Finding A Policy Solution To India’s Diabetes Epidemic

Viable diabetes control and prevention policies in India require the participation of all sectors of government and society.

by Karen Siegel, K.M. Venkat Narayan, and Sanjay Kinra

ABSTRACT: In India, thirty-five million people have diabetes—a number expected to more than double by 2025, disproportionately affecting working-age people. The economic impact of this increase could be devastating to India’s emerging economy. In this paper we discuss drivers of the epidemic, analyze current policies and practices in India, and conclude with recommendations, focusing on multisectoral and international collaboration. We see these recommendations as providing a blueprint for addressing diabetes in India by illuminating opportunities and barriers for policymakers and others. [Health Affairs 27, no. 4 (2008): 1077–1090; 10.1377/hlthaff.27.4.1077]

India is home to thirty-five million people with diabetes—nearly 15 percent of the global diabetes burden—and projections show that this will increase to seventy million by 2025. Diabetes disproportionately affects people of working ages and accounts for US$2.2 billion in annual health care costs in India alone. Because India has a population of 1.1 billion, 40 percent of whom are under age eighteen, investment in the health of India’s future workforce is crucial. Poorly controlled diabetes leads to complications, amplifying disability and mortality rates and leading to high direct, indirect, and intangible costs. If immediate multisectoral action is not taken, diabetes threatens India’s emerging economy. Projections show that in the next decade, India will lose US$237 billion in national income due to diabetes, stroke, and heart disease, yet Indian policymakers do not yet perceive the epidemic as a priority.

In this paper we describe India’s diabetes burden and analyze current policies and practices that contribute to rising rates. We conclude with prioritized policy recommendations rooted in global evidence. As the first comprehensive review of policy aspects of India’s diabetes epidemic, these recommendations provide a blueprint for addressing diabetes in India.

Karen Siegel (siegel@matrixphc.com) is an associate with MATRIX Public Health Solutions Inc. in New Haven, Connecticut. Venkat Narayan is a professor in the Department of Global Health, Rollins School of Public Health, Emory University, in Atlanta, Georgia. Sanjay Kinra is a lecturer in the Noncommunicable Disease Epidemiology Unit at the London School of Hygiene and Tropical Medicine in the United Kingdom.
Diabetes Burden In India

Diabetes is part of a larger global epidemic of noncommunicable diseases. Because these diseases share many risk factors, policies that encourage healthy eating and active living will prevent not only diabetes, but also obesity, cardiovascular disease (CVD), chronic respiratory illnesses, and diet-related cancers. An integrated system can maximize disease prevention while avoiding the need to develop separate courses of action. Strategies proposed here are prioritized according to their ability to be aligned and integrated into a comprehensive movement that addresses all noncommunicable diseases.

- **Diabetes and obesity prevalence.** National diabetes prevalence is 4.3 percent in India. Prevalence is higher among people living in cities compared to rural areas, those in the South compared to the North, and those of high socioeconomic status (SES) compared to low SES. During 1971–2000, urban diabetes prevalence rose from 1.2 percent to 12.1 percent. However, studies show that diabetes has risen rapidly in rural areas, with a threefold increase (from 2.4 percent to 6.4 percent) in rural southern India over a fourteen-year period.

Obesity is a key risk factor for diabetes. In 2005, urban obesity prevalence in India was in the range of 19.2–38.0 percent. India has the world's largest number of people with impaired glucose tolerance (IGT) and impaired fasting glucose (IFG), precursors to diabetes. Obesity and IGT are alarmingly prevalent in younger populations, portending a future diabetes burden among working-age people.

- **Drivers of obesity and diabetes.** Globalization, urbanization, and the nutrition transition act in synergy to change the way people live and eat, leading to increased rates of obesity and diabetes. Globalization facilitates the pervasiveness of diabetes risk factors, while cities create environments in which many people are exposed to these risk factors: access to prepackaged, processed foods; efficient transportation methods that discourage physical activity; and technology-oriented jobs that strengthen economies but require less expenditure of energy. Migration also increases exposure to urban life: 27 percent of the Indian population lives in cities, and this is projected to rise to nearly half by 2030.

The nutrition transition refers to a shift from consumption of simple, traditional foods to heavily marketed foods high in calories, sugar, and animal fat but low in vitamins and minerals derived from fruits and vegetables. Although the nutrition transition has reduced undernutrition, it increases diabetes risk. The key is to harness its positive aspects to improve the equitable distribution of healthier, higher-quality food. These global trends have an increased impact on the Indian population, who have the following biological susceptibilities to diabetes: (1) Lower threshold for development: Indians have, on average, a lower body mass index (BMI) than those of European descent, and risk of diabetes starts to increase at very low levels of BMI for Indians. (2) Higher percentage of body fat...
that is concentrated in the abdominal area: Indians have, on average, a higher percentage of body fat than those of European descent, and it is concentrated in the abdominal area. Abdominal obesity is a key risk factor for development of diabetes. (3) Programmed during pregnancy: Because of the coexistence of underweight and overweight, children are often born underweight and adapted to a low-nutrition environment. Low-birthweight infants are more susceptible than those of normal birthweight to obesity and diabetes, especially when raised in an obesogenic environment. (4) Insulin resistance: Excessive insulin resistance has been observed in Asian Indians as a predominant mechanism leading to Type 2 diabetes; ENPP1 I21Q has recently been identified as one of the genes that may contribute to this resistance.

**Current Policies And Practices**

Although diabetes action has been initiated, efforts are weak and fragmented. Progress is impeded by a health system that places a higher priority on communicable diseases and maternal and child health services and by a private health system driven by curative medicine. However, prevention is cost-effective and should be a focus. Change is possible, as demonstrated by successful tobacco-control efforts over the past twenty years, despite negative economic impacts to India's tobacco industry.

Research shows that diabetes is preventable through weight loss, physical activity, and healthy eating. Current conditions in India, however, promote sedentary lifestyles and unhealthy eating habits. Certain policies and practices contribute to India's rising diabetes rates or serve as barriers to action, but others can alleviate the diabetes burden.

**Diabetes as a national health priority.** The Ministry of Health spearheaded a national consultation in 2005 to “identify action pathways and partnerships for implementing the Global Strategy in the context of India.” The pilot phase of the National Program on Diabetes, CVD, and Stroke (NPCDS) was launched in seven states in January 2008. No national awareness survey has been performed, but a recent study in Chennai found that awareness of diabetes as a public health priority and knowledge of diabetes prevention is poor, especially among women and people with little education. Community empowerment can greatly increase physical activity. For example, it motivated a community in Chennai to construct a public park with its own funds, which suggests that community involvement can strengthen government efforts.

**Research, data collection, and surveillance.** Although India accounts for approximately 15 percent of the global burden of diabetes, it contributes 1 percent of the world's diabetes research. There are few data on the quality of diabetes care, no national monitoring system for processes and outcomes of care, and no translational research to turn knowledge into action. Only two national diabetes surveys have been conducted since 1975. The Integrated Disease Surveillance (IDS) program,
launched in 2004, analyzes populationwide chronic disease risk factors, but it needs improvement. The recent Ovations/National Heart, Lung, and Blood Institute (NHLBI) Chronic Disease Initiative and the International Diabetes Federation (IDF) BRIDGES Initiative provide potential for Indian researchers to work with policymakers and uncover practical, country-specific solutions.

**Health system.** Health care facilities are concentrated in large urban centers, are focused on tertiary care, and cater to the urban affluent. Government-run facilities are often crowded and underresourced, so even low- and middle-income patients prefer private care or alternative medicine. For these populations, as much as 25 percent of income can be spent on diabetes care. Initiatives such as National Rural Health Mission (NRHM, which aims to improve rural health services), the NPCDS’s health education components, the Public Health Foundation of India’s (PHFI’s) new public health schools, and the National Diabetes Control Program (which focuses on capacity building and rural health care delivery) are expected to increase capacity and resources.

**Food and nutrition.** India has the worst stunting and iron deficiency in the world and yet the largest number of people with diabetes, representing a failure in the nutrition governance system. Many nutritional surveys are conducted throughout India, but they focus on undernutrition; these should be expanded to include overnutrition. Food consumption patterns and trade and agricultural policies have changed, encouraging overconsumption of unhealthy foods and underconsumption of healthy foods.

*Consumption patterns.* Traditional Indian diets consist of a high percentage of complex carbohydrates and a low percentage of fat; modern dietary patterns show high consumption of refined carbohydrates, fat, dairy products, and sugar; decreased consumption of fiber; and large increases in overall caloric intake in both urban and rural settings. During 1979–2001, energy and fat intake greatly increased, and consumption of meat products, milk, sugar and other sweeteners, and vegetable oils increased by 50 percent, 60 percent, 25 percent, and 100 percent, respectively (Exhibit 1).

In response to high consumption of junk food, in 2006 the health ministry proposed a ban on soft drinks and junk food in schools, colleges, and universities nationally and is consulting with other agencies regarding implementation. A massive campaign to increase children’s awareness of these issues has been proposed, but the reaction in Indian civil society has been negative thus far.

*Trade liberalization and agricultural policies.* Trade liberalization has affected consumption. Whereas oil consumption in the 1970s mainly came from peanut, rapeseed, and cottonseed oil, soybean oil from Brazil and Argentina now make up 21 percent of India’s oil consumption. Sugar and fat are cheap and reduce food costs: because of India’s large population, keeping food costs low is crucial.

In 2000, India produced 26.6 million tons of fruit and 96.5 million tons of vegetables, but inaccessibility and lack of affordability of these foods keeps consump-
The National Agricultural Policy encourages the development of strategies to ensure that fruit and vegetables are accessible to poorer populations, but it could be more effective.  

**Urban design and transportation.** India’s urban design and transportation policies contribute to physical inactivity by encouraging the use of private cars and by making walking and cycling less feasible. Growth in the technology industry has encouraged the development of suburbs without adequate public transportation. More people are migrating to urban areas, straining urban infrastructure, but no national transportation survey has been conducted to identify needs.

**Walking and cycling.** Decreased walking and cycling are typically found in larger cities, because these methods of active transportation do not receive adequate funding, legal rights, or traffic priority. The proportion of walking drops from 37 percent in cities with 100,000–250,000 inhabitants to 28 percent in cities of greater than five million, while cycling declines from 26 percent to 9 percent. Separate bicycle lanes and paths are not available in any Indian city except the planned city of Chandigarh. Of those who do walk or cycle, most are the poorest people who cannot afford motorized transportation. Efforts should be made to make active transportation socially appealing.

Experts desire urban transportation policy that encourages “green” modes, but government continues to prioritize roadway expansion and modernization. The government has budgeted US$10 billion to expand roadways, which suggests a focus on motor vehicle ownership and neglect of public transportation needs.

**Use of private cars.** The government offers financial incentives to the transportation industry; costs for individual car ownership are low. New, inexpensive cars

---

**EXHIBIT 1**

| Food Consumption Trends For Selected Items In India, Selected Years 1979–2001 |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| **1979–1981** | **Avg. calories per capita per day** | **Percent of total daily calories** |
| **Food item** | **Avg. calories per capita per day** | **Percent of total daily calories** | **Avg. calories per capita per day** | **Percent of total daily calories** | **Avg. calories per capita per day** | **Percent of total daily calories** |
| Total | 2,080 | 2,370 | 2,440 |
| Fat (in grams) | 30 | 45 | 50+ |
| Meat products | 16 | 20 | 0.84 | 22 | 0.9 |
| Animal fats | 23 | 28 | 1.2 | 47 | 1.9 |
| Milk (excluding butter) | 71 | 102 | 4.3 | 111 | 4.5 |
| Sugar and sweeteners | 193 | 221 | 9.3 | 247 | 10.1 |
| Vegetable oils | 127 | 158 | 6.1 | 239 | 9.8 |
| Fruit (excluding wine) | 31 | 34 | 1.5 | 51 | 2.1 |
| Vegetables | 32 | 35 | 1.5 | 45 | 1.8 |
| Wheat | 390 | 461 | 18.8 | 493 | 20.2 |

further encourage the use of private cars. The annual rate of growth of motor vehicles in India was around 11 percent during the past decade; in 1997, the number of privately owned motor vehicles was 37.2 million and continues to rise.

Urban transportation policies. In 2006 the government approved the National Urban Transport Policy (NUTP), which “focuses on greater use of public transport and non-motorized modes,” especially for marginal urban populations. The policy taps into the private sector and considers mass rapid transit systems for cities with more than four million inhabitants. Efforts should be made to ensure that this policy, which encourages active transportation, is implemented.

The National Urban Renewal Mission (NURM), launched in 2005, gives the central government priority to construct bicycle lanes and pedestrian paths. A public bicycle rental program in designated areas is under study. However, capacity and resources are obstacles to implementation.

What Can Be Done? A Blueprint For Action

A comprehensive approach that addresses diabetes risk factors is needed. Harnessing positive aspects of globalization—increased information flow, improved technology, and innovation—via international collaboration is crucial. In India, a country with limited health resources, an approach that draws on many sectors—including the private sector—can ensure successful implementation. Our proposed policy response is organized into roles that stakeholders should play in the development and implementation of India's diabetes policy (Exhibit 2). 

Central/state governments. Central/state governments can drive diabetes prevention and treatment efforts. A positive step is Healthy-India.org, a new Web site sponsored by the Ministry of Health and Family Welfare and the PHFI, which advocates for healthy living and prevention of diabetes and other noncommunicable diseases. However, this initiative has not yet been reinforced by policies that make these lifestyle recommendations easy—and possible.

As proposed by Srinath Reddy and others, an intersectoral coordinating/regulatory group should be set up at the Planning Commission of India, a governmental institution that determines the country’s developmental priorities and resource allocation. This group would guide development and implementation of diabetes prevention and control policies; bring together relevant stakeholders; and ensure accountability, cohesion, and collaboration. Such a body is essential for increasing political will for diabetes action, ensuring that the voices of all stakeholders are heard, and could serve as an effective platform for business and the involvement of nongovernmental organizations (NGOs).

Central and state governments could develop better surveillance systems. More research is needed to understand diabetes risk factors in India and to guide effective policy. The IDS program analyzes chronic disease risk factors and could be improved to obtain data more frequently and systematically using high-quality methods.
**EXHIBIT 2**

**Key Stakeholders, Roles, And Capacity Building For Diabetes Reduction In India**

<table>
<thead>
<tr>
<th>Examples of stakeholders</th>
<th>Roles</th>
<th>How capacity should be modified/enhanced/developed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multilateral and bilateral organizations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Central/state governments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indian Parliament, Ministry of Health and Family Welfare, Planning Commission of India, Ministry of Agriculture, Ministry of Urban Development, National Urban Renewal Mission</td>
<td>Prevention and treatment. Develop better surveillance systems (improve Integrated Disease Surveillance program). Update dietary guidelines and ensure that available foods (and agricultural policies) reflect these guidelines. Promote active transportation. Consider health effects of all economic development policies; use fiscal and regulatory mechanisms to influence individual behavior as well as that of industries.</td>
<td>Develop multistakeholder regulatory body to bring all players together (Planning Commission of India). Shift amount of resources allocated to “healthy policies.”</td>
</tr>
<tr>
<td><strong>Private sector (food industry, pharmaceuticals, and others)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confederation of Indian Industry</td>
<td>Provision of healthier foods and low-cost medicines and market innovation encouraging healthy eating and physical activity. Increase access (via distribution expertise) to low-cost medicines</td>
<td>R&amp;D investments, intersectoral collaboration to develop products for diabetes prevention and control. Pricing and marketing these products to reach those most in need and to ensure the profitability of companies that invest to promote health.</td>
</tr>
<tr>
<td><strong>National and international funding bodies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>World Diabetes Foundation, Gates Foundation</td>
<td>Sponsor demonstration projects and increased research (for example, Ovations/NHLBI Chronic Disease Initiative and the Community Interventions for Health program)</td>
<td>Fund research initiatives to identify future strategies for diabetes prevention and control.</td>
</tr>
<tr>
<td><strong>Nongovernmental organizations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxford Health Alliance, Nutrition Foundation of India, Diabetes India, Center for Chronic Disease Control, Initiative for Cardiovascular Health Research in Developing Countries</td>
<td>Prevention and treatment, forming international networks and alliances to advocate for policy change. Research, knowledge generation, and translation to policymakers.</td>
<td>Funding, capacity building, advocacy, and development of educational resources. Provide space for collaboration and come up with multisectoral solutions.</td>
</tr>
<tr>
<td><strong>Academics and researchers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indian Council of Medical Research, National Institute of Nutrition, academic institutions</td>
<td>Increase research and surveillance, train young professionals to tackle the issues</td>
<td>Hire public health professionals with experience-based knowledge of NCD issues to inspire and educate young students.</td>
</tr>
<tr>
<td><strong>Public-private partnerships</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAL Global Partnership, Public Health Foundation of India</td>
<td>Actionable research. Ensure funding for promising ideas and proposals for diabetes prevention and control.</td>
<td>Build upon current public-private partnership models.</td>
</tr>
<tr>
<td><strong>Health care sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public and private health care providers</td>
<td>Patient education and empowerment, develop guidelines for prevention and control.</td>
<td>Increase in resources (human and financial).</td>
</tr>
</tbody>
</table>
To prevent diabetes through healthier diets, India’s dietary guidelines should be revised to reflect principles of chronic disease prevention and health promotion; food availability and affordability should reflect these guidelines through agricultural policies. In Brazil, for example, updated Food Guidelines were implemented in 2000–01 and distributed during a national hypertension screening campaign. In 2000, Brazil also legislated that at least 70 percent of the school meals program’s budget be spent on fresh vegetables, fresh fruit, and minimally processed foods, preferably purchased from local producers and small farmers.

Ghee, a saturated fat, is popular in traditional Indian cooking. Replacing it with healthier cooking oils could reduce intake of fatty acids, serum cholesterol levels, and ultimately CVD—risk factors associated with diabetes. A successful model of such government intervention comes from Mauritius, where changes in government nutrition policies in the 1990s and education led to greater preference for healthier types of cooking oil among the population.

Healthier packaged and processed foods are possible through government intervention, with food industry support. Through amendments to the Prevention of Food Adulteration Act of 1954, levels of salt, sugar, and saturated fats in manufactured food products can be limited; this should be considered. Streamlined food labeling initiatives, consistent with international approaches, can help inform consumers of healthier choices and even spur market competition.

Governments should implement urban design policies to facilitate physical activity as a component of daily life. In India, management of urban transportation currently rests with state governments, but a central policy is needed. NURM focuses on greater use of public transportation by offering financial incentives. This program should be expanded by providing air-conditioned buses and trains along with better sidewalks to encourage active transportation.

Globally, cycling shows potential as a cost-effective way to encourage physical activity, especially in cities. Because of India’s tropical climate, cycling may be more difficult to encourage than in less extreme climates; such initiatives should be considered and evaluated in an India-specific context.

A review of articles addressing transportation policy in India suggests that

---

**EXHIBIT 2**

*Key Stakeholders, Roles, And Capacity Building For Diabetes Reduction In India (cont.)*

<table>
<thead>
<tr>
<th>Examples of stakeholders</th>
<th>Roles</th>
<th>How capacity should be modified/enhanced/developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print, television</td>
<td>Increase awareness of the issues using clear, simplified messages</td>
<td>Package compelling and valid information</td>
</tr>
</tbody>
</table>

**SOURCE:** Authors’ analysis.

**NOTES:** NCDs are noncommunicable diseases. R&D is research and development.
gestion, air pollution, noise, deteriorating mobility for the poor, and traffic safety are main motives for sector improvement; efforts to prevent diabetes can piggyback on these priorities. Indian cities have not implemented congestion pricing or restraints on fuel or parking costs, policies that have reduced automobile use elsewhere and could work in India. The public transportation sector could be strengthened with an injection of funds, some of which could be reallocated from the US$10 billion roadway expansion budget mentioned above.

**Multilateral organizations.** Although India knows best what it can do, international bodies can strengthen national action. The World Health Organization (WHO) and the International Diabetes Federation (IDF) are well positioned to provide technical assistance, and the World Bank can provide financial support for public policy interventions against noncommunicable diseases.

**Private sector.** The private sector can collaborate to implement many of the prevention-oriented governmental policies proposed above, through funding, expertise in distribution systems for provision of healthier foods (and low-cost medicines for treatment), and market innovation encouraging healthy eating and physical activity. Research suggests that providing incentives for food manufacturers is an effective way to improve dietary habits, especially where the cost of healthier foods is an issue. The food industry should work with the health ministry to implement a national nutrition policy by developing foods that comply with dietary and labeling guidelines and are thus more marketable as healthy options. Expertise in distribution systems for providing affordable fruit and vegetables to hard-to-reach populations is key.

Currently, experts in India and abroad are developing products for diabetes prevention and control. How to price and market these products is crucial for reaching those most in need and for ensuring the profitability of investing to promote health. The private sector can also benefit (through increased productivity and reduced medical spending) from policies that encourage prevention. Treatment policies should involve the private sector, by providing screening equipment and better, evidence-based treatment options at low cost.

Foundations can further supplement funds for government changes mentioned above and help build research capacity. More should engage, following recent initiatives such as the Ovations/NHLBI Chronic Disease Initiative and the Community Interventions for Health program.

**Nongovernmental organizations.** NGOs have a role in both prevention and treatment. In India, NGOs wield significant power—much occurs at the grassroots level, bolstered by NGO support. NGOs also can assist with the formation of multisectoral international networks and alliances to advocate for policy change, knowledge generation, and translation of research findings for policymakers.

**Academics and researchers.** Academics and researchers should engage by improving research and surveillance systems and training young professionals to tackle these complex issues. Priorities include community-based studies of primary
prevention and identification of safer and cheaper drugs to prevent diabetes when lifestyle intervention is not feasible or fails; epidemiological and economics research; and health systems and operational research.54

- **Public-private partnerships.** India has taken steps toward an integrated approach to diabetes prevention and control, but these ideas are not fully implemented, partly because of insufficient funding. Public-private partnerships are necessary at all levels of policy. The PHFI, a partnership to address the limited institutional capacity for strengthening public health training, research, and policy development in India, is a good example. Funding comes primarily from the private sector, and the government is encouraged to match it.

- **Health care sector.** Although India accounts for about 15 percent of the world's diabetes burden, its spending on health care related to diabetes is only 6.4 percent of worldwide spending; health resource allocations should reflect burden of disease. Additional resources allocated to diabetes care should go toward stronger prevention efforts, diagnostic infrastructure (especially in rural areas), accessibility and affordability of treatment, and skilled health care workers, as recommended by the WHO Global Strategy. Screening for people with diabetes or prediabetes is crucial and can help stop or slow the progression to diabetes. For those with diabetes, cost-effective, accessible, and comprehensive care is needed.55

Patient education and empowerment in health care settings is crucial for ensuring good management and control, coupled with guidelines to standardize management and control practices. In Mexico, the number of people with well-controlled diabetes increased because of an initiative of the Secretariat of Health, which aimed to provide better health care to people with noncommunicable diseases through improved quality and a “structured diabetes education program.”56

In India, the National Diabetes Control Program and the National Rural Health Mission could be strengthened and expanded to reach more of the population.

- **Media.** Efforts are needed to educate the public about diabetes risk factors, prevention, and complications, using clear and simple messages. Global evidence shows that awareness strengthens national policy efforts and improves health outcomes.57 The media are beginning to engage but could do more. Doordarshan, India’s primary television broadcaster, should be involved and could learn from Brazil, where a national TV channel has created videos aimed at schoolchildren, with an emphasis on healthy foods and culture. Funding could come from the private sector and funding bodies interested in building telecommunications capacity.

- **Prioritizing strategies.** Considering limited health resources, high-priority strategies are identified in Exhibit 3. This is not an exhaustive list but, rather, a roadmap for conceptualizing “best buys” that could evolve into a set of new priorities as India’s economy grows. Because of rapidly rising diabetes rates and their consequences, it is crucial to begin targeted national prevention and control strategies with strong evaluation components, despite the fact that much is still unknown. While further evidence is collected in systematic ways, health can be improved and
lives saved. One idea to build evidence is through a six-step Delphi process to uncover diabetes prevention and control strategies with maximum feasibility and impact, and lowest cost. The effectiveness of these strategies could be measured by (1) reduction in diabetes incidence in ten years; (2) reduction in obesity prevalence in ten years; (3) awareness of diabetes as a public health priority; (4) changes in food

## EXHIBIT 3
**Best Buys For Diabetes Prevention And Treatment**

<table>
<thead>
<tr>
<th>Strategy/intervention</th>
<th>Who should be involved</th>
<th>Impact/potential impact</th>
<th>Cost/potential cost</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Societal (prevention) policies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work with the private sector to encourage investments in employee health (make case for increased profits/productivity and reduced medical costs)</td>
<td>Private sector, academics, researchers</td>
<td>High</td>
<td>Low</td>
<td>Med./high</td>
</tr>
<tr>
<td>Promote physical activity, especially active transport (walking and cycling routes, free bikes, and tax advantages)</td>
<td>Central/state governments, private sector, funding bodies</td>
<td>High</td>
<td>Low</td>
<td>Med.</td>
</tr>
<tr>
<td>Create a central regulatory body and involve players in policy development and implementation</td>
<td>All stakeholders</td>
<td>Med.</td>
<td>Low</td>
<td>Low/med.</td>
</tr>
<tr>
<td>Modify (via taxation and subsidies) agricultural policies/practices to encourage production and consumption of fruits and vegetables and healthier oils, create R&amp;D policies that focus on innovative ways to deliver affordable fruit and vegetables on mass scale</td>
<td>Central/state governments, food industry, academics, researchers</td>
<td>High</td>
<td>Med.</td>
<td>Med./high</td>
</tr>
<tr>
<td>Spearhead national effort (voluntary and legislative) to reduce salt/fat/sugar in processed foods, and implement streamlined, national labeling system (consistent with international efforts)</td>
<td>Multilateral and bilateral organizations, central government, food industry, media</td>
<td>Med.</td>
<td>Low/med.</td>
<td>Med.</td>
</tr>
<tr>
<td>Increase media coverage for heightened awareness and education</td>
<td>Media</td>
<td>Med./high</td>
<td>Low</td>
<td>Low/med.</td>
</tr>
<tr>
<td>Expand healthy school programs (build on junk food ban and incorporate physical activity into curricula)</td>
<td>Central/state governments, food industry</td>
<td>Med.</td>
<td>Med.</td>
<td>Med.</td>
</tr>
<tr>
<td>Prioritize research that explores innovative ways to prevent and control diabetes and other NCDs</td>
<td>Central/state governments, academics, researchers, funding bodies</td>
<td>High</td>
<td>Med.</td>
<td>b</td>
</tr>
<tr>
<td>Build capacity in public health schools, medical schools, other academic institutions</td>
<td>Academics, researchers, funding bodies</td>
<td>High (long term)</td>
<td>Med./high</td>
<td>Med.</td>
</tr>
<tr>
<td><strong>Clinical (treatment) policies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary prevention through selective screening/tests and lifestyle interventions in health centers</td>
<td>Central/state governments, health sector, private sector</td>
<td>Med.</td>
<td>Low</td>
<td>Med./high</td>
</tr>
<tr>
<td>Secondary prevention (including access to essential medicines and development and evaluation of the polypill)</td>
<td>Central/state governments, health sector, private sector</td>
<td>Med.</td>
<td>Low/med.</td>
<td>Med./high</td>
</tr>
</tbody>
</table>

**SOURCE:** Authors’ analysis based on various data sources. Space limitations preclude a comprehensive listing of these sources. They are available in an online appendix, at http://content.healthaffairs.org/cgi/content/full/27/4/1077/DC1.

**NOTES:** R&D is research and development. NCDs are noncommunicable diseases.

$^a$ Actual impact and cost data have been used where available, and a subjective assessment of potentials where data were not available.

$^b$ Not available.
consumption patterns; (5) increased physical activity levels; and (6) reduction in complications of diabetes and related health care costs.

India is a largely federated country, which creates challenges in creating a uniform national policy. Another major political barrier is a government focused on economic growth and its role in transforming India into a developed nation by 2030. These aspirations, although positive, have resulted in neglect of related health consequences and, combined with economic growth policies described above, have contributed to a diabetes epidemic. One strategy for overcoming this is to move from health policies to “health in all policies,” as recommended by Pekka Puska, director general of Finland’s National Public Health Institute, and others. Health Impact Assessments, which ensure that national and regional policies take health into consideration, are becoming more popular and could be one way of incorporating the above recommendations into India’s policy development.

As the communicable disease burden is reduced, it need not be replaced by a heavy burden of noncommunicable diseases. With the passage of the United Nations Resolution on Diabetes in 2006 and the launch of a pilot phase of the NPCDS, a national diabetes policy for India is justified and timely. Recent reports highlight growing global action on diabetes and related NCDs. India’s alignment with these efforts would bolster our proposed policy response, result in mutually beneficial exchanges of information and practices, and ultimately prevent millions of deaths due to these prevalent—and preventable—diseases.

The authors thank Debbie Humphries, Derek Yach, David Stuckler, and Kathleen O’Connor for reviewing drafts of this paper and providing helpful comments and insightful feedback.

NOTES
16. Ibid.
22. Reddy et al., “Responding to the Threat.”
30. Shobhana et al., “Expenditure on Health Care.”
35. Nutrition Foundation of India, Double Burden of Malnutrition: Case Study from India (New Delhi: FAO, 2005).
42. Reddy et al., “Responding to the Threat.”
47. Reddy et al., “Responding to the Threat.”
53. Stevens et al., “Global Interest.”
56. WHO, “Preventing Chronic Disease.”