

# A Survey of Physicians' Knowledge and Attitudes Regarding Antimicrobial Resistance and Antibiotic Prescribing Practices at the University Hospital of the West Indies

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## ABSTRACT

**Objective:** To identify physicians' knowledge and attitudes regarding antimicrobial resistance and antibiotic prescribing practices at the University Hospital of the West Indies (UHWI).

**Methods:** A cross-sectional survey of physicians at the UHWI was conducted between September 2008 and April 2009 using a 28-item, self-administered questionnaire. Eligible physicians from several specialities were identified from departmental rotas.

**Results:** A total of 174 physicians completed the questionnaire, a response rate of 73%. Most physicians considered antibiotic resistance to be an extremely important global problem (55%) but less significant nationally (35%). Factors identified as important in producing resistance included widespread use of antibiotics (91%), inappropriate empiric choices (79%) and use of broad-spectrum agents (70%). Hand-washing was not considered to be important in reducing resistance. Useful interventions included access to current information on local resistance patterns (90%), institutional specific antibiotic guidelines (89%) and educational programmes (89%). Antibiotic cycling (40%) and restriction (35%) were regarded as less helpful. Knowledge of resistance-prone antibiotics and specific resistant organisms at the UHWI was poor, except for methicillin-resistant *Staphylococcus aureus* (MRSA). Empiric therapy for common infections was appropriate in most cases, and antibiotic choices were guided by availability of drugs (89%) and patient factors such as renal disease or allergy (80%). Only 45% of physicians would de-escalate to a narrow-spectrum antibiotic guided by a microbiology report, and consultants were more likely to de-escalate therapy than junior staff ( $p = 0.002$ ).

**Conclusions:** Although physicians were aware of the problem of resistance to antibiotics and the contributory factors, their practice did not reflect measures to reduce it. Continuing educational programmes and institution-specific antibiotic prescribing guidelines are needed.

**Keywords:** Antibiotic resistance, antibiotic prescribing practice

## Un estudio Sobre los Conocimientos y Actitudes de los Médicos en Relación con la Resistencia Antimicrobiana y la Práctica de Prescripción de Antibióticos en el Hospital Universitario de West Indies

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## RESUMEN

**Objetivo:** Identificar los conocimientos y actitudes de los médicos con respecto a la resistencia antimicrobiana y la práctica de prescripción de antibióticos en el Hospital Universitario de West Indies (UHWI).

**Métodos:** Se llevó a cabo un estudio transversal en UHWI, entre septiembre del 2008 y abril del 2009 de abril, usando un cuestionario autoadministrado de 28 puntos. Los médicos elegibles de varias especialidades fueron identificados de las listas departamentales.

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**Resultados:** Un total de 174 médicos completaron el cuestionario, para una tasa de respuesta del 73%. La mayor parte de los médicos consideró que la resistencia antibiótica constituye un problema sumamente importante desde un punto de vista global (55%) pero menos significativo desde una perspectiva nacional (35%). Los factores identificados como importantes en la formación de la resistencia incluyeron el uso generalizado de antibióticos (91%), las elecciones empíricas inapropiadas (79%), y el uso de agentes de amplio espectro (70%). El lavarse las manos no se consideró importante para la reducción de la resistencia. Las intervenciones útiles incluyeron el acceso a la información corriente sobre patrones de resistencia locales (90%), normas institucionales específicas sobre el uso de antibióticos (89%) y programas educativos (89%). El ciclo (40%) y la restricción (35%) de los antibióticos se consideraron menos útiles. El conocimiento de antibióticos con tendencia a la resistencia y organismos resistentes específicos en el HUWI era pobre, excepto en el caso del *Staphylococcus aureus* resistente a la meticilina (SARM). La terapia empírica para las infecciones comunes fue apropiada en la mayoría de los casos, y las opciones antibióticas estuvieron dictadas por la disponibilidad de medicamentos (89%) y factores relacionados con los pacientes, tales como enfermedades renales o alergias (80%). Sólo el 45% de los médicos desescalarían a un antibiótico de estrecho espectro guiado por un informe microbiológico, y los consultantes mostraron una tendencia mayor a desescalar la terapia, en comparación con la observada en el personal subalterno ( $p = 0.002$ ).

**Conclusiones:** Aunque los médicos tenían conciencia del problema de la resistencia a los antibióticos y los factores contribuyentes, su práctica no reflejó las medidas para reducirla. Se necesitan programas de educación continua y normas institucionales específicas para la prescripción de antibióticos.

**Palabras claves:** Resistencia antibiótica, práctica de la prescripción de antibióticos

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## INTRODUCTION

The emergence of antibiotic resistance as a global problem underscores the need for physicians to be aware of its existence and the factors that drive its development. Relative resistance refers to the gradual increase in the minimal inhibitory concentration ( $MIC_{90}$ ) occurring in susceptible organisms. Absolute resistance occurs when a previously sensitive organism no longer responds to an antibiotic, independent of dose. Acquired absolute resistance to antibiotics is the most common and serious resistance problem seen clinically (1). Resistance results in increased hospital stay, costs, morbidity and mortality (2, 3).

Resistance develops through multiple mechanisms. Bacteria can undergo genetic changes, resulting in the production of enzymes that inactivate or destroy the antibiotic, alteration of the antibiotic target site, or prevention of antibiotic access to the target site (4, 5). Development of resistance may also be influenced by antibiotic usage which selects for resistant subpopulations (6). In some cases, antibiotics actually induce the production of enzymes that cause resistance (7). It has been observed that areas within hospitals that have the highest resistance rates also have the highest rates of antibiotic use (8). Appropriate antibiotic stewardship including optimal selection, dose and duration of treatment, could prevent or slow the emergence of resistance (6). Previous studies evaluating physicians have shown both deficient knowledge of the magnitude and causes of resistance, as well as poor correlation between knowledge and practice (9–12). The objective of this study was to identify physicians' knowledge and attitudes regarding

antimicrobial resistance and current antibiotic prescribing practices at the University Hospital of the West Indies (UHWI). The information gained can be used in designing more effective antibiotic control interventions and educational programmes.

## SUBJECTS AND METHODS

A cross-sectional survey of physicians at the UHWI, a 500-bed teaching hospital, was conducted between September 2008 and April 2009. Physicians were identified from departmental rotas and a total of 240 doctors were targeted. Eligible physicians included all levels of staff (intern to consultant) from anaesthesia, intensive care, internal medicine, surgery, obstetrics, gynaecology and emergency medicine. A 28-item, self-administered questionnaire was used. Full confidentiality was maintained and approval for the study obtained from the Faculty of Medical Sciences, The University of the West Indies/University Hospital of the West Indies Ethics Committee.

Physician demographics (age, gender, seniority, specialty) were collected. Physicians' perceptions on the magnitude of the problem, contributing factors, interventions and complications were assessed. Data collected on prescribing practice included empiric therapy choices, duration of therapy, factors affecting choices and de-escalation practice. Physicians' opinion of their scope of knowledge and interest in further education were obtained.

Questions on opinions used a 4–8 point Likert-style graded response option, ranging from unimportant to extremely important to describe their opinion on the magnitude

of the problem of resistance, minimally to very important for factors contributing to resistance, useful to not useful for interventions to prevent resistance and extremely rarely to often for outcomes of resistance. Data were entered in Microsoft Excel and re-checked to minimise errors, then analysed using SPSS version 12.0 software®. Statistical significance was assessed using the Fisher's exact test, and a *p*-value of less than 0.05 was considered significant.

## RESULTS

One hundred and seventy-four physicians completed the questionnaire, yielding a response rate of 73%. There were almost equal numbers of males and females, 48% and 52% respectively. Most were under five years post-registration (40%), one-third (33%) were 5–9-years and the remainder (27%) were over nine years. Residents made up the majority of respondents (*n* = 72, 41%), followed by consultants (*n* = 53, 31%), senior residents (*n* = 28, 16%) and interns (*n* = 21, 12%). Of the 174 physicians who responded to the survey, most (*n* = 61, 35%) belonged to the surgical specialties, approximately one fifth each were anaesthetists/intensivists (*n* = 35, 20%) and internists (*n* = 36, 21%) and the remainder were obstetricians and gynaecologists (*n* = 23, 13%) and emergency physicians (*n* = 19, 11%). Most had no additional training in microbiology postgraduation (93%).

### Magnitude of the Problem

Physicians were asked to make an assessment of the extent of the problem of antibiotic resistance in their own hospital, on a national level and worldwide. Most physicians thought that antibiotic resistance was an extremely important (55%) global problem. However, the institutional and national problems were not perceived to be as great. Fewer physicians (45%) felt that antibiotic resistance was a major problem in their hospital, and only 35% assessed the problem as being extremely important nationally. The majority (54%) thought the problem of resistance at the UHWI was less than globally, 22% considered it similar and 9% considered it greater. Statistically significant differences were detected by physician specialty regarding the perceptions of national and insti-

tutional problems (*p* = 0.03 and 0.02). Anaesthetists/intensivists were more likely to consider resistance very or extremely important (nationally 54%, institutionally 74%), while emergency physicians (32% respectively) and internists (25% and 39% respectively) were less likely.

### Causes, Solutions and Complications

Most physicians thought that widespread antibiotic use (91%), inappropriate empiric choices (79%), inappropriate course durations (79%) and use of broad spectrum antibiotics (70%) were very important contributors to resistance. Poor access to local antibiograms (66%) and lack of guidelines on antibiotic usage (61%) were also considered important. The factors perceived to be minimally important included hand-washing (34%), patient's demands and expectations for antibiotics (27%) and the role of pharmaceutical companies in promoting antibiotics (23%) (Table 1).

Interventions that were considered to be useful in prevention included access to current information on local resistance patterns (90%), institution-specific antibiotic guidelines (89%), educational programmes (89%) and regular microbiology consultations and ward rounds (72%). Only 40% of respondents thought that antibiotic cycling would be useful and even less (35%) chose antibiotic restriction (Table 2). When asked if the current UHWI antibiotic restriction policies should be changed, only 38% felt that they should be increased, 34% wanted no change and 22% were unsure.

Physicians were asked to identify resistant organisms seen at the UHWI. Methicillin-resistant *Staphylococcus aureus* (MRSA) was chosen by 90% and multi-resistant *Pseudomonas aeruginosa* by 60%. Multiresistant *Acinetobacter spp* and vancomycin resistant *Enterococcus* (VRE) were only identified by 37% and 33% respectively. Most physicians did not realize that the extended spectrum beta-lactamase producing *Escherichia coli* and *Klebsiella pneumonia* were resistant organisms at the UHWI, and they were identified by only 19% and 17% respectively.

Some physicians (21%) incorrectly thought that penicillin resistant *Streptococcus pneumonia* (PRSP) was a problem at UHWI.

Table 1: Physician ratings of the factors contributing to antibiotic resistance

Factor	Minimally important		Moderately important		Very important		Don't know	
	n	(%)	n	(%)	n	(%)	n	(%)
Widespread use of antibiotics	2	(1)	14	(8)	158	(91)	–	
Inappropriate empiric choices	8	(5)	28	(16)	137	(79)	1	(1)
Inappropriate duration of course	5	(3)	30	(17)	135	(79)	2	(1)
Use of broad spectrum antibiotics	7	(4)	43	(25)	121	(70)	3	(1)
Poor access to local antibiograms	6	(3)	52	(30)	114	(66)	2	(1)
Lack of prescribing guidelines	16	(9)	51	(30)	106	(61)	–	
Microbe Mutations	17	(10)	81	(47)	65	(37)	11	(6)
Inadequate antibiotic restrictions	28	(16)	60	(35)	83	(48)	2	(1)
Promotion by pharmaceutical cost	39	(23)	72	(42)	51	(30)	11	(6)
Antibiotic use in the livestock industry	41	(24)	55	(32)	43	(24)	35	(20)
Patient demands	47	(27)	60	(35)	62	(36)	5	(3)
Inadequate hand-washing	58	(34)	45	(26)	64	(37)	6	(3)

Table 2: Physician rating of interventions to reduce resistance (n = 174)

Factor	Useful		May be useful		Not useful		Don't know	
	n	(%)	n	(%)	n	(%)	n	(%)
Access to current antibiograms	156	(90)	16	(9)	2	(1)	–	–
Institutional – specific guidelines	154	(89)	18	(10)	2	(1)	–	–
Educational programmes	154	(89)	18	(10)	2	(1)	–	–
Regular microbiology rounds	126	(72)	42	(24)	3	(2)	3	(2)
Antibiotic cycling	68	(40)	62	(36)	13	(8)	29	(17)
Antibiotic restriction	60	(35)	80	(46)	28	(16)	6	(3)

Prolonged hospital stay (46%) and increased costs (53%) were thought to be frequent complications. Organ failure (23%) and death (21%) were perceived to be less common. Compared with obstetricians and gynaecologists, significantly more anaesthetists reported increased costs ( $p = 0.03$ ) and mortality rates ( $p = 0.02$ ) as complications of antibiotic resistance.

#### Antibiotic Prescribing Practices

For a community-acquired pneumonia (CAP), 77% of physicians chose augmentin for empiric therapy. Erythromycin was also a frequent choice, often in combination with augmentin (48%). Piperacillin-tazobactam (44%) and ceftazidime (29%) were the most popular choices for ventilator-associated pneumonia (VAP), and augmentin (50%), cefuroxime (21%) and metronidazole (21%) for surgical site infections. Empiric therapy for urinary tract infections (UTIs) included cotrimoxazole (42%) and augmentin (36%). For abdominal sepsis, metronidazole (65%) and ceftriaxone (23%) were the top choices (Table 3).

Most physicians (78%) were aware that vancomycin needs the counter-signature of a microbiologist but only 59% and 49% respectively knew that meropenem and ciprofloxacin are also restricted. Approximately one third (32%) were under the false impression that piperacillin-tazobactam was restricted. Most physicians were unable to correctly identify resistance-producing antibiotics such as ceftazidime (chosen by only 44%), ceftriaxone (42%), ciprofloxacin (35%) and meropenem (28%).

Regarding duration of therapy, most physicians would treat CAP for 7–10-days (67%). Anaesthetists and surgeons were more likely to choose a shorter course while emergency physicians treated for 14-days ( $p = 0.04$ ). Fourteen days was considered most appropriate for VAP (56%). About equal numbers chose either a 14-day (47%) or 7–10 day (46%) course for a blood stream infection (BSI). Urinary tract infections were treated for 7–10 days by 39% and five days by 35%. Only UTIs were treated for less than 5 days (20%) and VAPs (17%) and BSIs (6%) for 15 to 21 days (Table 4).

Table 4: Physicians' practice regarding duration of antibiotic therapy

Infection	< 5 days	5 days	7–10 days	14 days	15–21 days
CAP	1%	22%	67%	9%	–
VAP	–	–	27%	56%	17%
UTI	20%	35%	39%	4%	1%
BSI	–	1%	46%	47%	6%

The most important factors influencing antibiotic choice were availability (89%) and patient factors like renal disease, immunocompromise or allergy (80%). Most felt that microbiology results were quickly available, 56% within three days and 38% in 4–7 days. The majority (65%) felt that results obtained correlated well with their empiric coverage. If their patient responded clinically to the empiric therapy chosen, but the microbiology report identified organisms resistant to that regime, 36% would add one of the susceptible antibiotics to the regime, 32% would change to

Table 3: Empiric antibiotic choices of physicians (n = 174)

Antibiotic	Community acquired pneumonia	Ventilator associated pneumonia	Surgical site infection	Urinary tract infection	Abdominal sepsis
Augmentin	77%	3%	50%	36%	10%
Erythromycin	48%	3%	3%	–	–
Cotrimoxazole	1%	1%	–	42%	–
Cefuroxime	2%	6%	21%	1%	14%
Ceftriaxone	6%	10%	18%	4%	23%
Ceftazidime	1%	29%	12%	4%	19%
Piperacillin/tazobactam	–	44%	5%	–	18%
Ciprofloxacin	2%	16%	1%	24%	2%
Meropenem	–	13%	1%	–	7%
Metronidazole	1%	4%	21%	1%	65%

antibiotics based on the report and 32% would not change antibiotics.

Only 45% of physicians would de-escalate to a narrow-spectrum antibiotic guided by a microbiology report, despite the fact that most (70%) regarded the use of broad spectrum antibiotics as very important in the development of resistance. Consultants were far more likely to de-escalate therapy than junior levels of staff ( $p = 0.002$ ).

#### *Opinions on Knowledge*

Most physicians thought their knowledge of antibiotics and resistance was average (48%), 29% considered it good and 11% poor. Consultants and senior residents were more likely to view their level of knowledge as good ( $p = 0.015$ ). However, 91% of all physicians would like a refresher course.

## **DISCUSSION**

This survey has shown that UHWI physicians are aware of the problem of antibiotic resistance, and most consider the problem at their institution to be less than that seen worldwide. The rates of antibiotic resistance at the UHWI are comparable to first world countries for gram negative organisms, but less so for gram positives (13). It is understandable that anaesthetists would perceive a greater problem, as ICU patients usually have the most resistant organisms and their perception would be biased by this.

Physicians also had a reasonable idea of the major factors contributing to the problem. Interestingly, the role of hand-washing was minimized when numerous educational campaigns have emphasized its importance in infection control. The spread of resistant organisms throughout a ward or even a hospital has repeatedly been identified as being related to a breakdown in infection control measures, especially hand hygiene (14–16). Hand-washing has been shown to be the single most important factor in the prevention of transmission of infection in the hospital setting (17). Patient's demands and expectations were also not thought to play a major role but may be more important in general practice and private care than in a public tertiary institution. The role of marketing strategies by pharmaceutical companies was not considered highly significant but the effect may be underestimated. The top ten drug companies in the world consistently spent about 35% of sales for marketing during the 1990s (18).

Interventions to contain antibiotic resistance considered important included access to antibiograms, more regular consultation and guidelines from the Department of Microbiology and not more antibiotic restrictions. This is consistent with findings from other surveys which showed that physicians preferred voluntary changes in prescribing practices rather than interventions which imposed limitations (9, 19). Current antibiograms for the institution are not readily available and this is an area needing improvement. Although most physicians felt that their knowledge was

average or good, there was a general desire for more educational programmes.

There was awareness of the consequences of resistance including increased costs and hospital stay, and less frequently organ failure and death (20–21). MRSA was the resistant organism known to most physicians and MRSA outbreak at the UHWI during the time this survey was conducted would have contributed to this. Other resistant organisms were identified less frequently, and some incorrectly identified PRSP as a significant problem at the UHWI. Although some data is available regarding antibiotic resistance patterns at the UHWI (13, 22, 23), there is still need for more current information. However, empiric choices for common infections were appropriate in most instances.

There has been considerable debate on appropriate duration of antibiotic courses for various infections with a tendency towards shorter courses for uncomplicated infections, especially VAPs and UTIs (24–26). Optimum duration, however, may vary depending on the organism involved, the severity of the infection and the host's immunocompetence. When micro-organisms are exposed to sub-inhibitory antibiotic levels for prolonged periods, the selection of resistant strains is likely (1). Most physicians chose courses of 7–10 days for community acquired pneumonia and urinary tract infections and would increase the course to 14 days for more serious infections such as VAPs or BSIs. These results are consistent with recommendations from the Microbiology department at UHWI. Shorter antibiotic courses for VAP and UTIs were not generally embraced despite recent studies which have suggested their efficacy (24, 25).

Many physicians are unaware of resistance-inducing antibiotics, such as third generation cephalosporins, which should be avoided for empiric therapy (27). A reluctance to de-escalate therapy was seen, especially amongst junior staff. Physicians were also reluctant to continue a clinically effective antibiotic regime if the culture report indicated that the organism was resistant to the antibiotics chosen. Although *in vitro* results may indicate resistance, the *in vivo* response can differ, so it is perfectly acceptable to continue a regime to which the patient has responded. A clinical, not microbiological, response should be the primary end point (28, 29). Therefore, there was discrepancy between knowledge of resistance and causative factors and implementation of changes in practice to counteract the problem.

The major limitation of this study is that it is a single-centre survey, and the results may not be representative of the nation or region. An intrinsic problem of such a survey is the tendency of respondents to give what they consider to be "correct" or "more acceptable" answers, rather than their true opinions or practices. We assured all respondents of complete confidentiality in an attempt to minimize this problem. In conclusion, although physicians were aware of the causes of antibiotic resistance, their practice did not include measures to reduce the problem. Hand-washing was not

considered important, and de-escalation of antibiotics was not regularly practiced. Knowledge of resistance-prone antibiotics was poor. Lack of current antibiograms to assist in making appropriate choices of empiric therapy was highlighted, as well as the desire for a more active role of the Microbiology department in management decisions. Continuing educational programmes, antibiotic prescribing guidelines specific to the UHWI and effective infection control measures are needed. Finally, audits should be done to evaluate the effectiveness of the new policies and to increase professional accountability.

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