teach all the modules?
- If not, which modules/parts needed more time?

Question 3 - Time path course
Have you been able to complete the entire course (in accordance with the predefined learning objectives)?
- What modules (Modules A-F) did you deliver?
- If not, what were the reasons for this? Which parts have been excluded and which considerations played a role in this?

Question 4 – Obligations
Was it a compulsory course or an elective course for the students?
- Are the modules of the course part of another course or was it a stand-alone course?
- Was there an attendance requirement for the students? If not, can you indicate something about the degree of presence (compared to other (obligatory) courses)?

Question 5 – Quality of the course
What feedback would you give for improvement of the course?
Do you think there are any differences in the quality of the SF medicines course compared to other (longer existing) Pharmacy courses?
- Is the course set up in a similar way to other Pharmacy courses (teaching methods used, teaching material used, class size, level of difficulty etc.)?
- Do you think the students experienced the teaching material as challenging (enough)?

Question 6 – Motivation among students
Do you think that the students were motivated for the course?
- What impression did the student have on you?
- What do you think can help students to become more motivated to take the course (1) and to complete the assessment (2)?

Question 7 – Limitations
Did you lack any materials, support or knowledge in the implementation of the course (1) or during the evaluation phase (2) (when students took the assessment survey)?

Question 8 – Completion of the course
How is the course completed?
- In case of a compulsory final exam, what form of testing was used? Can the teachers share some information about average mark and/or pass percentage?
- In case of a compulsory final exam, did the teacher think the students were good enough informed about the learning objectives of the course?
- In other cases, why did the university choose not to have a compulsory final exam for this course?

Question 9 – Unforeseen circumstances
Are there any specific circumstances that may have influenced the education and/or implementation of the course?
- How does the COVID-19 situation influence student activities at your university?
- Any political, economic, social developments in the region?
- Any technical issues (Internet connection, face-to-face access to University, etc.)

Question 10 – Future perspectives
Would you recommend the course to other universities/countries around the globe?
- What tip/advice would you give other universities/teachers if they also strive for a successful implementation of the SF medicine curriculum?

Structured authors' reflexivity statement

Given this research was conducted from international partnerships, a structured authors' reflexivity statement summarizes the measures authors put in place in their efforts to promote equitable authorship in this publication.

Table 3: Structured authors' reflexivity statement

Study conceptualisation	**1. How does this study address local research and policy priorities?** The main objective of this study was to assess the change in knowledge regarding substandard and falsified (SF) medical products as understood by undergraduate pharmacy students. The paper focuses on the course delivered in three selected pilot pharmacy schools in Sub-Saharan Africa (Cameroon, Senegal and Tanzania). This topic is of great importance in these countries given it is a major public health issue. **2. How were local researchers involved in study design?**

	The protocol for the study design was developed in collaboration with local university teachers / professors (from LMIC) who were responsible for the deployment of the courses in their universities. Multiple meetings were held to discuss the design of the content, progress of the course, and status of the research project.
Research management	**3. How has funding been used to support the local research team(s)?** The local researchers from LMIC were the same university teachers who helped to design and implement the course. They are also staff members receiving salary from their universities. The funding benefitted them by providing them with material to use in their daily practice (e.g., the guide for teachers). The funding was invested to build their capacity and deployment capability (e.g., though Train-the-Trainer course).
Data acquisition and analysis	**4. How are research staff who conducted data collection acknowledged?** These are all co-authors of the paper that resulted from the research and are acknowledged in the curriculum guide that was developed to also implement the course. **5. How have members of the research partnership been provided with access to study data?** Involved local university teachers from LMIC are all experts within the field of SF medical products and those responsible within their respective universities for the deployment of the course within the pharmacy curriculum. They have been involved in conceptualising the study, collecting the data, evaluating the results and reviewing multiple versions of the manuscript. The research team relied heavily on their interpretation of the data and providing the context to the results. All local university teachers were included as co-authors in the manuscript. For ethical reasons and protection of personal information, the pooled study data was only accessible to the core team.

	6. How were data used to develop analytical skills within the partnership? The local university teachers from LMIC were involved in conceptualising the study and provided input at different stages. The data analysis was done by the first and the second author with supervision and help of senior university professors. A statistician was onboarded to ensure correct performance of the analysis. Results were presented to all co-authors and critically discussed and reviewed.
Data interpretation	**7. How have research partners collaborated in interpreting study data?** Results were reviewed by all co-authors and interpretation of the results was done using the local context, with valuable input from the local university teachers.
Drafting and revising for intellectual content	**8. How were research partners supported to develop writing skills?** The first author drafted the paper, and it was critically reviewed by all co-authors in multiple rounds. **9. How will research products be shared to address local needs?** Results from this study will be used to improve subsequent editions of the course within the universities and serve as guide for other universities to "adapt and adopt" for implementation. The programme is intended to run continuously in the future.
Authorship	**10. How is the leadership, contribution and ownership of this work by LMIC researchers recognised within the authorship?** Involved university teachers from LMIC are all experts within the field of SF medical products and those responsible within their respective universities for the deployment of the course within the pharmacy curriculum. They have been involved in

	conceptualizing the study, collecting the data, evaluating the results and reviewing multiple versions of the manuscript. The team relied heavily on their interpretation of the data and providing the context to the results. All researchers were included as co-authors in the manuscript. **11. How have early career researchers across the partnership been included within the authorship team?** The first and the second author of this paper are early career researchers, a PhD student and a master student respectively. **12. How has gender balance been addressed within the authorship?** There is an ensured gender balance with co-authors being both female and male, with majority of females (7 out of total 9 co-authors).
Training	**13. How has the project contributed to training of LMIC researchers?** This project trained the involved LMIC teachers in educational research, which provides evidence of the impact of new courses within the pharmacy curriculum. Scientific advice on educational research was obtained from a well-known expert at Utrecht University who was acknowledged in the relevant section of the paper. It should be noted that in the context of this project, the research partners based in LMIC gave guidance to the authors of this paper (i.e. researcher training was bi-directional) in particular to help adapt, contextualise, and interpret several elements.
Infrastructure	**14. How has the project contributed to improvements in local infrastructure?** The project demonstrated the need for specific demonstration equipment in universities - especially for the module on detection, and namely screening devices. This research and publication will be used as evidence for WHO and other partners to supply field screening devices to the pilot universities, so that the students can

	apply the theoretical knowledge and practice with adequate equipment.
Governance	**15. What safeguarding procedures were used to protect local study participants and researchers?** Study participants are students and evaluations are expected as part of the curriculum as for any course. Ethical advice was sought at Utrecht University. Informed consent was given by study participants and data are presented anonymously were possible. No personal data was used in the research and participants were able to withdraw their participation at any point in time.