

A1C Variability and the Risk of Developing New Diabetes for the Healthy Adults in Japan

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Background: Recently, the ADA proposed a shift to A1C for the initial diagnosis of diabetes. However, the association of A1C's variability with developing new diabetes has been little studied. We aimed to evaluate the effect of A1C variability on the risk of developing new diabetes in healthy adults in Japan.

Methods: Population-based, cohort study from 2005 to 2008 in Tokyo, Japan of healthy adults not taking diabetes medication and with a HbA1c lower than 6.5% at baseline. Based on annual measurement of serum HbA1c we calculated the annual visit-to-visit variability, and used this as a predictor of new onset diabetes in a multivariate logistic regression.

Results: At baseline, 14,587 people (50% female) with a mean age of 51 years old (SD: 12 years, range: 23 to 92), a mean fasting plasma glucose (FPG) level of 98.4 mg/dl (SD: 9.3 mg/dl) and a mean HbA1c level of 5.3 % (SD: 0.4 %) had annual check-ups over 4 years. After adjusting for the other potential risk factors new diabetes was predicted by the A1C variability (odds ratio (OR): 10.3 for highest ($\geq 0.16\%$) versus the lowest quantile ($<0.08\%$), 95%CI: 5.9 – 18.0) and by the baseline A1C (OR: 55.2 for A1C of 6.0 – 6.4 % versus A1C of $<5.0\%$, 95% CI: 13.2 – 230). FPG (OR: 1.1, 95%CI: 1.1 – 1.2) and Smoker (OR: 1.8, 95%CO: 1.3 – 2.6) weakly but also significantly related to develop the new diabetes. For predicting the development of diabetes, the combination of the level of A1C at baseline and the variability (Area Under the Curve (AUC) for the ROC=0.94) was superior to the level of A1C at baseline alone (AUC=0.89). (Figure)

Conclusions: Visit-to-visit variability in A1C independently added to the baseline A1C in predicting the risk of developing new diabetes for the healthy adults.

Evaluation of a Patient Financial Rewards Program to Encourage Preventive Care

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Background: The Affordable Care Act increased coverage for preventive health services, but research has shown that removing out-of-pocket costs will only have a limited impact on the discrepancy between recommended and actual use. Patient incentives have been promoted as a mechanism to increase receipt of preventive care. When making the choice to receive preventive care, patients must tradeoff current and future costs/ benefits. In theory, incentive programs can help by increasing short term benefits. An unusually innovative preventive care incentive program has been pioneered by Discovery, a private health insurance company operating in South Africa, the United States, the UK, and China. In their voluntary program, which now includes over one million people, the receipt of preventive care services “earns” an enrollee points and the points can then be used for gifts such as discounted travel and retail goods such as movie tickets or cell phones. These types of incentive programs have significant potential to improve preventive care, but there have been no empirical evaluations of their impact. We assessed the impact of the incentive program on receipt of preventive care services among 3.3 million Discovery health members in South Africa of whom 1.5 million were ever enrolled in the incentive program. Of note, South Africans with private health insurance are similar to the US population in terms of education and income.

Methods: We analyzed the receipt of 9 preventive care services (e.g. mammogram, Pap smear, HIV test) among all members of Discovery (those in the incentive program and those that are not) over the years 2005-10. To try and address the selection bias inherent in an elective program, we used a difference-in-difference analysis where we compared the change in an individual’s receipt of preventive care services before and after they enter the program compared to similar patients who are in not in the incentive program. We used a logistic model with random effects for each individual with controls for year and type of health plan product.

Results: Compared to those who never joined the incentive program, those who joined the incentive program were younger (e.g. ≥ 60 yo, 5% vs. 20%) and healthier (no chronic illnesses, 68% vs. 62%). In our models, being part of the incentive program was associated with a statistically higher odds of receiving all 9 preventive care services (e.g. Odd ratio for Cholesterol testing 1.5, Glucose testing 1.2, HIV test 1.9, Mammogram 1.3, Pap smear 1.3). However, receipt of preventive care among those in the incentive program was still low. For example, among members of incentive program eligible for the care, receipt of Pap smear was only 24%.

Conclusions: Voluntary participation in a patient incentive program was associated with a higher likelihood of receiving preventive care. However, receipt of preventive care among those in the program was still much lower than ideal.

Numeracy Versus Reading Skills: Unpacking Health Literacy

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Background: Recent work in the field of health literacy has led to the development of a variety of distinct measures of literacy, including assessments that focus specifically on reading skills or on numeracy exclusively. We sought to investigate the relationship between reading and numeracy as well as examine the relative impacts of each on comprehension, retention, and problem solving for health-related information.

Methods: Three-hundred-four primary care patients aged 55-74 completed a series of literacy assessments, three of which examined reading skills: the Rapid Estimate of Adult Learning in Medicine (REALM), the American Nelson Adult Reading Test (AMNART), and the reading section of the Test of Functional Health Literacy in Adults (TOFHLA), and three of which examined numeracy skills: the Lipkus Numeracy Scale, the Newest Vital Signs (NVS), and the numeracy portion of the TOFHLA. To assess the relationship between each measure, scores for all were correlated. Additionally, participants were presented with a number of different hypothetical health scenarios and asked to complete a series of health tasks about each to gauge comprehension, reasoning, and retention for the information contained in each scenario. To examine the relative impact of reading and numeracy skills on health performance, we performed a series of regression analyses to determine whether factor scores for reading skills and numeracy separately, as well as simultaneously, impacted health-task performance (scored on a scale of 1-100).

Results: Scores on all assessments of numeracy and reading skills were highly correlated ($0.39 \leq r \leq 0.69$, $p < 0.001$). After adjusting for age, gender, race, education, and comorbidity, in regression analyses, when reading ability was entered into a model it was found to significantly predict health-task performance (β , 10.4; CI, 9.0 – 11.8, $p < 0.001$), and 64% of the variance was explained. When numeracy was entered into a separate model, it also significantly predicted performance (β , 11.3; CI, 9.7 – 12.8, $p < 0.001$), and again 64% of variance was explained. Finally, in a model including both reading and numeracy concurrently, both factor scores significantly predicted performance (β , 7.1; CI, 5.7 – 8.6, $p < 0.001$; β , 7.3; CI, 5.7 – 8.9; $p < 0.001$ for reading and numeracy, respectively). In this final model, 72% of the variance was explained, providing a significantly greater goodness of fit than was found for either model that included either reading or numeracy alone ($p < 0.001$).

Conclusions: Reading and numeracy skills are highly associated, and each in isolation explains a large and comparable amount of variance in performance related to common health-based tasks. Additionally, consideration of both skills together provides an even clearer predictor for health-task success. As such, health literacy likely encompasses a broader set of abilities than either reading or numeracy alone, and rather entails cognitive processing at large. Designers of health-related interventions should consider universal cognitive constraints in information processing when creating interventions to mitigate the impacts of low health literacy.

Web-based walking to wellness: Adoption and impact of an insurance-incentivized Internet-mediated walking program for obese adults

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Background: Rising obesity rates and associated chronic conditions and costs are driving demand for effective and inexpensive weight loss interventions. While Internet-mediated programs have been shown to increase physical activity levels in randomized controlled trials, it is unclear whether such programs can affect population-level behavior change. The objective of this study was to evaluate adoption and acceptance of a novel, insurance-incentivized Internet-mediated walking program, and to assess the program's population-level impact on physical activity among obese adults.

Methods: We conducted a formative mixed-methods evaluation of the adoption, acceptance, and impact of an Internet-mediated walking program implemented by a large Midwest insurance company. Beginning in 2010, individuals with a BMI > 30 who were insured by this company could receive enhanced benefits if they participated in an Internet-mediated walking program or a traditional Weight Watchers program. Individuals who enrolled in the walking intervention received a free pedometer and could upload and monitor their daily step-counts (number of steps per day) on a personalized, interactive website. Participants who uploaded their step-count data at least once a month and achieved a goal of 5,000 average daily steps over three months were eligible for lower co-payments and deductibles—equivalent to 20% lower out-of-pocket expenses. We assessed program adoption and participation rates, and explored program impact among a subset of adherent participants, using a paired t-test to examine changes in step-counts over a four-month period. We complemented these findings with quantitative and qualitative analyses of participant feedback to a web-based survey.

Results: Among the 15,387 individuals who met eligibility criteria for the incentivized weight management program over the first nine months, 6,546 (43%) enrolled in the Internet-mediated walking program, and 5,045 (33%) enrolled in Weight Watchers. Participants in the walking program documented an average of 6,963 steps per day (SD 2,626 steps). Over 75% of walking program participants were classified as adherent based on uploads of valid pedometer data for at least 3 of 4 enrolled days. In a preliminary analysis of 1,818 adherent participants who had valid pedometer data during the first and last two weeks of the program's first four months, there was an average increase of 585 steps per day (SEM 53 days, paired t-test $t=11.05$, $p < .0001$). In a web-based survey (response rate 12%), 51% of respondents reported that they appreciated the value of the program for improving their health and decreasing their health care costs. Another 17% of respondents initially joined the program for the financial incentive and were unhappy with the program, but ultimately appreciated the program benefits.

Conclusions: In this formative study of a novel insurance-incentivized Internet-mediated walking program for obese adults, we found high rates of adoption, adherence, and satisfaction. Among adherent participants, physical activity rates increased significantly over a four-month period, suggesting that such programs—when implemented in the population—have the potential to affect widespread change in physical activity levels. Additional evaluations should explore the long-term impact of these programs on individual and population-level health, utilization, and costs.

Guatemala Internal Medicine Physicians' Knowledge of Non-Communicable Disease Clinical Preventive Services

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Background: Non-communicable diseases (NCDs) represent a considerable toll in Guatemala accounting for 47 % of all deaths. Clinical preventive services (e.g. smoking cessation counseling and colonoscopy) are key to reducing the burden of NCDs. Internal medicine staff are fundamental to providing these services, and their knowledge and practices are a cornerstone of NCDs control and prevention. On February 2011, the Guatemalan Ministry of Health released their NCDs Prevention and Treatment Guidelines. Designed to be implemented in rural health posts and centers, the guidelines are based on reports and guidelines from international associations (e.g. Alliance for Cervical Cancer Prevention) and other countries (e.g. Mexico) rather than on cost-effectiveness analyses from Guatemala.

Methods: We conducted a cross-sectional survey of internal medicine departments in teaching hospitals nationwide. Four trained surveyors invited interns, residents, and attendings to participate. The self-administered anonymous survey included demographic data, percentage of time devoted to outpatient care, preventive service recommendations, perceived availability and barriers to providing each service, and opinion on who should be responsible for preventive services guidelines and training. Answers regarding recommendation practices were compared with US Preventive Services Task Force (USPSTF) guidelines due to the scope and limitations of Guatemalan guidelines. USPSTF classifies preventive services as A (strongly recommend), B (recommend), C (recommend against routine use but can provide on individual basis), D (recommend against), or I (insufficient evidence recommend for or against). Services were considered cost-effective if they require less than \$35,000 per quality adjusted life-year saved. Data analysis was done with STATA/SE 11.2.

Results: Of 443 physicians invited to participate, 394 completed the survey (88.94% response rate). Recommended services (grade A or B) were offered as frequently as non-recommended services (grade D or I) (51.09% vs. 50.39%, $p=0.9$). Among A and B services, physicians did not prioritize those considered cost-effective. Only colorectal ($p<0.001$) and prostate ($p=0.006$) cancer screening recommendation practices differed by level of training.

Tobacco cessation interventions (grade A) had the highest recommendation rates (99.20%) and screening for colorectal cancer (grade A) had the lowest recommendation rates (55.75%). Almost two-thirds of physicians recommended screening for coronary heart disease with an EKG (grade D).

Regarding services availability, hypertension screening was perceived as the most available service (93.57% indicated it is available at their hospital) and tobacco cessation pharmacotherapy as the least available (4.83%). Furthermore, the most frequent barriers to providing services were lack of time (46.38%) and inadequate patient's resources (31.34%).

When asked about who should provide training in preventive services, 42% considered the Ministry of Health responsible, followed by Schools of Medicine (30%), and the Guatemalan College of Physicians (14%).

Conclusions: Internal medicine physicians in Guatemala are inappropriately trained on preventive services for NCDs control and prevention and do not prioritize recommendations based on cost-effectiveness. These data should prove useful to strengthen preventive medicine education and implement an evidence-based national screening program.

The Effect of Cigarette Smoking On Diabetic Peripheral Neuropathy: A Systematic Review And Meta-Analysis

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Background: Diabetic peripheral neuropathy (DPN) is a common and incapacitating syndrome affecting almost one-third of people with diabetes. About one-fifth of people with diabetes also smoke. Tobacco use is a known risk factor for development of cardiovascular complications in people with diabetes and studies suggest that it might also be a risk factor for development of microvascular complications such as DPN. The objective of the systematic review and meta-analysis is to assess the relationship between smoking and peripheral neuropathy in people with type 1 or type 2 diabetes.

Methods: A systematic review of MEDLINE, EMBASE, and Cochrane Clinical Trials databases was conducted from 1966 to August 2011. Each study was reviewed for eligibility independently by 2 authors. Studies were included if they reported DPN as an outcome and smoking status as an exposure in a population with type 1 or type 2 diabetes. Data from the included studies were extracted and quality assessed. We performed separate analysis for prospective cohort studies and cross-sectional studies. All pooled analyses were based on random effects models and heterogeneity was assessed using I² statistics. We used Review Manager to perform the statistical analyses.

Results: From 1,644 abstracts, 24 studies (9 prospective cohorts and 15 cross sectional) met the inclusion criteria and agreement between reviewers was good (Kappa 0.72).

The prospective cohort studies included 5,477 participants who did not have DPN at baseline. In 5 studies participants had type 1 diabetes, in 3 studies they had type 2 diabetes and in one study they had both. During a follow up ranging from 2 to 9 years, 1,539 cases of DPN occurred. Most studies reported an increased risk of DPN associated with smoking but 3 studies reported a decreased risk. Odds ratios (ORs) for DPN associated with smoking ranged from 0.22 to 2.20. The pooled OR of developing DPN associated with smoking using a random effect model was 1.16 (95% Confidence Interval (CI) 0.76-1.78). There was significant heterogeneity between studies. In sub-analysis restricted to studies where smoking status was well-defined and ORs were adjusted for at least HbA1c and diabetes duration, the pooled OR was 1.62 (95% CI 1.30-2.01) and there was no evidence of heterogeneity. There was no evidence of publication bias. The cross sectional studies included 5,627 participants, 11 with type 2 diabetes, 2 with type 1 diabetes and 2 with both. Only 7 studies had analysis adjusted for the main confounders and ORs ranged from 0.68 to 3.32. The pooled OR of DPN associated with smoking was 1.68 (95% 1.30-2.17) using a random effect model. There was no evidence of publication bias.

Conclusions: People with diabetes who smoke have an increased risk of having or developing neuropathy compared with non smokers. Targeting smoking cessation is a key factor for improvement of diabetic complications such as DPN.