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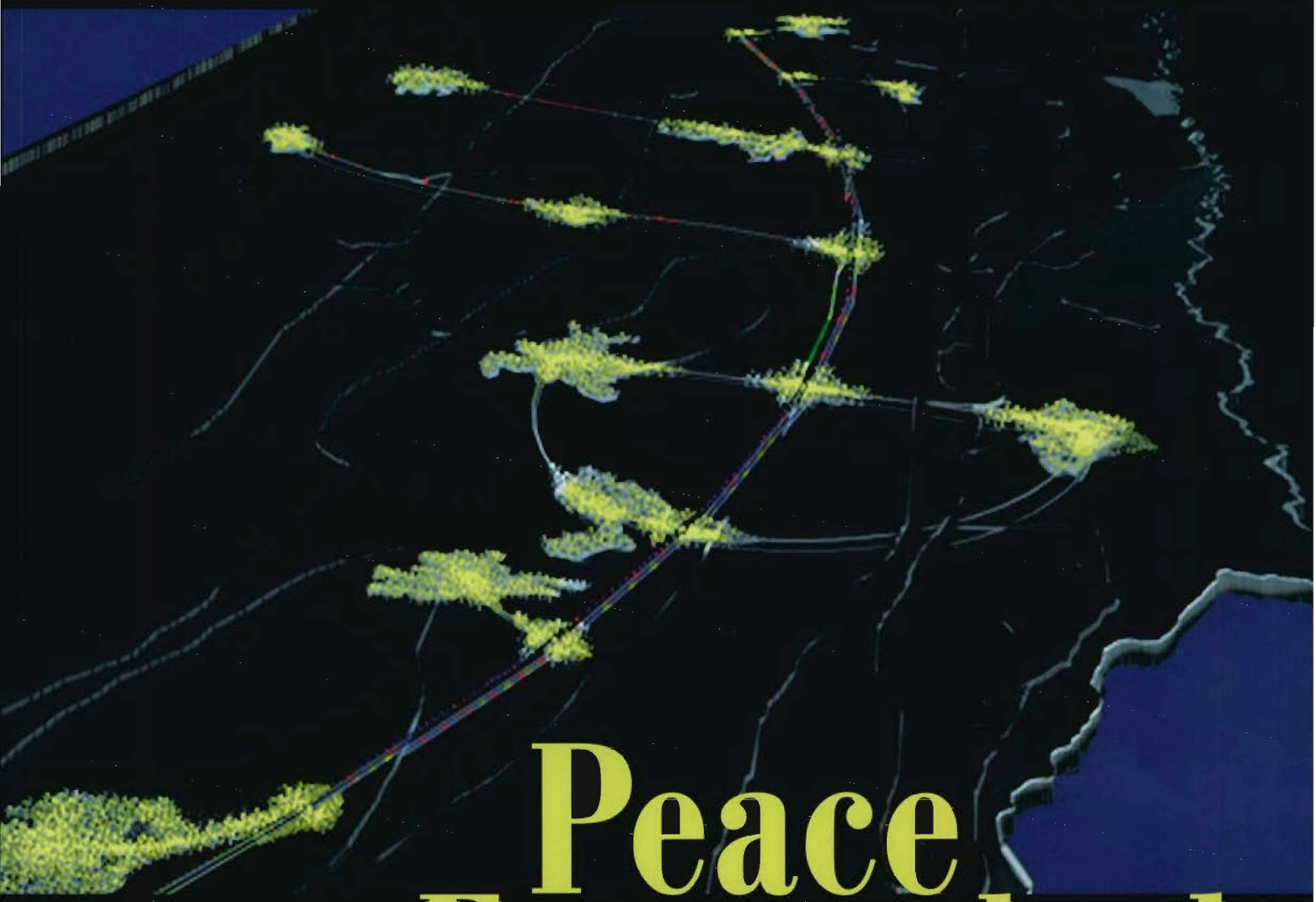

Peace Entrenched

Planning for a Palestinian State Should Not Await a Final Settlement

Army Stretched Thin: There's No Easy Way Out for the Nation
—By Lynn Davis and J. Michael Polich

Doctors' Orders: Better Electronic Prescribing Systems Could Improve Care
—By Douglas S. Bell and C. Jason Wang

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RAND: OBJECTIVE ANALYSIS. EFFECTIVE SOLUTIONS.

Message from the Editor

Two important components of spreading world peace today are resolving the Israeli-Palestinian conflict and maintaining the readiness of U.S. Army forces to defend America and its allies.

Apart from its intrinsic value, resolving the Israeli-Palestinian conflict would help improve the image of the United States in the Muslim, especially Arab, world. Meanwhile, maintaining the readiness of U.S. Army forces would help ensure stability in many spots around the globe, if only as a deterrent against opportunistic adversaries.

We at the RAND Corporation cannot stipulate the terms of a peace settlement between Israelis and Palestinians. However, we can—and do—show how the development of various public sectors can contribute to a successful Palestinian state. Moreover, we contend that the concrete work of building such a state should begin now, by laying the groundwork for a new national infrastructure and by improving public health, education, water resources, and security in Palestine. Work in these areas could empower the moderate Palestinian leadership today and boost the prospects of a negotiated peace settlement tomorrow. Rarely has there been such a promising and grounded message regarding the Israelis and Palestinians.

Our story about the U.S. Army is equally unusual, if disconcerting. Rarely, if ever, has there been such a straightforward, clear-headed, point-by-point itemization of the ways in which the strongest fighting force in the world has become strained. Lynn Davis and Michael Polich consider a variety of ways to rectify the situation. Yet the authors find no option, no policy, no alternative that could alleviate the problems, presuming a world where high levels of overseas deployments continue, without imposing some kind of significant cost or risk.

One story reads like a dream that can come true. The other story reads like a reality check.

—John Godges

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On the Cover

Nighttime aerial view of the Arc in the West Bank, with Tulkarem, Qalqiya, and the Mediterranean Sea (upper left), the Jordan Valley and Dead Sea (right), and Hebron (lower left).
SOURCE: *The Arc: A Formal Structure for a Palestinian State*, RAND/MG-327-GG, 2005.

Iraq and Afghanistan Missions Failing to Build Internal Security

America's current nation-building missions in Iraq and Afghanistan "largely have been unsuccessful in establishing law and order," according to Seth Jones, lead author of a new RAND study that examines nine nation-building efforts in the post–Cold War era.

Nation-building has many components, such as reconstructing a country's public health, economic, and education systems. However, said Jones, "Establishing police, courts, border control, and other elements of internal security should be the most important objectives of policymakers immediately after major combat."

Therefore, his study measures the level of internal security achieved in various post-conflict settings. The study compares nine efforts—Panama, El Salvador, Somalia, Haiti, Bosnia, East Timor, Kosovo, Afghanistan, and Iraq—in terms of how successful the United States and its allies have been at both reducing the level of violence and establishing a functioning rule of law.

As the figure shows, only two of the cases—East Timor and Kosovo—have met with success in both respects, with the level of violence declining and the rule of law improving over the course of reconstruction. The study found that success has been largely a function of initial conditions in the country (such as the existence of a peace treaty), inputs (such as the amount of financial assistance provided), and outputs (such as the number of civilian police trained). The outputs influenced subsequent outcomes, such as crime rates and the levels of political violence.

For Kosovo and East Timor, the data and case studies show consistently high levels of inputs provided and outputs produced: the amount of financial assistance, the duration of assistance, the size of international military and police contingents, the size of a national police force, and the number of police trained in proportion to the general population. Kosovo and East Timor have also had the highest proportions of civilian police forces who have been armed and given arrest authority. The other cases—both the unsuccessful and mixed ones—have had lower rates in these categories.

The report urges the United States to bolster the planning for post-conflict security institutions by

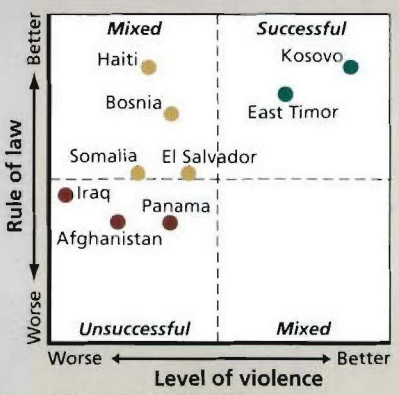
- paying as much attention to planning post-conflict internal security as to planning combat operations
- negotiating a peace treaty or formal surrender
- filling the security gap quickly with U.S. (or U.S. and allied) military and constabulary forces
- developing a comprehensive doctrine for post-conflict internal security reconstruction
- building mechanisms to ensure faster mobilization of personnel, funds, and equipment
- focusing on outcome measures, such as crime rates, when designing programs.

The researchers set rough guidelines for the successful reconstruction of security after combat. For example, average annual financial assistance should be roughly $250 per capita over the first two years of nation-building. And there should be 1,000 soldiers per 100,000 inhabitants to provide security and stability. ■

For more information: *Establishing Law and Order After Conflict*, ISBN 0-8330-3814-1, 2005.

For Kosovo and East Timor, the data show consistently high levels of inputs provided and outputs produced.

Building Internal Security Has Been Most Successful in Kosovo and East Timor, Least Successful in Iraq and Afghanistan



SOURCE: *Establishing Law and Order After Conflict*, 2005.

Military Spending: Which Path Will China Take?

China's military budgets are expected to grow substantially over the next two decades. According to Keith Crane, a RAND economist, "China's defense spending has more than doubled over the past six years, almost catching up with Great Britain and Japan. Although the rate of increase has slowed, by 2025 China will be spending more on defense than any of our allies."

Crane and his colleagues estimate that Chinese defense spending is between 2.3 and 2.8 percent of the country's gross domestic product (GDP), compared with U.S. defense spending of 3.9 percent of GDP. This estimated range is 40–70 percent higher than official Chinese government figures, but it is still considerably lower than many previous estimates of how much money China spends on defense.

As for future growth, the figure shows two projections: mid-range and maximum. Both projections yield very substantial sums by 2025. The lower sum of $185 billion from the mid-range projection amounts to about 60 percent of the 2003 U.S. defense budget. The larger sum of $403 billion from the maximum projection is a third more than the 2003 U.S. defense budget. (Both projections are expressed in terms of 2001 U.S. dollars.)

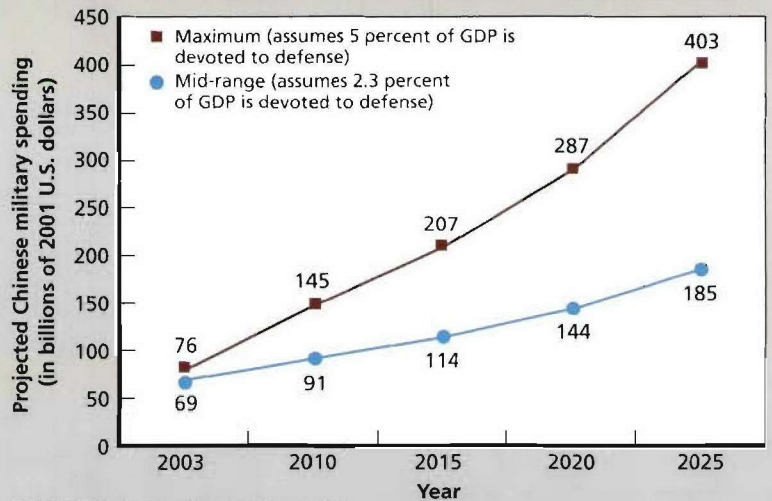
The maximum projection assumes that the Chinese leadership would be willing to raise military expenditures to 5 percent of GDP during a period when political pressures to increase spending on health, education, and pensions—plus infrastructure, the environment, and unemployment—will be very strong. This projection reflects both the upper bound of what middle-income developing countries have been willing to spend on defense over the past two decades and an evaluation of the People's Liberation Army's assessment of threats to China at this point in time. The mid-range projection assumes that military spending will not rise above the lower bound of the current estimate, or 2.3 percent of GDP.

How will we know which path China is taking? Tracking a set of indicators should help determine whether future military expenditures and capabilities are likely to diverge markedly, up or down. Those indicators include factors such as rates of growth in GDP, the introduction of a national pension program, closure of poorly performing defense plants and expanded production by better-performing ones, sizable contract awards to nontraditional defense suppliers (including nonstate enterprises), and changes in the total government budget for research and development. ■

For more information: *Modernizing China's Military: Opportunities and Constraints*, ISBN 0-8330-3698-X, 2005.

Both projections yield very substantial sums by 2025.

How Much Will China Devote to Its Defense?



SOURCE: *Modernizing China's Military*, 2005.
NOTE: GDP = gross domestic product.

Terrorism Insurance Failing to Cover Growing Threats to Private Sector

The U.S. terrorism insurance system is failing to provide businesses with adequate financial protection, leaving the nation vulnerable to economic disruption if there is a major terrorist attack, according to a new RAND study.

"Protecting businesses against the economic impact of a terrorist attack should be part of a robust homeland security effort," said Peter Chalk, lead author of the report.

Congress passed the federal Terrorism Risk Insurance Act, or TRIA, in 2002. The act requires insurers to offer insurance that will pay on claims resulting from terrorist attacks on commercial assets when perpetrated by foreign groups using conventional weapons and on the scale of 9/11.

But while such insurance is required by law, only about 50 percent of businesses have "taken it up." At present, TRIA is scheduled to expire in December; if that occurs, prices for such insurance will increase, "take-up" rates will fall, and the nation's financial vulnerability to future attacks will rise.

And although al Qaeda remains the principal "foreign" threat, its operational and organizational character has changed markedly since 9/11, now corresponding more to a "movement of movements" that works through local affiliates. In fact, the study postulates four main attack trends: (1) an increased focus on "soft," civilian-centric venues; (2) an ongoing emphasis on economically motivated assaults; (3) a continued reliance on martyrdom; and (4) a continued interest in chemical, biological, radiological, and nuclear (CBRN) attacks despite little ability to execute large-scale strikes.

Domestically, the antiglobalism movement, with its opposition to the growing concentration of state and corporate power, has influenced at least three homegrown entities that are very dissimilar but that have demonstrated, in varying degrees, a shared penchant for violence: (1) anarchists, (2) far-right extremists, and (3) radical environmentalists. The rise of domestic militants hostile to corporate power has coincided with al Qaeda's increased focus on attacks designed to yield magnified economic consequences.

Two key implications for terrorism insurance emerge. First, TRIA does not provide adequate financial protection, particularly in the face of economically targeted attacks against soft targets. The currently low levels of take-up rates could lead to widespread uninsured losses, intensifying the economic consequences of such attacks.

Second, TRIA has failed to keep pace with the evolving threat. Although the risk from CBRN attacks is profound, insurers are not required to offer this type of coverage (other than workers' compensation). Another key limitation of TRIA is its exclusion of coverage for attacks caused by domestic terrorist groups. This exclusion is problematic because al Qaeda "franchises" its attacks to local affiliates and because it is hard to attribute such attacks to a particular group.

The report recommends that the U.S. Congress consider the following proposals:

- Increase the number of businesses buying terrorism insurance by lowering its price, which could be accomplished by altering the terms of federal reinsurance.
- Expand and improve the financial protections offered by TRIA instead of allowing it to expire in December.
- Require that terrorism insurance cover attacks by domestic groups and attacks involving CBRN weapons (or possibly cover CBRN attacks through a direct government insurance program).
- Create a national board to assess the performance of TRIA or its successor. ■

TRIA is scheduled to expire in December; if that occurs, the nation's financial vulnerability to future attacks will rise.

For more information: *Trends in Terrorism: Threats to the United States and the Future of the Terrorism Risk Insurance Act*, ISBN 0-8330-3822-2, 2005.

Number of Asbestos Claims Continues to Rise at Steady Pace

Asbestos litigation is the longest-running mass tort litigation in the United States, and the number of claims "increased sharply" from the early 1990s to 2002, according to Stephen Carroll, a RAND senior economist and lead author of the most comprehensive study of asbestos litigation to date. The increase was "driven primarily by people who claim noncancerous injuries, a group that accounts for 90 percent of all new claims," he said.

Previously, most claims came from workers exposed through activities such as asbestos mining and manufacturing. Current litigation, however, has spread well beyond the asbestos and building products industries to industries such as textiles, paper, glass, and food. In the latter cases, workers did not routinely handle asbestos, but it was present in the workplace.

Researchers found that more than 730,000 individuals had brought asbestos claims against more than 8,400 defendants through 2002. Moreover, at least 73 companies named in a substantial number of asbestos claims had filed for bankruptcy through mid-2004.

All told, a total of $70 billion has been spent on this litigation through 2002. As the figure shows, nearly a third of the money ($21 billion) has paid for the legal costs incurred by defendants and insurers, with the remaining two-thirds being the gross compensation awarded to claimants.

Of that $49 billion in gross compensation through 2002, roughly $19 billion has paid for the claimants' legal costs, leaving about $30 billion—or 42 percent of total spending—as net compensation. Put another way, claimants have received about 42 cents of every dollar spent, with the rest going to attorneys on both sides and for other related costs.

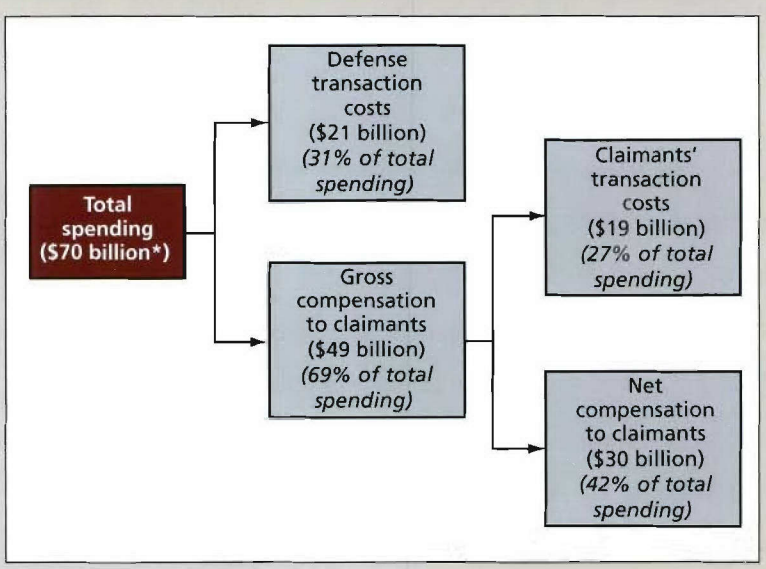
The study encourages policymakers to consider alternative strategies for resolving asbestos injury claims, strategies that would deliver adequate and fair compensation more efficiently. Among the alternatives described in the report is one that would allow claims to remain in the legal system but would limit compensation only to those people whose injuries meet certain medical criteria. Such a system would require the fewest changes but would prevent many asbestos-exposed workers from seeking compensation.

Yet another alternative would be to create a trust fund to make payments to injured workers who meet certain criteria. The fund would be created by pooling payments from defendant corporations and insurers. This alternative is similar to proposed legislation that was voted out of the Senate Judiciary Committee in late spring. ■

For more information: *Asbestos Litigation*, ISBN 0-8330-3078-7, 2005.

Current litigation has spread well beyond the asbestos and building products industries.

Where Asbestos Litigation Money Goes



SOURCE: *Asbestos Litigation*, 2005.
* Estimated spending through 2002.

Voices of Experience

Former Defense Officials See Threats Looming on the Horizon

LOOKING BEYOND the current wars in Iraq and Afghanistan, four men with a combined 25 years of experience at the helm of U.S. defense policy gathered for a conversation at the RAND Corporation and warned of several long-term national security dangers that are now brewing. In general, the four elder statesmen of the U.S. defense establishment suggested that current U.S. defense and foreign policy might be ignoring some long-term dangers and might even be intensifying them.

The men focused their attention neither on terrorism nor on Iraq but discussed those ongoing conflicts in the context of other, growing threats. Chief among the long-term dangers faced by America, according to the group, are the proliferation of weapons of mass destruction, the ballooning national deficit, a scarcity of diplomacy to buttress defense policy, and an estrangement of America from international institutions.

The men also voiced concerns about the military's long-term goals for "transformation." In this regard, the men stressed the need to strike the proper balance in U.S. defense planning, programming, and budgeting between technology and people.

Conversation participants included

- Robert McNamara, secretary of defense for Presidents John Kennedy and Lyndon Johnson from 1961 to 1968
- Brent Scowcroft, national security adviser for President Richard Nixon from 1975 to 1977 and for President George H. W. Bush from 1989 to 1992
- Harold Brown, secretary of defense for President Jimmy Carter from 1977 to 1981
- Frank Carlucci, national security adviser for President Ronald Reagan from 1986 to 1987 and secretary of defense for President Reagan from 1987 to 1989.

Nuclear and Economic Threats

"The two most important security problems we face do not include Iraq," declared McNamara. "The two most important problems are proliferation of weapons of mass destruction and a totally disastrous fiscal situation in this country that is bound to weaken our security."

The number one security problem, he said, is the march of nations toward acquiring nuclear weapons and the danger that yet other parties could obtain those weapons. "I don't see any other problem that's as serious as this."

He focused on North Korea and Iran. "Look at North Korea today. I believe they have nuclear weapons. I'm not sure anything we do will persuade them to give them up." Yet he saw no military solution. "I can't conceive of attacking North Korea, even if we knew where the nuclear facilities were—and I'm not sure we do. They have several thousand artillery pieces as close to Seoul and our troops as Dulles airport is to Washington, D.C. If we attack North Korea, those artillery pieces are going to be destroying Seoul and destroying our troops. It's inconceivable to me that we have a military option."

McNamara saw no military solution with respect to Iran, either. "I don't know how in the heck today we could go into Iran militarily. It would be a very, very serious problem. So with respect to North Korea and Iran, I think we have to do something different than we're doing. We've got to put more weight on diplomacy. We certainly ought to stop nations such as Iran from the nuclear cycle—from enriching uranium and

"The two most important security problems we face do not include Iraq. The two most important problems are proliferation of weapons of mass destruction and a totally disastrous fiscal situation in this country that is bound to weaken our security."
—Former Secretary of Defense Robert McNamara

processing plutonium. There are a whole series of other actions we should take. We're not taking them. And this is going to be our most serious, in my [opinion], security problem for the next several years."

"I agree," said Scowcroft. "It's a very serious problem. And I think there are two broad aspects to it. The first is control of the nuclear materials that we have now." He referred to efforts such as the Nunn-Lugar Cooperative Threat Reduction Program, which aims to secure the vast but "very, very poorly controlled" nuclear arsenals possessed by Russia.

"The second is the development of new nuclear powers. Bob [McNamara] mentions we ought to stop Iran from enriching uranium. Well, that is a huge problem. The Nuclear Non-Proliferation Treaty permits Iran to enrich uranium—as long as it's for peaceful purposes. They say it's for peaceful purposes, but who knows, because once you have the fissile material, making a weapon is a much simpler process."

Scowcroft recommended that the International Atomic Energy Agency (IAEA) exercise greater control over nuclear materials than currently allowed, as was recently proposed by a United Nations (UN) security panel. "They proposed that no new country be allowed to enrich uranium or to reprocess spent fuel rods to produce plutonium. Instead, the IAEA would guarantee a fuel supply for power reactors to any state in good standing with the IAEA." In addition, the IAEA "would supervise the taking back of the spent fuel rods. That, I think, would be a big step forward."

Scowcroft added that North Korea and Iran are not the only causes of concern. "Right behind Iran is Brazil," he said. "Brazil is saying, 'We think there's money in enriching uranium. We've got a lot of natural uranium. It's legal. We want to enrich uranium.' And the danger is that this will cascade and pretty soon we'll have 40 countries on the verge of the capability for nuclear weapons. So it's a very serious problem."

"I think all those statements are true," concurred Brown. "And I think it would be very, very good if we could somehow get international agreement on an IAEA control of all fissionable material. Whether the U.S. would agree to have its fissionable material so controlled is a question in my mind."

Brown renewed the emphasis on diplomacy in controlling the spread of nuclear weapons. "Fundamental to whether countries decide to take the step to go to nuclear weapons is their own judgment as to whether that will improve their security or not. They do it because they think it will. They may be wrong. Perhaps an approach would be to try to persuade them that their overall security—military, economic, and all the rest—is actually better if they don't have nuclear weapons. Now, that takes diplomacy. Whether it can be done with Iran, let alone North Korea, is a big, big question. We certainly can't do it alone—that is, the U.S. certainly cannot make a persuasive case by itself."

"The Global War on Terrorism is something of a misnomer. We're not worried about Basque terrorism in this country. We're not worried about the Chechens in this country. What we are worried about is Salafist Islam. It's really a civil war within Islam rather than a global war on terrorism. That limits what we can do militarily."

—Former Secretary of Defense Harold Brown

"Let me ask you a question," Scowcroft turned to Brown, "about North Korea and Iran and our behavior toward both of them. If you're Iran sitting back looking at it, would you think it better to have nuclear weapons or better not to?"

"Certainly vis-à-vis the United States," Brown answered, "you would feel safer if you had nuclear weapons, because Saddam Hussein didn't have them,

PHOTOS: DIANE BALDWIN

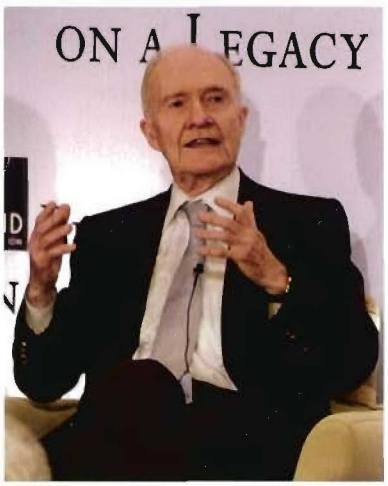
Robert McNamara, defense secretary for Presidents John Kennedy and Lyndon Johnson, and Harold Brown, defense secretary for President Jimmy Carter, share a moment of levity during a mostly weighty conversation.

"We have not really gotten our arms very well around how to integrate our military and our diplomacy for this kind of world. We can't win a war on terrorism by ourselves. We have to reach out. We have to have friends. We have to have allies to share intelligence. We've got a ways to go."
—Former National Security Adviser Brent Scowcroft

and look what happened to him. Now, if they look ahead at a somewhat longer perspective, which they're unlikely to do, they may not feel the same way.

"If North Korea successfully deploys nuclear weapons and gets away with it," Brown continued, "Japan is likely to follow. And I'm not sure that North Korea is then safer. If Iran adds nuclear weapons to its arsenal, they already have Israel to worry about, but they could very well have Turkey to worry about. They could very well have Saudi Arabia to worry about. It seems to me that you can solve this problem—that is, the incentive to have nuclear weapons—only on a regional basis in each of these cases."

"I very much agree with what Harold [Brown] is saying," McNamara chimed in. He proposed a diplomatic approach to North Korea. "In certain circumstances, some form of guarantee of security is required. I don't think there's any way to deal with this North Korean issue without some form of security guarantee.



Brent Scowcroft, national security adviser for Presidents Richard Nixon and George H. W. Bush, promotes an expanded international strategy to stem the proliferation of nuclear weapons.

"We've got to think about how we would feel if we were North Korea," he stressed. "We've got to think how we would feel if we were Iran. We have to try to put ourselves in the position of the nation that doesn't have nuclear weapons and look at it from their point of view. We haven't done nearly enough of that. There's no way to solve [the problems posed by] North Korea and Iran without doing that."

Diplomacy and Engagement

The four interlocutors recognized that the so-called Global War on Terrorism currently dominates the thinking within the U.S. Department of Defense. However, they doubted whether the defense department could bring the proper perspective to the war or could even be the proper place to guide national thinking about such a war.

Carlucci described an inherent difficulty faced by defense officials today. "Every member of this panel participated in the Cold War, where we had a horrible threat, but it was at least a stable threat, and you knew who to negotiate with and you knew how to deter it. In today's world, deterrence, by and large, is not a good option."

Brown focused on further limitations faced by defense officials today. "The Global War on Terrorism, it seems to me, is something of a misnomer. We're not worried about Basque terrorism in this country. We're not worried about the Chechens in this country. What we are worried about is Salafist Islam. And it's really a civil war within Islam rather than a global war on terrorism. And that limits what we can do militarily.

"We have to be prepared with homeland security. We have to be prepared to use the military option occasionally," he acknowledged. "But [coping with Salafist Islam] also puts a very, very high value on diplomacy, on understanding those societies, on educating ourselves to deal with that kind of society and to help the moderates, if you want to call them that, in that society. And that applies to educating our intelligence people, educating our military people, and even educating our diplomats—not all of whom are very well qualified for this."

Brown's premise met with nods from the other discussants. "As Harold [Brown] says," said Scowcroft, "it's partly military, but it's heavily political, it's heavily economic, it's heavily diplomatic. And I think we have not really gotten our arms very well around how to integrate our military and our diplomacy for this kind of world."

"But I would suggest that absolutely fundamental to security in that kind of a world," McNamara reiterated, "is economic stability in this country. And we're not on a course to assure that. There will be a deficit of half a trillion dollars each year over the next decade.

And that will rise further. Those of us interested in security should think about this. It's the foundation of our security. We must maintain a stable economy in this rather unstable world that we're going to move into with globalization."

Because of globalization, Scowcroft warned, it is more important than ever for the United States to help make international institutions more effective. "What globalization really means is that national boundaries are eroding. There are forces, whether it's capital flows, whether it's health, whether it's communications, whether it's entertainment, culture, environment—they're beyond now the capacity of a national government to control.

"Terrorism, for example. We can't win a war on terrorism by ourselves. We have to reach out. We have to have friends. We have to have allies to share intelligence. All of these kinds of problems that globalization is bringing require reaching out to friends, allies, international organizations. And we've got a ways to go."

"I don't think we're putting nearly enough attention on [international organizations]," echoed McNamara, "the UN in particular. We're not going to deal with this problem of weapons of mass destruction effectively, in the long run, without UN support. It's an absolutely fundamental interest of the United States to make these international organizations stronger."

Technology and People

The men also shared their concerns about Pentagon plans for a "transformation" of the military. Military transformation refers, in short, to the use of technologically advanced information systems to substitute for the heft of armored forces. In a transformed military, fewer troops would rely on lighter vehicles and greater situational awareness.

"There's a lot of talk about technology in our military," Carlucci warned, "but the real key to our success in the military has been the quality and training of our people. You can't let that erode." He endorsed current plans to add 30,000 troops to the U.S. Army. "But we have to equip those troops. It's the procurement accounts that are falling short right now. You can't just say we're going to add another 30,000 troops. You have to say: How are we going to train and equip them? And that has budget implications."

Carlucci said the Pentagon "is surely right in trying to transform our military from a Cold War model to one that can deal with emerging threats." However, he cautioned against placing too much responsibility for the job on technology.

"Technology can take you only so far if you don't have the quality of the soldier. We need to maintain the quality in training of our military people, above all. Technology is important. It's not a panacea. We saw [what] could be done in Afghanistan, where you had B-52s doing close air support with people on horseback calling them in. You see the limits of technology in Iraq, with the roadside bombs and how you deal with house-to-house fighting. So we need to have a balanced approach to technology."

He referred to one high-profile army initiative. "I am very concerned about the FCS, the Future Combat System, which is the big gamble the army is taking. It's practically the whole army budget, betting on a system of systems, which already had to be reconfigured once. A lot of the technology we're talking about is untried technology. You've got to be very careful that you don't stretch the technology too far. It may just not work."

Brown echoed the point. "If you have battlefield awareness, if you have the information about where everybody is and which way they're going and what they're capable of, and if you have precision munitions, you can win the conflict. The problem is: That may not degrade gracefully if you start to lose the information. And that is why you need that mixture of some of the traditional forces." ■

Frank Carlucci, national security adviser and defense secretary for President Ronald Reagan, emphasizes the need to balance technological and human resources for military transformation.

"The real key to our success in the military has been the quality and training of our people. You can't let that erode. Technology can take you only so far if you don't have the quality of the soldier. Technology is important. It's not a panacea."

—Former National Security Adviser and Secretary of Defense Frank Carlucci

Army Stretched Thin

There's No Easy Way Out for the Nation

By Lynn Davis and J. Michael Polich

Lynn Davis, a political scientist at the RAND Corporation, was U.S. undersecretary of state for arms control and international security affairs from 1993 to 1997. Defense analyst Michael Polich is a senior behavioral scientist at RAND.

The United States faces an enormous challenge in having to provide military forces for sustained overseas operations while protecting the American homeland and standing ready for other crises that may require rapid response. Driven by the wars in Iraq and Afghanistan, the increased operational tempo of the last four years has led to lengthier and more-frequent deployments of soldiers and units across the entire U.S. Army, putting stress on both its active and reserve components.

Today, the bulk of the active-duty army is either in Iraq, returning from Iraq, or preparing to go to Iraq. The formerly part-time soldiers in the National Guard now account for about 40 percent of the brigades deployed to Iraq and Afghanistan. And since the war began in Iraq two years ago, the length of a standard mobilization for reserve units going there has risen well above the one-year goal that was originally intended.

These events have placed a growing strain on the U.S. Army as it seeks to train its soldiers and to maintain a pool of units ready to respond rapidly to new contingencies. This situation confronts the nation with urgent questions about the proper size of the army's active and reserve forces, about the optimum number and types of combat units needed to sustain high levels of overseas deployments while maintaining readiness for other missions, and about the effects on soldiers and units stretched thin by the repeated, rapid rotations.

We have examined various ways in which the army might respond to the current and future demands upon its forces. We have also gauged the likely long-term effects of several policy options on army combat brigades. The options utilize brigades from the Active Component (AC) and Reserve Component (RC) operating under either a standard rotational schedule or an intensified one. (The RC includes both the U.S. Army Reserve and the National Guard, although only the National Guard has combat brigades.)

As illustrated in the centerpiece on pp. 16–17, what emerges from our analysis is a picture of the difficult trade-offs the army faces today, assuming a world in which high levels of overseas rotations continue. The difficult trade-offs could augur major changes in

What emerges from our analysis is a picture of the difficult trade-offs the army faces today.

the future size, structure, cost, and management of the active and reserve forces. The challenge is daunting. We see no viable option free of substantial risks, sacrifices, or both.

Rough, but Ready?

In our analysis, we focused on two outcome measures that characterize the army's ability to fulfill its missions over time: (1) "time at home" between deployments for active-duty brigades, and (2) the number of "ready" active-duty brigades.

Time at home is important because of its broad ramifications for unit training and soldier well-being, recruitment, and retention. The number of ready units is a metric for assessing the nation's defense posture and the army's ability to respond rapidly to new threats.

These two outcome measures depend on several factors that could vary simultaneously:

- *Size of the operational requirement:* We analyzed a range of requirements, from 8 brigades to 20 brigades required at any given time. As a point of reference, the army's requirements have grown over the past couple of years from 12 brigades to 17 brigades in Iraq and Afghanistan alone.
- *Army force size and structure:* We examined the effects of different operational requirements on the baseline force (pre-2004) and the planned (or "transformed") force, which is expected to be in place by 2007 in the AC and 2010 in the RC. We also examined the effects of relying on a future force that might include an expanded AC or might have a different mix of RC units than currently planned.
- *Utilization policies:* We compared variations in the frequency of reserve unit mobilizations and in the amount of preparation time given to the units prior to deploying. Under current policy, the goal is for reserve units to be mobilized for a maximum of one year out of every six. Given the need for training during this year of mobilization, we assumed that reserve units would train for six months and deploy for six months. We modified this policy hypothetically to allow for more-intensive utilization of the reserves in all three respects, such as mobilizing the reserves one year out of every *five* years, training them for only *three* months of that year, and extending their deployments to *nine* months.

We also accounted for the three types of army combat brigades now being planned by the army for its transformed force: heavy, medium, and infantry. Heavy brigades have armored vehicles for maximum protection and firepower. Medium brigades have wheeled vehicles for mobility and versatility. Infantry brigades typically lack an extensive complement of ground vehicles. The classification is important because the different types of units are specialized for particular combat missions and environments, and there are limitations on the extent to which the units can substitute for one another.

In our analysis, we assumed that heavy and medium brigades could substitute for one another. Therefore, we combined them into a category called "heavy-medium" brigades. On the other hand, we generally assumed that infantry units could not do the job of heavy-medium units, though we considered cases where the types of units were interchangeable in meeting the overseas requirements.

Few Options

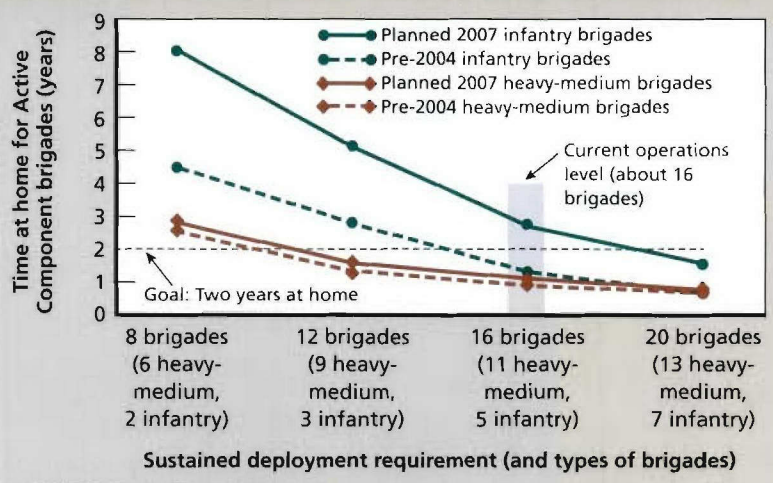
Our analysis began by considering what would happen if the U.S. Army relied solely on its supply of active-duty brigades. We weighted the in-theater requirement toward heavy-medium brigades, in line with the emphasis currently placed on deploying these types of brigades to Iraq and Afghanistan. For political reasons, we subtracted certain brigades from the pool of available rotating brigades. From the pre-2004 force, we subtracted one brigade, assigning it to Korea. From the transformed force, we subtracted two brigades, assigning one to Korea and one to Europe.

Figure 1 shows the results, both for the pre-2004 force of 32 rotating active-duty brigades and the post-transformation force of 41 rotating active-duty brigades. In both cases, the inventory of heavy-medium brigades falls under considerable stress when sustained deployment requirements exceed 10 combat brigades. The burden on heavy-medium brigades is eased only slightly by the army's plans for transformation, because those plans call for the addition of mostly infantry brigades.

The burden is eased only slightly by the army's plans for transformation.

At larger requirements (12 through 20 brigades), the time at home for heavy-medium brigades drops to less than two years. Two years of time at home is

Figure 1—Active-Duty Army Readiness Suffers Greatly When Sustained Deployment Requirements Exceed 10 Brigades



SOURCE: *Stretched Thin*, 2005.
NOTE: We assume deployments of only active-duty brigades, no reserve brigades.

a well-established army goal for refreshing, refitting, retraining, and thus "readying" units between subsequent deployments.

Some improvement could be made by permitting units of any type to substitute for one another, such as sending infantry units in place of heavy-medium units. This change would equalize the strain across all army units. As the requirements rise above 14 combat brigades, however, both the heavy-medium and infantry units would begin to face less than two years at home. At these high levels of demands, the nation would be left with few brigades primed and ready for other needs.

Time at home for the active-duty heavy-medium brigades remains substantially below two years no matter how hard the reserves are pushed.

We then examined the potential of using the reserve brigades to extend the time at home for the active brigades and thereby to increase the number of ready active brigades. We stipulated the use of the entire post-transformation supply of 11 heavy-medium reserve brigades to fulfill a sustained deployment requirement of 16 brigades, of which 11 are specified to be heavy-medium.

Figure 2 shows the results for time at home for the active-duty heavy-medium brigades. Their time at home remains substantially below two years no matter how hard the reserves are pushed. We initially assumed that the army would mobilize the reserves for one year out of every six, in line with defense department policy. We then investigated a series of modified RC policies, such as more frequent mobilizations (one year out of every five, four, or three) and reduced preparation times (with longer deployments). We found these modifications to be somewhat helpful but still insufficient, even in combination, to bring the time at home for AC heavy-medium brigades up to the two-year threshold.

To meet its goal of two years at home for all AC brigades between deployments, therefore, the army would need to take further steps. One possible approach would be to increase the number of AC and/or RC heavy-medium units beyond those in the army's transformation plan—a costly but conceivable solution.

Another approach would be to use infantry and heavy-medium brigades interchangeably *and* to use all AC and RC brigades interchangeably. In this case, though, the nation would have to accept the appreciable risks of assuming that any type of brigade could accomplish any type of mission and that each of the reserve brigades would be equal in capability to the active brigades.

Many Risks

Each policy alternative involves significant costs, risks, or both. We have posited a series of future conditions that raise progressively tougher questions for the nation. Where possible, we have proposed how the army might adapt to meet the immediate requirements and to sustain its forces over the longer term. But in most of the cases that we could envision, the future conditions would present the army—and the nation—with notable risks of one kind or another.

Suppose, initially, that overseas rotation requirements drop back to 10 brigades. All AC units would have at least two years at home between deployments. The army would have a full stock of more than 20 ready combat brigades, of which at least 11 would be heavy-medium brigades.

The question for the nation is whether policymakers are comfortable basing future army planning on this rosy scenario of consistently lower levels of overseas rotational requirements. This assumption could be plausible if we view the current requirements in Iraq and Afghanistan as an aberration or something to be endured for only a short time now or periodically in the future.

Alternatively: What if high overseas rotation requirements—of 14 to 20 brigades—continue for some time? The army would experience serious problems with active-unit readiness. The nation would have few, if any, ready AC brigades to turn to in a crisis. Transforming the army as planned would alleviate the strain a bit. But transformation would be largely in the future, would bring its own uncertainties, and could not meet the full demand for rotational forces by itself.

The nation could decide to live with low levels of active-unit readiness—*if* it assumed that the army would only rarely need to respond quickly to contingencies with large numbers of forces, either overseas or at home. This course presumes that international or domestic contingencies would not require the army to do much beyond supporting its current level of overseas rotations.

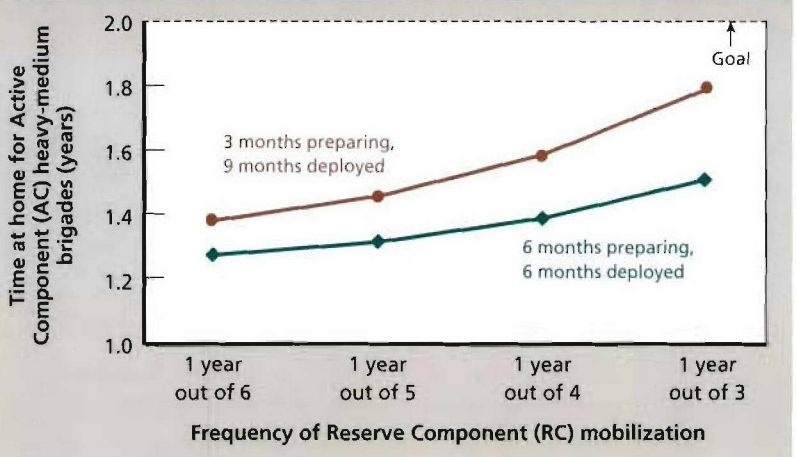
What if the risks are too high for the army to plan for low levels of contingency requirements? There are two possible adaptations. First, the army could turn to the reserves and plan to utilize them at reasonable rates, such as mobilizing RC brigades for one year out of every six years. But RC units would still cover only a modest portion of the total requirement for overseas forces.

Second, the army could assume that any AC or RC unit could perform the mission demanded by any contingency. This course would carry considerable risk if a theater environment were not benign or if a mission required armored protection or ground mobility. To date, the army has hedged against these risks by deploying predominantly heavy-medium forces to Iraq. And even if full flexibility were possible among all types of units, AC time at home would still dip below two years if the total overseas rotational requirements were to increase beyond about 17 brigades.

What if it is too risky to assume that AC and RC infantry and heavy-medium brigades can substitute for one another in future missions? We see only two realistic options. One is for the army to forgo its transformation plans to convert some of its RC heavy-medium units to infantry units. This option would also require the army to find the financial resources to make all 25 of its existing RC heavy-medium units equal in readiness to AC heavy-medium brigades.

Alternatively, the army could add more AC heavy-medium brigades. This could be accomplished either by adding units or by changing the mix of units in the transformation plan. This option would require many billions of dollars beyond the current plan and would take years to achieve.

Figure 2—Even Extreme Utilization of Army Reserves Wouldn't Give Active-Duty Heavy-Medium Brigades Two Years at Home



SOURCE: *Stretched Thin*, 2005.
NOTE: We assume 41 transformed rotating AC brigades, 11 transformed rotating RC brigades, and a sustained deployment requirement of 16 brigades, including 11 heavy-medium and 5 infantry.

To decide among these options will require the nation to confront a number of trade-offs. The trade-offs pertain to the army's reliance on the AC versus the RC; the risks to the nation if the army has few ready units for new contingencies; the training required of army units for different types of operations; and the resources available for the AC, the RC, or both.

Our analysis suggests that none of the trade-offs will be easy. No single policy is likely to meet all goals. Each option involves sacrificing something important or incurring substantial costs. ■

Related Reading

Army Forces for Sustained Operations, RAND/RB-9125-A, 2005, 4 pp., www.rand.org/publications/RB/RB9125.

Stretched Thin: Army Forces for Sustained Operations, Lynn E. Davis, J. Michael Polich, William M. Hix, Michael D. Greenberg, Stephen D. Brady, Ronald E. Sortor, RAND/MG-362-A, 2005, 122 pp., ISBN 0-8330-3816-8, $20.

No Single Policy Is Likely to Meet All Army Goals

THE U.S. ARMY HAS BORNE THE BRUNT of sustained military operations over the past four years. The wars in Iraq and Afghanistan have led to lengthier and more-frequent deployments of soldiers across the entire army, including both its active and reserve components. The deployments have placed growing stress on the army as it seeks to train its personnel and to maintain a pool of units ready to respond rapidly to new contingencies.

We identified two key measures of the army's ability to fulfill its missions: (1) total "time at home" between deployments of active-duty brigades, and (2) the number of "ready" brigades. The table shows that the army has become stretched thin according to both criteria—and that each option that could mitigate the problems comes with its own downside. The table outlines the risks and likely outcomes of seven policy options for the army's active-duty, "heavy-medium" brigades (units organized around armored or wheeled vehicles). All seven options presume a continuation of the current rate of sustained operations over the long term.

Option A places sole responsibility for overseas rotational deployments on the Active Component (AC). This policy would allow only a year at home between yearlong deployments and shrink the number of ready AC heavy-medium brigades to just 2 out of a grand total of 25.

Option	Policy U.S. Army Personnel Mix of Active Component (AC) and Reserve Component (RC) Brigades for Overseas Operations	Risks	Resources Additional Heavy-Medium Brigades (above and beyond planned AC) RC New AC	RC Utilization Years at Home Year Mobilized Months Pre Months De
A	Use planned (transformed) AC only; no use of RC	AC units at home only for short time; few ready brigades	0 (planned AC only)	Not applicable
B	Use planned (transformed) RC per current utilization policy	AC units at home only for short time; few ready brigades	11	1 2 3 4 5
C	Use planned RC more intensively than in current utilization policy	Assumes more-frequent RC use and improved preparation time; results still fall short of goal	11	1 2 3 4 5
D	Keep current RC heavy-medium brigades and use per current policy	Financial costs of keeping 25 heavy RC brigades and transforming them	25	1 2 3 4 5
E	Keep current RC heavy-medium brigades *and* use more intensively	Requires major investments *plus* frequent RC use *plus* shortened preparation	25	1 2 3 4 5
F	Permit flexibility in all unit types; use planned RC per current policy	Works well only if AC and RC are interchangeable and if armored protection is not important	34	1 2 3 4 5
G	Add new AC heavy-medium brigades or shift units from infantry	Meets operational goals but entails substantial financial costs to nation	11 7	1 2 3 4 5

Assumptions: Sustained requirement of 16 overseas brigades, 11 of which must be heavy-medium brigades, from a total of 41 rotating AC transformed brigades (
RAND cost estimates are approximate and should be viewed as minimums. Cost estimates are expressed in 2005 U.S. dollars.

SOURCE: *Stretched Thin: Army Forces for Sustained Operations*, Lynn E. Davis, J. Michael Polich, William M. Hix, Michael D. Greenberg, Stephen D. Brady, Ronald E.

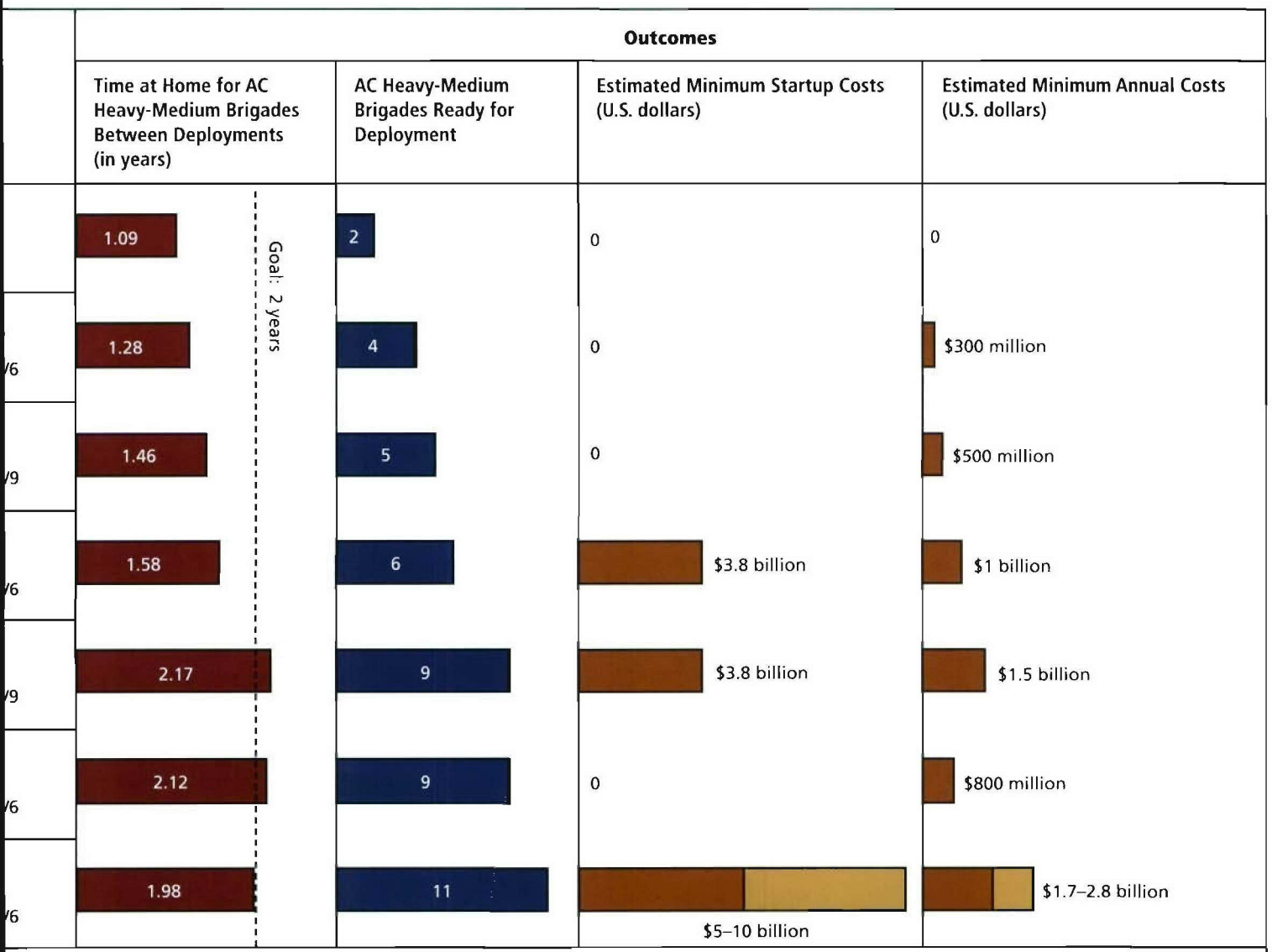
Given Current Rate of Sustained Operations

The next four options rely on the Reserve Component (RC) in increasingly intensive, costly, and risky ways. Of these four, only Option E, which is the most drastic option, appears to meet the goals. Option E would alter the army's plans for transformation by doubling the supply of RC heavy-medium brigades available for deployment abroad, deploy them more frequently than currently planned, and cost billions more.

Option F might appear to meet the goals at relatively little expense, but this option could pose appreciable risks on the battlefield. By permitting maximum flexibility in using AC and RC units interchangeably *and* infantry and heavy-medium units interchangeably, Option F could create a situation in which the army might have the wrong type of units in theater if tensions rose or the situation deteriorated.

Option G calls for either adding seven new AC heavy-medium brigades or shifting the planned mix of AC units away from infantry brigades toward costlier heavy-medium brigades. This option would ease the army's burdens and risks considerably, but only at great expense to the nation.

What emerges in stark relief is the dilemma faced by the army today—and the complexity of making decisions that could help lengthen the time at home between deployments for AC brigades and increase the number of ready brigades available to respond quickly to new threats. ■



-medium) and variable RC brigades.

AND/MG-362-A, 2005, 122 pp., ISBN 0-8330-3816-8, $20.

Peace Entrenched

Planning for a Palestinian State Should Not Await a Final Settlement

If Israelis and Palestinians agree to a peace settlement, then the difficult task of building a successful Palestinian state would be achievable and affordable, according to a series of RAND studies. However, a Palestinian state would require considerable and sustained support from the international community—particularly the United States, the European Union, the United Nations, the World Bank, and the International Monetary Fund.

Researchers analyzed key challenges that would confront a Palestinian state on the morning after peace, developed policy alternatives to meet the challenges, and then estimated the investments needed. The challenges included internal security, water, health, education, and infrastructure.

To help a Palestinian state meet the challenges in these and other key areas, the new state was estimated to require at least $33 billion in gross public and private capital investment over the first ten years of statehood, according to a growth model used by the researchers. In estimating costs, the researchers considered the demographic, economic, and political factors at play.

The $33-billion estimate includes the cost of a rail and road infrastructure that would constitute the physical backbone of an economically prosperous and environmentally sustainable state. Building the transportation infrastructure would invite the parallel construction of infrastructures for water, energy, telecommunications, and open space for a linear chain of Palestinian cities and their offshoots. The researchers refer to the envisioned collection of infrastructures simply as "the Arc." From the air, the Arc and its offshoots would resemble an olive branch.

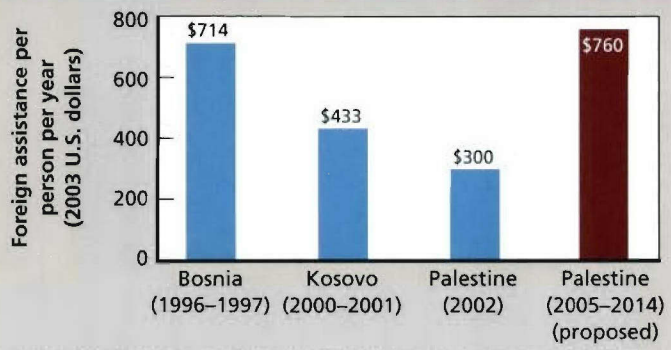
From the air, the Arc and its offshoots would resemble an olive branch.

Beyond its financial needs, a new Palestinian state will be more likely to succeed (1) the greater its territorial contiguity; (2) the more open its borders, allowing free movement of people and goods between Palestine and its neighbors; (3) the greater the security within Palestine and for its neighbors, including protection against political violence; and (4) the better its governance, including a commitment to democracy and the rule of law. If these conditions are met and wise policy choices are made, then the international investments outlined below could bear great fruit, according to recent spending precedents.

The $33-billion estimate was found to be comparable, on an annual per-capita basis, to the investments made by the international community in two of the most successful nation-building endeavors of the recent past: Bosnia and Kosovo (see Figure 1). Moreover, the RAND proposals outline a set of sorely needed priorities to help focus international and domestic activities.

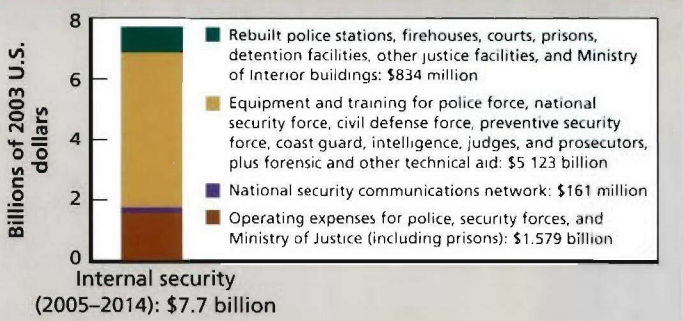
Although the premise of the RAND studies was a peace settlement between Palestine and Israel coupled with Palestinian statehood, many of the recommendations could—and should—be implemented now. Doing so would not only improve the daily lives of Palestinians, it would also empower the current

Figure 1—Proposed Aid to Palestine Would Be Comparable, on an Annual Per-Capita Basis, to Aid Given to Bosnia and Kosovo



SOURCES: World Bank, *West Bank and Gaza Update*, Washington, D.C., April–June 2003; *Building a Successful Palestinian State*, 2005a; *Helping a Palestinian State Succeed: Key Findings*, 2005.

Figure 2—Money for Internal Security Would Pay for Buildings, Equipment, Training, Communications, and Operating Expenses



SOURCE: *Building a Successful Palestinian State*, 2005a.
NOTES: The estimate of $7.7 billion represents the total cost of running the internal security sector but does not distinguish between domestic financing and international aid. Costs assume a 5 percent annual population growth in the Palestinian territory.

moderate Palestinian leadership and thereby improve the prospects for a negotiated settlement.

Internal Security: Prerequisite for Success

The success of a Palestinian state is inconceivable in the absence of peace and security for Palestinians and Israelis alike. These conditions must be established from the moment of independence. Unlike infrastructure or industry, security is not something that can be built gradually.

Successful arrangements for internal security range from protecting borders that surround a state to maintaining law and order within it. Even under the most favorable conditions, success will probably require extensive international assistance for several security agencies. The money would pay for everything from rebuilding courthouses and police stations to training personnel to supplying them with computers and other equipment (see Figure 2).

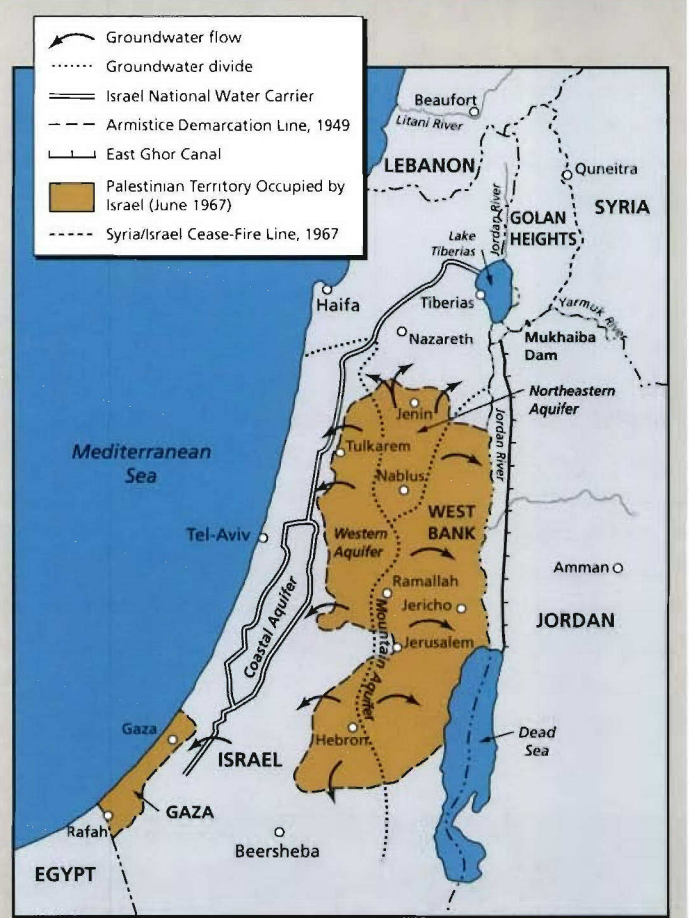
Water: Lacking in Supply and Efficiency

Rapid population growth will stretch the ability of a Palestinian state to provide water for homes, commerce, industry, and agriculture. Already, the supply of clean water is inadequate, and its current use is unsustainable. Current water and waste management practices are degrading streams, rivers, and aquifers.

Most water in the Palestinian territories, which consist of the West Bank and Gaza, comes from springs and wells fed by aquifers that are shared with Israel (see Figure 3). The amount of water that Palestinians and Israelis are extracting today from most of the region's aquifers exceeds the replenishment rate (see Figure 4).

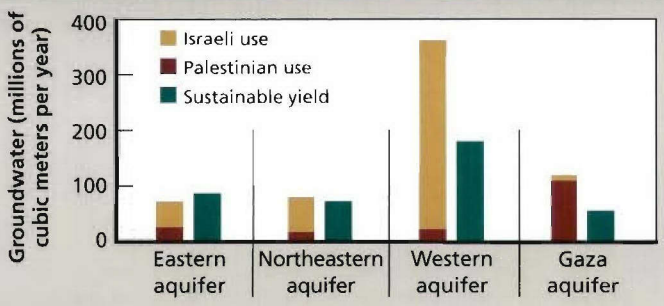
A smart water strategy for a Palestinian state would be to simultaneously increase the water supply and use it more effi-

Figure 3—The Only Natural Sources of Fresh Water for Israel and a Palestinian State Are the Jordan River, Its Tributaries, and Underground Aquifers



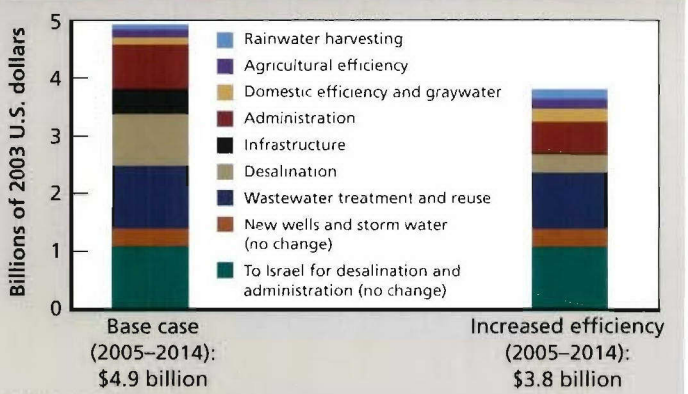
SOURCE: Adapted from Thomas R. Stauffer, *Water and War in the Middle East: The Hydraulic Parameters of Conflicts*, Washington, D.C.: The Center for Policy Analysis on Palestine (currently The Palestine Center), Information Paper Number 5, July 1996.
©The Jerusalem Fund.

Figure 4—Israelis and Palestinians Overuse Their Aquifers



SOURCES: CH2M HILL, Draft West Bank Integrated Water Resources Management Plan, CH2M HILL, 2002; Palestinian Central Bureau of Statistics (PCBS), *Selected Water Statistics*, Ramallah: PCBS, 2003; and the Oslo Accords.
NOTES: There are disagreements and uncertainty about how much water is being pumped from the aquifers. The Israeli Water Commission estimates that the Palestinians draw up to 320 million cubic meters per year (nearly twice as much as the above sources show).

Figure 5—Increased Efficiency Could Reduce Total Costs for Water and Sanitation by $1.1 Billion over Ten Years



SOURCE: *Building a Successful Palestinian State*, 2005a.
NOTES: The estimates represent the total cost of running the water sector and assume that the international community would pay all expenses. Both cases include $1.1 billion in compensation to Israel for reducing its withdrawals from aquifers. Other costs assume a 1 percent annual increase in energy costs and yearly population increases of 3.3 percent in the West Bank and 4.2 percent in Gaza.

ciently. Palestinians can increase their water supply by increasing groundwater use (accommodated by Israel's reduction in use); increasing rainwater capture; and, when no other options exist, expanding costly desalination capabilities. Meanwhile, Palestinians can manage their water demand by investing in drip irrigation systems for crops; switching from water-intensive crops to less-water-intensive crops; installing water-efficiency devices in homes; recycling household wastewater from sinks and showers ("graywater") to flush toilets, to water yards, and to wash cars; and improving the water and wastewater infrastructure.

Increased efficiency could reduce the ten-year costs for water and sanitation by more than $1.1 billion. Figure 5 shows that small investments in water efficiency could lead to large savings.

Health: Strong Pulse, but Needs Tending

The health system of a future Palestinian state begins with many strengths, including a relatively healthy population (see Figure 6), a high societal value placed on health, many highly qualified health professionals, national plans for health system development, and a strong base of governmental and nongovernmental institutions. Nonetheless, important areas of concern include poor systemwide coordination of programs and considerable deficits in operating budgets.

Increased efficiency could reduce the ten-year costs for water and sanitation by more than $1.1 billion.

Future investments from international donors should be directed toward two areas of priority: (1) integrating the health system more closely, with input from all relevant governmental and nongovernmental stakeholders, and (2) improving health care programs, particularly in public health and primary care. These programs include immunization, micronutrient fortification and supplementation, prevention and treatment of chronic and noninfectious diseases, and treatment of developmental and psychosocial conditions.

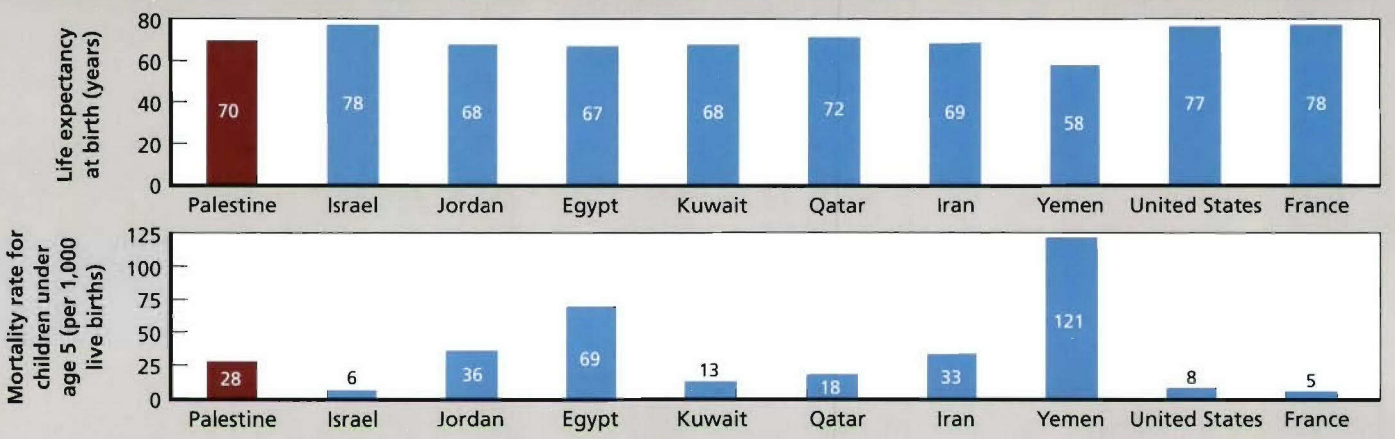
The Palestinian health system could constructively absorb between $125 million and $160 million per year in new, additional international support over the first decade of an independent state. This support, combined with increased Palestinian spending for health care, would raise the level of spending on health care per person to an internationally respectable level (see Figures 7 and 8).

Education: More Students, More Investments

Despite having a strong foundation, the Palestinian education system faces notable challenges. These include rising levels of malnutrition, homelessness, and poor health among children; inadequate facilities and supplies; unsafe schools and routes to schools; lack of special-education options for students with special needs; and the absence of life-long learning opportunities. The system is severely underfunded. Meanwhile, student enrollment is expected to increase substantially over the next decade (see Figure 9).

But with proper investment from the international community, a Palestinian state could become a powerful player in the

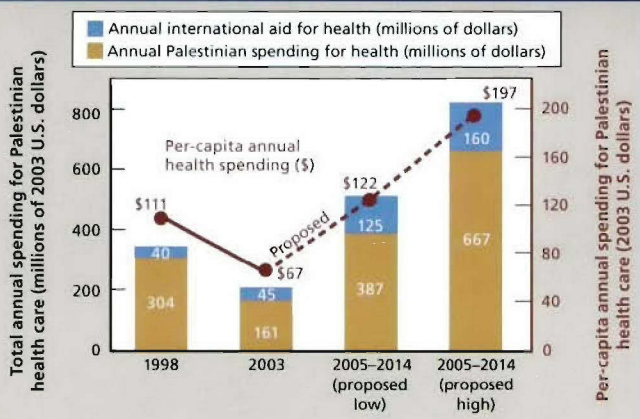
Figure 6—Palestinians Are Relatively Healthy Compared with Some Neighbors but Not Others[a]



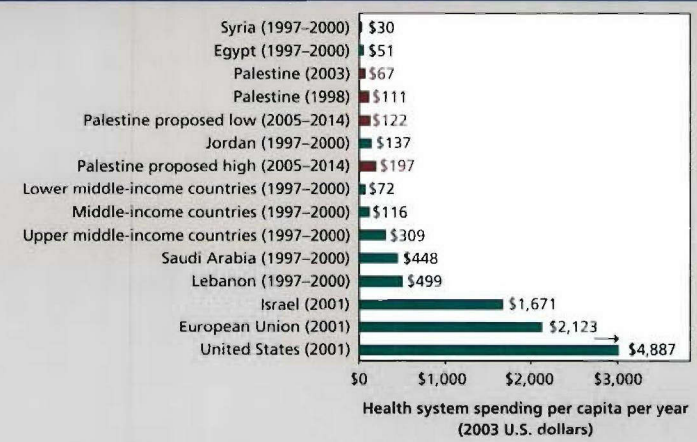
SOURCES: United Nations Children's Fund, *The State of the World's Children*, New York, 2000 (online at http://www.unicef.org/sowc00/ as of July 2005); Palestine Authority Ministry of Health, *Health Status in Palestine: Annual Report 2001*, July 2002.

[a]The United States and France are not regional neighbors, but their figures are included for the sake of comparison.

Figures 7 and 8—Tripling Annual Health Care Spending from the 2003 Level to $197 Per Person Per Year . . . . . Would Not Be an Exorbitant Expense for Health

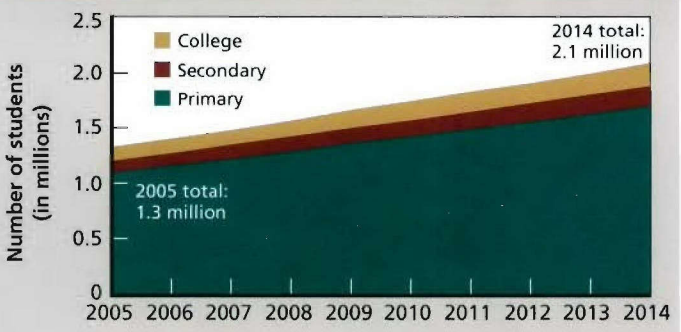


NOTE: The estimates assume a population of 3.1 million people in the Palestinian territory in 1998 and 2003, an initial population of 3.5 million in 2005, and 4 percent annual population growth thereafter.



SOURCES: *Building a Successful Palestinian State*, 2005a; *Helping a Palestinian State Succeed: Key Findings*, 2005.

Figure 9—Palestinian Student Enrollment Is Expected to Increase by More Than 50 Percent in the Next Decade

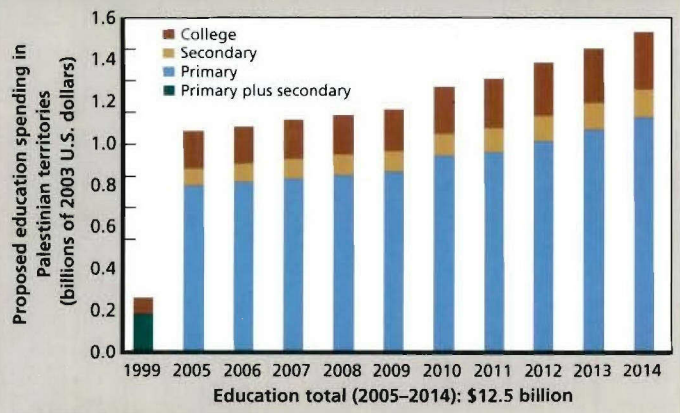


SOURCES: Palestinian Authority, *Emergency and Public Investment Plan, 2003–2004*, Ramallah: Ministry of Planning and International Cooperation, 2003; *Building a Successful Palestinian State*, 2005a.

region's knowledge economy. A stronger education system will be an indispensable down payment on future economic success. Investments should be directed toward expanding enrollments in early childhood programs and secondary schools, making special education available, stressing development of civic skills and social responsibility, modernizing vocational education to produce workers with needed skills, and expanding science and engineering programs at universities.

The Palestinian education system will need between $1 billion and $1.5 billion per year in financing over the first decade of statehood to support national ambitions for development (see Figure 10). This investment level, about four times the current spending level, is based on international benchmarks for spending per pupil in successful education systems.

Figure 10—World-Class Education for a Palestinian State Would Cost Four Times the 1999 Spending Level



SOURCE: *Building a Successful Palestinian State*, 2005a.
NOTES: Proposed spending represents the total cost of running the education sector but does not distinguish between domestic financing and international aid. Estimates assume yearly enrollment increases but no significant effect from net migration. If migration flows result in more children of school age, the spending requirements will increase correspondingly.

Infrastructure: An Arc of Roads, Rails, and Other Trails

Palestine's infrastructure, inadequate even for current needs, will soon be called upon to support perhaps twice as many people. The population of the West Bank and Gaza, now at 3.6 million people, could grow to about 6.6 million by 2020 (see Figure 11).

Population density in Palestine already places it near the top of the world's densest nations. In 2020, its density is expected to exceed even that of Bangladesh (see Figure 12). Therefore, the model for growth should be a compact and sustainable urban form and not an unbounded sprawl.

The key to a successful Palestinian state could lie within its own topography. The West Bank is divided down the middle by a curving north-south line, or "arc," of mountain ridges. Because rainfall is much higher on the western side, people and agriculture have concentrated there for millennia. The ridgeline is the natural unifying component of a Palestinian state (see Figure 13).

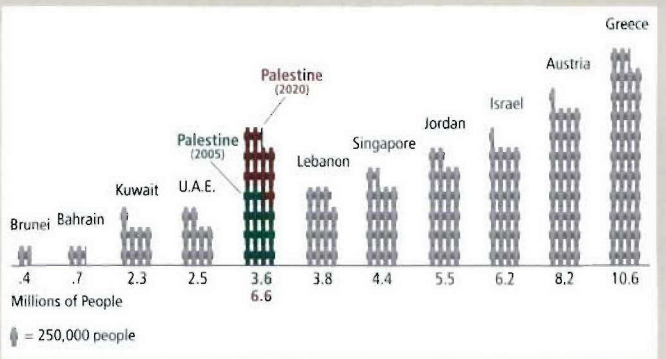
Economic development requires the creation of rapid north-south transportation links for goods and people, both in the West Bank and between the West Bank and Gaza. Combining the need for a north-south link plus the opportunity afforded by the north-south topography creates the prospect for a major new project parallel to the ridgeline. Construction of a transportation line, including a railroad and toll road, along the ridgeline would encourage concurrent construction of parallel lines for electricity, natural gas, telecommunications, and water. A national linear park could weave back and forth across the line as influenced by the landscape (see Figure 14).

The full ensemble, "the Arc," could have great symbolic power for the new nation. Construction of just the railroad, toll road, and privately funded housing around the transit lines would also employ between 100,000 and 160,000 Palestinians per year over a five-year span.

The researchers assumed that Gaza would be the site of an international airport as well as an international seaport connecting Palestine to the rest of the world. The Arc's rail and road links would provide rapid access for people and freight to and from the ports for all parts of Palestine. The rail line would link

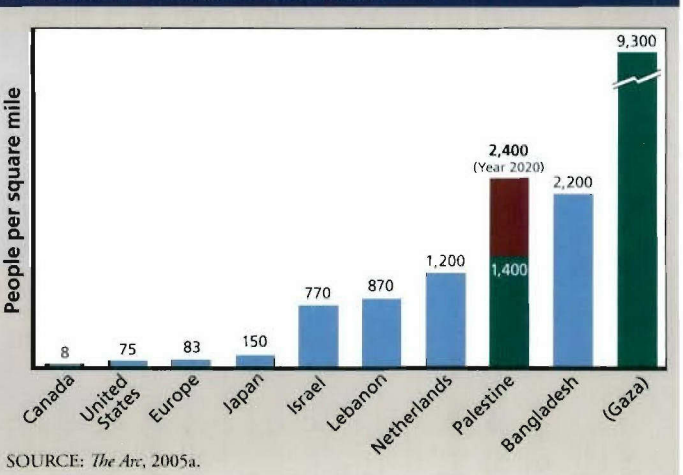
The model for growth should be a compact and sustainable urban form and not an unbounded sprawl.

Figure 11—The Population of the West Bank and Gaza Is Expected to Nearly Double Within 15 Years



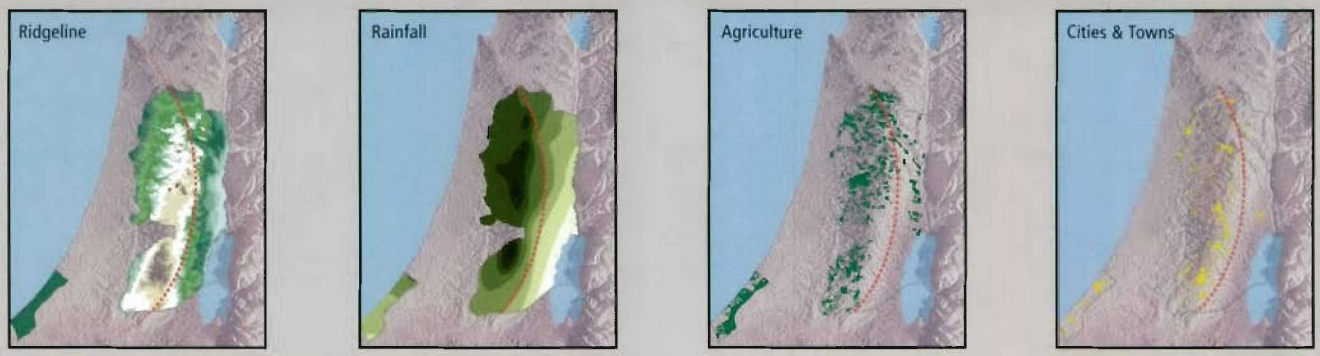
SOURCES: Palestinian Central Bureau of Statistics; *The Arc*, 2005a; *Building a Successful Palestinian State*, 2005a.

Figure 12—A Palestinian State Could Surpass Bangladesh in Population Density; Gaza Already Does



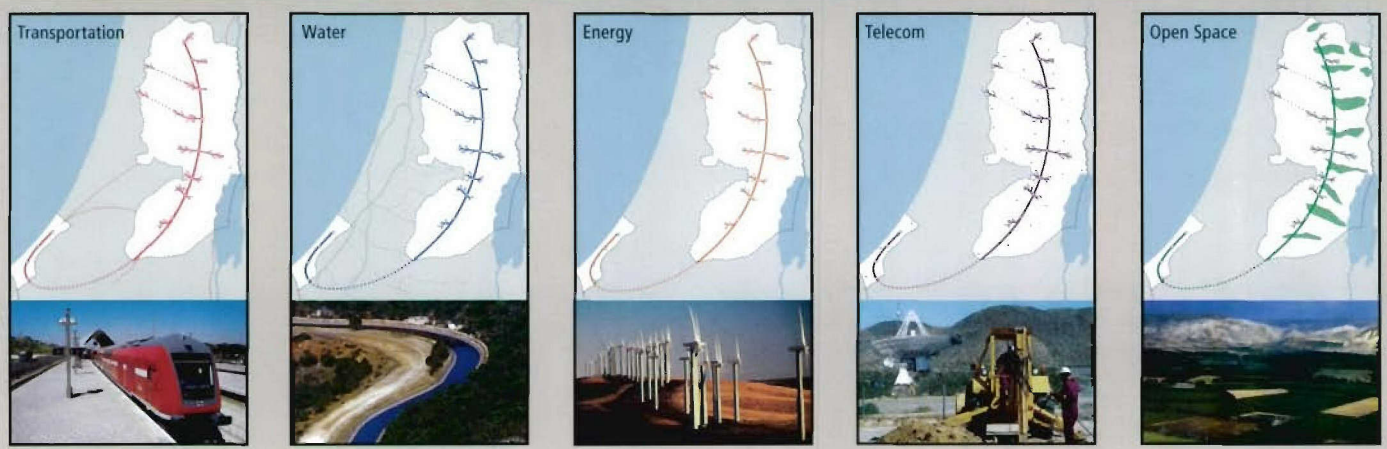
SOURCE: *The Arc*, 2005a.

Figure 13—An Arc of Mountain Ridges Forms a Natural Unifying Backdrop for a Palestinian State



SOURCE: *The Arc*, 2005a.

Figure 14—Five Infrastructures Could Follow the Ridgeline; the Transit Infrastructure Could Link the West Bank with Gaza



SOURCE: *The Arc*, 2005a. Photos (left to right) courtesy Israel National Railway, Baron Wolman, Florida Power and Light, Suisman Urban Design, Baron Wolman.

almost all of the primary cities of Gaza and the West Bank in just over 90 minutes (see Figure 15).

Growth Corridors: Accommodating Millions More

Each new rail station should be set at a considerable distance, anywhere from 2 to 15 miles, from historic urban cores. Remote stations would encourage compact, regulated forms of expansion designed to meet the needs of long-term growth, stretching from historic urban cores along new boulevards equipped with public transit, either bus or light rail lines (see Figure 16).

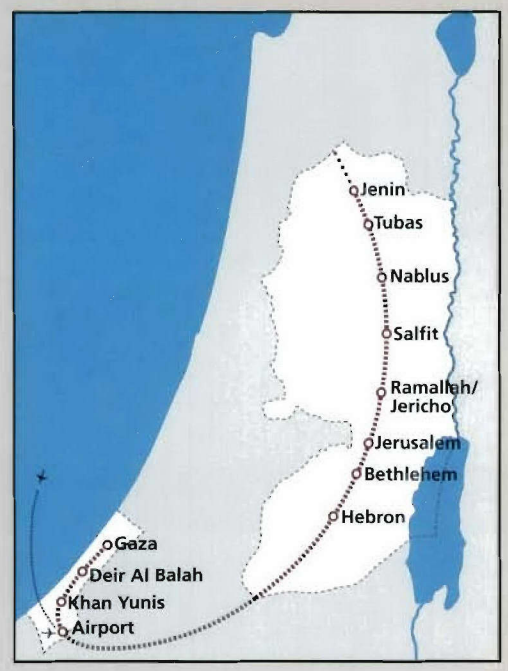
New neighborhoods along the boulevards could accommodate as many as 3 million people in the next 15 years. The linear neighborhoods would encourage transit use and discourage dependence on the automobile.

Construction of the main section, or "trunk," of the Arc railway would cost about $3.3 billion, including railcars. Total costs of the rail and road infrastructure, along with stations and branch roads, was estimated to be about $6 billion (see Figure 17).

The Arc offers the promise of a system of national open space that could merge two existing environmental systems: the extensive

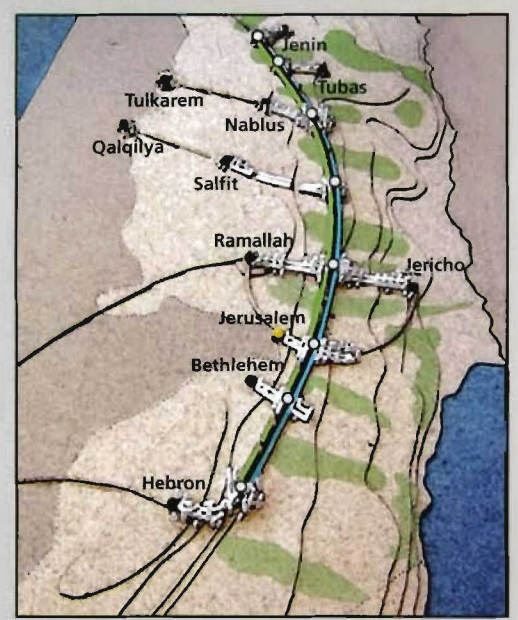
The linear neighborhoods would encourage transit use and discourage dependence on the automobile.

Figure 15—A Fast Interurban Rail Line Would Be the Core Infrastructure Along the Arc, Linking Almost All Primary Cities



SOURCE: *The Arc*, 2005a.

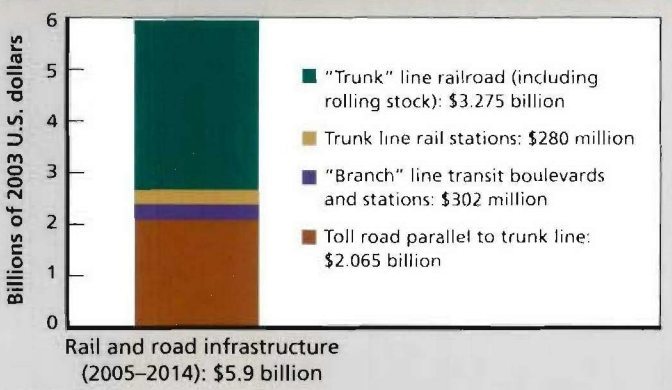
Figure 16—Because Each New Station Would Be Some Distance from a City Center, the Arc Would Promote New Businesses and Create New, Sustainable Living Spaces



Aerial view of the Arc shows the infrastructure "trunk" line, the lateral "branches" between historic urban centers (black dots) and new stations (white dots), and the parks and reserves of a national open space system.

SOURCE: *The Arc*, 2005b.

Figure 17—About $6 Billion over Ten Years Would Fund the Transit Infrastructure, Both the "Trunk" Line and Its "Branches"



SOURCE: *The Arc*, 2005a.

landscape of agricultural fields, terraces, groves, and the farms and villages associated with them; and the collection of protected forests and nature reserves already designated throughout the West Bank. It ought to be possible to take a brief walk or bike ride along the linear park within any single metropolitan area or, more ambitiously, to undertake a hike or ride along the full extent of the Arc.

The RAND Corporation acknowledges its partner, Santa Monica–based Suisman Urban Design, for leadership in the development of the Arc concept and design. The combined tactics of urban density, public transit, and protected open space should be capable of supporting a sustainable, livable environment for generations (see Figure 18). ■

Related Reading

The Arc: A Formal Structure for a Palestinian State, Doug Suisman, Steven N. Simon, Glenn E. Robinson, C. Ross Anthony, Michael Schoenbaum, RAND/MG-327-GG, 2005a, 106 pp., ISBN 0-8330-3770-6, $32.50.

The Arc: A Formal Structure for a Palestinian State, RAND/RB-9119-GG, 2005b, 3 pp., www.rand.org/publications/RB/RB9119.

Building a Successful Palestinian State, The RAND Palestinian State Study Team, led by Steven N. Simon, C. Ross Anthony, Glenn E. Robinson, David C. Gompert, Jerrold D. Green, Robert E. Hunter, C. Richard Neu, Kenneth I. Shine, RAND/MG-146-DCR, 2005a, 452 pp., ISBN 0-8330-3532-0, $35.

Building a Successful Palestinian State, RAND/RB-9072-DCR, 2005b, 3 pp., www.rand.org/publications/RB/RB9072.

Helping a Palestinian State Succeed: Key Findings, The RAND Palestinian State Study Team, RAND/MG-146/1-RC, 2005, 84 pp., ISBN 0-8330-3771-4, $12, includes the Arabic translation.

Strengthening the Palestinian Health System, Michael Schoenbaum, Adel K. Afifi, Richard J. Deckelbaum, RAND/MG-311-1-DCR, 2005, 118 pp., ISBN 0-8330-3730-7, $20.

Figure 18—A Prototypical Hub Shows Rail, Water, Energy, Road, and Park Infrastructures Around a New Rail Station

SOURCE: *The Arc*, 2005a.

Doctors' Orders

Better Electronic Prescribing Systems Could Improve Care

By Douglas S. Bell and C. Jason Wang

Douglas Bell is an associate natural scientist at RAND and an assistant professor in the department of medicine, David Geffen School of Medicine, University of California, Los Angeles (UCLA). Jason Wang is a doctoral fellow at the Pardee RAND Graduate School and a National Research Service Award fellow and pediatrician at UCLA.

In December 2003, a physician inadvertently prescribed daily dosages of a powerful cancer drug for a 79-year-old woman with arthritis. The drug, methotrexate, can indeed be used to relieve arthritis—but for arthritis, the medication should be taken once or twice a week, not daily. The error was discovered only after the woman had taken the drug for nine consecutive days. That was too late. She subsequently died.

Such errors are all too common. Medical patients today are at serious risk of injury from medication errors. Typical errors include dispensing the correct medication in the wrong dosage or frequency, as described above, or dispensing an incorrect medication whose name sounds similar to the correct one.

Fortunately, the use of a new technology, called electronic prescribing, has the potential to reduce medication errors substantially and to improve the efficiency of health care. With electronic prescribing, doctors use computers containing extensive drug information to help them select and prescribe proper medications for particular conditions. Electronic prescribing systems are part of a new trend in health care toward the adoption of electronic medical record systems, or computerized versions of paper health records.

A number of electronic prescribing systems are in operation around the world today. However, no attempt has been made to standardize how they work or to ensure that they fulfill their promise of minimizing the risk for medication errors, maximizing patient safety, and helping consumers manage their drug costs.

The Medicare Modernization Act of 2003, which enacted a prescription drug benefit for Medicare recipients, also mandated that safety standards and other guidelines be developed for electronic prescribing systems. Accordingly, we at the RAND Corporation convened an expert panel that created a set of 60 proposed guidelines—or recommendations for guidelines. We then used the recommendations to test how well some of the electronic prescribing systems are working today in typical doctors' offices.

Our key findings are as follows:

- Electronic prescribing systems could greatly reduce medication errors, thereby maximizing patient safety and health.
- Computerized menus that aid in selecting appropriate medication doses and other medication characteristics are important tools for maximizing patient safety and health.
- Currently, electronic prescribing systems vary widely in their features and capabilities and might not produce the best results for patient safety and health. Nonetheless, hospitals and physicians' offices should be able to implement about two-thirds of our recommendations for better systems within the next three years.

Many Preventable Errors

The medical term for an injury that results from medication is an "adverse drug event" (ADE). ADEs caused

by errors are called "preventable ADEs." Estimates of the likelihood of suffering a preventable ADE vary from a low of 1 in 200 hospitalized patients to a high of 1 in 33 patients seen at doctors' offices. The percentage of preventable ADEs considered serious, life threatening, or even fatal also varies—from about 10 percent in one study to 100 percent in another. Such high risks underscore the need for a system that can prevent medication errors.

Errors can occur at various steps in the process of obtaining a prescription medication. Prescribing begins with the health care provider making a diagnosis and determining what medication or treatment to prescribe. The process continues with the provider issuing a written prescription and either the patient delivering the prescription to a pharmacy or the provider's staff transmitting the prescription (by phone or fax) to a pharmacy. The provider, office staff, or pharmacist may then provide the patient with oral or written information about how and when to take the medication and about possible side effects. For some prescriptions, the provider may subsequently order lab tests to monitor the patient for improvement or adverse events. Finally, the provider will follow up to check on the patient's response.

Errors could occur at each step along the way, but electronic prescribing systems may be able to prevent many of the errors. For example, the life of the woman who died because her physician had written erroneous dosage frequency information on her arthritis prescription might have been spared had an electronic prescribing system provided a menu of appropriate dosage choices for her condition.

It is also possible, however, that flawed electronic prescribing systems could unintentionally introduce new kinds of errors into the process. For example, if pharmacists or pharmacy technicians assume that computer-generated prescriptions are free of errors, they could be more likely to fill the prescriptions blindly, without checking them.

An Evolving Technology

Electronic prescribing systems are one form of a technology called "computerized physician order entry." This technology has not been greeted with universal praise.

In 1993, doctors at a major university hospital on the East Coast staged a work action to protest a physician order entry system that they felt interfered with the way they routinely practiced medicine. Only a series of meetings among senior hospital managers and doctors to address the barriers created by the new system enabled it to be accepted.

Ten years later, in 2003, physician complaints about compromised patient safety led the largest private hospital in the West to shut down its physician order entry system. Doctors had complained about premature or delayed dispensing of prescription medications (although none of the incidents had led to patient harm). Doctors had also complained about inconveniences, such as the difficulty in learning to use the system and the length of time it took to enter an order.

For years, the only electronic prescribing systems that were evaluated were noncommercial or "homegrown" systems—those built by medical researchers and operated only in their teaching hospitals (the hospitals associated with medical schools). With a few notable exceptions, these systems were found to increase efficiency, greatly reduce medication errors, and lower costs.

Until recently, though, none of the commercial systems being used in doctors' offices had been thoroughly evaluated. Despite the existence of at least 50 commercially available systems, we at RAND were the first to try to assess how well they are working in the average doctor's office.

The widespread lack of evaluation of the commercial systems prompted us to convene our expert panel. Drawn from the fields of medicine and medical information systems, the expert panel recommended its 60 guidelines for electronic prescribing systems. Each recommendation corresponds to one or more steps of the prescribing process. Of the 60 recommendations, 52 can help to enhance patient safety and health. The table shows 14 of the recommendations, arranged according to key steps of the prescribing process.

Using the 60 recommendations as criteria, we evaluated ten commercial electronic prescribing systems in common use in doctors' offices. We chose systems that were being used in outpatient settings rather than in hospitals because far more patients visit their doctors than are ever admitted to the hospital. Five of the systems were part of larger electronic medical record systems, and five were stand-alone systems.

Market Needs Guidance

We found that the ten commercial systems were implementing, on average, about half of our recom-

Sample Recommendations Correspond to Steps in the Prescribing Process	
Steps in the Process	**Sample Recommendations**
Patient identification	(1)* A minimal set of patient identifying information (name, gender, and date of birth or age) should be visible on the screen throughout the process of creating the prescription.
Access to information about the patient's medical history	(2) The system should be able to import information about the patient from an electronic medical record.
Current medications/history	(7) Prescribers with responsibility for caring for the patient should be able to review the patient's complete current medication list, including those from other physicians.
Medication selection	(13) The system should allow for viewing a list of medications appropriate to the diagnosis when a diagnosis or tentative diagnosis is entered.
Helping patients manage costs	(21) The system should enable providers to determine . . . the actual cost to the patient for each medication option, based on the patient's prescription insurance coverage.
Alerts and other safety messages	(27) The system should alert the prescriber when a medication is selected that is contraindicated or has a significant precaution, based on the patient's allergies, current medication, medical conditions, and/or laboratory test results.
Patient safety and health	(31) The system should prioritize safety alerts, based on clinical importance (for example, the frequency, severity, and certainty of the possible adverse consequences).
Patient education	(39) The system should provide information for patients on how to take the prescribed medications and why they should be taken.
Data transmission and storage	(41) The prescriber should be able to transmit prescriptions to the patient's pharmacy of choice (mail-order or retail).
Reducing underuse of medication	(48) The system should notify the prescriber when a prescription or refill is not dispensed and delivered to the patient within a time interval specified by the prescriber.
Monitoring and renewal	(49) The system should remind the clinician to place orders for follow-up laboratory tests recommended by the manufacturer for monitoring.
Other Desirable System Characteristics	**Sample Recommendations**
Transparency and accountability	(53) The system should display notification of corporate sponsorships and other critical business relationships that could represent conflicts of interest, and vendors should completely and clearly disclose details of these relationships in publicly available documents.
Prescriber-level feedback	(55) Prescribers should be able to review profiles of their prescribing patterns (useful for helping doctors determine whether they are over- or underprescribing some medications for some groups of patients).
Security and confidentiality	(57) Systems should support compliance with the most current Health Insurance Portability and Accountability Act (HIPAA) standards for privacy and security.

SOURCE: Supplement to "Recommendations for Comparing Electronic Prescribing Systems," 2004.
* Recommendation number. The order of the recommendations is based roughly on the steps to which they correspond in the prescribing process.

mendations. Because full access to a patient's medical record was required to satisfy a number of the recommendations, those electronic prescribing systems that were part of a larger electronic medical record system tended to implement more of the recommendations (an average of 60 percent) than did the stand-alone systems (an average of 35 percent).

Some of the simpler recommendations were implemented by most or all of the systems. One example is Recommendation 41: allowing the prescriber to transmit prescriptions to a patient's pharmacy of choice. But a more sophisticated recommendation—alerting the prescriber when a medication is selected that is contraindicated or that calls for significant precaution based on a patient's allergies, current medication, medical conditions, and/or laboratory test results (Recommendation 27)—was implemented fully by only one of the systems (see the figure).

The recommendation to help patients manage their costs (Recommendation 21) was implemented less often than those designed to increase patient safety. And a recommendation to reduce the underuse of medications—notifying the prescriber when a prescription or refill is not dispensed and delivered to the patient within a time interval specified by the prescriber (Recommendation 48)—was not implemented at all. This is unfortunate, because reducing underuse of medication could have as beneficial an effect on health as reducing inappropriate medication.

Overall, we found that the commercially available electronic prescribing systems currently fail to offer many capabilities that could provide significant ben-

efits with respect to improving the health of patients and reducing their costs. Thus, the commercial market for these products might not be selecting the functional features that would be most important for helping patients.

Working Out the Kinks

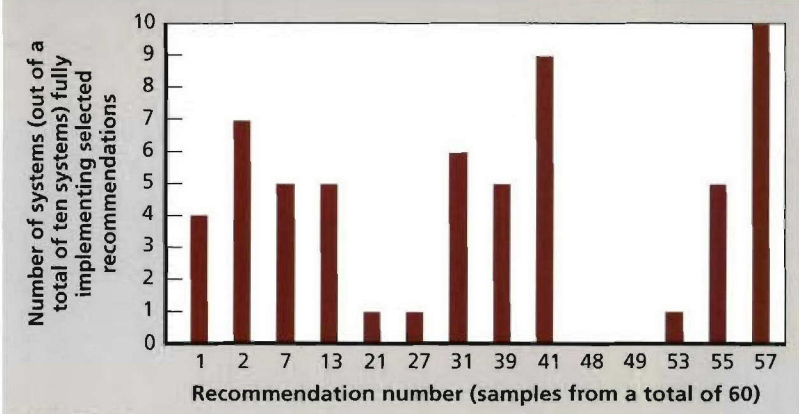
The panel found that some of the recommendations with the greatest expected benefits are probably not achievable within the average physician's office for at least three years. These recommendations include those for helping patients manage their costs and for reducing the underuse of highly effective medications. The latter is a major quality problem for elderly Medicare beneficiaries.

The main barrier to meeting these recommendations is the lack of integration among information systems used by physicians, pharmacies, laboratories, hospitals, payers, and others responsible for patient care in a given community. As of yet, these entities have little incentive to share data. Policy initiatives are needed to encourage community-wide integration of health information systems. The U.S. Department of Health and Human Services is beginning to fund efforts toward such integration, but these efforts will likely need to be sustained and expanded.

The panel also expressed concern that the increasing commercial sponsorship of electronic prescribing systems could lead to inappropriate influences—by pharmaceutical companies, insurance companies, or health maintenance organizations—on the medication options offered by the electronic prescribing systems. For this reason, federal design standards for the systems should aim to curb potential conflicts of interest, to ensure that patient safety is the paramount priority, and to provide doctors who might purchase the systems with instructions to help them choose among the myriad of designs.

Design flaws in electronic prescribing systems can introduce new safety hazards, but little is known about which specific design features create the hazards. The growing awareness of the potential hazards has given rise to two conflicting impulses: the desire to design systems for greater control by prescribers (to circumvent potential system errors) versus the desire to move control away from prescribers (to prevent human errors). Further research is needed to balance the safety risks from system inadequacy on the one hand and from human fallibility on the other.

Of Ten Commercial Prescribing Systems, Many or All Do Not Fully Implement Several Key Recommendations



SOURCE: "Functional Characteristics of Commercial Ambulatory Electronic Prescribing Systems," 2005.

Some studies suggest that doctors have been slow to embrace the idea of electronic prescribing or the addition of computerization to medical practices in general. Researchers need to learn more about doctors' concerns and about how best to address them in order to smooth the integration of these new technologies into daily clinical practices.

Under the Medicare Modernization Act, limited federal grants to encourage the adoption of electronic prescribing systems are not scheduled to begin until 2007, but commercial efforts are already under way. As medical practices increasingly adopt the systems, their performance should be monitored to determine whether the recommendations derived from expert opinion help to promote safety and cost management among patients. In this way, our initial recommendations could yield to new federal guidelines based on clinical evidence. ■

Related Reading

"A Conceptual Framework for Evaluating Outpatient Electronic Prescribing Systems Based on Their Functional Capabilities," *Journal of the American Medical Informatics Association*, Vol. 11, No. 1, January/February 2004, pp. 60–70, Douglas S. Bell, Shan Cretin, Richard S. Marken, Adam B. Landman.

"Functional Characteristics of Commercial Ambulatory Electronic Prescribing Systems: A Field Study," *Journal of the American Medical Informatics Association*, Vol. 12, No. 3, May/June 2005, pp. 346–356, C. Jason Wang, Richard S. Marken, Robin C. Meili, Julie B. Straus, Adam B. Landman, Douglas S. Bell.

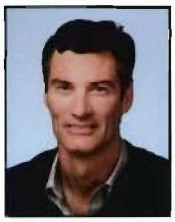
"Recommendations for Comparing Electronic Prescribing Systems: Results of an Expert Consensus Process," *Health Affairs–Web Exclusive*, May 25, 2004, pp. W4305–W4317; Douglas S. Bell, Richard S. Marken, Robin C. Meili, C. Jason Wang, Mayde Rosen, Robert H. Brook, and the RAND Electronic Prescribing Expert Advisory Panel.

Unmanned but Not Untethered

Robots on the Future Battlefield

By John Matsumura and Randall Steeb

John Matsumura is a senior engineer at RAND. Randall Steeb is a senior computer scientist at RAND.



PHOTOS: DIANE BALDWIN

When a Predator drone fired a Hellfire missile at a car and killed six suspected members of al Qaeda in Yemen in 2002, the direct hit dramatically highlighted the potential for using robots during war. But it also raised the specter of robots replacing human beings and, for some, conjured up images of future armies of Star Wars "droids" running amok on the battlefield.

At this point, robots fighting without humans in the loop is science fiction; but using robots on the battlefield is a reality, one that received a huge jump start from a mandate in the fiscal year 2001 Senate defense authorization bill that "by 2015, one third of the operational ground combat vehicles of the armed forces will be unmanned." Growing numbers of robots will clearly move across and above future battlefields, but the robots will augment—not replace—soldiers, performing missions that can best be described as "the dirty, the dull, and the dangerous."

Future battlefields, potentially contaminated by harmful or deadly toxins, could become much less suitable for humans. Taking advantage of the inherent robustness of robots in such "dirty" environments could not only compensate for shortfalls but also provide new capabilities. For example, robots could be used to mark contaminated areas or to neutralize dirty areas (by means of biological cleanup).

Robots will augment—not replace—soldiers.

Robotic technology that largely already exists can free up manpower by accomplishing many of the "dull" tasks of military missions—tasks such as hauling supplies—that now employ soldiers simply because they may be the only readily available resource. And emerging technologies, such as enhanced voice recognition software and adaptive route planning methods, can expand the range of the "dull" missions into areas where it is just more practical to use robots, such as in providing battlefield surveillance.

Robots also offer the promise of helping to keep soldiers more out of harm's way. But such "dangerous" missions—where weapons are fired during the "fog of war" and when friendly forces and noncombatants are in the mix—require an autonomy that robots do not yet possess. Despite progress in artificial intelligence technology, we still have a very long way to go before robots can replicate the human thought process in such complex situations. The best strategy for the foreseeable future is to integrate soldiers and robots so that the whole is greater than the sum of the parts. Although the Predator was uninhabited, it was very much "manned" in the sense that a soldier controlled its every move, seeing what it saw and, ultimately, pulling the trigger.

Concepts for how robots can be used in dirty, dull, and dangerous situations are rapidly developing, but it is unclear how practical and feasible such concepts are. Critical pieces of concept exploration, technology development, and force analysis do exist. But given the mandate to have a substantial number of unmanned systems in the force by 2015, the research, analytic, and development communities are sure to be tested in the coming years.

What makes sense now is to organize the core challenges—technical, tactical, and strategic—into an integrated framework that can be quantitatively explored and assessed. Although many of the analytic models and simulations needed for this task are already in place, many more will have to be developed. The key variable for success over the next few years will be how well the research, analytic, and development communities can work together to shape what will surely be a revolution in military affairs. ■

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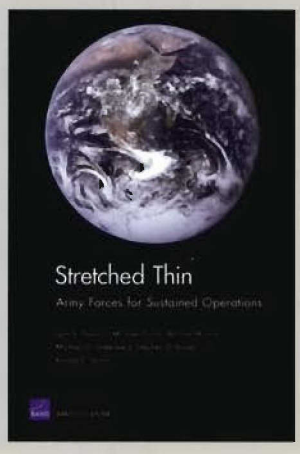

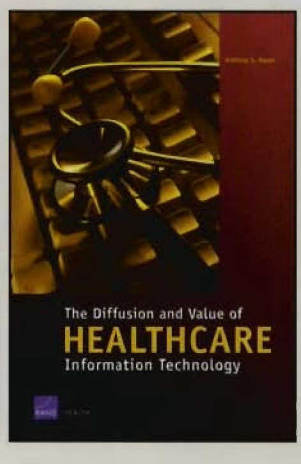

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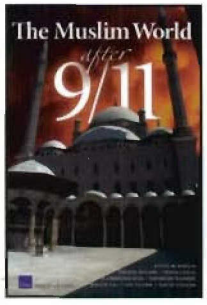

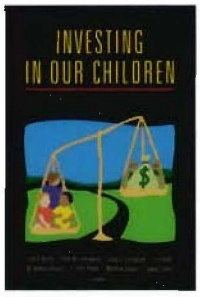

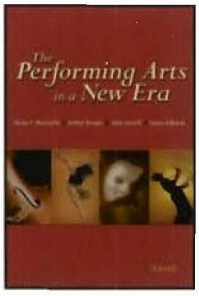

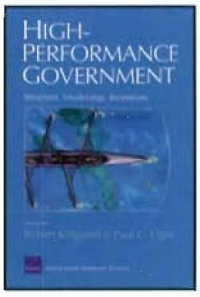

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