MEDICINE QUALITY & PUBLIC HEALTH 2018

ABSTRACT BOOK

Medicine Quality & Public Health Conference

23-28 September 2018

IDDO INFECTIOUS DISEASES DATA OBSERVATORY

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NUFFIELD DEPARTMENT of MEDICINE

UNIVERSITY OF OXFORD

Monday 24th September		
08:00-08:30	Poster, display & exhibition set up – open throughout the conference, until Thursday evening	
08:30-10:30	**Opening** - Professor Louise Richardson, Ms Agnes Sitta Kijo, Dr Suzanne Hill, Professor Moji Christianah Adeyeye, Professor Sir Nicholas White	
10:30-11:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
11:00-13:00	**Prevent, detect, respond – WHO** : Chair = Raffaella Ravinetto	
11:00-11:40	*Review – World Health Organisation* – Michael Deats	WHO will discuss their mandate and role in tackling substandard and falsified (SF) medical products from both a political and technical perspective. Specific focus will be placed on the role and evolution of the Member State Mechanism on SF medical products, its prioritized activities and significant outputs including the agreement on definitions of SF medical products and the recent study on the public health and socio economic impact of SF medical products. The publication has stimulated political interest in the issue and further research. The presentation will then shift to the technical work of WHO including the establishment of the Global Surveillance and Monitoring System (GSMS) on SF. Over 150 Member States medicine regulatory authorities are trained in the use of the system which receives reports, provides technical assistance in emergencies and issues alerts where appropriate. With 200O SF medical products reported to the system a significant body of validated evidence is being accumulated to inform policy and investment. The recently published report of the first 4 years work of the GSMS will be discussed which sets out the causes, consequences and solutions to addressing SF medical products through a strategy of prevention, detection and response. A number of projects are underway to improve and simplify reporting, strengthen regulatory capacity, raise awareness, implement educational programmes, improve data collection and analysis and a 4 year programme of medicine quality surveys in 24 Countries in relation to antibiotics, anti malarials and maternal health products. Finally a look at the next 5 years, the emerging threats and challenges faced by Member States and the urgent need for political will to ensure the quality of medical products and safeguarding of public health.
11:40-12:00	Moji Christianah Adeyeye *'Universal Health Coverage (UHC): Access and Good Quality Medicines'*	The development of any nation is dependent on the health of its populace and Universal Health Coverage (UHC) is very important towards achieving this. This is a continual process and has its challenges. Every country needs to identify its challenges in this regard and put in mechanisms to reduce the gaps in furtherance if it's quest to attainment of UHC. In doing this, the existing Healthcare system needs to be taken into account and targeted and tailored initiatives undertaken to support reform in relevant areas. Countries need to facilitate UHC through effective and strengthened regulation. There is a need to ensure Regulatory System Strengthening in all its ramifications to ensure sustainable and effective regulatory mechanisms to support access quality medicines that are safe and effective. The National Agency for Food and Drug Administration

		and Control (NAFDAC) has the mandate to safeguard the health of the nation, and by extension ensure Universal Health Coverage in the aspect of access to quality, safe and efficacious medicines. The Agency has a regulatory framework in place as well as policies and regulations to aid and support the execution of this critical mandate. These policies and regulations are in the aspect of rational use of medicines, local production, ensuring integrity in supply chain distribution, lifesaving commodities, inspections, dossier evaluations, collaborations and pharmacovigilance and post-marketing surveillance. The paper will highlight and expand on how the Universal Health Coverage can be facilitated through regulatory policies and reforms that have been put in place in Nigeria while proffering some insights into policy changes and shifts that can further enhance the attainment of UHC.
12:00-13:00	Panel/Audience discussion [above, plus Souly Phanouvong, Nicholas White, Suzanne Hill & Agnes Sitta Kijo]	
13:00-14:00	Poster set up & Lunch – Keble Hall	
14:00-15:30	**Epidemiology:** Chair = Agnes Sitta Kijo	
14:00-14:15	Andria Mousa *'The burden of antimalarial failure in Africa: evidence from household surveys'*	Despite recent scale-up of malaria control interventions such as provision of nets, access to artemisinin combination therapy (ACT) in Africa remains low. Antimalarial treatment failure can result in progression to severe disease or death and is due to several reasons including poor drug absorption, use of substandard or counterfeit drugs, non-adherence, or drug resistance. The latter is a particular problem when older drugs such as sulphadoxine-pyrimethamine (SP) are still used. Data on use of ACT, SP, chloroquine and quinine in 37,826 children under five were obtained from Malaria Indicator Surveys (MIS) and Demographic and Health Surveys (DHS) from 22 African countries in which both rapid diagnostic tests (RDT) and microscopy had been performed. We assumed that a positive RDT indicated a recent infection with *P. falciparum*. An efficacy estimate was calculated for each drug, defined as parasite clearance by microscopy. The overall crude weighted clearance rate was 36.8% for chloroquine, 43.2% for SP, 46.1% for quinine and 60.3% for ACT, but country-specific rates varied significantly. The estimate for ACT was significantly lower than that observed in clinical trials. In the DHS/MIS, 15% of those taking ACT did not adhere to treatment guidelines. Country-specific estimates of the proportion of poor quality drugs in private sectors were applied, which accounted for 16.2 % of failures. A further 5% of failures is expected to stem from incorrect treatment recall. This study relies on self-reported data and it is difficult to estimate the extent to which incorrect recall influences efficacy estimates. Ongoing work aims to explore efficacy of drugs distributed by different sectors (public vs. private) and further quantify the proportion of treatment failure which is due to drug resistance, re-infection and other causes, and to obtain a burden estimate across Africa. Our analysis highlights that the efficacy of antimalarials used in the community in Africa appears low, and particularly for ACTs it is lower than expected. The reasons for this need to be further explored.

14:15-14:30	Simon Schaefermann & Lutz Heide *'Quality of medicines in southern Togo: Investigation of antibiotics and of medicines for non-communicable diseases from pharmacies and informal vendors'*	In this study, 12 essential medicines, including antibiotics, antidiabetics, cardiac drugs and antiasthmatic drugs, were collected from six informal vendors and six licensed pharmacies in the southern part of Togo (regions Maritime and Plateaux). A mystery shopper approach was used in both types of outlets. In total, 60 samples were collected from licensed pharmacies and 34 from informal vendors. Both availability of medicines and prices of medicines were higher in licensed pharmacies than in informal vendors. 92 medicine samples were analyzed by visual examination, followed by chemical analysis for the content and for the dissolution of the active pharmaceutical ingredients according to the respective monographs of the United States Pharmacopoeia. 7 samples (8%) did not comply with the pharmacopoeial specifications, and one (1%) showed even extreme deviations. Medicines stated to originate from Asia (i.e. mainly from India and China) showed a significantly higher proportion (24%) of non-compliant samples, than those from Africa and Europe (4%, p=0.007). Higher failure rates were observed in medicines from informal vendors (13%) than from licensed pharmacies (5%), but the difference between both groups was not statistically significant due to the small sample size (p=0.152). Testing of selected samples for related substances indicated that inappropriate transport and storage conditions may have been an important cause for substandard quality. However, one sample labeled as amoxicillin capsules 500 mg contained only 47% of the declared content, with a low standard deviation in between individual capsules. This indicated that this sample represented 250mg amoxicillin capsules, commonly used in pediatrics, instead of 500mg capsules as declared on the label.
14:30-14:45	Mohammad Sofiqur Rahman *'The Health Consequences of Falsified Medicines: A Study of the Published Literature*	It is generally agreed that falsified medicines pose a serious public health problem, but there is little quantitative or qualitative information about the extent of their impact on people's health. We searched PubMed for articles dealing with the health cost of falsified medicines, focusing on their consequences for mortality and morbidity, as well as the scale of the issue, the geographic extent, the medicines affected, and the harm caused, using preoptimized keywords "(counterfeit OR fake OR bogus OR falsified OR spurious) AND (medicine OR drug)". Searches up to February 2017 yielded 2006 hits, of which 1791 were full-length articles in English. Among them, we found 81 papers that qualitatively or quantitatively described 48 incidents in which falsified medicines caused patients to suffer serious adverse effects, injury, symptoms or death. The distribution of incidents were examined according to the economic status of the countries involved, regional location in the world, therapeutic category of the medicines, number of incidents by year, number of victims by year, and characteristics of the falsified medicines. Among the 48 reported incidents, 27 (56.3%) occurred in developing countries and 21 (43.7%) in developed countries. These incidents involved a total of 7200 casualties including 3604 deaths (death rate 50.1%). The results indicate that all types of medications

		have been targeted for falsification, and falsified medicines have had a serious impact on the health of both adults and children worldwide, with similar numbers of incidents in developing and developed countries.
14:45-15:00	Marie Antignac *'First quality evaluation of cardiac drugs in Africa: the multination SEVEN study'*	The growing menace of poor quality and falsified drugs constitutes a major hazard, compromising healthcare and patient outcomes. Efforts to assess drug standards worldwide have almost exclusively focused on anti-microbial drugs; with no study to date on cardiovascular drugs. Our study aims to assess quality of seven routinely used cardiovascular medications (anticoagulants, antihypertensives and statins) in ten Sub-Saharan African countries. Drugs were prospectively collected using standardized methods between 2012 and 2014 from licensed (random pharmacies) and unlicensed (street-markets) places of sale in Africa. We developed a validated reversed-phase liquid chromatography with tandem mass spectrometry method to accurately quantify the active ingredient in a certified public laboratory. Three quality categories were defined based on the ratio of the measured to the expected dosage of the active ingredient: A (good quality): 95% to 105%, B (low quality): 85 to 94.99% or 105.01 to 115%, C (very low quality): < 85% or > 115%. All expected medicines (n=3468 samples) were collected in Benin, Burkina-Faso, Congo-Brazzaville, the Democratic Republic of Congo, Guinea, Côte d'Ivoire, Mauritania, Niger, Togo and Senegal. Out of the 1530 samples randomly tested, poor quality (types B and C) was identified in 249 (16.3%) samples. The prevalence of poor quality was significantly increased in certain specific drugs (amlodipine 29% and captopril 26%), in generic versions(23%) and in drugs produced in Asia (35%). The proportion of poor quality reached 50% when drugs produced in Asia were sold in street-markets. In this first study assessing the quality of cardiovascular drugs in Africa, we found a significant proportion of poor quality drugs. This requires continued monitoring strategies.
15:00-15:15	Diane Macquart de Terline *'Substandard drugs among five common antihypertensive generic medications: an analysis from 10 African countries'*	Hypertension results in more deaths than any other risk factor and has been on the rise in sub-Saharan Africa over the past few decades. Generic drugs have helped improve accessibility and affordability of antihypertensive therapy in developing countries. However, assessment of quality standards of these products is important. We performed a quality assessment of five commonly used antihypertensive generic drugs in 10 sub-Saharan African countries and studied the impact of price on quality. Drug samples were prospectively collected using standardized methods between 2012 and 2014. We developed a validated reversed-phase liquid chromatography with tandem mass spectrometry method to accurately quantify the active ingredient in a certified public laboratory. Quality was defined based on the percentage ratio of measured to expected dosage of active ingredient. A total of 1185 samples were assessed, of which 70.0% were generic (n=830). Among the generic drugs, the percentage of poor-quality

		drugs was 24.3% (n=202/830). The percentage ratio of measured to expected dosage of active ingredient ranged from 49.2 to 111.3%; the majority (81.7%) of the poor-quality samples had insufficient quantity of the active ingredient. Moreover, poor quality was not associated with purchase price of the drug. In this study from 10 sub-Saharan African countries, nearly one-quarter of the available generic antihypertensive drugs were found to be of poor quality. Concerted measures to improve the quality of antihypertensive drugs could lead to major improvements in hypertension control with attendant reduction of its deleterious consequences in low-income and middle-income countries.
15:15-15:30	Sachiko Ozawa *'Prevalence and estimates of economic impact of substandard and falsified medicines in low - and - middle-income countries: A systematic review and meta-analysis'*	Substandard and falsified medicines burden health systems by diverting resources to ineffective or harmful therapies, causing medical complications, and prolonging illnesses. However, the prevalence and economic impact of poor quality medicines is unclear. We conducted a systematic review and meta-analysis to assess the prevalence and estimated economic impact of substandard and falsified essential medicines in low- and middle-income countries. Five databases (PubMed, EconLit, Global Health, EMBASE, and SCOPUS) were searched from inception until November 2017. Publications were assessed to determine if they examined medicine quality, prevalence, and/or economic impact of substandard and falsified medicines in developing countries. Studies with a sample size ≥ 50 were included in the meta-analysis. The study is registered in PROSPERO (ID#: CRD42017080266), reported via PRISMA, and study quality was assessed using an adapted MEDQUARG scoring metric. We identified 265 studies that estimated the prevalence of poor quality essential medicines in low- and middle-income countries. Among 96 studies that tested 50 samples or more, overall prevalence of poor quality medicines was 13.6% (11.0% - 16.3%) with regional prevalence of 18.7% (12.9% - 24.5%) in Africa and 13.7% (8.2% - 19.1%) in Asia. Of studies included in the meta-analysis, 19.1% (15.0% - 23.3%) of antimalarials and 12.4% (7.1% - 17.7%) of antibiotics were substandard or falsified. We identified eight approximations of the economic impact with poor or undisclosed methodology in estimation, ranging from USD 10 to 200 billion. Our findings suggest that poor quality essential medicines are a substantial and understudied problem. Methodological standards for prevalence and economic studies are needed to accurately assess the scope of the issue and inform efforts to address it. Global collaborative efforts are needed to implement laws, increase quality control capacity, and improve surveillance and data sharing to strengthen the global supply chain against poor quality medicines.
15:30-16:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	

16:00-17:10	**Modelling AMR & Impact:** Chair = Nicholas White	
16:00-16:20	Lisa J White *'Modelling the impact of poor quality antimicrobials on patient outcome and drug resistance'*	The potential impact of poor quality medicines on patient outcome depends on several interacting biological and behavioural systems. It has been hypothesised that poor quality medicines may contribute to the spread of antimicrobial resistance (AMR) but the pathways for this phenomenon have yet to be clearly identified and measured. A mathematical modelling framework is under development to conceptualise such pathways for three diseases: malaria, tuberculosis and hepatitis C. The framework will account for the natural history of infection of each disease (for drug sensitive and drug resistant pathogens), the treatment seeking behaviour of those infected and the pharmacodynamic-pharmacokinetic processes during treatment with medicines of a range of qualities. The main aim of this exercise is to derive potential scenarios where the quality of antimicrobials affects patient outcome and the spread of AMR. Another expected outcome of the research is to contribute to the research agenda for exploring the impact of antimicrobial quality by recommending rankings of priority datasets which if collected could elucidate the system most effectively. We present a prototype model using malaria as an example and invite feedback on the utility of the approach and proposed modifications for future versions.
16:20-16:35	Paul Newton *'Pathogen-antibiotic high risk pairs and antibiotic quality'*	The importance of medicine quality as an important driver of AMR seems likely but its relative importance in comparison to other drivers, such as poor prescribing and adherence, remains unclear. The impact of poor quality medicines on AMR will be discussed - this is likely to vary between different pathogen-antimicrobial pairs, depending on the ecology of both the pathogen and antimicrobials in different niches, the numbers engaged in the encounters and their pharmacodynamic-pharmacokinetic relationships.
16:35-17:00	Modelling AMR & Impact – Panel/ Audience discussion [above, plus Aronrag Meeyai, Philippe Guérin, Erin Wilhelm, Elizabeth Pisani, Muhammad Zaman]	
17:10-18:00	**6 minute speed talks**: Chair = Nicholas Day	
17:10-17:16	Adriadna Nebo Girai, A Nebot Giralt, K Van Assche, R Ravinetto *'Assessing the risk on poor-quality medicines in low and middle-income countries: Analysis of the quality assurance systems of pharmaceutical distributors'*	In many low and middle-income countries (LMICs), pharmaceutical regulatory oversight is weak, due to lack of resources of National Regulatory Authorities (NRAs), and supervision on international supply. Therefore, pharmaceutical distributors play de facto a key-role in defining the quality of available medicines. The WHO Model Quality Assurance System (MQAS) sets standards for procurement agencies/distributors. Low MQAS - compliance indicates a risk that poor-quality medicines are supplied. We analyzed the MQAS-compliance of 10 public African distributors, 8 European humanitarian distributors, and 60 private distributors in LMICs. Data from the QUAMED database (www.quamed.org) were analysed based on standardised criteria representing the key-MQAS-principles. In-depth interviews were conducted to explore reasons behind low MQAS-compliance. For public and humanitarian distributors, MQAS-compliance was generally better in European than in African distributors, but critical parameters (sources' pre-selection and re-evaluation) were low for both. For private distributors, MQAS-compliance was low for all the analyzed criteria.

		Findings suggest that public and humanitarian distributors supplying LMICs do not consistently apply stringent criteria for selecting and evaluating products. Local private distributors are generally weak in good storage and distributions practices. It is urgent to strengthen the capacities of the NRA, to assure the quality of provided by distributors and of supplied medicines.
17:16-17:22	Matthew Hassett & Paul Roepe *'The Substandard Artemisinin Epidemic - Accelerating Drug Resistance in P.falciparum Malaria?'*	The acceleration of antimicrobial resistance (AMR) is often hypothesized to be, in part, an unfortunate consequence of more frequent use of subtherapeutic dosages of drugs. Recently, the World Health Organization (WHO) estimated that nearly 1 in 10 medical products in low- and middle-income countries are substandard or falsified (WHO (2017) A Study on the Public Health and Socioeconomic Impact of Substandard and Falsified Medical Products). Artemisinin combination therapies (ACTs) are currently the frontline treatment for malaria infections recommended by WHO, and currently our last line of defense to effectively combat malaria in the clinic. Troublingly, use of substandard ACT has been well-documented. Perhaps relatedly, over the past decade, there has been an increasing number of cases of delayed clearance of parasites in patients who were treated with ACTs, suggesting decreasing ACT efficacy (Noedl H. et al., (2009) N Engl J Med 361:540). Testing the potential link between substandard treatment and the spread of ACT resistance would help shape future policy decisions, heighten public education, and encourage full compliance of treatment for patients. We have developed a tissue culture-based approach for testing possible connections between substandard drug use and the selection vs spread of ACT resistance. Via sequencing of kelch13, a molecular marker that is predictive for artemisinin resistance (Ariey F. et al., (2014) Nature 505:50-55), we are able to monitor competition of mixed populations of sensitive and resistant strains over time and under various conditions. We will present data related to subtherapeutic dosages of drug that promote more rapid outgrowth of ACT resistant strains of *P. falciparum* malaria.
17:22-17:28	Sauman Singh *'Poor Quality Antimalarials in Mali: Results from a Medicine Quality Survey'*	There are substantial concerns with the quality of antimalarials in endemic countries, with estimates up to 30% of poor quality medicines reported in the literature circulating on the markets. Evidence-based information on antimalarials quality in most endemic countries are scarce or difficult to access. The National Quality Control Laboratory in Mali conducted a post-marketing surveillance with the help of US Pharmacopeia to monitor the quality of antimalarials in 2014-15. A total of 643 samples (tablets, injections, syrups) of antimalarial medicines were collected using convenient sampling approach from public (54%), private (37%) and informal (9%) sectors from Gao (n=100), Kayes (n=43), Kulikoro (n=100), Mopti (n=100), Segu (n=100), Sikasso (n=100) regions and Bamako district (n=100). Samples were subjected to physical inspection, disintegration test and Thin Layer Chromatography (TLC) following the protocols of the Minilab® kits. Of 643 antimalarials tested, 19 samples (3%) were falsified. They failed both visual examination and TLC. Further stratification

		revealed no quality issues with injections (211/643) and suppository (3/643) but 11% (8/72) of quinine and 4% (8/197) of artemether-lumefantrine tablets had no active pharmaceutical ingredient (API), while 12% (2/17) of amodiaquine tablets as well as 7% (1/14) of amodiaquine syrups had a lower API than stated. All non-conforming samples were either from the public (53%) or the informal (47%) sector. Except for the regions of Kayes and Mopti where no sample failed the testing, the rate of failure across regions ranged between 1% to 6% in Gao and Koulikoro respectively. This survey found a comparable presence of poor quality antimalarials in the public and informal sectors even though the former follows stringent procurement rules. Moreover, the results might represent the tip of the iceberg as Minilab is characterized by limited sensitivity in detecting substandard medicines with low API and warrants further studies.
17:28-17:34	Sauman Singh *'WHO Prequalification and Product Strategy of Indian Pharmaceutical Firms: Same Brand, Different Quality?'*	The WHO Prequalification Programme has become the minimum standard to assure product quality for international procurement of medicines using donor funding. While it acts as a measure of uniform quality and reduces uncertainty for procurement agencies, it also provides a highly consolidated market to pharmaceutical firms. Indian firms have become a major player in this domain and account for 60% of all WHO prequalified medicines. Nevertheless, how Indian firms are placing WHO prequalified products on the market to gain legitimacy and recognition and its potential impact on medicine quality has received little research attention. This exploratory study aimed to investigate the marketing strategy of five Indian pharmaceutical firms – Ajanta Pharma, Cipla, Ipca Laboratories, Macleods pharmaceutical, and Strides Shasun – in Mali where they sell one or more WHO prequalified artemisinin-based combination therapies (ACTs). We analysed all artemisinin-based products registered by these companies in Mali as of December 2014 and then checked their prequalification status by matching with WHO prequalification database. Indian firms have not only registered WHO prequalified formulations in Mali but they also hold product authorizations from the Malian regulatory authority for not-prequalified antimalarials such as oral suspensions, injections, suppositories, and formulations of higher strengths. Furthermore, all five firms have registered their WHO prequalified and not-prequalified formulations of artemether and lumefantrine (AL) under the same brand name. That is, firms are using the same brand name for products which are approved by rigorous regulatory scrutiny and those which are not. While Indian firms have launched novel affordable formulations adapted to patient needs, these products may not comply with uniform standards of quality. Moreover, use of the same brand name for products that are prequalified and not-prequalified raises concerns related to the marketing practices of pharmaceutical products and calls for strengthening the regulatory framework governing.

17:34-17:40	Phonepasith Boupha *'The quality of anti-retrovirals: a systematic review'*	Poor quality antiretrovirals (ARV) may decrease treatment efficacy and favour the development of resistances of the human immunodeficiency virus (HIV). The extent of issues regarding the quality of ARV is unknown. The objective of this work was to review the evidence about the quality of ARV to better inform policy. We conducted a systematic review of ARV quality in scientific databases in French and English from 1946 to March 2018. Lay literature, international organizations and MRAs websites were also interrogated. Reports aimed at testing ARV quality and those with information on assays/technologies to determine ARV quality and medicine regulation were included. Of the 113 articles included, 32.7% (n=37) contained data on ARV quality, with 336 data points (collection in a specific location at a specific time). A total of 1,665 samples were collected in 25 countries of four WHO regions. Thirty samples (1.8%) failed at least one quality test. Thirty percent (n=9) did not contain the stated amount of active ingredient(s) and 30% (n=9) failed dissolution and/or disintegration tests. Thirteen publications (11.5%) were surveys aimed at evaluating the prevalence of poor quality ARV, with 740 samples [median (Q1-Q3) number of samples : 35 (10.5-48)] collected in 19 countries (131 data points). Only four of these surveys (31%) were conducted using random sampling techniques. The current evidence regarding ARV quality is scarce. Few prevalence surveys were conducted and prevalence data was available for only nine of the 42 countries with HIV prevalence >1%. With 20.9 million people treated with ARV globally in 2017, even a small proportion of poor quality ARV is not acceptable. Poor dissolution/disintegration or low ARV(s) content may cause HIV resistance, high API may cause adverse drug reactions. More research is needed to properly understand the epidemiology of ARV quality to better guide policy-makers.
17:40-17:46	Simon Schaefermann *'Two case studies of falsified antibiotics in Cameroon: WHO Medical Product Alerts N° 4/ 2017 ("Penicillin V") and N° 2/2018 ("Augmentin®")*	In cooperation with local faith-based organizations of the Ecumenical Pharmaceutical Network (EPN), we carry out a survey on the quality of medicines in Cameroon. Tablets labelled "Penicillin V 500 mg" were collected from an informal vendor in September 2017. TLC screening by our local partners using the GPHF Minilab readily showed the absence of the stated API, but spots of another unknown substance. The sample was forwarded to Tuebingen University, Germany. HPLC analysis according to USP39 confirmed the absence of penicillin V and the presence of an unknown compound. HPLC coupled with high-resolution mass spectrometry identified the unknown substance as acetaminophen (paracetamol). Using a certified reference standard from EDQM, the amount of acetaminophen was determined as 50 mg per tablet, ten times lower than the usual therapeutic dosage. WHO was notified and published the discovery in November 2017 (WHO Medical Product Alert N° 4/2017). The falsified tablets are of good technical quality, apparently produced by an organization with considerable pharmaceutical know-how. In sharp contrast, the packaging and labeling are of extremely poor quality. The manufacturer stated on the label does not exist. From another informal vendor, tablets labelled as "Augmentin®"

		(amoxicillin 500 mg/clavulanic acid 125 mg; GlaxoSmithKline) were collected in December 2017. TLC analysis by GPHF Minilab by local personnel in Cameroon noted the absence of both active ingredients. HPLC analysis according to USP 39 confirmed this result. No other API was identified. Upon request by WHO, the sample was forwarded to GlaxoSmithKline (Global Anti-Counterfeiting Product Security department) who confirmed that it was falsified. WHO published this finding in March 2018 (Medical Product Alert N° 2/2018). In this case, both the tablets and the packaging were highly professional imitations of the true GSK product, and the falsification was only identified by chemical analysis.
17:46-17:52	Theophilus Ndorbor *'Assessing the quality of antimalarial medicines in Nimba County, Liberia*	In Liberia, malarial prevalence has declined from 66% in 2005 to 28% in 2011.However, malaria is still endemic in Liberia. The use of poor quality antimalarial medicines including amodiaquine monotherapies in malarial treatment could be one factor affecting malarial control in Liberia. However, the absence of a functional medicine quality control laboratory in Liberia is affecting the monitoring of medicines quality. This study seeks to determine the quality of antimalarial medicine circulating in Nimba County, Liberia, using visual and physical inspections. Guidelines and standard operating procedures for post market surveillance of the Liberia Medicines and Health Products Regulatory Authority (LMHRA) and Pharmacy Board (PBL) were used to collect samples from pharmacies, medicine shops and informal markets. Samples quality assessment were performed using Global Pharma Health Fund (GPHF)-minilab manual tool for visual and physical inspections. The World Health Organization (WHO) tool for visual inspection was also used. Out of 1,719 samples collected from 343 facilities, 308 (18%) were declared to be poor quality. The majority of these (n =264, 86% %) were artemisinin-combined therapy /artemether and amodiaquine monotherapies in the form of tablets, injections, suspension and syrups. About 96% of the poor quality medicines were unregistered, while 76% had no manufacturer information. More than half (n=202, 59%) of the facilities selling medicines in Nimba were unlicensed and accounted for 53% (n=162) of poor quality medicines. All the artemether injection and suspensions showed clear signs of falsification. While these findings are alarming, they demonstrate that visual and physical inspection are still important tool for monitoring the quality of medical products in resource-limited environments. More than that the, circulation of poor quality antimalarial medicines in Nimba County poses a threat of resistance to the artemisinin derivative or its partner drugs in artemisinin based combination therapies (ACT).
17:52-17:58	Theophilus Ndorbor *'Assessing the quality of antimalarial medicines in five counties in Liberia'*	Malaria is endemic in Liberia and poses a public health threat to the Ebola- affected nation. Significant progress has been made in malaria treatment and prevention. However, poor quality antimalarial medicines could undermine gains made so far. This study seeks to assess the quality of antimalarial medicines available in the public and private sectors in five Liberian counties and to determine whether

		antimalarials quality was related to the level of the distribution chain where the samples was collected or related to the manufacturer. Sample selection and sites of collection were in accordance with Liberia Malarial Indicator Survey data. Sample collection, packaging, transportation and analysis were in accordance with protocols for post market surveillance in Liberia developed by the United States Pharmacopeia (USP) Convention program (Promoting the Quality of Medicines). Analyses were performed using the Global Pharma Health Fund Minilab™ test and methods from the USP, British and International pharmacopoeia. A total of 230 antimalarial samples were collected. Thirteen percent (19%, n=48) of samples failed at least one of the tests. Nineteen percent (19%, n=9) of failed samples were collected from public hospitals while 79% (n=39) were collected from private medicines stores and street peddlers. It was also observed that 19% (n=9) of sample failure was due to poor manufacturing practice (PMP) while 79% (n= 79) was due to poor storage in medicines stores and unregistered medicines. The presence of unregistered and substandard antimalarials in the distribution chains in the private and public sectors is worrying. Regulatory Authorities should ensure that only quality assured medicines reach patient by conducting regularly post market surveillance of medicines and facilities of both public and private sector establishments. Enforcing compulsory public and private sectors medicines registration is critical to reducing poor quality medicine.
18:00 - 19:30	Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
19:30 -	Dinner – Keble Hall	
20:30 - 22:00	Open Microphone in Keble Lecture Theatre - Elizabeth Pisani	

Tuesday 25th September		
08:00-08:30	Summary of Day 1: Souly Phanouvong	
08:30-10:30	Screening technologies – will they save the day? Chair = Philippe Guérin	
08:30-09:00	Céline Caillet '*Medicine quality screening technologies : scientific evidence and recent advances'*	A plethora of innovative portable devices to screen for poor quality medicines has become available, leading to hope that they could empower medicine inspectors and enhance surveillance in the field. Although a diverse range of portable field detection devices for medicines quality screening with various technologies is available, their performances/abilities are not well defined in the literature, as underlined by a recent review of the scientific literature by our group. Although the majority of devices showed promise to distinguish genuine from falsified medicines, evidence regarding the abilities of the devices to detect substandard medicines containing lower active pharmaceutical ingredient (APIs) content than stated on the label is lacking for most of them. There are many other evidence gaps, including the very limited number of APIs tested per device (median of 2 !) and studies to assess the performances of the devices in the field setting, the lack of evidence on their accuracy to test non-tablet formulations (e.g. capsules, liquids) or difficulties to create and update reference libraries of spectrophotometers that will be discussed. The work of the US Pharmacopeial Convention on screening technologies, and recent studies on new devices and methods with the potential to enhance devices capabilities will also be presented. Intensive research is still needed in order to inform national medicines regulatory authorities of the optimal choice of device to combat poor-quality medicines.
09:00-09:15	Serena Vickers '*Portable screening devices for medicine quality: a comparative field evaluation*'	Many different portable devices have been developed to aid regulators in the fight against substandard and falsified medicine. Only three have been field-evaluated, and no standard methodology for their evaluation (and therefore their comparison) exists. Our pilot study used a time-and-motion methodology, more commonly employed in systems management, to compare the usability of seven different devices by Lao drug inspectors in a specially-constructed mock pharmacy. We present the results of the field evaluation, with advantages and disadvantages of the different devices evaluated, and recommendations for further work.

09:15-09:30	Kris Natarajan & Ben Wilson *'Utilizing low cost, portable spectrometers to screen for falsified drugs and to quantify API and formulation accuracy'*	Sales and production of substandard and falsified drugs are on the rise, with a significant impact on public health and socioeconomic activities, particularly in low-resource countries. Portable devices that screen for falsified and substandard drugs, as a component of robust post-marketing surveillance (PMS) programs, can enable regulatory authorities to establish a first line of defense against their spread. Vibrational spectroscopy devices are ideal candidates due to their sampling ease and speed, and recent developments have led to low-cost, simple to use portable devices suitable for use in low and middle-income countries. Previously, we demonstrated the efficacy of low-cost near-infrared (NIR) spectroscopy in detecting genuine versus falsified solid dose drug formulations. Now, pilot implementations and drug quality surveys utilizing Global Good's NIR spectroscopy system are underway across sub-Saharan Africa, to screen for falsified drugs as a complement to national PMS programs. In our new work, focused on substandard drugs, we evaluated the abilities of five portable spectrometers based on NIR, Raman, or mid-infrared (MIR) technology to quantify active pharmaceutical ingredients (APIs) and formulation accuracy. Binary sample mixtures containing an excipient and one of three typical APIs for anti-malarial, anti-retroviral, and antibiotic drugs were prepared at typical API concentrations and then diluted with additional excipient. The formulation accuracy test was conducted with binary mixtures of two excipients prepared at constant concentration intervals. Based on univariate regression for the API data, the performance of one low cost NIR scanner and a moderate cost Raman device approached or even surpassed that of a scientific grade MIR spectrometer. All devices tested were able to demonstrate less than 5% error from the formulation accuracy measurements. We concluded that portable NIR and Raman devices are suitable for screening drug samples, with NIR being the more cost-effective tool at this time.

09:30-09:45	Marya Lieberman *'Case study: Screening with paper analytical devices uncovers falsified amoxicillin'*	Paper analytical devices (PADs) can detect functional groups and excipients in many medicines. Samples were collected in Bangladesh and tested with PADs by local researchers. For one amoxicillin sample, several of the expected colors from the active ingredient were missing. Their assessment of the product as suspicious was confirmed immediately by a PAD developer, who noted that the product appeared to contain starch as a filler. The next morning, covert shoppers searched for other products with similar names/brands (dynamic sampling) and they found a similar product with slight differences in printing. This product passed the PAD screening test. At this point there was good evidence that a deceptive counterfeit was present in the market. The suspicious and the presumed authentic samples were transported to a lab at Notre Dame for chemical analysis. The presumed authentic sample had the correct amount of amoxicillin, but the suspicious product contained no amoxicillin. It was a mixture of calcite (calcium carbonate) and starch. This case shows the rapidity of action enabled by a fast field screening test. Standard practice for post-market screening programs is to collect samples over several months to a year and turn them in for instrumental analysis, which takes months to years. By the time a fake product is confirmed by the lab, it is no longer available in the markets. With PAD testing, it was possible to identify a suspicious product within 24 hours, confirm it by instrumental methods in under 10 days, and undertake quiet follow up activities to determine its prevalence and trace its supply chain.
09:45-10:00	Richard Jähnke *'The global challenge of falsified medicines and the detection of harmful fakes in developing countries using GPHF-Minilabs'*	Owing to the widespread danger of falsified medicines, quality control in distribution systems of developing countries has acquired new dimensions today. If adherence to good pharmaceutical manufacture, distribution and trading practice cannot be assumed, a greater number of samples have to be tested in order to maintain an appropriate assurance of drug quality. At the same time, however, pharmacopoeial analyses have become more and more expensive and only a few centres of excellence in low-icome countries are currently available to perform them. The development and use of simple tests should therefore facilitate a balance between the need to increase the extend of drug testing on the one hand, and the need to contain costs on the other. The Global Pharma Health Fund, a charity initiated and maintained by Merck in Germany, set out to develop and supply a portable, tropics-compatible and easy-to-use mini-laboratory that could verify the drug's identity and content and thus detect fake pharmaceuticals of different, much higher or lower medicine content by employing inexpensive analytical techniques. The GPHF-Minilab could close the capacity gap on drug quality testing in countries where the means for effective drug quality-control are not yet fully in place or where full testing is expensive, hardly accessible or time consuming. The GPHF-Minilab will enable health facilities responsible for drug purchase, storage and distribution to protect themselves against the menace of dangerous trade in spurious and dodgy medicines. The Minilab is an entry-level technology not intended as a laboratory replacement. It is a 'complement' to the lab when it is not in full working order or one simply not exists. When

		combined with advanced instrumental analyses, for example high-pressure liquid chromatography (HPLC), GPHF-Minilabs could reduce costs and still maintain a comprehensive, efficient, and risk-based medicines quality surveillance.
10:00-10:30	Panel/Audience discussion [above plus, Muhammad Zaman, David Olszowka, Daniel Bempong]	
10:30-11:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
	Split Session - Main Lecture Theatre	
11:00-13:00	Economics & Policy: Chair = Fiona Theunissen	
11:00-11:20	Elizabeth Pisani *' Money, votes and medicine quality: an evidence-based framework for prioritising effective regulation'*	Substandard and falsified medicines undermine progress towards universal health coverage. We investigated the political and economic factors that incentivise and facilitate the production, trade and consumption of these products, and developed an analytic framework to guide locally-appropriate responses. We conducted in-depth case studies in China, Indonesia, Turkey and Romania. We reviewed academic papers and press reports, developing a preliminary coding structure and semi-structured questionnaires. We interviewed regulators, policy-makers, pharmaceutical manufacturers, physicians, pharmacists, patients and academics. Using critical interpretive synthesis, we developed an analytic framework to assess national risks for substandard and falsified medicines. We tested the framework against cases reported to the World Health Organization. Substandard medicines are likely where aggressive cost-cutting displaces quality assurance, sometimes in response to public procurement policies. Falsified medicines are produced by those seeking to profit illegally from shortages of clinically indicated, cost-effective products, or from unmet consumer demand, sometimes for clinically unnecessary products. Supply shortages often result from market withdrawal, arbitrage and other legal measures taken by profit-driven pharmaceutical companies responding to low prices. Irrational demand can be driven by physician/provider incentives as well as by marketing by legitimate and illegal suppliers. Shortages, irrational demand and high prices push consumers outside of the regular supply chain, providing an easy entry point for falsifiers. The framework describing these interactions was able to explain cases reported to the WHO from high, middle and low income settings. Market incentives are as important as product regulation in influencing medicine quality. Unless quality is explicitly included in procurement policies, cost-containment measures can incentivise the production of substandard medicines. Meanwhile, industry's quest to maximise profit globally creates local shortages and irrational demand, providing opportunities for falsifiers. A system-wide analysis of incentives can flag risks and pinpoint actions to protect medicine quality, and global health.
11:20-11:35	Nantasit Luangasanatip *'Cost-effectiveness of field*	Poor quality antimalarials are a common problem in many malaria-endemic areas, leading to devastating consequences including increased morbidity, mortality and economic losses. Field

	detection devices for medicines quality screening in Laos PDR'	detection devices to screen the quality of medicines are increasingly available, however, their cost-effectiveness is not known. To evaluate the cost-effectiveness of handheld devices for medicine quality screening during drug inspections in pharmacies in Laos, conservatively focusing on their benefit in detecting substandard or falsified antimalarial artemisinin-based combination therapies (ACTs). We use a decision tree model to simulate the deployment of devices in inspections at the pharmacy level. Six devices were evaluated including Truscan, MicroPHAZIR, 4500a FTIR, NIRScan, Progeny and Paper Analytical Devices (PADs). We performed two scenario analyses of the prevalence of poor quality medicines. In Scenario 1, 20% of ACTs were assumed to be substandard and 20% falsified, while in Scenario 2, 10% were assumed to be substandard and 5% falsified. We evaluated different sampling strategies using 1, 2, or 3 sample(s) for each brand of ACT. Analyses were carried out for each device against a baseline of visual inspections, and in a multiway head-to-head comparison of all devices and sampling strategies. In Scenario 1 all devices were cost-effective with a 1-sample strategy. In Scenario 2 only four devices, MicroPHAZIR, 4500a FTIR, NIRScan, and PADs were cost-effective with a 1-sample strategy. In the multi-way comparative analysis of all devices, in both scenarios the NIRScan with a 2-sample is the most cost-effective option, followed by a 3-sample and a single sample strategy. Routine inspection for poor quality ACTs with field detection devices is cost-effective in Laos where malaria is highly endemic. This information can aid policy-makers or regulators considering investment in handheld screening devices to improve medicine quality and reduce the undesired health and economic burden associated with poor quality medicines.
11:35-11:50	Koray Parmaksiz *'Political and Economic Drivers of Medicine Quality: Main Drivers of Success of the Pharmaceutical Track Trace System in Turkey'*	During the last century, Turkey was displaying high fragmentation of service provision, relatively low governmental health expenditure, and poor health indicators compared to other OECD countries. Turkey introduced the Health Transformation Program in 2003 to increase health coverage and financial risk protection after a new political party came into power that needed to establish political legitimacy. As a result, insurance coverage increased considerably from 65% (2002) to 98% (2012). Since the state's Social Security Institution (SSI) operates mainly as a single buyer covering almost the entire population, it reduces the incentives for patients to procure medicines outside the regulated supply chain. This generated a substantial pharmaceutical market that producers did not want to leave, despite downwards price pressures on medicines. Although Turkey made considerable efforts to provide affordable health coverage, the state experienced losses of approximately one billion US dollars annually due to reimbursement fraud. To combat both this fraud and medicine falsification, Turkey implemented an End-to-End pharmaceutical Track-and-Trace (T&T) system throughout the entire regulated supply chain. The system cross-checks every movement of the product between each stakeholder by comparing sales- and purchase-notifications. However, the implementation process and drivers of success of this T&T system in Turkey remain largely unknown.

		We conducted sixteen semi-structured interviews with key informants, including pharmaceutical manufacturers, wholesalers, pharmacists, ministry of health officials, SSI, academics and technical agencies. This system provides a 'clean' regulated supply chain and high detection possibilities. Additionally, it has a higher possibility of substandard medicine detection due to transfer of human resources to product inspections (e.g. GMP, GDP). In conclusion, the main drivers for success for pharmaceutical T&T in Turkey reflect a combination of political support originating from facing a problem (i.e. reimbursement fraud), having mainly one single buyer that covers almost entire population, and a substantial pharmaceutical market.
11:50-12:05	Amalia Hasnida *'Political and economic drivers of medicine quality: understanding the systemic risks on medicine quality on the road to achieving universal health coverage in Indonesia.'*	Indonesia, the fourth most populous country worldwide, has a strong political promise to provide accessible and affordable health coverage, including medicines. It aims to achieve universal health coverage (UHC) by 2019 for more than 260 million citizens, but concerns have been expressed about sustainability and service quality. A vaccine falsification in 2016 extended those concerns to the quality of medicines. We therefore studied the enablers and deterrents of vaccines falsification; we further investigated the interaction of political and economic factors influencing access to good quality medicines as Indonesia scales up its national health insurance scheme. Thirty-one semi-structured interviews were conducted from December 2017-May 2018 with patients and civil society, pharmaceutical manufacturers and distributors, health care professionals, medicine regulators, and other government officials. Data were analyzed using NVivo 12, as part of a wider four-country study. Although free vaccines are widely accessible through a government immunization program, patient perceptions of product quality and health care practitioners' desire for profit created a market opportunity for falsified vaccines. A structurally underfunded national insurance scheme is slashing medicine prices, actively incentivizing the production of sub-standard medicines, and compromising good distribution across the vast Indonesian archipelago, potentially leading to degradation. Moreover, fragmentation of institutional roles results in a poorly planned system and thus medicine shortages, creating opportunities for falsification. Our findings suggest that there is a strong need for strategic coordination and system-wide thinking across both demand and supply sides to ensure access to good quality medicines in achieving UHC. In addition, a robust regulatory system remains essential, especially in protecting patients against sub-standard and falsified medicines in the more downstream side of the supply chain.

12:05-12:20	Adina-Loredana Nistor *'Political and economic drivers of medicine quality: Within the EU single market, Romania's low prices undermine access to quality pharmaceuticals'*	Since joining the EU in 2007, legislative elections in Romania have been dominated by political promises of guaranteeing UHC and the lowest medicine prices within EU. However, Romania's expenditure for healthcare continues to be the lowest per capita among EU countries. To support the underfunded health budget throughout the 2009 economic recession, a financially unpredictable claw-back tax was imposed on reimbursed medicines. And in 2015, medicine prices were abruptly reduced. We studied the influence that political and economically-motivated decisions about production, product registration and trade for pharmaceuticals have on the quality of medicines for Romanian patients. This research is part of a four-country project focused on understanding the underlying political and economic factors that impact medicine quality. In the case of Romania, a literature review on the topic was complemented by twenty-two in-depth interviews with patients and civil society representatives, manufacturers, distributors, health care professionals and regulators. We found that EU manufacturing and distribution standards have effectively secured the quality of medicines in Romania's regulated supply chain. However, low domestic prices and arbitrage opportunities lead to export to other countries within Europe's single market. Because of low prices and high taxes, producers withdraw medicines from the Romanian market, or impose product quotas to limit parallel exports. The accumulated effect of these market responses, combined with poor sector-wide planning, translates into shortages that are not effectively addressed. Ad hoc responses sometimes aggravate shortages. Health-professionals and patients procure medicines from unregulated sources, opening the door to poor quality products. Romania's pricing and market planning policies should be revised to take account of the realities of EU and global production priorities and market dynamics.
12:20-13:00	Panel/ Audience discussion [above, plus Dinesh Thakur, Tariro Makamure-Sithole]	
	Split Session - Pusey Room	
11:00-13:00	Optimising medicine quality in supply chains: Chair = Philip Coyne	
11:00-11:30	Raffaella Ravinetto '*Optimising medicine quality in supply chains*'	In 2010, a WHO study that mapped the supply management systems in 16 African countries showed that they were too complex, and characterized by poor coordination between Ministries of Health and key-stakeholders. The latter resulted in dysfunctions, e.g. supply outside national Essential Medicines Lists, too many exceptional authorizations for unregistered medicines, and parallel stock management systems. The storage capacity was often exceeded at all levels, with logistics constantly underfunded. In 2018, a report on pharmaceutical systems in Asia and Pacific revealed comparable issues: complex pharmaceutical systems, with too many intermediaries, and poor coordination across stakeholders. Currently, the risk that poor-quality medicines infiltrate the supply chains in the public, private or non-for-profit sector of low- and

		middle-income countries is fueled by various factors: uncoordinated presence of heterogeneous actors; weakness of many national regulatory authorities; lack of transnational regulatory supervision; and complexity of supply chains, implying a plethora of commercial intermediates and subcontracting, and resulting in poor traceability of products and suppliers. A case of substandard propofol detected in Zambia in 2015 shows how such factors concur to creating room for poor-quality medicines. The product, reportedly manufactured in India and non-registered in Zambia, was supplied by an European broker to the Ministry of Health for the public sector. Since it did not transit through the broker's European warehouse, it was neither checked by the regulatory authority there. In practice, it reached patients in Zambia having escaped all regulatory controls. There is urgent need to improve the national medicines supply management systems, reinforce national supervision, and create transnational supervision. The WHO's Model Quality Assurance System Guideline for Procurement Agencies sets standards for pre-qualification, purchasing, storage, distribution and reassessment of medical products, and it could be used as an evaluation and training tool to upgrade the current standards of pharmaceutical procurement and supply.
11:30-11:45	Mohamed Ali Gamal *'NMSF measures to assure the quality of medicines throughout the supply chain'*	The National Medical Supplies Fund (NMSF) is the national centre for procurement and distribution of medicines in Sudan. NMSF has implemented a comprehensive reform programme that started in 2011. In Sudan, Medicines and Poisons Act 2009 requires premarketing authorization of pharmaceuticals. Up until 2010, the NMSF did not comply with the law. This extraordinary situation caused a number of scandals that were widely publicised in the media and national press. This report aims to describe the changes that have taken place in the NMSF's medicine supply system to assure the quality of medicines. This report has mainly relied on the archival records, national newspapers, courts' cases against NMSF and personal experience and records of the lead author. The NMSF has introduced new operational policies and strategies. Thus, in the NMSF 2015 pubic tender for pharmaceutical products, 80% of the awarded medicines had marketing authorization, that is, the products were registered in Sudan, compared to 77% in 2011 and compared to 4% in the public tender of 2008 (i.e. the last tender before the reform). By 2017, the level of procurement of unregistered medicines had reduced to 3%, demonstrating the effective application of the new policies and strategies, the efficiency of NMSF staff and their understanding of the importance of using and therefore procuring, registered medicines. The percentage of rejected medicines for quality reasons dropped from 9% in 2010 to 2% by the end of 2011 and to only 0.1% by the end of 2017. Further, to assure the quality of medicines, the transportation of pharmaceuticals in temperature controlled vehicles to NMSF and from NMSF to its customers across the country, and the application of electronic monitoring of temperature and humidity in NMSF's warehouses, are among the major developments in the reform of the NMSF.

11:45-12:00	Mike Grijseels *'Addressing medicines market failure with a social entrepreneurship approach; a multiple country case study from Congo, Rwanda and Uganda'*	Millions of people in low income countries lack access to good quality medicines. At public facilities medicines are not available and market failures are common. Local medicine markets are often inefficient or incomplete. There are problems with corruption, fake and substandard medicines, a lack of competition and underfunded regulators. A possible solution is a Social entrepreneurship, a company that combines social value generation with entrepreneurial skills and knowledge. The aim of this study was to gain a deeper understanding of factors that influence a social entrepreneurship when trying to improve access to medicines in rural parts of low income countries. The implementation of Healthy Entrepreneurs, a Dutch social entrepreneurship, in Congo, Rwanda and Uganda was used as a case. In this mixed-method multi-country case study we combined document analysis with semi-structured in-depth interviews with purposively selected key informants. The initial business model focused on distributing good quality medicine via specially trained local entrepreneurs. Over the years this model underwent multiple adaptations under influence of different forces; local regulations on the selling and storage of medicine and changes in these regulations, donor fund requirements leading to a different focus but also difficulties in dealing with bureaucracy and sometimes non-transparent processes. Adding to these influences cooperation with different NGO's and local partners was challenging and cultures regularly clashed. Under strain of these influences the business model transformed into a more public oriented model where community health workers were trained and a combination of prevention, selling medicines and health related products was employed. This study shows that donor requirements, local regulation, different business cultures and local realities all influence a social entrepreneurship in trying to improve market functioning and accessibility of good quality medicine.
12:00-12:15	Elizabeth A Pettit *'Sustainability in Quality Medicine'*	There are an estimated 370 million indigenous peoples that represent a rich diversity ...yet continue to be among the world's most marginalized populations. The health status of indigenous peoples varies significantly from that of non-indigenous populations all over. For medicine to be considered quality or "ethical", it must respect ; autonomy, justice, beneficence, and non-maleficence, as well as, focus on sustainable vitality. WHO's definition of health is in constant dialogue, yet have we taken into adequate consideration minorities and the actions needed to safeguard fair access to care? "Indigenous peoples remain on the margins of society: they are poorer, less educated, die at a younger age, are much more likely to commit suicide, ... than the rest of the population". What are the implications affecting us as the stakeholders and the stewards of quality medicine when our care is filtered through the quantities of political and financial profitability mores o than the care itself. Where is the sustainable value being missed? The marginalization of rural and indigenous minorities illustrates this

		moral bankruptcy that has isolated the balance of cooperation.The imposition of the dominant culture of materialism has affected the horizon of focus implicating the quality of medicine. Quantities are measured over and over i.e. How many served, the measures of morbimortality. but quality is sacrificed or lost in the quantities. Clinica Integral Almas in Mexico acompanies several communities that are from the Utoaztecan language roots. We witness these inequities offer experiences for reflection. Many failures that inform more than our successes. Therefore, our touchstone of 'sustainability'...from the Latin sustinere " hold upright; furnish with means of support; bear, endure, and 'ability' habilis "fit for a purpose." Is pivotal. Vitality and sustainability are active not passive. Examples from these Indigenous communities demonstrate pertinent action that all things are interconnected in accord with resiprosity.
12:15-13:00	Panel/Audience discussion [above, plus David Olszowka, Phillip Nguyen, Diana Lee, Fiona Theunissen, Mirfin Mpundu]	
13:00-14:00	Lunch._Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
	Split Session - Main Lecture Theatre	
14:00-15:30	Optimising survey techniques & data sharing: Chair = Philippe Guérin	
14:00-14:15	Paul Newton *'Survey techniques & data sharing'*	Objective and standardized data collection techniques are required to provide reliable epidemiological evidence on the spatial and temporal distribution of SF medicines, their impact on patients and societies and the effectiveness of interventions. Similarly, the positive public health impact of both research and routine post-market surveillance of SF medicines will be greatly impaired by inadequate data sharing and by appropriate health worker and lay public engagement. These aspects will be reviewed.
14:15-14:30	Clark Freifeld *'MAPQAMP: Monitory Internet Media for Medicine Quality Signals'*	Falsified and substandard medicines continue to pose a substantial public health hazard worldwide, and particularly in countries where supply chain regulations and enforcement are less developed. At the same time, accurate information as to the nature and scope of the problem is difficult to obtain due to fragmented, siloed data systems across regulators and the pharmaceutical industry. However, worldwide adoption of emerging information and communication technologies, especially electronic news media, has increased dramatically in recent years. We present MAPQAMP, that includes a system for monitoring events related to poor quality medicine supply and distribution, via Internet media. The system searches Google News English-language edition continually with approximately 80 keywords relating to various medicine types and quality risks. It then stores resulting articles in a database system for review and analysis. Articles are filtered for relevance, geo-referenced, deduplicated, and curated for medical products, type of quality issue, and product source, via a partially automated process. The data are then visualized on a

		bespoke mapping system intended to give early warning of potential medicine quality problems to regulators, international organisations, civil society, and the pharmaceutical industry. We have collected over 54,000 articles from April 2017 to present, and are beginning the analysis process. Thus far we have curated 1,860 articles, of which 86 were deemed relevant. Of the relevant content, 66 were identified as distinct after deduplication, and categorized by product type, quality issue, and source. 3 related to erectile dysfunction medications, 3 veterinary medicines, 2 each for anti-inflammatory, vaccine, abortive, and analgesic, with the rest falling under other categories. Top quality issues were falsified medicines (18), substandard (5), and poor quality medicine (4). Sources were distributed across categories, including seaport, unlicensed outlet, hospital pharmacy, manufacturer, and clandestine lab, 2 each. In the presentation, we will present more comprehensive results and visualization.
14:30-14:45	Kalynn Kennon *'A REDCap tool for recording medicines samples collected in the market'*	REDCap (Research Electronic Data Capture) is a web application for building and managing online surveys and databases (www.projectredcap.org). It has an accompanying Mobile App, which allows for online or offline data capture. The system allows for multiple users, controlled terminology, cloning of an existing database to share with other users, and a high level of flexibility and customization to match individual researchers' needs. The REDCap Mobile App is an ideal tool for creating databases to capture information on medicine samples collected on-site in areas with and without reliable internet access. The session will provide an introduction to the REDCap software, illustrate how projects are built and customized within REDCap, and an provide an overview of an example Medicine Sample Collection project.
14:45-15:00	Lutz Heide *'Prevalence of substandard and falsified medicines in low- and middle-income countries: reasons for conflicting data in the literature'*	Substandard and falsified medicines pose a significant risk to public health, especially in low- and middle income countries. Howevery, published data on the prevalence of such medicines is surprisingly incomplete and contradictory. A review in Lancet Infectious Diseases reported that 35% of antimalarial medicines in sub-Saharan Africa did not meet quality standards, and 20% were falsified. In contrast, another study analysed 10,000 antimalarial drug samples, mostly from African countries, and found only 1% to be falsified falsified and a further 7.7% to be substandard; in half of the African countries studied, no falsified antimalarials were found at all. How can such dramatic differences in study results be explained? Careful analysis shows very incomplete reporting in many studies. Furthermore, the methods of chemical analysis are often not comparable. E.g. thin layer chromatography and HPLC have very different sensitivities. For the classification as "substandard", sometimes the tolerance limits of the pharmacopoeias are followed (in Ph.Int. and USP usually 90-110% of the declared content of the API), but other authors arbitrarily set other tolerance limits, e.g. 85-115%, or 95-105%. Some studies test for dissolution of the API, others do not. Furthermore, the methods of sample collection are different between studies. Some studies sample only from informal vendors where the prevalence of falsified medicines is especially

		high; others sample only from licensed pharmacies or from hospitals. As has been shown in good-quality multinational studies, the true prevalence of poor-quality medicines varies greatly inbetween different countries and different types of medicines. The World Health Organization recently published a systematic evaluation of the literature on falsified and substandard medicines worldwide. It concluded that in low- and middle-income countries, approximately one in ten medicine samples is "substandard or falsified", but in addition it clearly noted that the heterogeneity of the published studies makes reliable statements very difficult.
15:00-15:15	Paul Nkansah *'Implementing a risk-based approach to ensure effective and sustainable medicines quality surveillance'*	Although quality-assured medicines are fundamental to reaching global health goals, many low- and middle-income countries lack robust regulatory systems and comprehensive post-marketing quality surveillance programs which often are not feasible given constraints on local resources, capacity, and priorities. When medicines quality surveillance is performed, it is often restricted to sporadic or ad hoc sampling and testing surveys with weak or unclear protocols which limit the utility of data generated. A risk-based approach to designing and implementing quality surveillance allows countries to tailor activities according to local needs and focus efforts on areas that present the greatest risks to public health. This type of approach can help optimize the use of human and financial resources, enhance the efficiency and effectiveness of medicines quality surveillance, and help institutionalize this important regulatory function. This session will review the risk-based approach to post-marketing surveillance and the accompanying MedRS tool which were recently developed by the USAID-funded PQM program. The session focus on how these tools can be used by countries in developing effective sampling and testing strategies.
15:15-15:30	Panel/ Audience discussion [Above, plus Céline Caillet, Paul Nkansah, Diana Lee, Tariro Makamure-Sithole, Dinesh Thakur]	
	Split Session - Pusey Room	
14:00-15:30	Chemistry – Chair = Marya Lieberman	
14:00-14:20	Marya Lieberman *'Review of methods for analysis of suspicious pharmaceutical formulations'*	Quality standards for pharmaceutical formulations are well established. But when a formulation fails pharmacopeial monograph tests, the appropriate regulatory response depends on understanding why the product failed. This review will focus on analytical methods to identify unknown constituents of small molecule pharmaceuticals, detect degradation products, or identify filler materials that don't show up on HPLC analysis. Costs and complexity will also be discussed to illuminate which methods are most practical for low resource settings.

14:20-14:35	Muhammad Zaman *'Direct observation of Rifampicin resistance due to degradation products'*	Rifampicin resistance is a critical concern for tuberculosis treatment and continues to pose a major global public health challenge in high TB burden countries. While sub-therapeutic doses of medicine are known to select for antibiotic resistance, the effect of degradation products present in poor quality medicines on the evolution of resistance is unknown. Our study aims to fill this critical gap in knowledge. Using quantitative, robust and multi-plexed assays we demonstrate, for the first time, that a rifampicin degradation product selects for resistance to standard medicines. We generated drug resistant E. coli and M. smegmatis strains by serially culturing bacteria in the degradation product of rifampicin, rifampicin quinone. Strains resistant to rifampicin quinone developed cross-resistance to the standard drug rifampicin, with some populations showing no growth inhibition at maximum concentrations of rifampicin. Sequencing of the rifampicin quinone treated strains indicated that they acquired mutations in the DNA-dependent RNA polymerase B-subunit rifampicin resistance clusters. Rifampicin quinone treated mycobacteria also had cross-resistance to other rifamycin class drugs: rifabutin and rifapentine. This first of its kind study demonstrates a direct link between poor quality medicines and resistance that goes beyond sub-therapeutic doses. Furthermore, it also creates a platform to understand, at a fundamental level, how other degradation products or impurities in high impact antibiotics can lead to bacterial resistance.
14:35-14:50	Zahra Anita Trippe *'Quality assessment of anti-malarial combination tablets coartemether in Zimbabwe: Use of different screening and confirmatory analytical technologies'*	Quality assessment of anti-malarial combination tablets coartemether in Zimbabwe: Use of different screening and confirmatory analytical technologies. We did not include the results as two participating laboratories in Zimbabwe and US are analyzing the last samples and are blinded to the results of the reference laboratory. Malaria is a major burden in Zimbabwe with 50% of the population at risk. Previous studies have shown that Zimbabweans are at high risk from substandard and falsified (SF) medicines, resulting in mortality, financial strain and long-term resistance. However, systematic studies of leading anti-malarial quality have been lacking. Further, testing for SF can be technically challenging and expensive in developing countries. This field project investigated the accessibility, pricing and quality of essential medicinal products containing artemether/lumefantrine combination acquired from private, public and illicit sectors in malaria prone areas of Zimbabwe. This first of its kind field project, in a partnership between academia, industry and private institution, investigates the quality, accessibility and pricing of 286 samples of brand and generic versions of artemether/lumefantrine, which are front-line therapeutics against malaria. Samples were collected from retail pharmacies and private and governmental hospital pharmacies from 18 cities in malaria endemic areas of Zimbabwe. Both random and convenient sampling approach was applied for the selection of locations. After visual and physical inspection the quality of purchased samples was further evaluated through using

		different screening field devices including Raman, Near-Infrared Spectrometry (NIR), X-Ray Fluorescence (XFR) and PharmaChk device as well as spectrophotometer and high performance liquid chromatography (HPLC) analysis for confirmatory analysis in multiple sites in Zimbabwe, Switzerland and the United States. Furthermore dissolution profile was ascertained in order to verify the bioavailability of the sourced products. This study quantitatively demonstrated the quality challenges in Zimbabwe, showed that quantitative screening device PharmaChk is ready for in-field testing and has underscored the importance of collaboration between different academic, industry and laboratory stakeholders.
14:50-15:05	Pierre-Yves Sacré *'Bayesian securing of the pharmaceutical supply chain'*	Introduced in 2001, the European Union Falsified Medicines Directive asks for an enhance security of the pharmaceutical supply chain. In this frame, manufacturers must apply safety measures to enable the verification of authenticity and identification of individual oacjs. This is the so-called serialization of the pharmaceutical suppled chain. However, these measure are only dedicated to the analysis of the secondary packaging and do not enable the analysis of the product's quantity. Therefore, we propose and end-to-end strategy based on spectroscopic fingerprints and risk-oriented statistical models for the verification of the quality of medicines along the supply chain. They can provide a precise description of the chemical composition of samples, and hence can be used to fingerprint a pharmaceutical product. A representative set of these spectra is sampled from each batch at release using appropriate devices. This set it used to build a statistical tolerance band, which is assumed to contain a high proportion, say at least 90% of the future spectra of the product. The construction of such a band relies on the newly emerging chemometric techniques such as function daya analysis (e.g. Bayesian wavelet or splines regressions). The upper and lower limits of the tolerance band are used as threshold or reference spectra for the conformity of a new spectrum. This allows us to declare the conformity of a product with a certain probability confidence. Compared to classical measures (p-values, Hit Quality Indexes), this functional data analysis and risk-oriented approach enable to detect very small perturbations of the spectrum caused, for example by degradation, batch inversion, etc. The computed tolerance band may be stored in a cloud server and accessed throughout the supply chain to check the conformity of the product itself. The spectral serialization of pharmaceutical batches is another brick in the wall of pharmaceutical supply chain securing.
15:05-15:30	Panel/Audience discussion [above plus, Lutz Heide, Harparkash Kaur, Kazuko Kimura]	
15:30-16:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	

	Split Session - Main Lecture Theatre	
16:00-17:15	Internet sector & medicine quality – Chair = Timothy Mackey	
16:00-16:25	Timothy Mackey *"Digital Danger: A Landscape View of the Challenges and Potential Solutions Needed to Combat Illegal Online Pharmacies"*	This session will include participation from an interdisciplinary panel comprised of researchers, regulators, industry, and patient safety advocates focusing on how Internet technologies impact the supply, distribution, and access to poor quality medicines. Advances in digital technologies, the world-wide-web, and global e-commerce has made life more convenient, but also enabled a conduit for illicit supply of medicines. This includes the growing threat of Internet pharmacies, which often sell pharmaceuticals direct-to-the-consumer without the need for a prescription or physician oversight. It is estimated that up to 96% of the approximately 30,000 online pharmacies currently operating do so illegally in violation of laws or pharmacy practice standards. The session will begin with an overview of the risk characteristics of online pharmacies and types of technologies used to protect online consumers. It will then shift to a discussion detailing how regulators and patient advocacy groups are tackling the issue, including through enhanced regulatory enforcement and consumer education. The session will close with a panel discussion about challenges ahead and opportunities to collaborate in order to protect patients online from poor quality medicines.
16:25-16:40	David Olszowka *'Distance sales of medicines'*	The world is getting smaller with the growth of online Internet services. Distance sales of medicine is becoming ever more popular meeting the demands of today's lifestyles. But how is this type of service controlled and what drives the service provider, your health or your money? If you have ever bought a medicine online what should you look for? There might be a difference between what you see at the virtual front end to what is actually happening at the source of supply. Service providers can use different supply models, which may involve more than one regulator or place in the world. So what is available for the customer to make an inform judgement on the provider? This is a sprint talk by MHRA, the UK's medicines regulatory, on the challenges of regulating medicines offered for sale over the web.
16:40-16:55	Mike Isles *' Fighting Fakes by Raising Public Awareness'*	The illegal manufacturing, sale, and distribution of falsified medicines is an enormous and growing public health risk with an untold cost to lives. International criminal organisations make vast profits from these illegal sales and often use the proceeds to support other sinister criminal activities. The penalties for those who are caught and prosecuted are not proportionate to the severity of the crime and do little to deter or disincentivise future illegal activity. A truncated, secure, simple and covert supply chain compared to hard drugs; web page to e-payment to a criminal posting it to the country is all that is required And thus, the Internet provides the ideal channel with price, convenience and secrecy. Furthermore, ignorance to the dangers is driving consumer demand, creating the perfect market for over 35,000 illegally operating websites. To solve the problem requires the collaboration of many different parties; law enforcement, healthcare providers,

		patients, Internet intermediaries (ICANN, registrars, registries, registrants, search engines, advertising service providers), shipping companies and payment system operators. Organisations such as The Alliance for Safe Online Pharmacy (ASOP EU) are often the catalyst to help make this happen. One sure way to help curb the problem is to stem the demand. Recent research has revealed that the vast majority of those going online to buy medicines are not aware that approximately 96% of websites which sell medicines are doing so illegally. However, recent research does note an impetus for consumer outreach. When asked if they would change their behaviour armed with this knowledge, up to 88% of respondents said that they would seek out a safe place to buy or go to their local pharmacist. The presentation will highlight recent evidence about the growing threat, and show that the cooperation between the private and public sectors is making a difference.
16:55-17:15	Panel/Audience discussion [above, plus, Aline Plançon, Theophile Sebgo]	
	Split Session - Pusey Room	
16:00-17:15	Medicine Quality & Education – Chair = Diana Lee	
16:00-16:20	Oksana Pyzik *' Global Pharmacy Education & UCL Fight the Fakes'*	Whilst medicines safety is a core component of the Masters of Pharmacy Degree in the UK, as mandated by the General Pharmaceutical Council (GPhC), it is less common for the growing global health threat of substandard and falsified (SF) medicines to be included in the core pharmacy curricula across the UK. However, with the incoming EU Falsified Medicines Directive (FMD) mandating serialisation of prescription-only-medicines using a 2 dimensional (2D) barcode by pharmaceutical companies and the systematic verification of this (2D) barcode in pharmacies, it will be more likely for the underpinning reasons of the FMD to be explored in greater detail and presents an opportunity for pharmacy curricula reform across the EU. In general, broader global health issues are usually taught in an option or an elective module rather than embedded in the core curriculum despite that pharmacy graduates are de facto working in a highly globalised profession. Previous surveys at the UCL School of Pharmacy have shown some resistance from both staff and students around the necessity for expanding global health teaching in already crowded curriculum, and inclusion to be highly dependent on individual teaching staff interest. To address this, staff at the UCL School of Pharmacy have developed Global Pharmacy learning outcomes and increased staff and student buy-in via awareness raising activities led by the UCL Fight the Fakes (FTF), UCL FTF Erasmus Ambassadorships and UCL Global Citizenship Programme. Globally all healthcare professions should have a baseline awareness of the SF issue to increase the detection and reporting by practitioners as indicated by the latest World Health Organization SF Review published in 2017. This awareness shift must start with education e.g. core pharmacy curriculum and further developed by continuous professional development (CPD) Programmes for Pharmacists, particularly as the online pharmacy sector is set to accelerate with Amazon entering the pharmacy space. In this "digital health" era, patients require further support in accessing medicines safely and pharmacists are well-positioned

		to navigate patients through online services. This talk will explore teaching methods, education based case studies and engagement strategies, as well as challenges and opportunities, to further develop and advance global pharmacy education and beyond.
16:20-16:35	Alessandra Ferrario *'Education about substandard and falsified medicines: a review of Bachelor in Pharmacy curricula in six countries'*	Substandard and falsified (SF) medicines are a global problem which requires the coordinated action of several actors within the health system (e.g. drug regulatory authorities, inspectors, distributors, doctors, pharmacists and consumers) and outside the health system (e.g. national and international policy forces, customs authorities) to be addressed. Pharmacists have an important role in the supply chain, and in dispensing, to ensure efficiency, safety and quality of medicines and their use. It is therefore essential that pharmacists are trained in subjects relevant to the control of substandard and falsified medicines to effectively fulfil their different roles. The aim of this study was to assess to what extent Bachelor of Pharmacy (BPharm) students are trained in subjects relevant to the identification and control of substandard and falsified medicines in selected Sub-Saharan African and Asian countries. We reviewed national BPharm curricula in 6 countries (Bangladesh, Ghana, Ethiopia, Nigeria, Pakistan and South Africa). We searched for terms such as "substandard", "falsified", "counterfeits", "quality assurance" and related terms to identify the relevant course work. We asked teaching faculty for complementary information on the contents of courses relevant to SF medicines. Quality control and quality assurance from a basic chemistry and good manufacturing practices perspective were included in all curricula. None of the curricula mentioned courses explicitly addressing the problem of substandard or falsified medicines and policy or technological strategies to address it within their contents or learning objective descriptions. We found evidence that some bilateral donor programs are collaborating with teaching institutions to offer training related to SF medicines. There is currently no gold standard or international consensus regarding the training that pharmacists should receive on SF medicines. These findings can support a discussion at global level on which knowledge and competencies in SF medicines licensed pharmacists should be equipped with.
16:35-16:50	Chioma Ejekam *'Clinical experiences of oxytocin quality used by healthcare providers in Lagos State, Nigeria'*	Postpartum Hemorrhage (PPH) is the leading cause of maternal mortality and is a significant contributor to severe maternal morbidity and long-term disability generally associated with substantial blood loss, including shock and organ dysfunction. Administration of oxytocin childbirth is recommended for prevention of PPH by the WHO. The low quality of oxytocin is a contributor to the unacceptably high rates of PPH and maternal mortality and morbidity in lower and middle-income countries. A number of studies have reported high levels of sub-standard oxytocin in those countries.

		Understanding and addressing healthcare worker knowledge of and experience with oxytocin quality may assist in improving the efficacy of uterotonic use. The study sought to assess the knowledge of oxytocin storage requirements and of dosage for use among healthcare providers in Lagos State, Nigeria and to assess perceptions of the effectiveness of oxytocin. This was a descriptive cross-sectional study with subjects selected using multi-stage sampling. The population included registered doctors and nurse-midwives employed in registered public or private health facilities in Lagos State who offered obstetrics and gynecological services and used oxytocin in their practice. We used a pretested, self-administered questionnaire developed through review of published literature and by expert contributions, reviews and opinions. Nearly half of all participants failed to identify the correct storage requirements for oxytocin and only one third administered the correct dose of oxytocin for prevention of PPH, with some administering up to 6 times the recommended dose. However, perceived effectiveness of oxytocin was high. The study suggests that education is required to ensure that healthcare workers are able to correctly identify when oxytocin quality is low. Improved education of healthcare workers could significantly reduce the level of low quality oxytocin in the health system, in turn improving maternal health outcomes.
16:50-17:15	Panel/Audience discussion [above, plus Aline Plançon, Muhammad Zaman, Raffaella Ravinetto]	
17:15-18:03	6 minute speed talks Chair = Muhammad Zaman	
17:15-17:21	Raffaella Ravinetto *' The marketing authorization for multi-source medicines procured by national procurement centers for public sector : a model process for sub-Saharan Africa'*	The National Procurement Centres (NPC) in sub-Saharan Africa generally pre-select the medicines they procure via a tender process. The supply decisions are made based on the information on each product-manufacturer couple, and on the relevant product samples, as provided by the suppliers. Most products supplied by NPCs are multi-source medicines, often coming in bulk packaging. For each product selected by the NPC via the tender process, the manufacturer must require the marketing authorization (MA) from the National Regulatory Authority (NRA), if not available yet. To grant the MA, the NRA carries out an evaluation which is similar to the one used by the NPC at the tender stage, but is often based on different formal procedures. Unfortunately, many manufacturers fail to comply with the requirement of getting in-country MA, and there are generally no sanctions for this. We conducted a comprehensive analysis of the current tendering and MA process in some French-speaking African countries, from the perspective of NPCs, NRAs and suppliers, and having in mind the overarching objective of assuring the quality and timely availability of medicines supplied through the public sector. Our assessment showed the urgency to improve the coordination between NPCs and NRAs, by creating a common technical dossier, and by putting in place a streamlined MA process for multi-source

		medicines procured by NPCs for the public sector. Our work resulted in a new model for the qualification of medicines supplied by NPCs, which should be compliant with adequate quality assurance (QA) standards, with national regulatory requirements, and should be more efficient and less time- and resources-consuming. We hope that the model may now be piloted in some countries or regions, in order to improve the quality, efficiency and regulatory compliance of the supply system in the public sector.
17:21-17:27	Sachiko Ozawa *'Development of an agent-based model to assess the impact of substandard and falsified antimalarials in Uganda'*	Global efforts to address the burden of malaria have stagnated in recent years with malaria cases beginning to rise. Substandard and falsified antimalarial treatments contribute to this. Poor quality antimalarials directly affect health outcomes by increasing malaria morbidity and mortality, as well as threaten the effectiveness of treatment by contributing to artemisinin resistance. Research to assess the scope and impact of poor quality antimalarials is essential to raise awareness and allocate resources to improve the quality of treatment. We developed a probabilistic agent-based model to provide country-specific estimates of the health and economic impact of poor quality antimalarials on pediatric malaria. We present a methodology and case study of the SAFARI (Substandard and Falsified Antimalarial Research Impact) model applied to Uganda. We estimated the annual economic impact of malaria in Ugandan children under age five at US$323 million, including $54 million in direct costs. Substandard and falsified antimalarials were a significant contributor to this annual burden, accounting for $36.3 million (11%) in total economic impact involving $4.7 million in direct costs. Further, we estimated that 12% of malaria deaths in Ugandan children under age five were attributable to poor quality antimalarials. In the event of widespread artemisinin resistance in Uganda, we simulated a 14% yearly increase in costs associated with pediatric malaria, inflicting $45.5 million in additional economic impact annually. Improving the quality of antimalarial treatment is essential to combat the burden of malaria and prevent the development of antimalarial resistance. The SAFARI model provides country-specific estimates of the health and economic impact of substandard and falsified antimalarials to inform governments, policy makers, donors and the malaria community about the threat posed by poor quality antimalarials. The model findings are useful to illustrate the significance of the issue and inform policy and interventions to improve medicinal quality.
17:27-17:33	Fatima Tauqeer *'Institutional barriers and facilitators to implementation of global quality standards for medicines in local pharmaceutical industry in Pakistan- a qualitative*	Production and consumption of substandard medicines remain a significant public health issue globally, yet limited research from low- and middle-income countries exist on the implementation of good manufacturing practices (GMP) and the experience with putting in place a system of quality assurance (QA) for pharmaceutical manufacturing. This study investigated the situation of GMP compliance and QA focusing on local production

	exploratory study'	of medicines by national private pharmaceutical companies of Pakistan—a lower middle-income country with an ever-increasing number of local pharmaceutical producers. The objectives were studying the barriers to GMP and QA non-conformance, and progress to implement and enforce global standards. A qualitative study design involving semi-structured interviews with 22 key informants from the drug regulatory authority (DRA) (n=9), academia (n=3), and local manufacturers (n=10). Document analysis was used to collect additional information and supplement the data obtained through interviews. The study findings show that local GMP standards in Pakistan were adopted from previous WHO GMP guidelines and have not been updated. The GMP compliance and QA varied across the country and divergent views were presented on their status and understanding. From the perspective of regulators, improvements made to assure quality included the establishment of an independent QA head, counselling and fair time given to companies to shift to GMP, and encouragement to be above-board. On the other hand, manufacturers pointed to financial restraints to procure raw materials, hire trained staff, and the need to upgrade the expertise of hired staff, better equipment and technological innovation. A prominent factor hampering progress, from the perspective of academia and QA managers, was a dearth of quality-oriented institutional mindset in a profit-driven professional culture; and regulatory incapacity of the DRA. Overall, the study findings indicate that a robust collaboration is needed among these stakeholders with a joint aim to provide affordable quality medicines to patients.
17:33-17:39	Pierre-Yves Sacré *'Forensic formulation fingerprinting of falsified medicine by Raman hyperspectral imaging'*	With the Medicrime convention (in 2010) and the European Parliament directive 2011/62/UE (in 2011), the notion of pharmaceutical crime appeared allowing effective, proportionate, and deterring sanctions against the falsifiers. However, to be able to apply these sanctions, the authorities must collect information allowing them to go up to the manufactoring sites. This is however extremely complex at a global scale. The opportunity to link several falsification cases is one more brick laid in building the investigation. Hyperspectral imaging is not a new analytical tool and has been used in many research papers some of them about falsified medicines. However, the time has come to re-evaulate its place in the suspect formulation workflow. From our point of view, after a formulation is confirmed falsified (or substandard) by a first line investigation (e.g. visual inspection, handheld Raman or colorimetric testing), hyperspectral imaging should always be performed when possible (solid pharmaceutical forms). Indeed, in a single imaging analysis, one may access qualitative, semi-quantitative and distributional homogeneity of organic and inorganic constituents of the formulation. These inform on the risk of taking the medicine but most of all it provides a unique fingerprint of the production allowing the linking of falsification cases. To illustrate this, six artémether/luméfantrine formulations (two batches of Combiart 20/120 and four batches of Coartem 20/120) have been analyzed for falsification suspicion. Handheld Raman spectroscopic analysis rapidly confirmed the falsification and possibly the absence of active compound. Once confirmed falsified, one tablet of each formulation underwent Raman

		hyperspectral imaging on the whole sample surface. A chemometric analysis of the spectral data revealed the presence of traces of two active compound (sildenafil and ciprofloxacine chlorhydrate monohydrate) and the same excipients (organic and inorganic) in five formulations (2 Combiart and 3 Coartem) allowing us to link these cases.
17:39-17:45	Eugenia Olliaro *'Legislative uncertainty - the grey area around substandard medicines'*	The latest WHO definition of poor-quality medicines includes unintentionally substandard (S) as well as intentionally falsified (F) products, collectively referred to as 'SF medicinal products'. The difference between a 'falsified' and a 'substandard' product rests in the intrinsic intention to deceive in the case of falsified medicines, as opposed to an 'error' in substandard, implying that they are mutually exclusive. However, there is a grey area. While the falsified products should eventually fall under criminal law despite heterogeneous country legislations, there is a legislative uncertainty and practical difficulties when classifying poor-quality products. First, it might be difficult to establish intent to deceive, including whether substandard practices were deliberately adopted along the manufacturing and supply chain. Second, independent of the intent to fraud, also negligence and misfeasance can generate harm and public health damage. Third, the new WHO definition lays a framework that is not necessarily matched by national legislations, as laws about SF medicinal products vary broadly in different countries, and do not always adequately or clearly cover all situations. Low- and middle-income countries with weak regulatory systems are especially concerned. We have started analysing the problem from the pharmaceutical, public health and legal angle. Filling this legislative void, e.g. by applying a criminal liability scale, is crucial to respond to the WHO call to "prevent, detect and respond to any actions, activities and behaviours" resulting in poor-quality medications, "while maintaining a public health perspective." This should be accompanied by other measures: strengthening country regulatory capacity; strengthening country capacity to detect and act upon all cases of malfeasance in the production, importation and distribution of medicines; strengthening capacity of local manufacturers to produce quality-assured medicines, and of national importers/distributors to select quality-assured products; building political will to support such actions, including at donors' level.
17:45-17:51	Patricia Tabernero *'A random survey of the prevalence of falsified and substandard antibiotics in the Lao PDR'*	Substandard antibiotics with poor dissolution and bioavailability have devastating consequences for public health and their contribution to the development of Antimicrobial resistance (AMR) is still poorly understood. In 2012, a survey was conducted to investigate the availability and quality of antibiotics sold to patients in the private sector in five southern provinces of the Lao People's Democratic Republic (Laos). A total of 147 outlets were sampled in 10 districts. The API content measurements for 909 samples of nine APIs were determined using High-Performance Liquid Chromatography

		(HPLC) including: amoxicillin, ampicillin, ceftriaxone, ciprofloxacin, doxycycline, ofloxacin, sulfamethoxazole, tetracycline and trimethoprim. All the samples labelled as antibiotics analysed contained the stated API and all except one sample had all the units with a %API between 75-125% of the content stated on the label.15.6% of the samples were sold loose with no labelling or manufacturing information. The main problem identified was the presence of substandard, rather than falsified medicines, as 19.6% samples had their units outside the 90-110% content of the label claim and 60.2% of the samples had units outside of the International Pharmacopoeia uniformity of content limit range. Amoxicillin had a high number of samples (67.1%) with units above its International Pharmacopoeia limit range followed by ciprofloxacin (58.8%) and ofloxacin (57.4%). Trimethoprim, sulfamethoxazole and ceftriaxone had high number of samples with low amounts of API (51.6%, 34.7% and 57.1% of samples, respectively). Significant differences were found by the country of manufacture and stated manufacturer. Trends in API degradation suggested potency before and after the expiry date. Trimethoprim, ciprofloxacin tablets and amoxicillin ampoules showed correlation between %API and expiration date. Antimicrobials with low %API, poor bioavailability or degradation, may engender drug resistance. Inadequate labelling will result in poor drug use and will provide opportunities for the sale of unregistered and falsified medicines.
17:51-17:57	Erin Coonahan *'An aptamer-based assay for the detection of piperaquine'*	Artemisinin-based combination therapies (ACTs) have begun to fail as first-line therapies for the treatment of Plasmodium falciparum malaria in Southeast Asia. Preventing the further spread of drug-resistant parasites is a top priority for global malaria elimination campaigns. A low-cost, field-based assay to detect slow-clearing ACT partner drugs from patient blood samples would allow us to track antimalarial drug use, monitor drug compliance, and could serve as an indicator of therapeutic efficacy and spreading resistance. It could also allow for sensitive detection of active components to assess tablet quality. We are developing a rapid assay to detect several ACT partner drugs. In order to do this, we have identified aptamers that bind and differentiate between small molecule partner drugs. Aptamers are single-stranded DNA molecules selected from a pool of random DNA sequences for their binding affinity to various targets. They can be selected in vitro and their binding can be tailored for specificity and sensitivity under varying conditions. We are using a capture-SELEX method to identify aptamers that, when dye-tagged in a structure switching sensor format, will allow for a micromolar limit of drug detection. Our current focus is to optimize aptamer selection protocols to improve sensitivity and specificity of a fluorescent assay.

17:57-18:03	Guilherme Cintra *'Pat-INFORMED a new platform that aims to make more readily acessible public patent information on registered medicines'*	Pat-INFORMED is a NEW platform that aims to make more readily accessible public patent information on registered medicines. It has been designed as a resource for medicine procurement experts in public health agencies, multilaterals and a variety of NGOs engaged in the procurement of medicines who need access to patent information to inform their decisions about how, when, where and from whom to obtain most frequently used medicines. This multi-stakeholders' initiative involving the World Intellectual Property Organization (WIPO), the International Federation of Pharmaceutical Manufactures and Association (IFPMA), and over 20 global research-based pharmaceutical companies, aims to bring solutions to ultimately deliver patients the benefits of modern medicine. Pat-INFORMED is a searchable database by country of patent information open to all and a platform for facilitating communication between procurement agencies and the patent owners. The first phase to be launched in 2018 will contain patent information for small molecules in oncology, Hepatitis C, cardiovascular diseases, AIDS, diabetes, respiratory conditions, and all products on the WHO Essential Medicines List that are not within these therapy areas.
18:10	Penicillin Walk – maximum number = 12 (signing sheet at registration desk) (umbrella may be needed !) - Jeffrey Aronson	
18:00	Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
19:30	Dinner – Keble Hall	

Wednesday 26th September		
08:00-08:30	Summary of Day 1 & 2: Marya Lieberman	
08:30-10:30	View from LMIC National Medicines Regulatory Authorities: Chair = Moji Christianah Adeyeye	
08-30:09:00	Moji Christianah Adeyeye *'Plans and Aspirations for Medicine Regulation and Quality in Nigeria: NAFDAC Perspectives'*	The aims and aspirations of Nigeria's National Agency for Food & Drugs Administration and Control (NAFDAC) are to safeguard the health of the nation. To make the vision a reality, good leadership and governance in regulatory controls with a motivated workforce become fundamental attributes that must take place. The quality management systems (QMS) paradigm is being used as a template for the "Customer-focused and Agency-minded" motto. This has led to changes such as use of standard-operating procedures for all its technical and non-technical processes, transparency in its management and operations, more training of staff, enforcement of regulatory controls, and strengthening of the pharmacovigilance and post marketing surveillance. Backlog of applications were cleared, while faster application to approval time has led increased access to medicines. In addition, emphasis is being given to quality control and laboratory services through re-equipping and procurement of needed standards and supplies. Regional and continental collaboration, and global reliance mechanisms are being used for harmonization of its regulation, capacity building and global benchmarking for self-assessment and development of an institutional development plan (IDP). The Agency has enabled manufacturers to obtain WHO cGMP status through the WHO Pre-qualification program, and has collaborated with UNIDO in developing a national GMP Road Map. As a continuation of detection and elimination of substandard and falsified medicines (SFs), different technological tools are being employed. Instead of the random PV/PMS, Agency is embarking on a structured pre- and post-shipment approval. The new paradigm is strengthening the Agency customer-focused culture in order to safeguard the health of the nation.
09:00-09:30	Agnes Sitta Kijo *'Progress and Challenges faced by TFDA and way forward'*	Tanzania Food and Drugs Authority (TFDA) is an Executive Agency under the Ministry of Health, Community Development, Gender, Elderly and Children which is responsible for regulating safety, quality and effectiveness of food, medicines, cosmetics, medical devices and diagnostics. TFDA implements its mandate through four directorates at headquarters offices seven zone offices located throughout the country. Medicine analysis laboratory located in headquarters carries analysis of medical products samples. Since its establishment, TFDA has recorded significant progress in the following areas: evaluation and registration of medical products to include medicines, medical devices and diagnostics, inspections and licensing of premises, import and export certification and control, monitoring of adverse drug reactions and public education. Other significant progress include increase in laboratory capacity, attaining ISO 9001:2015 certification for quality management system, obtaining ISO 17025:2005 accreditation for food chemistry laboratory and WHO prequalification for medicine analysis laboratory. TFDA has also been assessed by the WHO using the Global Benchmarking Tool aspiring to

		reach maturity level 3 and the first NRA to reach that level in Africa. Despite the recorded progress, TFDA is also faced by a number of challenges which hinders full implementation of its legal mandate, this include inadequate human resources to cope with ever increasing regulatory work, shortages of infrastructures to perform some of the key regulatory activities, challenges in regulating some advanced therapies for newly emerging diseases. Other challenges include presence of unofficial borders in some parts of the country which gives room for illegal importation of unauthorized products. Future strengthening of the system shall involve implementation of online systems for delivery of key regulatory services as well as other support functions, risk based post marketing surveillance programs and improved systems for reporting adverse reactions. In addition, the authority intends to continue the participation in medicine regulatory harmonization programs in both EAC and SADC regions in order to maximize scarce resources.
09:30-10:30	Panel/ Audience discussion [above, plus Paul Nkansah, Graham Carroll, Catherine Dujardin, Joel Breman]	
10:30-11:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
11:00-13:00	Regulatory Harmonisation**:** Chair = Katherine Bond	
11:00-11:30	Tariro Makamure-Sithole *'Regulatory harmonisation and African Medicines Agency'*	The Luanda Commitment, adopted at the first Joint African Ministers of Health meeting in 2014, mandated the establishment of African Medicines Agency (AMA). A Task Team, coordinated by a joint secretariat made up of the Africa Union Commission (AUC), New Partnership for Africa's Development (NEPAD) Agency and World Health Organization (WHO led the drafting of the AMA Treaty. In 2017, three continental consultations with legal and regulatory experts were conducted to review the draft AMA Treaty in South Africa, Ethiopia and Tunisia. On 19th May 2018, African Ministers of Health unanimously adopted the draft Treaty for the establishment of a single continental body for the regulation of medicines and medical products, AMA. The establishment of AMA will strengthen regulatory capacity and harmonize medicines regulatory systems ensuring that the health of the African people is protected from threats posed by Sub-Standard and Falsified (SF) medicines, medical products and technologies. Harmonization efforts have proved successful at regional level in the East African Community (EAC) and the Southern African Development Community (SADC) through the ZAZIBONA approach (a collaboration between national medicines regulatory authorities in Botswana, Namibia, Zambia, and Zimbabwe). AMA is taking a strategic step-wise approach by leveraging existing initiatives [i.e. the African Medicines Regulatory Harmonization (AMRH) and African Vaccines Regulatory Forum (AVAREF)] as building blocks to addressing regulatory challenges faced by African countries in ensuring effective coordination, scaling up activities and inculcating sustainability aspects. AMA will serve six (6) main functions i.e, marketing authorisation, inspection, market surveillance, safety monitoring, oversight of clinical trials and quality

		control. The treaty will be presented to African Union (AU) Heads of State and Government in January 2019 for endorsement. Once the required minimum number of countries (15) ratifies the Treaty, the AMA will be established.
11:30-12:00	Hiiti Sillo '*Harmonization and regulatory systems strengthening – global overview'*	WHO plays a unique role in promoting access to safe, effective, quality and affordable essential medicines and other health technologies as a key pillar of a well-functioning health care system. The importance of this work is emphasized by World Health Assembly Resolution 67.20 on *Regulatory System Strengthening for Medical Products*, adopted by Member States in May 2014. The Resolution recognizes that 'effective regulatory systems are an essential component of health system strengthening and contribute to better public health outcomes, that regulators are an essential part of the health workforce, and that inefficient regulatory systems themselves can be a barrier to access to safe, effective and quality medical products'. As of March 2018, WHO assessments of national regulatory authorities (NRAs) indicates that only 26% of NRAs have the capacity to perform all core regulatory functions in relation to the oversight of medicines and vaccines. To address this gap, WHO Regulatory System Strengthening (RSS) Programme is implemented based on a five-step capacity building strategy starting with development of tools (a harmonized Global Benchmarking Tool) for assessing NRAs, development of an Institutional Development Plan (IDP) to address areas for improvement and providing technical support in the implementation of the IDP followed by continued monitoring of progress and outcome. Investments in RSS at national, regional and global level should therefore consider more modern models of regulation that consider resource constraints, increasingly complex technologies, globalization and public expectations. One way to address these regulatory challenges is through promoting networking of regulators, reliance, work-sharing, harmonization of regulatory standards and convergence. WHO has over the years been involved in providing technical leadership in various global, regional and sub-regional initiatives. This presentation would explore the current status of WHO RSS Programme with emphasis on the global overview of various initiatives on regulatory harmonization, convergence, collaboration and networking.
12:00-13:00	Review & Panel/ Audience discussion [Leigh Verbois, Graham Carroll, Farouk Umaru, Murray Lumpkin]	
13:00-14:00	Conference Photo & then Lunch. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	

14:00-15:30	Universal health coverage, access & good quality medicines: Chair = Veronika Wirtz	
14:00-14:30	Christa Cepuch & Alain Alsalhani *'UHC, Access and Good Quality Medicines'*	The quality of medicines is an essential component of access to medicines and Universal Health Coverage, and therefore a civil right and a government responsibility. The SDGs represent the first global treaty that explicitly mentions "quality" of medicines and vaccines. Multisource (generic) medicines constitute the backbone of any public health system. They represent the vast majority of WHO's Essential Medicines List. Beyond the debate around availability and affordability of multisource medicines, one major impediment to ensure equitable access to medicines for people living in resource-limited settings is their quality. The notions of access and equity here are fundamental, as the problem of substandard medicines affects disproportionately people living in developing countries. The quality of multisource medicines is the result of a constellation of factors. However one factor seems to have a great and constant influence: that is the regulatory environment in which medicines are produced and distributed before reaching the end-user. In fragile regulatory environments, the standards applied to the manufacturing process and the quality attributes of the starting materials and the finished products have been shown to be determined by the requirements of the buying party (be it a country, a UN agency or a medical NGO like MSF). The bulk of the current production of more affordable generic medicines that are found in the least regulated markets in the world is happening in a handful of countries characterised by fragile and inconsistent regulatory oversight. Analyses of the systemic failures in medicines regulation sectors in countries with significant pharmaceutical manufacturing allow for the formulation of concrete recommendations. Given the commonalities that exist among countries with inconsistent regulatory capacity, such analyses will contribute to the global discussion on improving the quality of medicines in resource limited settings, in the broader debate of access to medicines and UHC.
14:30-14:45	Helen Petach *'Principles for donor-funded procurement of RMNCH QA essential medicines'*	The process of assuring quality medicines is typically the responsibility of a national medicines regulatory authority (NMRA), however, depending upon the maturity level of the NMRA, the quality assurance task may extend beyond the capacity of the NMRA. This presentation will focus on how the donors are working to assure quality for RMNCH essential medicines procured using donor funds, while still recognizing the role of the NMRAs. Programs that supply drugs to combat HIV and malaria have mainstreamed quality assurance for some time, while RMNCH essential medicines, typically procured directly by national governments, may carry a higher quality risk due to the wider range of sources and wider range of product quality. Donors are working together to harmonize principles for the quality assurance of RMNCH medicines when procured using donor funds. The principles support the use of a WHO-listed regulatory agency for quality assurance, and where feasible, that WHO-listed agency is the NMRA. These harmonized principles represent an example for how the evidence base and knowledge around quality assurance of

		medicines intersects with policy development. The overarching goal of these principles is to improve access to quality assured RMNCH medicines.
14:45-15:30	Panel/Audience discussion [above, plus Graham Carroll, Moji Christianah Adeyeye, Mohga Kamal-Yanni, Elizabeth Pisani, Mirfin Mpundu]	
15:30-16:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
	Split Session - Main Lecture Theatre	
16:00-18:00	Ethics & sociology: Chair = Heather Hamill	
16:00-16:15	Patricia Kingori *'Ethical challenges presented for frontline workers in contexts with quality of medicine concerns'*	In recent years there has been growing concerns raised about the challenges posed to patients by the uncertainty surrounding the quality of medicines. However, there has been little attention paid to the frontline practitioners tasked with dispensing such medicines. This paper seeks to initiate discussion on some of the ethical dilemmas which nurses, doctors, pharmacists and other frontline workers are faced with in contexts where it is difficult to ascertain the efficacy and quality of medicines. Based on initial pilot interviews with frontline staff operating in LMICs contexts this paper explores the features of some of their dilemmas. It further argues that these dilemmas, as experienced by frontline workers, cause considerable distress and are worthy of careful consideration.
16:15-16:30	Rui Liu & Susanne Lundin *'Where and how do you buy medicines? A social and cultural study of attitudes towards buying medicines online and abroad among Swedish public and doctors'*	We start our presentation with a brief overview of the literature written about SF medical products in the social and cultural sciences. In September 2015, we broadly reviewed literature about the phenomenon of SF medical products, and identified research gaps regarding social, cultural and ethical aspects. Studies, presented below, are two pilot studies aimed to fill some of the gaps. In May 2018 we completed a new literature search focusing specifically on the social sciences and cultural sciences. In order to understand where and how the Swedish public access their medicines, especially prescribed medicines, an online survey was conducted. Among a collection of 155 answers, the data shows that, although a majority of the respondents feel hesitated and negative towards shopping prescribed medicines online, a tendency is demonstrated that people would seek out medical assistance from other sources in foreign countries if their need could not be satisfied by the current national healthcare service. This might expose these vulnerable patients to the danger of falsified medicines. Our findings point out the need to map out medical consumers' shopping patterns and call for more qualitative studies to understand this mechanism and to provide the public with necessary information regarding shopping medicines in a safe environment. Thereafter a survey with 200 Swedish doctors was carried out. The main purpose was to gather information on how much knowledge and experiences these frontline medical professionals had regarding SF medical products. The results show that 1 in 4 respondents have not heard about this phenomenon and there is a lack of awareness among physicians on the use of the reporting system. Related education is needed and desired. Currently a comparative study is taking place in the community Kayamandi in Stellenbosch, South Africa.

16:30-16:45	Carine Baxerres *'When quality shapes the global economy of pharmaceutical distribution: An Anthropological reflection based on research in Benin, Ghana and Cambodia'*	This presentation is based on empirical qualitative research conducted since 2005 in Benin, and since 2013 in Ghana and Cambodia, with formal and informal sellers of pharmaceuticals (retailers and wholesalers), as well as consumer families (adults and children). These studies grew from PhD research to an European Research Council Starting Grant. It first highlights the complex perceptions which individuals in the three countries had of the quality of pharmaceuticals related to the real or perceived geographical origin of these products. Available pharmaceuticals were found to be situated on the value scales related to "origin" in each of the three contexts. At the top of these scales were pharmaceuticals perceived to be made by the former colonial powers of each country ("French medicines" in Benin and Cambodia, "UK products" in Ghana), followed by those produced locally ("Pharmaquick products" in Benin, "local products" in Ghana and Cambodia), and finally those produced in neighboring or historically connected countries ("pharmaceuticals from Nigeria and Ghana" in Benin, "pharmaceuticals from Vietnam" in Cambodia, "Indian products" in Ghana). Secondly, this presentation examines how the subjective "quality" of products was engaged by pharmaceutical producers and distributors. Conceptions of quality were key to how the pharmaceutical markets of the three countries were structured. This is also the case for the markets of other commodities outside of the health sector. Finally, it presents a reflection on the increasing economic liberalization of pharmaceutical distribution in connection with the national legislations of the three research sites. Far from existing only in the informal sector or in << low and middle income countries >>, this subject is becoming increasingly important in the contemporary pharmaceutical economy globally.
16:45-17:00	Ilyad Ahmad Aria *'Global Governance of Drug Quality: Examining the Disbanding of the WHOs IMPACT'*	The globalization of pharmaceutical supply chains has introduced new challenges in ensuring the safety and quality of medicines. To support health systems, the World Health Organization established the International Medicines Product Anti-Counterfeiting Taskforce (IMPACT) in 2006. Despite unanimous initial support from member-states, the activities of the IMPACT were controversially suspended by the World Health Assembly four years later, and ultimately disbanded by 2012. Informed by the theoretical framework of historical and sociological institutionalism, this PhD thesis examined why the IMPACT was disbanded. A causal mechanism is proposed with three interrelated factors based on 'ideas, interests and institutions'. In the first instance, the paper argues that framing the problem as "counterfeit" medicines invoked the structural and normative domains of intellectual property rights, which undermined the public health mandate of the IMPACT and the WHO (ideas). Establishing a 'taskforce' furthermore delegated agenda- and priority-setting authority away from member-states as well as the formalized governing bodies of the WHO (institutions). Lastly and relatedly, the prominent role of non-state actors within the IMPACT (most notably from the pharmaceutical industry and enforcement agencies) exacerbated the perceived subversion of the motivations and activities of the IMPACT (interests). In other words, disbanding of the IMPACT by the WHO governing bodies has arguably reasserted the public health mandate, while member-states reclaimed priority- and agenda-setting authority in global health. This was exemplified in the abandonment of the "counterfeit" nomenclature following the

		IMPACT's disbanding in 2012, as well as the formalization of the Member State Mechanism by a WHO governing bodies. The findings presented in this dissertation have notable implications in global health governance. In addition to illustrating the importance of problem framing, the story also highlights the explanatory capacity of institutionalist theory in examining how values are contested within the WHO as well as other international organizations.
17:00-17:15	Naira Ghanem *'A review of Healthcare Professional's Knowledge and Perspectives regarding Substandard and Falsified Antimicrobials'*	This study aims to measure healthcare professionals' 'knowledge of', 'exposure to' and 'attitudes towards' substandard and falsified antimicrobials Current literature discusses prevalence rates, technologies for detection and outcomes of low-quality medicines. There is a reduced emphasis on the importance of healthcare professionals awareness of issues, the difference in societies and which interventions will be the most effective. A cross-sectional study was used to assess healthcare professionals' (HCPs) perspectives in high-income countries (HICs) and low-middle income countries (LMICs). The study used convenience sampling through distribution channels via the Commonwealth Pharmacy Association (CPA). A total of 256 healthcare professionals took part in the study from six regions worldwide. 54% of the participants were aware of the difference between a substandard and falsified antimicrobial. The most prevalent definitions for a substandard antimicrobial was a medicine with a 'lower Active Pharmaceutical Ingredient (API) content' (67%). The most prevalent definition for a falsified antimicrobial was a 'counterfeit medicine' (78%). Healthcare professionals from African and Asian LMICs had the highest rates of correctly identifying substandard and falsified antimicrobials. Healthcare professionals' attitudes towards preventative methods to combat falsified antimicrobials were reflective of the problems in each region. Preventative methods such as 'raising public awareness' and 'educating HCPs' were ranked highly in the UK. In comparison, healthcare professionals from African LMICs supported 'improved reporting methods', 'detection methods' and a 'tighter, regulated supply chain'. The different weighting given to preventative methods according to economic classification further emphasizes that no 'one size fits all' approach can be used to effectively tackle this issue. More comprehensive insight is needed, relative to regions and economic status to determine the best approach to tackle this global problem in a localised manner.
17:15-17:30	Mirza Lalani *'An absence of evidence breeds contempt; health system stakeholder perceptions of the quality of medicines available in Senegal.'*	Poor quality medicines are a challenging issue in low to middle income countries (LMICs). Evidence suggests that health professionals and consumers perceive the source and type of medicine to be associated with its quality. We explored the perceptions of medicines quality amongst senior representatives of the national agencies responsible for medicines quality assurance (MQAS), as well as treatment providers in Senegal, West Africa. The study was conducted in April/May 2013 in three urban centres in Senegal. Overall, 27 semi-structured interviews were held with key informants including managers from MQAS authorities as well as

		public and private sector doctors, nurses and pharmacists. A thematic approach to analysis was undertaken with emerging themes organised under two main categories; the source and type of medicine. A key emerging theme was the perception of inferior quality of generic medicines compared to their brand versions as they were lower in cost and thought to be less effective in alleviating symptoms, with additional concerns about their origin (primarily those manufactured in Asia and Africa). Additionally, the medicines available in the less regulated (informal) health sector were thought to pose a risk to public health as they were not subjected to national regulatory processes or stored appropriately. In contrast, the interviewees expressed confidence in medicines quality in the regulated sectors due to perceived stringent national medicines regulation and adequate technical capacity. The view that generic medicines are of inferior quality because they cost less may act as a barrier to their use, undermining international efforts to increase access to affordable medicines. The informal health sector in LMICs provides a convenient alternative for consumers, especially in locations where regulated health facilities are difficult to access. The views presented here may have implications for the development of national medicines policy and the procurement and supply of affordable medicines.
17:30-18:00	Panel /Audience discussion [above, plus Patricia Tabernero, Koen Peeters, Phaik Yeong Cheah, Raffaella Ravinetto]	
	Split Session - Pusey Room	
16:00-18:00	Strengthening QC Laboratory Analysis Capacity: Chair = Lutz Heide	
16:00-16:20	Lutz Heide *'Strengthening laboratory capacity for medicine quality control in low- and middle income countries'*	The worldwide spread of falsified medicines has been referred to as a "global pandemic", and it has been emphasised that "diagnostics are at the heart of any successful epidemic response effort" [Nayyar *et al.* The global pandemic of falsified medicines. Am J Trop Med Hyg. 2015; 92: 2-7.]. Therefore, strengthening laboratory capacity for medicine quality control is essential in order to fight this specific pandemic. For low-income countries, the complete pharmacopeial analysis of medicines is a major challenge. Pharmacopeial methods are primarily based on high performance liquid chromatography (HPLC). The instruments required are costly, and they are complex and sensitive tools that require careful handling by well-trained professionals and regular maintenance by skilled technicians. Many low- and middle-income countries lack the equipment and personnel for this type of analysis, which prevents regular monitoring of medicine quality at different levels of the drug supply chain and thus opens up the possibility for substandard and falsified medicines to enter the market. Appropriate technologies developed for medicine analysis in resource-limited settings enable more regular surveillance of the formal and informal drug market and help in the rapid detection of falsified medicines. Such technologies are discussed in another session of this conference. This presentation examines from a global perspective how both the availability and the performance of laboratories for the analysis of pharmaceuticals can be improved worldwide. Examples are presented from grass-root projects using appropriate technologies for low-resource settings, from the

		establishment of fully equipped WHO Prequalified Quality Control Laboratories, from the "Promoting the Quality of Medicines Program" of the US Pharmacopeial Convention, and from several other projects. Different approaches are discussed with their particular strengths and weaknesses.
16:20-16:35	Daniel Bempong *'Effective Approaches to Strengthening QC Laboratory Analysis Capacity'*	Laboratory testing of medicines is a core function in medicine regulation. In some LMICs, however, the medicine QC laboratory of the regulator is often limited in their ability to accurately and reliably test medicines, in conformance to international standards, such as ISO/IEC 17025:2005 and WHO prequalification program. Pre- and post-marketing surveillance of medicines in these countries is typically minimal, often restricted to sporadic sampling and sending samples for testing in laboratories in the developed world. Strengthening laboratory systems to assure the quality of medicines in LMICs are often complicated by challenges stemming from weak governance, lack of proper legislation, insufficient funding, inadequately trained laboratory staff, weak laboratory infrastructure, old or inadequately serviced equipment, lack of essential reagents and consumables, and limited quality assurance and control protocols. To tackle these challenges and resource limitations, introducing a regional model concept whereby one functional laboratory provides high-quality, accessible and efficient laboratory testing services for the entire region is an effective approach to reducing the burden placed on inadequately equipped national QC laboratories. The approach will encourage effective use of resources, information sharing, while mitigating the duplication of efforts. Examples of QC laboratories that have successfully overcome the above challenges and regional approaches to QC testing will be presented.
16:35-16:50	Nhomsai Hagen *'The identification of substandard misoprostol tablets leads to product recall: Improving patient safety through collaboration of academic research and national authorities in Malawi'*	Post-partum haemorrhage (PPH) is the leading cause of maternal mortality in low- and middle income countries (LMICs). Oxytocics, such as oxytocin and misoprostol, are used for the prevention and treatment of PPH, and are essential for lowering maternal mortality ratio. Misoprostol is also used for the induction of labour and for abortions. Previous studies showed a high prevalence of substandard oxytocin and misoprostol preparations in LMICs [Torloni *et al.*, Quality of oxytocin available in low- and middle-income countries: a systematic review of the literature. BJOG, 2016. 123: 2076-2086; WHO, Quality of misoprostol products. WHO Drug Information, 2016. 30(1)]. The University of Tuebingen and the University of Malawi carry out a joint study on the quality of oxytocics in Malawi. Misoprostol tablets and oxytocin injections are sampled at different points of the supply chain, and they are analysed according to the methods of USP and Ph. Int. In this ongoing study, two extremely substandard brands of misoprostol tablets were identified. They showed only 13% and 30% of the declared content of the API, respectively. Dissolution testing showed that only 8% and 21% of the API dissolved, respectively. Both brands were produced in India. Notably, a third brand, also produced in India, showed good quality (assay: 95 %; dissolution: 94 %). The poorest brand (assay: 13 %) had been distributed by the Malawian Central Medical Stores Trust (CMST) to all government

		health facilities. We informed the national drug regulatory agency of Malawi as well as CMST of the findings in January 2018. Notably, all responded immediately. The national drug regulatory agency (Pharmacy, Medicines and Poisons Board of Malawi; PMPB) issued a product recall. CMST discontinued supplying the substandard brand, and replaced it with the brand identified to be of good quality.
16:50-17:05	Guilhem Sivadier '*CHMP, a French structure accompanying developing countries to handle the counterfeit drugs issue'*	The CHMP (Humanitarian Center of Pharmacy Professions) is a French Humanitarian and Pharmaceutical independent association, created in 1992, recognized non-governmental organization by the Ministry of Foreign Affairs. We develop specific pharmaceutical know-how based on international pharmaceutical recommendations, and our credo "increase access to reliable medicines for populations in need" is solidified around four main fields of expertise : - Quality Control of medicines, through the only French WHO pre-qualified laboratory. It analyses the conformity of a great amount health care products and essential medicines to guarantee their reliability in the countries involved. - Training pharmacists and health professional, through its labelled training center, - Pharmaceutical expertise missions led in mainly African countries, some of these trough development projects financed by international funders (UNDP, UNFPA, Global Fund, etc.), - Innovation projects led in various fields (Chemistry, Physics, Metabolomics, Big Data & Deep Learning), led by CHMP, or in partnership with Universities, Companies, or National Public Research Institutes (CNRS, INSERM, etc.). These projects aims at solving recurrent critical issues in developing countries. Through this short presentation, a focus on the activities of CHMP dealing with the strengthening of the national QC laboratories in developing countries will be carried out.

17:05-17:20	Lutz Heide *'Specificity, sensitivity, cost and convenience of the GPHF Minilab as screening device for falsified and substandard medicines: experience from surveys in sub-Saharan Africa'*	Simple, low-cost technologies are required (in addition to full pharmacopeial analysis) to accomplish widespread surveillance for poor-quality medicines in low- and middle-income countries. Thin-layer chromatography (TLC) in form of the Minilab of the Global Pharma Health Fund (GPHF) is such a technology. Only very limited training is required for its use. TLC analysis using the Minilab has been employed in several studies of our group in sub-Saharan Africa, in combination with pharmacopeial analysis. TLC testing using the GPHF Minilab was found to be specific and reproducible for the identification of medicines which do not contain the stated API. These medicines represent an important and dangerous subgroup of substandard and falsified medical products. On the other hand, Minilab analysis showed only limited sensitivity and specificity of the in the detection of incorrect quantities of APIs. Photographic documentation of the UV-illuminated TLC plates, aided by a simple box for shielding from ambient light, greatly assisted in the evaluation and communication of Minilab results. The Minilab disintegration test proved to be a specific, albeit insensitive, pre-test for dissolution. In an medicine quality survey involving ten faith-based drug supply organizations in seven countries of Africa and Asia, the total external budget support required for Minilab analysis resulted as 50 US$ for each medicine sample. In contrast, the average cost of pharmacopeial analysis in a faith-based WHO prequalified laboratory in Kenya was 450 US $ per sample, and was quoted as 1,580 US $ by a South-African WHO prequalified laboratory. Use of the Minilab alone is not sensitive enough to reliably detect substandard medicines. However, in low- and middle-income countries the use of pharmacopeial methods alone is too expensive for routine surveillance and for larger surveys. The solution of this dilemma most likely lies in an appropriate combination of both methods.
17:20-18:00	Review & Panel/ Audience discussion [Above, plus Stephen Kigera, Marya Lieberman, Tariro Makamure-Sithole, Hiiti Sillo]	
18:00	Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
18:00-19:30	MQ Game in the Garden – Elizabeth Pisani	
19:30	Dinner - Keble Hall	

Thursday 27th September		
08:00-08:30	Summary of Day 3 – Raffaella Ravinetto	
08:30-10:30	View from the pharmaceutical industry: Chair = Catherine Duggan (to be confirmed) In this session we take an industry look at ensuring quality in medicines for public health in lower-income countries. With price driving procurement decisions, industry has responded in a number of ways to the challenge of ensuring quality at low price. The speakers will present perspectives from innovator and generic perspectives, as well as the role of organisations like the Medicines Patent Pool in increasing access to quality medicines	
08:30-08:50	Lester Chinery '*Quality in the Generics Industry'*	To categorise all generics manufacturers under a single banner would be inappropriate and misleading. The generic sector would be better described as two distinct industries – quality generics manufacturers and poor-quality generics manufacturers. What characterizes each of these two quite distinct groups of manufacturers? What are the incentives driving each group in their different directions? What challenges exist in moving more manufacturers towards quality? Concept Foundation has worked with generic manufacturers of reproductive and maternal health products for over 20 years, assisting many to achieve WHO prequalification for their products. This presentation will provide insights into quality in the generic manufacturing industry.
08:50-09:10	Patrizia Carlevaro *'Challenges in ensuring quality in technology transfers'*	Dr Carlevaro led one of the first pharmaceutical technology transfer projects, transferring know-how from innovator to generic manufacturers for TB medicines in the early 2000s. She is now a member of the Board of the Medicines Patent Pool. Quality is one of the fundamental principles of medicines technology transfers. Comparing early tech transfer approaches and with more recent approaches, this session will shed light on how technology transfers have contributed to improving medicine quality and what some of the challenges have been in ensuring quality.
09:10-09:30	Temitayo Erogbogbo '*Innovator role in reducing price and maintaining quality for global health products'*	Innovators, or research based pharmaceutical companies are often criticized for high medicine prices. Many however, contribute extensively to ensuring access to high-quality, low-priced medicines. Often, the activities they undertake come at significant internal cost. This presentation will look at what is involved in projects to increase access to innovative medicines beyond high-income country markets, including current examples.
09:30-09:50	Beth Boyer *'Access to Medicines Index'*	The Access to Medicine Foundation analyses 20 of the world's largest research-based pharmaceutical companies on how they make medicines, vaccines and diagnostics more accessible in low- and middle-income countries, publishing a biannual Index. The Foundation works to encourage companies to change their approach to access to medicine according to a set of expectations defined through a multi-stakeholder process. In relation to ensuring quality of medicines, the Index incorporates several measures where stakeholders agree that companies have an important role.

		Companies are expected to report substandard and falsified medicines to authorities, such as local regulatory authorities and WHO Rapid Alert, in a timely manner. By ensuring proper authorities are alerted of cases as quickly as possible, companies can reduce public health risks associated with substandard and falsified medicines. Stakeholders also agree that companies have a role in improving local manufacturing capacity and strengthening supply chain capacity in low- and middle-income countries. Through engaging in activities to build capacity in these areas, companies can reduce risks of manufacturing substandard medicines, falsified medicines entering the supply chain, and compromising medicine quality during storage and distribution. Through these measures, the Index both incentivises companies to do more in these areas through comparison with peers and by recognising good practice. This talk will go into more detail on what the Access to Medicine Index is, how it measures, and describe hose measures which relate to the quality of medicines. Examples of good practice and areas where companies can improve will be highlighted.
09:50-10:30	Panel/ Audience discussion [Above, plus Elizabeth Pisani, Raffaella Ravinetto, Theophile Sebgo, Christa Cepuch]	
10:30-11:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
11:00-13:00	Laws and their application: Chair = Wilbert Bannenberg	
11:00-11:20	Catherine Dujardin *'The Belgian commitment to pharmaceutical quality: a new model to assure the quality of medicines available through humanitarian and development programs'*	Poor-quality medicines circulate in the global market and penetrate less-regulated countries, due to a combination of globalization of production/distribution, lack of regulatory harmonization, and weakness of National Medicines Regulatory Authorities. They harm individuals (therapeutic failure, toxicity), public health (resistances) and health systems (erosion of trust, waste of resources). Medicines regulation is the responsibility of the State, but if insufficient resources are available for regulators, donors and implementers play de facto a key-role in determining the quality of medicines they supply. These acrots have the ethical responsibility to avoid differences in quality assurance (thus, in patients' protection) in the "donor" vs. the "recipient" country. Unfortunately, translating this principle into practices is complex, since quality risks are usually higher in low-income "beneficiary" countries, compared to the high-income "donor" countries, and because the procurement policies of many donors/implementers lack adequate quality assurance requirements. The Belgian Directorate-General for Development Cooperation & Humanitarian Aid has engaged in active dialogue on such challenges with its implementers. This process resulted in a "Commitment to Quality Assurance for Pharmaceutical Products", signed in October 2017 by the Vice Prime Minister and Minister for Development Cooperation and 19 Belgian implementers. They subscribed to a double commitment: to ensure medicines' quality in programmes funded by Belgium's Official Development Assistance; and to build quality-assurance capacities in recipient countries. The Commitment integrates pragmatic administrative

		rules: implementers should integrate in their financing applications a sections for quality assurance and for capacity building plans, with a justified budget. They should rationalize and mutualize costs, by aligning strengths of the various implementers. The new policy is being implemented in a stepwise approach, through ongoing monitoring and evaluation, with peer-reviews and concerted corrections. This model could be considered by other donors, to contribute to reduce inequity in pharmaceutical quality, and to protect vulnerable communities from poor-quality medicines.
11:20-11:40	Mohga Kamal-Yanni *'Quality , counterfeit and trade: dangerous confusion'*	It is important to differentiate between "quality" and "counterfeit" of medicines. The confusion leads to inappropriate actions, which hinders access to medicines. The presentation will cover : Definitions. There are clear differences between quality problems such as substandard or falsified medicines, and trade issues of counterfeit. • WHO definition of substandard and falsified medicines. • WTO definition of counterfeit products as a violation of trade roles. The dangers of confusing bad quality with counterfeiting. While ensuring actual quality of medicines is essential for effective treatment, the idea of "quality" has been used as a sort of Trojan Horse to enforce stricter intellectual property rules. Ensuring quality medicines is the responsibility of national drug regulatory authorities, which have the appropriate capacities to assess medicine quality. On the other hand, applying trade rules to stop counterfeit medicines is the responsibility of the judicial system, including the international Interpol, and requires an entirely different set of skills. Confusing bad quality medicines with those that violate trade rules, i.e. are counterfeit, results in pushing countries to adopt detrimental actions that do not improve quality. In such cases the enforced actions focus on increased enforcement of strict intellectual property rules, preventing access to legitimate generic medicines. Examples of actions that deal with trade violations instead of improving quality and their impact on access to medicine. It is critical that governments take actions to ensure quality medicines and to stop substandard and false medicines from circulating and damaging people's health. However, it is also essential that global, regional and national bodies stop using the argument of protecting quality in order to enforce more intellectual property rules, hindering access to medicines and thus damaging people's health.
11:40-12:00	Ali Barde Umoru *'Combating the Incidence of Poor Quality Medical Products through Legislation: The Nigerian Experience'*	Nigeria has been struggling for the past two decades to reduce the incidence of poor quality medical products with modest achievement. The World Health Organisation recent reports suggest that 42% of reported cases of poor quality Medicines are in the WHO African region. Further reports from the London School of Hygiene and Tropical Medicine estimate an additional 15800 annual deaths from malaria in sub-Saharan Africa is due to counterfeit medicines. In Nigeria, recent studies have shown that about 17% of essential medicines and as much as 30% of antimalarial medicines are

		routinely faked. The problem of poor quality medical product in Nigeria among other reasons results from gaps in regulatory capacity, weak and fragmented medicines supply chains, inadequate post marketing surveillance, inadequate quality control measures, Inappropriate procurement process and in sufficient penalties for offenders. The incidence of poor quality medical products can be grossly reduced in Nigeria through legislative review and oversight, by addressing the insufficiency and ineffectiveness in enforcing existing drug laws. Nigeria is a Federation consisting of the Federal, State and Local government. Drug laws in Nigeria are in the exclusive legislative list and only the Federal Parliament [National Assembly] is responsible for amendments and enactment of the Drug laws. A review of drug laws in Nigeria shows that there are at least ten drugs and drug–related laws. However there is an urgent need for the amendments of some of these laws, which are grossly insufficient to meet the demands of current realities of combating poor quality medical products. Currently some of these laws are before the parliament for review and amendment to address the identified gaps, ensure accurate regulation and implementation, and strengthen the administrative, legal and supervisory framework of the medicine regulatory authority to combat incidences of poor quality medical product in Nigeria.
12:00-12:20	Eugenia Olliaro *'Medicine falsification: legislative discrepancies and gaps'*	WHO defines falsified medicines as "medical products that deliberately/fraudulently misrepresent their identity, composition or source". They pose a serious threat to people's health worldwide, to which low- and middle-income countries are especially vulnerable. Adequate, up-to-date country legislation (including definitions and sanctions) is one of the key elements to mount an effective and coordinated response. We undertook to identify, analyse and map out legislations – or lack thereof, whether directly applicable to falsified medicines (i.e. with provisions specifically regulating falsified medicinal products) or indirectly applicable (i.e. with provisions regulating an infringement which could secondarily be used for falsified medicines). Country-specific information was sought through web searches, solicited information from relevant country agencies, and establishment of a network of key informants. We identified 122 applicable laws in 63 different countries: 40% (n=25) from Africa, 25% Europe (n=16), 21% Asia (n=13), 14% Americas (n=9). We obtained 49 directly applicable legislations from 39 of these countries (i.e. containing one or more provisions specifically addressing issues pertaining to falsified medicine), whereas the remaining 24 countries only had 73 indirectly applicable legislations at their disposal (e.g. Laws on Customs, Consumer protection). By compiling an inventory of legal definitions and regulations on falsified medicines at country level, we aimed to generate an open-access legislative repository to be used as an updatable online tool.

		Our work substantiates concerns about the legislative unpreparedness to the growing threat of falsified medicines, and pinpoints areas where investments into strengthening the legislative framework are required. We will present the legislative mapping and provide representative examples of the range of situations identified. Possible actions, including the advantages of a model law that could be tailored to country-specific situations, should be considered to address the current legislative gaps.
12:20-13:00	Panel/Audience discussion [above, plus Chris Bird]	
13:00-14:00	Lunch. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
14:00-15:00	Strengthening & Financing Medicine Regulation: Chair = Raffaella Ravinetto	
14:00-14:20	Graham Carroll *'MHRA's approach to strengthening and financing medicine regulation'*	The Medicines and Healthcare products Regulatory Agency has a well-established global reputation as a leading regulator of medicines, medical devices and blood components. This reputation has been achieved through a long history of working collaboratively with other medicines regulators and representatives of industry to develop and maintain effective legislation and guidance, and to understand and adapt to the changing nature of the industry. This talk will briefly review the role, structure and governance of the Agency and how its work is financed. It will then look in more detail at how the Agency supports innovation and collaborates with other regulatory agencies around the world to promote standardisation and harmonisation, and to achieve its goal of protecting and improving public health.
14:20-15:00	Panel/ Audience discussion [above, plus Agnes Sitta Kijo, Dinesh Thakur, Rachel Cooper, Tariro Makamure-Sithole, Hiitti Sillo]	
15:00-16:30	How to engage over public concerns over poor quality medicine 'outbreaks' – learning from infectious disease outbreak engagement ? Chair = Peter Horby	
15:00-16:30	Panel/ Audience discussion - TBA	
16:30-17:00	Coffee/tea. Exhibition, Displays & Posters – ARCO & Douglas Price Rooms	
17:00-18:30	Pre-qualification – different models**:** Chair = Souly Phanouvong	
17:00-17:30	Lembit Rago *'WHO Prequalification of Medical Products: Present Status and Future Aspirations'* '	WHO prequalification (PQ) of vaccines, medicines and medical devices has been a success story. It has dramatically increased access to quality medical products without making them more costly. It has been a collective effort of many partners united by WHO leadership. Clear transparent standards and processes from WHO, unified quality assurance policies of procurers and funders referring to prequalification as a preferred standard, technical assistance and lending regulatory expertise from national regulators, collaboration from manufacturers, input from academia and support from funding agencies and governments – all have been crucial. The impact of PQ has been vast. Most of the vaccines used in developing countries are prequalified and prequalified (mostly generic) antiretroviral medicines make up most of the treatment in most HIV prevalent countries - to mention some. The

		use of prequalified reproductive health products and in vitro diagnostics is also on increase. PQ has established procedures that can address relative lack of quality products enabling risk based quality assessment of existing products inform procurers about quality risks. PQ has also established procedures to assess products in case of emergency. The clear added value of PQ has been systematic effort of regulatory capacity building by practical involvement and training of regulators from countries of limited resources. PQ rotational programme is seen as of special value. It enables regulators from these countries to work 3-6 month in PQ programme and then return to their home authorities. It is clear that PQ has from one hand to increase its coverage moving into new product areas. It also has to develop strategies how it could be starting to move more towards works-sharing and reliance on regulatory decisions from a bigger number of regulators – not only relying on those that have been called "stringent".
17:30-17:45	Stephen Cook *'WHO Prequalification and National Product Licensing: Are they needed?* '	WHO Prequalification (PQ) is an important part of the global quality system for medicines and vaccines. It is an assessment to ensure that candidate products meet WHO criteria and may be required for purchase of candidate products by the United Nations and other international procurement agencies. As such, the centralized PQ system sets transparent quality standards for manufactured products and can be considered an effective mechanism for countries with limited or no regulatory capabilities to secure access to medicines and vaccines of known quality and safety via supranational supply. However, PQ does not connote a legal standard and is not a prerequisite for national registration. It does however complement and in some cases, support regulatory approvals by national authorities. The collaborative registration procedures associated with the WHO PQ Program are one mechanism that WHO has developed to support the streamlined regulatory review and approval by national regulatory authorities thereby ensuring the timely and efficient registration of prequalified medicines. However, this is not the only mechanism via which national authorities with limited resource can be assured of the quality of the product. For example, WHO has also developed collaborative registration procedures to facilitate national regulatory approval which do not reply upon PQ but are based on a "Stringent Regulatory Authority" (SRA) approval. This presentation will review the WHO PQ process from an industry perspective and provide insights on the role that PQ can play in both supporting national registrations and facilitating product supply. It will also highlight other mechanisms that can be used to accelerate product availability.
17:45-18:00	Lester Chinery *'Regulatory pathways for market access'*	In order for manufacturers of medicines to make their products available to LMICs, there are a range of access pathways that can be adopted, each one influenced by the profile of the target customer and country and the profile of the manufacturer. Companies tailor their market access strategies taking into account the best pathway to achieve fastest market access. These pathways range from full prequalification by the WHO or similar

		stringent regulatory pathway through to complying with internal requirements of a UN agency or other customer. The presentation will discuss each approach in the context of ensuring medicine quality.
18:00-18:30	Panel/Audience discussion [above, plus Raffaella Ravinetto, Paul Nkansah, Hiiti Sillo, Isabel Lucas Manzano]	
18:30-19:30	Posters/Bar. Exhibition & Posters – ARCO Room & Displays – Rooms above Lecture Theatre	
19:30	Dinner at Keble with talk 'Learning from the Aviation Industry' –by Keith Conradi, Chief Investigator, Healthcare Safety Investigation Branch (previously Chief Investigator of Air Accident Investigation Branch) at 20:30	

Friday 28th September		
08:00-08:30	Summary of Day 4 – Veronika Wirtz	
08:30-10:30	How should policy change and how to facilitate this? Chair = Nick White	
08:30-09:00	*Alice Jamieson* *'Policy change to improve the quality of medicines: what's happening and where do we go from here?'*	Poor quality medicines threaten the health of the most vulnerable people and their trust in health systems. They are also linked to growing antimicrobial resistance, making some of our best treatments against malaria, pneumonia and other serious conditions increasingly inadequate. Driven by research that Wellcome funds, Wellcome's policy team is scoping how to better work with key stakeholders to improve the quality of medicines reaching patients in low and middle income countries. There are many existing programmes and initiatives that aim to improve the quality of medicines. These often target different aspects of complex global and national systems for medicine production, supply, access and use. These global and national initiatives, the World Health Organization taking a leading role in tackling substandard and falsified medicines and the definitions agreed at the 2017 World Health Assembly, have provided the foundations for a growing political recognition of the public health importance of medicine quality. This political interest needs to be galvanised to bring about long-term change. Critical questions are how to build on these efforts to drive policy change to address medicine quality issues, avoid duplication of activities, make the most of the expertise in different fields and bring them together. This presentation will give an overview of some of the key initiatives to influence policy at national and international levels and consider if and how medicine quality could be championed as an integral part of a wider global health agenda.
09:00-09:15	Jingying Xu *'A Social Constructionist Examination of China's Policy on Falsified, Substandard and Counterfeit medicines (1978 - 2017) and Implications for Global Health Governance'*	The Chinese pharmaceutical industry today plays a significant role in the global market. It supplies 80 percent of the active pharmaceutical ingredients and an increasing volume of generic drugs and biosimilars to the world market. However, frequent incidents of falsified, substandard and counterfeit (FSC) medicines continue to jeopardise the industry's reputation and pose challenges to policy makers. To date, Chinese policy responses to the problem of FSC medicines have been less than sufficient, coherent and well-coordinated, reflecting a whole array of policy contexts and actors involved. This research examines Chinese policy responses to FSC medicines by applying framing theory to understand how the issue of FSC medicines has been socially constructed over the past four decades. The concept of framing helps explain the various ways in whih FSC medicines have been perceived and addresses by Chinese policy makers. Based on extensive fieldwork and secondary literature on FSC medicines, this study proposes that policy debates on and responses to FSC medicines in China have been shaped by four policy frames, namely, economism, health and well-being, legalism, and security. This research argues that each frame is

		used to define the nature of the policy problem, goals and solutions within a particular set of ideas, interests and institutions. Competition among frames is an indication of differences in the ways in which actors see, interpret and respond, and how such differences have given rise to competing policy priorities and thus potential policy incoherence. By considering Chinese policy response to FSC medicines from the perspective of framing, the research seeks to shed light on the prospects of strengthening policy responses in China and globally.
09:15-09:30	Marie Lamy *'Falsified and Substandard antimalarial medicines in the Greater Mekong Subregion: problem definition and policy making in Cambodia, Laos, and Thailand'*	Falsified and substandard medicines (SFs) pose a considerable threat to human lives and an obstacle to infectious disease control. Since the 1990s, there has been widespread debate in the literature on the drivers and determinants of SF and while past studies highlight the definition discrepancies of SFs in national laws and policies, few studies have explored how the problem of SFs is understood by policy actors across national and institutional settings, and what the implications of this are on a policy response. This paper explores varying interpretations of the SF problem among policy actors in Cambodia, Lao PDR and Thailand through a document analysis and semi-structured interviews with key 51 policy actors. It proposes an analysis of the role of ideas in policy processes. Through framing analysis, this paper explores the variations in perceptions of this threat across institutional and national settings and analyses how these varying interpretations influence policy developments and impact cross-border cooperation. Despite notable national policy efforts against SF antimalarial medicines in the GMS, evidence suggests that the problem of SFs persists, particularly of substandard medicines. As trade liberalization in the region intensifies, there are concerns that reduced custom controls and higher mobility of people and goods may cause further increase in this illicit trade. National laws and policies in Cambodia, Lao PDR and Thailand define SFs differently yet three dominant frames emerge from speaking with policy actors; the security, the health systems and the regulatory frames. Respondents highlight the potential for more efficient policy coordination against poor-quality essential medicines in Southeast-Asia by invoking the regional health security concept. This, they argue, is a key component of harness political will among decision makers.
09:30-09:45	Katherine Bond '*Medicines We Can Trust: A Campaign for Safe, Quality Medicines'*	Poor-quality medicines threaten families, countries and global health progress everywhere, and yet they are rarely prioritized – or even discussed –by political leaders, health advocates, researchers or journalists. Those people who *have* committed to work on safe, quality medicines often lack platforms to coordinate their advocacy for maximum impact. A campaign on the right to safe, quality medicines can: • **Generate a sense of urgency** by raising awareness of the scope and impact of the problem to policy makers, professional and practitioner groups, patients and the public;

		• **Put people and their experiences first** to illustrate that poor-quality medicines cannot be confined to technical, isolated conversations; they are a fundamental breach of patient trust with life-or-death consequences • **Inspire collective action** and unify a diverse and broad coalition of partners in a Call to Action. This presentation will outline the rationale, principles and plans for the Medicines We Can Trust Campaign driven by a coalition of regulators, academics, and civil society organizations to generate more investments and targeted action to stem the tide of substandard and falsified medicines globally, and to generate a discussion on key strategic elements of the Campaign for targeted action.
09:45-10:30	Panel/ Audience discussion [above, plus Nicholas White, Keith Conradi, Raffaella Ravinetto, Moji Christianah Adeyeye, Elizabeth Pisani, Muhammad Zaman, Hiiti Sillo]	
10:30-11:00	Coffee/tea	
11:00-12:30	Consensus statement discussion & Final Discussion. Chair = Paul Newton	
	To debate and discuss a brief consensus statement	
12:30-13:30	Lunch Close	

Posters

Ayenew Ashenef *'Comparative In Vitro and In Vivo Quality Evaluation of Some Metformin Hydrochloride and Glibenclamide Tablets Marketed In Addis Ababa, Ethiopia'*	The increasing use of generic drugs in clinical practice creates the need for adequate quality assurance and control and also assessment of bioavailability. Thus, the present study was aimed to assess quality as well as physicochemical bioequivalence of six brands of metformin hydrochloride and five brands of glibenclamide tablets marketed in Addis Ababa, Ethiopia using in vitro and in vivo methods. All the brands of metformin hydrochloride and glibenclamide tablets complied with the official specification for hardness, friability, disintegration and assay. In addition, all brands of metformin hydrochloride tablets possessed acceptable uniformity of weight as per the pharmacopoeial limit. Five brands of metformin hydrochloride complied with the USP dissolution tolerance limits but Metformin Denk failed to release the stated amount. The f1 values were less than 15 and f2 values were greater than 50 for all products of glibenclamide. This suggests that the release of glibenclamide from all products of glibenclamide was similar with Daonil (the innovator product). However, the in vivo studies of products of metformin hydrochloride tablets indicated that there is no significant difference in percent reduction of blood glucose level between the brands of Neomid and Metformin Denk, between Neomid and Brot, and between Metformin Denk and Brot as shown by the analysis of variance ($p > 0.05$). Therefore, based on the in vivo results Metformin Denk, Brot and Neomid might exert similar biological effect and hence, might be substituted for each other. On the other hand, the in vivo studies of products of glibenclamide tablets indicated that there is no significant difference in percent reduction of blood glucose level between the brands of glibenclamide and innovator product (Daonil) ($p > 0.05$). Hence, based on the in vivo results and in vitro dissolution studies, the brands might be substituted with the innovator product in clinical practice.
Keiko Maekawa *'Quantification of Gentamicin by hydrophilic interatcion chromatography with tandem mass spectrometry'*	Gentamicin (GM) is a broad spectrum water-soluble aminoglycoside antibiotic widely used as sulfates for the treatment of various infections caused by both Gram-negative and Gram-positive bacteria. It is a composite pharmaceuticals consisting of three major components, C1, C1a and C2 together with numerous minor components including C2a, C2b, garamine and sisomicin. The antimicrobial potency of GM is determined by microbial assay, which is based on antimicrobial activities of all components including major and minor components, and impurities. Therefore, besides microbial assay, its quality should be evaluated by physicochemical methods such as chromatographic analysis for each component. However, components of GM are hydrophilic, structurally closely related compounds without UV absorbing chromophores, making the HPLC analysis more difficult and challenging. In this study, an HPLC/MS/MS method was developed for the measurement of each GM component. Using this method, 32 samples of GM injections in Cambodia and Myanmar were analyzed to evaluate their qualities. GM components were separated by hydrophilic interaction liquid chromatography (HILIC) using tobramycin (TB) as an internal standard. MS analysis was performed by an electrospray ionization (ESI) followed by multiple reaction monitoring (MRM) in the positive ion mode. The total GM was reported as the sum of the components, C1, C1a and C2, which were quantified individually by LC-MS/MS. [Results and discussion] The linearity of calibration curve for each GM major component, C1, C1a and C2 was investigated in the concentration range of 20 – 400 μg/mL as a total GM. For

	these components, the correlation coefficients were better than 0.99 for peak area ratios (GM/TB). Of 32 samples, 3 samples contained little or no GM, while one sample contained more than 150% of defined content. The developed analytical protocol based on LC-MS/MS for the quantification of GM is useful for routine assays.
Tomoko Kakio *' Detection of Substandard and Falsified Tablets in Asia with Pharmacopeial Tests and Principal Component Analysis'*	The WHO has warned that substandard and falsified medical products (SFs) can harm patients and fail to treat the diseases for which they were intended, and they affect every region of the world, leading to loss of confidence in medicines, healthcare providers and health systems. Therefore, development of analytical procedures to detect SFs is extremely important. We investigated the quality of pharmaceutical tablets collected in China, Indonesia, Japan, Myanmar, using the pharmacopeial analytical procedures, together with principal component analysis (PCA) of Raman spectrum. Some samples showed delayed dissolution and failed to meet the pharmacopeial specification, while others failed the assay test. These products appeared to be substandard. PCA showed all Raman spectra could be explained in terms of two components: the amount of the active pharmaceutical ingredient (API) and the kinds of excipients. PCA score plot indicated one substandard and the falsified tablets have similar principal components in Raman spectra, in contrast to authentic products. The locations of samples within the PCA score plot varied according to the source country, suggesting that manufacturers in different countries employ different excipients. Our results indicate that the handheld Raman device will be useful for detection of SFs in the field. PCA of that Raman data clarify the difference in chemical properties between good quality products and SFs that circulate in the Asian market.
Irina Ghazaryan *' National System of Pharmacovigilance in Armenia'*	In many low- and middle income countries there is need for strengthening a national system of Pharmacovigilance (PV) to safeguard safety and quality of medicines. The aim of this work was to assess the PV system in Armenia and evaluate whether it meets recommendations of the World Health Organization (WHO). Four components (legislation and regulation, structure, data management and communication) were analyzed. Data were collected from official regulation documents and other publication, web-sites of official organizations: National Assembly, Ministry of Health, Scientific Centre of Drug and Medical Technologies Expertise (SCDMTE). The results of assessment show certain achievements. For implementing functions of a national PV center Pharmacovigilance Department was established at SCDMTE; its duties include detection, assessment, understanding of Adverse Drug Reactions (ADRs) reports, providing expertise, etc. SCDMTE is a member of the WHO International Program of ADR Monitoring since 2001. In the new Law "On Medicines", approved in 2016, provisions on ADRs Monitoring were expanded; in particular, the current system involves reporting cases of falsified medicines, lack of efficiency and medication errors. However, term Pharmacovigilance is not used in the Law and definitions of ADR, adverse event are not available. New Regulation and Form for reporting were approved in 2017. Underreporting is observed; in 2008-2010 only 352 reports on adverse events were received by SCDMTE. Thus, PV system in Armenia mostly meets minimum requirements that should be present in any national PV system: national PV centre, national spontaneous reporting system, national database, and clear communication strategy are in place. Our experience with inclusion of seminar on PV in continuing education courses for pharmacists demonstrated effectiveness of training. There is need in further strengthening PV system through certain changes in regulation, improving knowledge of

	physicians and pharmacists. Inclusion PV topic in all curricula taught at the Medical University would be helpful.
Irina Ghazaryan '*Quality of medicines in supply chain'*	Quality of medicines in supply chain is not always assured, especially in low- and middle-income countries where resources are restricted. The objectives of this work were to evaluate appearance of falsified and substandard medicines in Armenian pharmaceutical market as well as to study opinion of local community pharmacists about the situation regarding quality of medicines in the country. Data about counterfeit medicines and products with quality defects identified in Armenia were taken from web-sites of the Scientific Centre of Drug and Medical Technologies Expertise (SCDMTE). Opinion of local pharmacists was studied by interviewing 352 randomly selected community pharmacists and pharmacy technicians from different regions of Armenia. The results show that 21 counterfeit medicines were identified by authorities for the period from 2001 to 2017. 9 substandard and 4 counterfeit medicines were recalled during 2016 and 2017. Community pharmacists think that response to poor quality of medicines in the pharmaceutical market is a challenge. 77.8% of them suppose that this issue is very important for Armenia, 13.4% consider it rather important and only 1.7% think that this challenge is not important at all and rather not important. 90.4% of responders believe that issue of poor quality of medicines should be urgently solved. 84.4% of community pharmacists think that presence of falsified medicines in the pharmaceutical market in Armenia is very important or rather important problem and the same percept of respondents suppose that it has to be urgently solved. There is no significant difference between opinions of pharmacists and technicians, men and women, respondents of different age. Thus, falsified and sub-standard medicines still appear in the Armenian pharmaceutical market, and response to poor quality of medicines is considered as important challenge by the majority of professionals from community pharmacies. There is urgent need in implementing appropriate strategies for improving the situation.
Mirfin Mpundu *' GMP improvement: A way to increase medicine quality and patient quality'*	TBA
Mirfin Mpundu *' Quality Control of medicines in Burundi'*	TBA
Mirfin Mpundu *'Improvement of pharmaceutical Type 2 diabetic care in Zambia'*	TBA

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