ORIGINAL ARTICLE

National Survey of Practices to Prevent Healthcare-Associated Infections in Thailand: The Role of Safety Culture and Collaboratives

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OBJECTIVE. To evaluate hospital characteristics and practices used by Thai hospitals to prevent catheter-associated urinary tract infection (CAUTI), central line–associated bloodstream infection (CLABSI), and ventilator-associated pneumonia (VAP), the 3 most common types of healthcare-associated infection (HAI) in Thailand.

DESIGN. Survey.

SETTING. Thai hospitals with an intensive care unit and 250 or more hospital beds

METHODS. Between January 1, 2010, and October 31, 2010, research nurses collected data from all eligible hospitals. The survey assessed hospital characteristics and practices to prevent CAUTI, CLABSI, and VAP. Ordinal logistic regression was used to assess relationships between hospital characteristics and use of prevention practices.

RESULTS. A total of 204 (80%) of 256 hospitals responded. Most hospitals (93%) reported regularly using alcohol-based hand rub. The most frequently reported prevention practice by infection was as follows: for CAUTI, condom catheters in men (47%); for CLABSI, avoiding routine central venous catheter changes (85%); and for VAP, semirecumbent positioning (84%). Hospitals with peripherally inserted central catheter insertion teams were more likely to regularly use elements of the CLABSI prevention bundle. Greater safety scores were associated with regular use of several VAP prevention practices. The only hospital characteristic associated with increased use of at least 1 prevention practice for each infection was membership in an HAI collaborative.

CONCLUSIONS. While reported adherence to hand hygiene was high, many of the prevention practices for CAUTI, CLABSI, and VAP were used infrequently in Thailand. Policies and interventions emphasizing specific infection prevention practices, establishing a strong institutional safety culture, and participating in collaboratives to prevent HAI may be beneficial.

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Healthcare-associated infection (HAI) related to invasive medical devices is a major threat to patient safety in both developed and developing countries.[1,2] In developing countries, the risk of HAI has been estimated to be 2–20 times higher than that in developed countries.[3-7] Because the potential impact of HAI is perceived to be of minor importance with respect to other healthcare priorities, hospital resources are often diverted from infection control programs, especially in low-resource countries where the annual per capita income is less than US$1,500 or where less than 5% of the gross national product is spent on health care.[4] This perception, coupled with limited spending on HAI prevention in developing countries, can unfortunately lead to missed opportunities for cost-effective healthcare interventions through infection control measures in hospitals.

Thailand initiated its national commitment to improve patient safety in June 2007 after signing the pledge with the World Health Organization (WHO) and joining with the World Alliance for Patient Safety to campaign for patient safety through the 2005–2006 Global Patient Safety Challenge project "Clean Care Is Safer Care." The primary focus of this project was on the prevention of infections associated with health care through the implementation of low-cost, simple, and effective strategies, such as hand hygiene and evidence-based practices to prevent HAI.[8,9] Despite the commitment to the Global Patient Safety Challenge by the Thai govern-

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TABLE 1. Hospital Characteristics (n = 204)

Characteristic	Value
General	
Has hospitalists	176 (86)
Good/excellent infection control program support from leadership	164 (80)
Has hospital epidemiologist	145 (71)
Medical school affiliated	97 (48)
Lead infection control professional is an RN	69 (34)
Member of a collaborative focusing on HAI prevention	52 (25)
No. of ICU beds, mean ± SD	20.0 ± 14.4
No. of full-time infection control professionals, mean ± SD	2.3 ± 1.5
Safety score,[a] mean ± SD	0.9 ± 0.7
CAUTI specific	
Provides UTI rates to direct care providers	162 (79)
Has system in place to monitor urinary catheter placement	150 (74)
Has system in place to monitor urinary catheter duration	149 (73)
Has urinary catheter team	45 (22)
CLABSI specific	
Short-term nontunneled catheters used	186 (91)
PICC lines used	103 (50)
Has designated PICC line insertion team	48 (24)
Has designated insertion team for other central venous catheters	41 (20)
VAP specific	
None[b]	...

NOTE. Data are no. (%), unless otherwise indicated. CAUTI, catheter-associated urinary tract infection; CLABSI, central line–associated bloodstream infection; HAI, healthcare-associated infection; ICU, intensive care unit; PICC, peripherally inserted central catheter; RN, registered nurse; SD, standard deviation; UTI, urinary tract infection; VAP, ventilator-associated pneumonia.

[a] Defined as the average of responses regarding agreement to 2 statements about safety ("leadership is driving us to be a safety-centered institution" and "I would feel safe being treated here as a patient").

[b] No hospital characteristics were specific to the prevention of VAP.

ment, limited data are available concerning the use of various infection control practices to prevent HAI. We thus performed a national study to evaluate current practices used by hospitals in Thailand to prevent common HAIs.

METHODS

Survey Instrument

Between January 1, 2010, and October 31, 2010, we surveyed all hospitals in Thailand that had an intensive care unit (ICU) and at least 250 hospital beds (n = 256), according to a list from the Ministry of Public Health of Thailand. The survey instrument was developed by Krein, Saint, and colleagues[10-12] and translated into Thai by an experienced hospital epidemiologist (A.A.). The survey (available as a PDF file in the appendix in the online edition of the journal) was developed to gain an understanding of strategies that are being used for infection prevention and included questions about the following: facility characteristics, the infection control program, hospital epidemiologist, infection control professionals, use of evidence-based practices, and hospital practices related to the prevention and monitoring of catheter-associated urinary tract infection (CAUTI), central line–associated bloodstream infection (CLABSI), and ventilator-associated pneumonia (VAP). Responses about the frequency of use of practices to prevent CAUTI, CLABSI, and VAP took values between 1 and 5 (with 1 meaning "never" and 5 meaning "always"). For the descriptive results in Figure 1, survey measures with responses of 4 or 5 (ie, "almost always" or "always") were defined as regular use (with regular use coded as 1, and 0 coded otherwise). A safety score was defined as the average of responses regarding agreement to 2 statements about safety ("leadership is driving us to be a safety-centered institution" and "I would feel safe being treated here as a patient"). These statements were selected for conceptual reasons stemming from our prior work.[10] Each item was scored from 1 ("strongly agree") to 5 ("strongly disagree").[11,12] Before averaging the items we reverse-scored them, so a higher score indicates greater safety centeredness.[11,12]

Research nurses used this survey instrument to interview the lead infection control professional at each of the participating hospitals. Three training sessions were held to instruct the 5 research nurses on the survey and data collection procedures. The survey instrument was pilot tested in 10 hospitals to ensure the validity, reliability, and acceptability of the survey results by 5 research nurses; 100% agreement in

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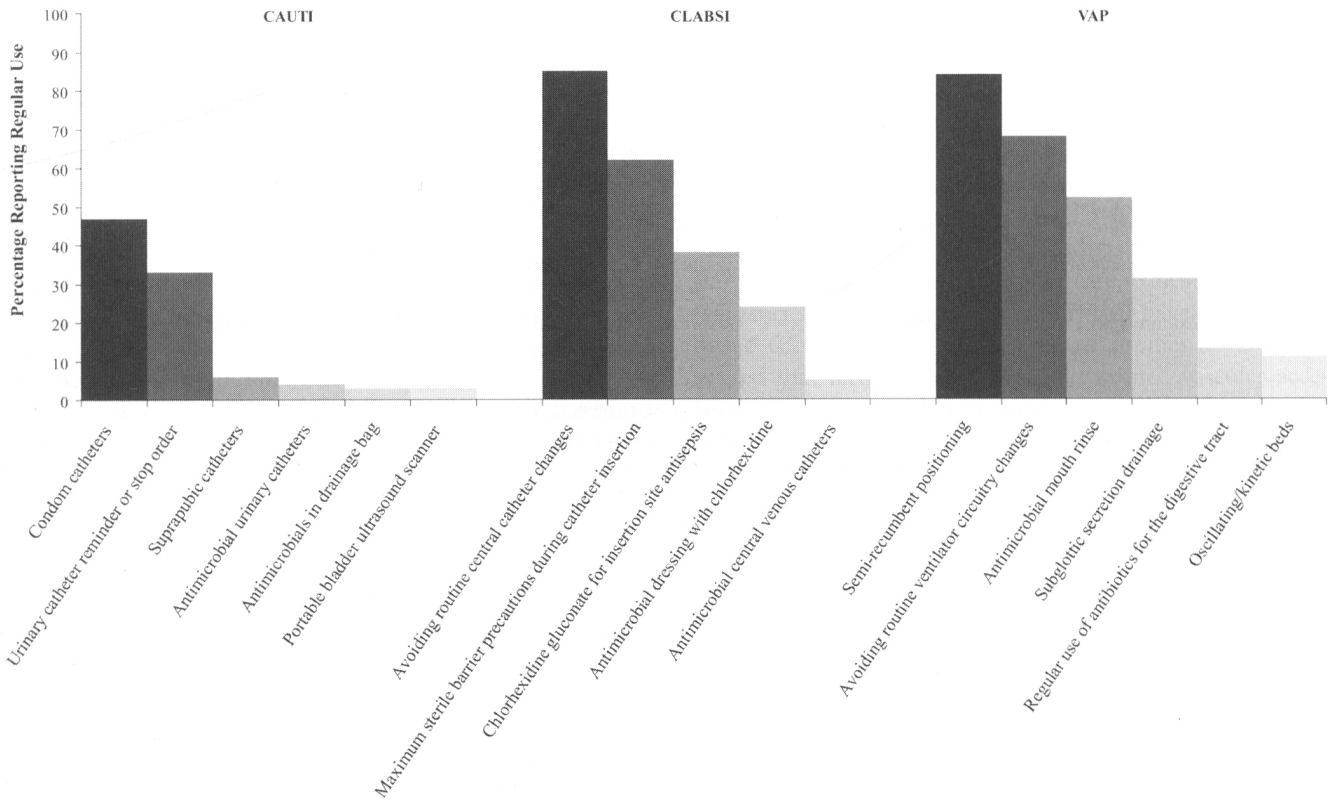

FIGURE 1. Reported regular use of prevention practices. CAUTI, catheter-associated urinary tract infection; CLABSI, catheter-associated bloodstream infection; VAP, ventilator-associated pneumonia.

the responses captured was observed in the pilot test. This study was approved by the Institutional Review Board of the Faculty of Medicine, Thammasat University.

Statistical Analysis

To explore multivariable associations between hospital characteristics and practice use, we used ordinal logistic regression assuming a proportional odds model;[13] this approach allows one to preserve the multicategory nature of the outcome and therefore yields increased power relative to logistic regression with artificial dichotomization. Four practices were excluded from modeling because of high prevalence of infrequent use—3 for CAUTI (antimicrobials in the drainage bag, portable bladder ultrasound scanners, and antimicrobial urinary catheters) and 1 for CLABSI (antimicrobial central venous catheters). To avoid overfitting, we used stepwise model selection with the Bayesian Information Criterion (BIC). BIC was used because it selects more parsimonious models than the similarly popular Akaike Information Criterion (AIC) and because AIC can overestimate the number of model parameters.[4] We used the Bonferroni correction to address issues of multiple testing. The number of ICU beds, the number of full-time-equivalent infection control professionals, and the safety score were included as continuous covariates; all others were binary. The number of ICU beds was log transformed for purposes of model fit (assessed using BIC).

RESULTS

There were 256 hospitals that met the inclusion criteria. A total of 204 of 256 hospitals were willing to participate and responded to the survey, yielding a response rate of 80%. Table 1 shows the descriptive characteristics of all responding hospitals. Of these responding hospitals, 86% had hospitalists, 80% reported that their infection control program had good or excellent support from hospital leadership, and 71% had a hospital epidemiologist. A total of 48% of hospitals were affiliated with a medical school, and 34% had a licensed registered nurse serving as the lead infection control professional. Membership in a collaborative focusing on HAI prevention was noted in 25% of the responding hospitals. The distribution of the largest collaboratives across the 52 hospitals that reported membership in a collaborative was as follows: Thailand National Nosocomial Infections Surveillance (21.2%), Collaborative Quality Improvement to Prevent VAP (11.5%), and Nosocomial Infection Group of Thailand (11.5%). The remaining hospitals that reported membership in a collaborative focusing on HAI prevention either indicated

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TABLE 2. Factors Significantly Associated with More Frequent Use of Prevention Practices in Multivariable Analysis after Bonferroni Correction

Infection	Practice	Variable	AOR (95% CI)
CAUTI	Urinary catheter reminder or stop order	None[a]	...
	Condom catheters	Has system in place to monitor urinary catheter duration	2.9 (1.5–5.4)
		Good/excellent infection control program support from leadership	2.9 (1.4–5.9)
		Has system in place to monitor urinary catheter placement	2.8 (1.5–5.3)
		No. of ICU beds	2.1 (1.4–3.2)
	Suprapubic catheters	Member of a collaborative focusing on HAI prevention	6.4 (3.1–12.9)
		No. of ICU beds	2.2 (1.3–3.6)
CLABSI	Maximum sterile barrier precautions	Good/excellent infection control program support from leadership	4.7 (2.4–9.3)
		PICC line insertion team	4.6 (2.3–9.4)
		PICC lines used	3.2 (1.9–5.6)
		Member of a collaborative focusing on HAI prevention	2.9 (1.6–5.5)
		Hospital epidemiologist	2.6 (1.4–4.6)
	Chlorhexidine gluconate for insertion site antisepsis	PICC line insertion team	3.8 (1.9–7.7)
	Avoid routine central catheter changes	None[a]	...
	Antimicrobial dressing with chlorhexidine	PICC line insertion team	6.8 (3.1–15.1)
		PICC lines used	3.5 (1.9–6.6)
VAP	Semirecumbent positioning	Lead infection control professional is an RN	4.0 (1.9–8.3)
		Hospital epidemiologist	3.9 (2.1–7.2)
	Antimicrobial mouth rinse	Lead infection control professional is an RN	2.5 (1.4–4.4)
		No. of ICU beds	2.4 (1.5–3.8)
		Safety score[b]	1.9 (1.3–2.8)
	Subglottic secretion drainage	Member of a collaborative focusing on HAI prevention	4.1 (2.2–7.4)
		Safety score[b]	2.3 (1.5–3.5)
	Oscillating/kinetic beds	Lead infection control professional is an RN	3.5 (1.6–7.6)
	Antibiotics for digestive tract	None[a]	...
	Avoid routine ventilator circuitry changes	None[a]	...

NOTE. AOR, adjusted odds ratio; CAUTI, catheter-associated urinary tract infection; CI, confidence interval; CLABSI, catheter-associated bloodstream infection; ICU, intensive care unit; PICC, peripherally inserted central catheter; RN, registered nurse; VAP, ventilator-associated pneumonia.

[a] No variables were significantly associated with more frequent use of the respective infection prevention practice.

[b] Defined as the average of responses regarding agreement to 2 statements about safety ("leadership is driving us to be a safety-centered institution" and "I would feel safe being treated here as a patient").

membership in other regional or local collaboratives or did not specify the name of the collaborative.

Nearly all hospitals (93%) reported regular use of alcohol-based hand rub as a general infection control practice. The percentages of hospitals reporting regular use of the specific prevention practices for each infection are displayed in Figure 1. For CAUTI, 47% of hospitals reported regular use of condom catheters in men, and 33% reported regular use of urinary catheter reminders or stop orders. Very few responding hospitals reported regular use of suprapubic catheters (6%), antimicrobial urinary catheters (4%), antimicrobials in the drainage bag (3%), or portable bladder ultrasound scanners (3%). For CLABSI, regular use of prevention practices was reported as follows: avoiding routine central catheter changes (85%), maximum sterile barrier precautions during catheter insertion (62%), chlorhexidine gluconate for insertion site antisepsis (38%), and antimicrobial dressing with chlorhexidine (24%). Of note, only 6% of hospitals reported regular use of all of the elements of the recommended bundle of care (maximum sterile barrier precautions, chlorhexidine gluconate for antisepsis, avoiding routine central catheter changes, antimicrobial dressing with chlorhexidine, and alcohol-based hand rub), while 30% of hospitals reported concomitant regular use of 2 key measures to prevent CLABSI: maximum sterile barrier precautions during catheter insertion plus chlorhexidine gluconate for site antisepsis. Hospitals rarely reported using antimicrobial central venous catheters (5%). For VAP, regular use of prevention practices was reported as follows: semirecumbent positioning (84%), avoiding routine ventilator circuitry changes (68%), antimicrobial mouth rinse (52%), and subglottic secretion drainage (31%). Few hospitals reported regular use of antibiotics for the digestive tract (13%) or oscillating/kinetic beds (11%).

Table 2 shows the adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for variables that were significantly associated with more frequent use of prevention practices after application of the Bonferroni correction. The only hospital characteristic associated with increased use of at least 1 prevention practice for each infection examined was membership in a collaborative focusing on HAI prevention. Hospitals in such collaboratives were significantly more likely to report more frequent use of suprapubic catheters to prevent

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CAUTI (AOR, 6.4 [95% CI, 3.1–12.9]), maximum sterile barrier precautions during catheter insertion to prevent CLABSI (AOR, 2.9 [95% CI, 1.6–5.5]), and subglottic secretion drainage to prevent VAP (AOR, 4.1 [95% CI, 2.2–7.4]).

The number of ICU beds was the only hospital characteristic that was significantly associated with more frequent use of multiple CAUTI prevention practices; specifically, a 2-fold increase in the number of ICU beds was associated with 67% and 73% increases in the respective odds of more frequent use of condom catheters and suprapubic catheters. For CLABSI, hospitals that used peripherally inserted central catheter (PICC) lines and hospitals with designated PICC line insertion teams were more likely to regularly use maximum sterile barrier precautions during catheter insertion and antimicrobial dressing with chlorhexidine. Hospitals with designated PICC line insertion teams were also more likely to regularly use chlorhexidine gluconate for insertion site antisepsis. For VAP, hospitals whose lead infection control professionals were licensed registered nurses were more likely to regularly use semirecumbent positioning, oscillating/kinetic beds, and antimicrobial mouth rinse. Hospitals with higher safety scores were also more likely to regularly use antimicrobial mouth rinse, as well as subglottic secretion drainage.

DISCUSSION

Implementing infection prevention practices can be difficult in developing countries because of limited resources, poor infrastructure, and lack of administration support. Our national cross-sectional study revealed that, among a large sample of hospitals in Thailand, few reported frequent use of many of the individual CAUTI, CLABSI, or VAP prevention practices investigated. Of note, the rates of regular use of each prevention practice were different, reflecting the discrepancy in use of components of prevention bundles among these hospitals. For example, the use of both maximum sterile barriers during catheter insertion and chlorhexidine gluconate for insertion site antisepsis—2 important components of the CLABSI bundle—was infrequent, despite evidence supporting the effectiveness of using the CLABSI bundle in Thailand.[15,16] Our findings also suggest that membership in a collaborative focusing on HAI prevention seemingly correlates with regular use of multiple prevention practices, as this was the only hospital characteristic investigated that was significantly associated with more frequent use of various practices across all 3 infections.

Several of the infection prevention practices targeted at reducing HAI warrant discussion. Many of the hospitals in Thailand reported regular use of hand hygiene as a general infection prevention practice. This finding may stem from the fact that implementation of the WHO Guidelines on Hand Hygiene in Health Care was a central action included in the Global Patient Safety Challenge.[8] Overall, the prevention practices specific to CAUTI were rarely used; none of the practices were regularly used in more than half of the hospitals. Of note, despite strong evidence to suggest the benefit of using urinary catheter reminders or stop orders to reduce CAUTI,[17-19] this prevention practice was used in only one-third of the hospitals.

Although dedicated PICC line insertion teams were established in only a quarter of the hospitals, the presence of these insertion teams was strongly associated with regular use of the prevention practices of the CLABSI bundle. A recent meta-analysis of CLABSI in limited-resource countries has shown that hand hygiene, catheter care, education, and performance feedback are interventions that have effectively reduced CLABSI rates.[20] Other previous studies have demonstrated that having a dedicated and trained vascular access team is associated with decreases in CLABSI.[21] Promoting and establishing dedicated PICC line insertion teams may be an effective strategy for reducing CLABSI, as the team members could serve as champions for the prevention practices within the recommended bundle of care and assist in the development and implementation of educational infection prevention efforts.

We also found that participation in a collaborative focusing on HAI prevention and greater safety scores were associated with regular use of several VAP prevention practices. Results from a recent study of a collaborative approach to preventing VAP across 18 hospitals in 3 regions of Thailand have demonstrated a significant decreasing trend in the VAP rate per 1,000 ventilator-days, improved VAP surveillance, increased personnel knowledge of VAP patient care, and essential improvements in cooperation among personnel from multidisciplinary teams.[22] Our finding that several hospital personnel characteristics (eg, lead infection control professional is a licensed registered nurse, hospital epidemiologist, and/or hospitalist) were associated with regular use of VAP prevention practices underscores the importance of addressing complex VAP prevention issues through collaborative, multidisciplinary approaches.

Compared with findings among a representative sample of hospitals in the United States that we have previously reported, we identified several differences and similarities in prevention practice use in hospitals across Thailand. For CAUTI, a greater percentage of hospitals in Thailand reported regular use of condom catheters and urinary catheter reminders or stop orders, whereas regular use of the other CAUTI prevention practices examined (particularly portable bladder ultrasound scanners) was reported less frequently than in the United States.[12] CLABSI prevention practices were uniformly used less frequently in Thailand than in the United States, particularly the use of more costly antimicrobial central venous catheters.[10] Regular use of the VAP prevention practices examined was generally comparable between Thailand and the United States.[11] Similar to what we have found in the United States, CAUTI seemingly receives less attention than CLABSI and VAP among Thai hospitals, and the prevention practices specific to CAUTI were generally used less often than those specific to CLABSI or VAP.

Involvement in collaborative networks has been shown to be associated with improvement in HAI prevention in Thailand,[22,23] and it was the only factor associated with regular use of at least 1 prevention practice for each infection examined in our study. This important finding suggests the potential roles of collaborative networks in increasing awareness and providing continuous education on HAI prevention, ensuring more consistent surveillance and feedback of HAI rates, and facilitating opportunities for discussion and jointly developing infection control intervention strategies. Previous research has suggested that collaborative membership can accelerate the implementation of HAI prevention initiatives even if it might not facilitate the uptake of initiatives in the first place.[24] Our findings corroborate the importance of collaborative membership that has been shown elsewhere.[10,11]

Our study has several important limitations. First, since we did not have data on actual infection rates, we were unable to explore relationships between the use of the various HAI prevention practices and infection outcomes. Second, since the response rate was less than 100%, our results are susceptible to nonresponse bias. If the 52 nonresponding hospitals were substantially different from the 204 that did respond, generalization of our results to the full population of Thai hospitals would not be possible. Third, we relied on self-reported data from the lead infection control professional at each hospital to determine how frequently the various infection prevention practices were being used, so our results could be inaccurate if lead infection control professionals were unaware of actual practices or were inclined to provide overly optimistic responses. Although it is possible that an individual respondent may have overstated or understated how frequently the various practices were used, we have no reason to believe that this would be a systematic issue. Fourth, several of the prevention practices were used infrequently across the sample of hospitals, limiting our ability to detect hospital characteristics associated with those practices. Finally, we did not have access to (and thus could not adjust for) patient-level or hospital case-mix data. As such, our regression adjustments could be biased because of unmeasured confounding, and our results can only be interpreted as providing evidence for associations rather than causal mechanisms.

Limitations notwithstanding, our study is, to our knowledge, the first national assessment of HAI prevention practices outside the United States. As such, this study represents an important first step in collecting information that is crucial for the development, implementation, and management of interventions to improve patient safety in developing countries. Despite involvement in the WHO patient safety campaigns since 2007, a major gap still exists between the actual use of HAI prevention practices and corresponding national expectations in Thailand. Our findings highlight the importance of organizational characteristics in fostering an environment where specific HAI prevention practices can be effectively adopted, implemented, and sustained. Our study suggests the need for national- and institutional-level policy, along with strategies for strengthening hospital administrations' commitment to patient safety campaigns. These strategies could include the establishment of care teams to prevent HAI, initiatives to promote and strengthen organizational commitment to institutional safety culture, and participation in collaborative networks focused on preventing HAI. Additional studies that rigorously evaluate such strategies would help bolster efforts to prevent HAI in developing countries and elsewhere.

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