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Antibiotic prescribing practices: A national survey of Cambodian physicians

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Key Words:

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Public hospital**Background:** Antibiotic resistance is a threat to global health security. We assessed knowledge, attitudes, and practices in regard to antibiotic prescribing and resistance in Cambodian physicians from public hospitals.**Methods:** A cross-sectional knowledge, attitudes, and practices survey was distributed to physicians from 19 public hospitals.**Results:** The response rate was 78% (689 out of 881). The majority (88%; 607 out of 686) of physicians understood that antibiotic resistance was a local challenge. More than half (54%; 366 out of 682) believed that antibiotic prescribing was inappropriate in their hospital and 93% (638 out of 684) had difficulties in selecting appropriate antibiotics to treat common infections. The majority (86%; 574 out of 667) and one-third of physicians (36%; 236 out of 665) would prescribe antibiotics for uncomplicated common cold and diarrhea in children < 5 years of age, respectively. Half (58%; 385 out of 668) had experience treating methicillin-resistant *Staphylococcus aureus* infection, but the majority (73%; 188 out of 258) could not identify antibiotics to treat this infection. Only 17% (115 out of 667) had experience treating endemic melioidosis. All physicians agreed that knowledge about local antibiotic resistance, treatment guidelines, and educational programs were necessary.**Conclusions:** Cambodian physicians are aware of antibiotic resistance challenges but they do not possess the required knowledge of local antibiotic resistance patterns that would assist their prescribing practices. Cambodian physicians need support to improve antibiotic prescribing.

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BACKGROUND

Antibiotic resistance that is exacerbated by inappropriate use and prescribing practices poses a significant threat to global public health security.^{1,2} Inappropriate antibiotic use is driven by multiple factors, including socioeconomic and behavioral determinants and lack of law enforcement that allows nonprescription antibiotic use worldwide.³⁻⁵ In clinic settings, inappropriate antibiotic

prescribing is facilitated by diagnostic uncertainty,^{3,6} insufficient diagnostic microbiology services,^{3,7} fear of poor treatment outcomes,^{3,7} and poor hygiene and infection control practices in health care facilities.^{4,8}

Recent microbiology studies from different sites in Cambodia have reported high prevalence of multiresistance to antibiotics commonly available within the country. For example, 80%-97% of *Salmonella* Typhi strains isolated from bloodstream infections demonstrated decreased susceptibility to ciprofloxacin⁹⁻¹¹ and 20%-50% of *Staphylococcus aureus* bloodstream infections were methicillin-resistant *Staphylococcus aureus* (MRSA).^{9,12} The challenge of inappropriate antibiotic prescribing is intensified by unrestricted access to antibiotics.¹³ To help improve antibiotic prescribing, it is imperative to understand knowledge, attitudes, and practices (KAP) of physicians. We conducted a KAP survey of Cambodian physicians working in public hospitals to provide evidence that could assist policy formulations and interventions to address inappropriate antibiotic prescribing and resistance.

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Conflicts of Interest: None to report.

METHODS AND MATERIALS

Study design and setting

Our study was a cross-sectional KAP survey conducted between August 19 and September 25, 2013, by using a self-administered questionnaire. Cambodia is a low-income country located in South-east Asia with a population of 15.33 million.¹⁴ About 80% of Cambodians live in rural areas.¹⁴ The Cambodian health care system is divided into 3 levels (national, provincial, and district) and consists of 1,236 health care facilities, including 8 national hospitals, 24 provincial hospitals, and 59 district hospitals.¹⁵

Sampling

Sampling was purposefully weighted for national hospitals located in the capital city and nonnational hospitals located in provinces and districts in areas of high population density. Our research budget dictated the sampling rationale that attempted to reach physicians in populated areas so that as many as possible of the physicians who prescribe antibiotics would be surveyed. Six of the 8 national hospitals were selected for the survey, whereas 2 were excluded because neither had prescribing practice comparable with public hospitals (1 was a tuberculosis hospital and the other was a charity pediatric hospital). A random selection of 5 out of 17 provincial hospitals and 8 out of 48 district hospitals were in highly populated areas to improve the generalizability of prescribing practices. In total, 19 hospitals were selected, of which 5 had a microbiology laboratory (4 were national hospitals and 1 was a provincial hospital). All physicians in the selected hospitals were invited to participate in the survey.

Questionnaire

A self-administered questionnaire previously used for a KAP survey in a developing country¹⁶ was modified with the inclusion of Likert-type scale items and common clinical case presentations specific to Cambodia. A panel of national and international experts reviewed the questionnaire for content and face validity. The questionnaire was field tested with 23 physicians who were located in a nonparticipating provincial hospital. The questionnaire was distributed directly to each physician in the 19 hospitals together with an envelope in which to seal the questionnaire before collection 2 days later. Four items collected demographic data; 23 items measured attitudes on a 7-point Likert-type scale (with a high Cronbach's α correlation: $r = 0.862$) plus a Yes/No question; 11 items, including 6 clinical case presentations assessed knowledge; and 7 items assessed practices. The distributions of the responses to the Likert-type items were all skewed and therefore all were recoded into dichotomous responses of agree/disagree, frequent/infrequent, useful/nonuseful, and important/unimportant.

Data analysis

Two research assistants entered data into an Excel spreadsheet (Microsoft, Redmond, WA) and 1 author (CO) checked the data entry for accuracy before importing the data into SPSS version 21 (IBM-SPSS Inc, Armonk, NY) for analysis. To minimize the influence of responses from national hospitals, analyses were stratified by national and nonnational physicians. Nonnational physicians included those working in provincial and district hospitals. Association between national and nonnational physicians and hospitals with and without microbiology laboratory was examined using χ^2 test. Alpha was set at the 5% level. Denominators vary in the analysis because not all physicians answered every question in this survey.

Ethical consideration

This study was approved by the National Ethics Committee for Health Research of the Cambodian Ministry of Health; the University of New South Wales Australia; and the Institute of Tropical Medicine, Antwerp, Belgium. Participating physicians were not asked to sign informed consent form to preserve their anonymity.

RESULTS

Demographic and professional profile

There were 881 physicians in total from the 19 public hospitals and 689 physicians completed and returned the questionnaire, giving a response rate of 78% (689 out of 881). The majority of physicians (74%; 505 out of 684) had more than 10 years of clinical experience. National hospitals had significantly more physicians with > 10 years of clinical experience compared with nonnational hospitals (78% [374 out of 479] vs 64% [131 out of 205]; $P < .001$). Table 1 gives further demographic data and professional profiles of the participating physicians.

Attitudes toward antibiotic resistance and prescribing

Most physicians perceived that antibiotic resistance is a problem globally (95%; 652 out of 684), in Cambodia (98%; 673 out of 685), in their hospitals (88%; 607 out of 686), and in their private practices (82%; 561 out of 685). The majority of physicians (93%, 638 out of 684) reported that they had difficulties in selecting appropriate antibiotics to treat infections. More than half (54%; 366 out of 682) perceived that antibiotics were inappropriately prescribed in their hospital and this perception was significantly more common in nonnational physicians compared with national physicians (64% [130 out of 204] vs 49% [236 out of 478]; $P = .001$). The majority (81%; 548 out of 679) believed that the community used antibiotics inappropriately and 95% (646 out of 683) perceived that patients self-prescribed antibiotics before presenting to hospitals. Only 38% (258 out of 685) of physicians were confident that most antibiotics they prescribed were effective, 56% (386 out of 685) were somewhat confident, whereas 6% (41 out of 685) were not confident at all. The level of confidence was similar between national and nonnational physicians (38% [180 out of 479] vs 38% [78 out

Table 1

Demographic and professional characteristics of physicians participating in the knowledge, attitudes, and practices survey—Cambodia, 2013

Items	% (n/N)
Participating physicians	
National hospitals	70 (482/689)
Provincial hospitals	20 (141/689)
District hospitals (CPA level 1 and 2)	10 (66/689)
Department	
Medical ward	41 (284/689)
Surgical ward	31 (216/689)
Gynecology and obstetrics ward	16 (112/689)
Pediatric ward	10 (68/689)
Others	1 (9/689)
Profession	
Head of department	18 (123/689)
Specialist physicians	31 (215/689)
Nonspecialist physicians	46 (317/689)
Others and unspecified	5 (34/689)
Access to microbiology laboratory	
Physicians from national hospitals	85 (409/482)
Physicians from provincial hospitals	33 (47/141)
Physicians from district hospitals	0

CPA, Complementary Package of Activities.

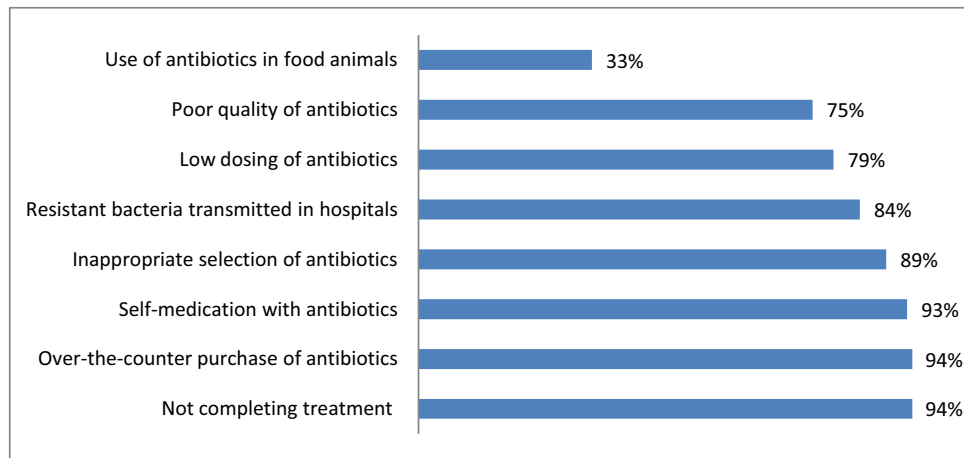


Fig 1. Physicians' perceptions about factors contributing to antibiotic resistance in the knowledge, attitudes, and practices survey—Cambodia, 2013.

of 206]; $P = .123$). Sixty percent of physicians (409 out of 682) believed that some antibiotics in their hospital were of poor quality and no significant difference in this belief was found between national and nonnational physicians (58% [277 out of 477] vs 64% [132 out of 205]; $P = .123$). Half (52%; 352 out of 667) preferred to prescribe broad-spectrum antibiotics in their private practices and this prescribing preference was similar between national and nonnational physicians (50% [237 out of 474] vs 57% [115 out of 203]; $P = .113$). Physicians believed that there were various factors contributing to antibiotic resistance in Cambodia, whereas only 33% (210 out of 630) agreed that the use of antibiotics in food animals contributed to resistance (Fig 1). All physicians agreed that knowledge about antibiotics and about local antibiotic resistance patterns were important in helping them prescribe and they all welcomed educational and training programs on antibiotic prescribing.

Knowledge of antibiotic resistance and prescribing

The majority (78%; 517 out of 662) of physicians correctly identified metronidazole as the treatment for anaerobic bacterial infection. More than half (56%; 373 out of 663) reported some level of resistance in *Salmonella* Typhi to ciprofloxacin, of which only 7% (49 out of 663) estimated correctly that the resistant level was >70%, whereas 44% (290 out of 663) did not know the rate. There was no significant difference between physicians from hospitals with and without a microbiology laboratory (7% [31 out of 444] vs 8% [18 out of 219]; $P = .567$) who could estimate correct level of resistance to ciprofloxacin in *Salmonella* Typhi. More than half (58%; 385 out of 668) reported that they had experience treating MRSA but only 27% (103 out of 380) of the experienced physicians could identify the correct level of MRSA endemicity (20%-50%) in their hospital. Only 17% of all physicians (115 out of 667) reported treatment experience for melioidosis pneumonia. Among the experienced physicians from hospitals with a microbiology laboratory, 73% (188 out of 258) and 57% (56 out of 98) could not identify antibiotics to treat MRSA infections and melioidosis pneumonia, respectively.

Specific clinical case presentations

Common cold and diarrhea. The majority (86%; 574 out of 667) and one-third (36%; 236 out of 665) of physicians would incorrectly prescribe antibiotics for uncomplicated common cold and nonbloody afebrile diarrhea in children younger than age 5 years, respectively. The most preferred antibiotics for the treatment of common cold were amoxicillin, erythromycin, and azithromycin,

whereas cotrimoxazole and metronidazole were the preferred antibiotics for the treatment of uncomplicated diarrhea. No significant differences were found between national and nonnational physicians who prescribed antibiotics to treat the 2 conditions: common cold (85% [393 out of 462] vs 88% [181 out of 205]; $P = .267$) and uncomplicated diarrhea (34% [157 out of 462] vs 39% [79 out of 203]).

Treatment of bacterial infections. Half (53%; 357 out of 667) of all physicians selected ciprofloxacin (alone or with other antibiotics) and 59% (394 out of 667) selected ceftriaxone (alone or with other antibiotics) to treat typhoid fever. The preference to prescribe the 2 antibiotics was similar between national and nonnational physicians, with ceftriaxone at 57% (264 out of 464) versus 64% (130 out of 203) ($P = .084$) and ciprofloxacin at 56% (260 out of 464) versus 48% (97 out of 203) ($P = .05$). The majority (74%; 493 out of 667) would prescribe ceftriaxone, alone or together with other antibiotics, to treat bacterial meningitis. The preference for ceftriaxone alone was similar between national and nonnational physicians (93% [175 out of 189] vs 96% [87 out of 91]; $P = .336$). For the treatment of urinary tract infection in a 12-weeks pregnant woman, amoxicillin, ceftriaxone, and ciprofloxacin were the most preferred antibiotics. No significant difference in prescribing these antibiotics was found between national and nonnational physicians: amoxicillin (52% [141 out of 271] vs 52% [60 out of 115]; $P = .979$), ciprofloxacin (16% [44 out of 271] vs 13% [15 out of 115]; $P = .425$), and ceftriaxone (21% [57 out of 271] vs 24% [28 out of 115]; $P = .472$).

Antibiotic prescribing in patients with renal impairment. Only 38% of physicians (250 out of 658) would correctly adjust antibiotic dose in a diabetic patient with impaired renal function who was receiving ceftriaxone and gentamicin empirical treatment for sepsis. Nonnational physicians were more likely to adjust the antibiotic dose compared with national physicians (45% [91 out of 202] vs 35% [159 out of 456]; $P = .013$).

Prescribing practice

Half of all physicians (52%; 354 out of 679) reported that they prescribed antibiotics more than once a day and 48% (325 out of 679) prescribed antibiotics once or less a day. The majority (70%; 466 out of 670) believed that generic and brand-name antibiotics were equivalent in efficacy. Prescribing generic antibiotics was significantly more frequent among nonnational physicians compared with national physicians (45% [91 out of 204] vs 26% [122 out of 473]; $P < .001$), whereas prescribing brand-name antibiotics was not significantly different (15%; 30 out of 204 vs 20% [96 out of 473];

$P = .086$). More than half of physicians (58%; 251 out of 436) from hospitals with microbiology services reported that they used results from the microbiology laboratory, whereas 33% (146 out of 436) used them occasionally. One-quarter of all physicians (26%; 178 out of 677) received a little training in antibiotic prescribing during the year before the survey, whereas 63% (424 out of 677) did not receive any training.

DISCUSSION

This is the first antibiotic prescribing KAP survey of Cambodian physicians from public hospitals. Anonymous surveys can produce responses that are biased by socially desirable answers rather than reflecting reality. This bias may have occurred in some of the attitudinal responses but it is unlikely to have affected the knowledge responses because most knowledge items, including the treatment of the clinical case presentations, were answered incorrectly.

Our physicians understood that antibiotic resistance is a problem and the use of antibiotics is inappropriate in the community, with patients self-medicating before their hospital visit. Our physicians also understood that their prescribing was not always appropriate and they had difficulties in selecting appropriate antibiotics to treat common infections. They were concerned that some available antibiotics in their hospitals were of poor quality. These perceptions were similar to other reports from low-income countries.^{16,17}

Our surveyed physicians should have been aware of the clinical case presentations for which they were asked to provide treatment options because infectious diseases represent the largest proportion of hospitalizations in their community.¹⁸ However, the findings suggest that they did not treat these conditions appropriately. The surveyed physicians prescribed antibiotics for uncomplicated upper respiratory tract infections and diarrhea in children younger than age 5 years that are mostly viral infections.^{19,20} Other studies have also revealed that these conditions were being inappropriately treated with antibiotics by Cambodian physicians and health care workers at the primary health care level.^{13,21} This suggests that Cambodian physicians need urgent training in how to treat these conditions and the change in these prescribing practices may reduce the burden on antibiotics. *Salmonella* Typhi is highly resistant to ciprofloxacin but our physicians still prescribed it for typhoid fever. Ceftriaxone is a safe treatment option for urinary tract infections during the first trimester of pregnancy, yet it was considered a second option after amoxicillin. The choice of amoxicillin is not always effective because 88% of urinary tract infections tested in Cambodia were resistant to amoxicillin.²² The majority of our physicians had access to microbiology services and reported that they use these services to help them prescribe. However, from our field experience this is an overestimation of use and is likely to be the result of providing socially desirable answers. Because the majority of physicians could not identify antibiotic resistance levels and appropriate antibiotics for common infections such as MRSA, typhoid fever, and melioidosis that is endemic in Cambodia,^{23,24} we believe this strongly supports our field observations that they did not fully utilize microbiology services. The ability to provide safe antibiotic prescribing is a concern because our physicians prescribed harmful ciprofloxacin for urinary tract infections during the first trimester of pregnancy and they did not adjust the dose of gentamicin in a patient with impaired renal function.²⁵

CONCLUSIONS

This survey establishes that Cambodian physicians are aware of the challenges of antibiotic resistance but they do not possess the required knowledge of local antibiotic resistance patterns that would assist their appropriate antibiotic prescribing practices. To improve

prescribing practices, Cambodian physicians must have local antibiotic resistance data and locally developed antibiotic prescribing guidelines in addition to education and training programs and promotion of microbiology services use.

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