Annex 12A. Effectiveness and Quality of Evidence Regarding Diabetes Screening, Prevention, and Treatment Interventions

Supplementary material for: Ali, M., K. Siegal, E. Chandrasekar, N. Tandon, P.A. Montoya, and others. 2017. "Diabetes: An Update on the Pandemic and Potential Solutions." In *Cardiovascular, Respiratory, and Related Disorders* edited by D Prabhakaran, S Anand, TA Gaziano, J-C Mbanya, Y Wu, and R Nugent. Volume 5 of *Disease Control Priorities, third edition.* Washington, DC: World Bank.

Strategy	Effectiveness	Quality of evidence	LMICs with relevant data (population)	Effect size
Screening or early detection				
Glucose test for high-risk individuals[a] followed by lifestyle advice or therapy	Possibly delaying onset of type 2 diabetes; possibly better control of CVD risk factors; possibly lower diabetes complications and costs	III		
Glucose testing at first prenatal visit or 24–28 weeks gestation followed by lifestyle advice or metformin	Possibly lower risk of adverse maternal, fetal, and neonatal outcomes	II		
Preventing type 2 diabetes				
Lifestyle modification counseling or metformin for high-risk individuals[a]	30–60% relative reduction in diabetes incidence; 47 and 41% long-term reductions in retinopathy and cardiovascular mortality, respectively	I	Tianjin, China (Hu and others 2012), 1,180 post-gestational diabetes women; Colombo, Sri Lanka (Karalliedde and others 2014), 4,606 high-risk youth[a]; Da Qing, China (Gong and others 2011; Li and others 2014), 577 persons with IGT;	Reductions in body mass index, waist circumference, and body fat; 26–45% relative reduction in diabetes incidence

Strategy	Effectiveness	Quality of evidence	LMICs with relevant data (population)	Effect size
			Chennai, India (Ramachandran and others 2013), 537 men with IGT; Pakistan (Iqbal Hydrie and others 2012), 317 persons with IGT; Chennai, India (Weber and others 2012 and 2016), 602 persons with IFG or IGT	
Managing diabetes				
Lifestyle modification (balanced diet, 150 minutes a week of moderate-intensity physical activity, and resistance training)	4–6 times higher likelihood of regression from diabetes mellitus; preserved mobility, lower depression, less sleep apnea, fewer medications, better physical function and quality of life	I	Elazig, Turkey (Acik and others 2004), 100 diabetes patients; New Mexico, United States (Gilliland and others 2002), 104 Native Americans; Rural Costa Rica (Goldhaber-Fiebert and others 2003), 75 patients	Reductions (1.0 to 2.0% points) in glycated hemoglobin; 20–30 mg/dl reductions in fasting blood glucose
Diabetes self-management education (patient-centered, at diagnosis)	Probable better decision making, better self-care, and metabolic control (weight, blood glucose level), quality of life, coping, less hospitalization	III	Cochrane review (Attridge and others 2014), 33 trials with 7,453 participants; Xalapa and Veracruz, Mexico (Barcelo and others 2010); Chile (Barcelo and others 2001), 406 patients; Benin, Nigeria (Bello and others 2012), 170 patients; Argentina (Caporale and others 2011); China (Chan and others 2014), 3,588 patients; Changsha, China (Li and others 2012), 248 patients;	7% absolute increases in self-monitoring blood glucose; 14% absolute increases in lifestyle changes; Reductions (−0.2 to −1.5% points) in glycated hemoglobin; occasional benefits for blood pressure (up to −8 mmHg) and lipids (total cholesterol −7.2 mg/dl; HDL +1.6 mg/dl);

Strategy	Effectiveness	Quality of evidence	LMICs with relevant data (population)	Effect size
			Shanghai, China (Liu and others 2012), 208 patients; United States (Philis-Tsimikas and others 2011), 207 Mexican Americans; Rotterdam, Netherlands (Uitewaal and others 2005), 104 Turkish immigrants; Bangkok, Thailand (Wongrochananan and others 2013), 124 patients	12–43% absolute improvements in quality improvement goals
Self-monitoring of blood glucose	Individualized to patient profile, helps to prevent hypoglycemia, moderately lowers blood glucose levels, and helps to adjust medications and doses	II		
Intensive glycemic control (glycated hemoglobin below 6.5%)	No incremental benefit	III		
Moderate glycemic control (either glycated hemoglobin below 7.0% or individualized target)	25–40% reduction in microvascular complications; 15–33% reduction in long-term macrovascular events and death	I–II		
Intensive blood pressure control (blood pressure less than 140/80 mmHg and use of ACEi/ARB agents)	8–50% reduction in CVD events, ESRD, and deaths; ACEi/ARB agents have compelling incremental benefits	I–II		
Intensive lipid control	9–42% reduction in CVD events and deaths	I		

Strategy	Effectiveness	Quality of evidence	LMICs with relevant data (population)	Effect size
Aspirin use	Possible 10–20% reduction in CVD events and deaths in people at ≥10% 10-year CVD risk	I-III		
Smoking cessation counseling	Fewer complications and deaths	I	Kerala, India (Thankappan and others 2013), 224 male patients	Intensive counseling leading to higher quit rate (45.8 vs. 19.8%)
Annual influenza vaccination	Fewer influenza-like illnesses, less pneumonia, and fewer hospitalizations	II–III		
Pneumococcal vaccination	Possibly less pneumonia and fewer hospitalizations and deaths	III		
Screening for diabetes complications				
Regular retinopathy screening	60–70% reduction in severe vision loss or blindness	II		
Annual neuropathy screening	Probable faster symptom relief and prevent progression	II		
Foot examination and care	Probable reduction in infections, wounds, and amputations	II	U.S.-Mexico border (Borges and Ostwald 2008); Guangxi, China (Liang and others 2012), 62 inpatients	Better foot care behaviors; fewer ulcers; fewer amputations
Annual nephropathy screening	20–50% fewer missed cases of nephropathy or progression	I		
ACEi/ARB use to prevent ESRD	15–30% reduced albuminuria progression, dialysis, and ESRD	I–II		

Note: CVD = cardiovascular disease; IGT = impaired glucose tolerance; mg/dl = milligrams per deciliter; mmHg = millimeters of mercury; HDL = high-density lipoprotein; ACEi = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker; ESRD = end-stage renal disease. I = clear evidence from multiple, robust generalizable randomized controlled trials or meta-analyses with transparent reporting. II = supportive evidence from cohort studies, registries, or meta-analyses of cohort studies. III = conflicting evidence, expert opinion, or evidence from poorly controlled, poorly conducted, or low-quality studies.
a. High risk = some combination of: age 40 or 45 years; body mass index ≥ 25 kilograms per square meter and physically inactive, family history of diabetes, or minority race or ethnicity; history of gestational diabetes or baby weighing more than 9 pounds; blood pressure greater than or equal to 140/90 mmHg; HDL less than 35 or triglycerides higher than 250 mg/dl); or history of polycystic ovary syndrome, previous high glucose, or cardiovascular disease.

References

Acik, Y., and others. 2004. "Effectiveness of a Diabetes Education and Intervention Program on Blood Glucose Control for Patients with Type 2 Diabetes in a Turkish Community." *Southeast Asian Journal of Tropical Medicine and Public Health* 35 (4): 1012–18.

Attridge, M., and others. 2014. "Culturally Appropriate Health Education for People in Ethnic Minority Groups with Type 2 Diabetes Mellitus." *Cochrane Database of Systematic Reviews* doi:10.1002/14651858.CD006424.pub3.

Barcelo, A., and others. 2001. "An Intervention to Improve Diabetes Control in Chile [Spanish]." *Revista Panamericana de Salud Pública* 10 (5): 328–33.

Barcelo, A., and others. 2010. "Using Collaborative Learning to Improve Diabetes Care and Outcomes: The VIDA Project." *Primary Care Diabetes* 4 (3): 145–53.

Bello, S. I., and others. 2012. "Pharmacist's Intervention in the Control of Blood Sugar Levels in Randomised Diabetes Patients at a Primary Health Care Setting in Benin City." *Nigerian Quarterly Journal of Hospital Medicine* 22 (4): 245–48.

Borges, W. J., and S. K. Ostwald. 2008. "Improving Foot Self-Care Behaviors with Pies Sanos." *Western Journal of Nursing Research* 30 (3): 325–41; discussion 342–49.

Caporale, J. E., and others. 2011. "Educational Interventions in Patients with Type-2 Diabetes Improve Clinical and Metabolic Outcomes and Optimize the Use of Treatment Resources in Argentina: The Prodiacor Study." *Value in Health* 14 (7): A547.

Chan, J. C. N., and others. 2014. "The Effects of a Web-Based Integrated Care Program with or without a Nurse Coordinator on Cardiometabolic Control in Type 2 Diabetes: The China Jade (Joint Asia Diabetes Evaluation) Program." *Diabetes* 63: A301.

Hu, G., and others. 2012. "Tianjin Gestational Diabetes Mellitus Prevention Program: Study Design, Methods, and 1-Year Interim Report on the Feasibility of Lifestyle Intervention Program." *Diabetes Research and Clinical Practice* 98 (3): 508–17.

Iqbal Hydrie, M. Z., A. Basit, A. S. Shera, and A. Hussain. 2012. "Effect of Intervention in Subjects with High Risk of Diabetes Mellitus in Pakistan." *Journal of Nutrition and Metabolism* 2012: 867604. doi:10.1155/2012/867604.

Karalliedde, J., and others. 2014. "Effect of Lifestyle Modification on the Prevention of Type 2 Diabetes and Impaired Glucose Tolerance in a Young Healthy Urban South Asian Population." *Diabetologia* 57 (suppl. 1): S34.

Li, G., and others. 2014. "Cardiovascular Mortality, All-Cause Mortality, and Diabetes Incidence after Lifestyle Intervention for People with Impaired Glucose Tolerance in the Da Qing Diabetes Prevention Study: A 23-Year Follow-Up Study." *Lancet Diabetes and Endocrinology* 2 (6): 474–80.

Li, X., and others. 2012. "Effectiveness of Systematic Self-Management Education on Blood Sugar Level of Patients in the Community with Type 2 Diabetes [Chinese]." *Journal of Central South University (Medical Sciences)* 37 (4): 355–58.

Liang, R., and others. 2012. "Two-Year Foot Care Program for Minority Patients with Type 2 Diabetes Mellitus of Zhuang Tribe in Guangxi, China." *Canadian Journal of Diabetes* 36 (1): 15–18.

Liu, S., and others. 2012. "Effectiveness of Using Group Visit Model to Support Diabetes Patient Self-Management in Rural Communities of Shanghai: A Randomized Controlled Trial." *BMC Public Health* 12 (December 3): 1043.

Gilliland, S. S., and others. 2002. "Strong in Body and Spirit: Lifestyle Intervention for Native American Adults with Diabetes in New Mexico." *Diabetes Care* 25 (1): 78–83.
Goldhaber-Fiebert, J. D., and others. 2003. "Randomized Controlled Community-Based Nutrition and Exercise Intervention Improves Glycemia and Cardiovascular Risk Factors in Type 2 Diabetic Patients in Rural Costa Rica." *Diabetes Care* 26 (1): 24–29.
Gong, Q., and others. 2011. "Long-Term Effects of a Randomised Trial of a 6-Year Lifestyle Intervention in Impaired Glucose Tolerance on Diabetes-Related Microvascular Complications: The China Da Qing Diabetes Prevention Outcome Study." *Diabetologia* 54 (2): 300–07.
Philis-Tsimikas, A., and others. 2011. "Peer-Led Diabetes Education Programs in High-Risk Mexican Americans Improve Glycemic Control Compared with Standard Approaches: A Project Dulce Promotora Randomized Trial." *Diabetes Care* 34 (9): 1926–31.
Ramachandran, A., and others. 2013. "Effectiveness of Mobile Phone Messaging in Prevention of Type 2 Diabetes by Lifestyle Modification in Men in India: A Prospective, Parallel-Group, Randomised Controlled Trial." *Lancet Diabetes Endocrinolology* 1 (3): 191–98.
Thankappan, K. R., and others. 2013. "Smoking Cessation among Diabetes Patients: One-Year Follow-Up Results of a Randomized Controlled Trial in Kerala, India." *Diabetes* 62: A2.
Uitewaal, P. J., and others. 2005. "No Clear Effect of Diabetes Education on Glycaemic Control for Turkish Type 2 Diabetes Patients: A Controlled Experiment in General Practice." *Netherlands Journal of Medicine* 63 (11): 428–34.
Weber, M. B., and others. 2012. "A Model of Translational Research for Diabetes Prevention in Low and Middle-Income Countries: The Diabetes Community Lifestyle Improvement Program (D-CLIP) Trial." *Primary Care Diabetes* 6 (1): 3–9.
Weber, M.B., and others. 2016 "The Stepwise Approach to Diabetes Prevention: Results From the D-CLIP Randomized Controlled Trial." *Diabetes Care* Aug 2016, dc161241 DOI: 10.2337/dc16-1241
Wongrochananan, S., and others. 2013. "The Effectiveness of Interactive Multi-Modality Intervention on Self-Management Support of Type 2 Diabetic Patients in Thailand: A Clusterrandomized Controlled Trial." *Journal of Diabetes* 5 (suppl. 1): 151–52.