medication. Increasing visit frequency to primary care (HR=1.85; 95% CI, 1.58-2.18) and endocrinology (HR=2.08; 95% CI, 1.45-2.97) were associated with decreasing delays, as were increasing income levels (HR=1.04; 95% CI, 1.00-1.07). **Conclusions:** Patients with diabetes facing inertia are at risk of further delays in appropriate management. Our findings suggest the presence of patient, physician and system barriers to appropriate care. Increased contact with the health care system may mitigate risk.

Abstract C-C1-03

Moving the Big N

Ellen Vanderboom, MSN, RN, *Marshfield Clinic*; Theodore Praxel, MD, MMM, FACP, *Marshfield Clinic*; Marilyn Follen, RN, MSN, *Marshfield Clinic*; Daniel Erickson, MD, *Marshfield Clinic*; Thomas Gabert, MD, MPH, *Marshfield Clinic*; Kori Krueger, MD, *Marshfield Clinic*; Eric Penniman, DO, *Marshfield Clinic*; Mary Beth Dickinson, RN, BSN, *Marshfield Clinic*; Trina Ford, MSN, NP, RD, *Marshfield Clinic*

Background: Nationally the trend for hospitalization of diabetics has been slow to show improvement. In 2003, the rate of hospital discharge for diabetes as any-listed diagnosis (360.7 per 1000 people with diabetes) was only slightly lower than the rate in 1980 (398.7 per 1000 people with diabetes). Decreasing hospitalizations and improving health outcomes for 17,678 patients has been a system wide initiative in Marshfield Clinic since 2005. **Methods:** Numerous interventions have occurred since 2005 to improve health outcomes and decrease costs for the diabetes population. Evidenced-based guidelines were deployed and CME activities were created for providers. Clinical information support tools and applications deployed included wireless tablets for primary care providers and staff, an electronic point of care reminder tool, medication management and electronic planned care applications were also deployed. The diabetic foot exam process was standardized and medical assistants were trained to perform foot exams. Standing orders for staff to give influenza and pneumococcal vaccinations and schedule necessary lab tests or office visits were developed. Feedback on diabetes quality metrics at the organization, division, department and individual primary care provider level was provided every quarter on a rolling 12-month basis. **Results:** The all-cause hospitalization rate for persons with a diagnosis of diabetes has decreased from 360 per 1000 in 2005 to 317 per 1000 in 2007. This decrease in hospitalization lead to improved economic outcomes and quality of life by avoided hospitalizations. Conservative estimates of the cost savings range from \$5,202,000 to \$14,137,200. **Conclusions:** Significant improvement in this population has been demonstrated system wide by a decrease in all-cause hospitalization rates and composite diabetes process and outcome measures. Use of an electronic health record is essential but not sufficient to affect change. Ongoing measurement of practice performance has assisted in the change. Physician champions have been crucial for spread. Improvements are significant, however, opportunities remain.

Abstract C-C1-04

The Effectiveness of Diabetes Care Management in a Large, Integrated Delivery System: a TRIAD Study

Julie A. Schmittiel, PhD, *Kaiser Permanente Northern California Division of Research*; Connie Uratsu, BA, *Kaiser Permanente Northern California Division of Research*; Bruce Fireman, MA, *Kaiser Permanente Northern California Division of Research*; Joe V. Selby, MD MPH, *Kaiser Permanente Northern California Division of Research*

Background: Numerous studies have examined the effect of care management (CM) programs on diabetes outcomes such as A1c control. Most evaluations have been small randomized controlled trials; few studies examine how CM translates to real-world settings in terms of success at reaching target populations, or effectiveness for improving outcomes in large populations. The aims of this project are to assess the appropriateness of entry into a diabetes (DM) nurse-delivered CM program in Kaiser Permanente Northern California (KPNC) compared with program guidelines, to determine the proportion who meet program entry criteria, and to compare the trajectory of intermediate outcomes in patients who receive CM to that of similar patients who don't receive CM. **Methods:** KPNC automated databases were used to identify all DM patients from 2000-2005 and to determine whether patients enrolled in CM. We examined whether CM enrollees and non-enrollees met

the eligibility criteria for the CM program. Using propensity score matching, we matched CM patients to similar patients who were eligible but did not enter CM. We compared trajectories of A1c, LDL-c, and blood pressure levels of CM patients to those of their matched controls, adjusting for baseline risk factor levels. **Results:** Between 2000 and 2005 less than 10% of all KPNC diabetes patients entered CM, representing approximately 25% of all eligible patients. Up to 22% of those in CM each year did not meet program entry criteria. CM patients were similar to the overall DM population in age, gender, blood pressure, and LDL-c levels; they had higher A1c and microalbumin levels. There were small but statistically significant differences in A1c, LDL-c, and blood pressure levels between CM patients and their matched controls 6, 12, and 15 months after program exit. There were significant improvements in CVD risk factor levels in all KPNC DM patients over time, regardless of whether or not they received CM. **Conclusions:** While eligibility guidelines for diabetes nurse care management were not strictly adhered to, care management did have a small but significant impact on intermediate outcomes. However, these improvements were small compared to the risk factor improvements over time in the overall DM population.

Abstract C-C1-05

Who Does Not Complete a First-Fill for a Diabetes-Related Prescription?

Nirav R. Shah, MD, MPH, *Geisinger Center for Health Research*; Annemarie G. Hirsch, MPH, *Geisinger Center for Health Research*; G. Craig Wood, MS, *Geisinger Center for Health Research*; Amanda F. Wingate, BS, *Geisinger Center for Health Research*; Ilene G. Ladd, MS, *Geisinger Center for Health Research*; Walter F. Stewart, PhD, MPH, *Geisinger Center for Health Research*

Background: Research on medication adherence is primarily conducted using insurance or pharmacy claims data, focusing on patients who have already obtained their first prescription for a defined condition. Claims data alone cannot be used to assess first-fill rates. **Methods:** We conducted a retrospective cohort study that examined first-fill rates for patients prescribed medications to treat diabetes by linking prescribing information from electronic health records (EHR) to pharmacy claims data of one insurer. EHR data were obtained from the Geisinger Clinic, a large group practice serving a 31-county area of central and northeastern Pennsylvania. The Clinic includes 41 community practice sites with primary and multi-specialty care, all of which have used an EHR since 2001. Claims data were obtained from Geisinger Health Plan, a payer that accounts for 30% of Geisinger Clinic patient volume. Adherence was defined as a claim generated for the first-fill prescription within 30 days of the index date. **Results:** Of 1132 patients written a new, first-time prescription for any diabetes medication, 962 (85%) generated a corresponding claim within 30 days. Therapeutic class, refills, co-pay, baseline A1c values, and change in A1c values were associated with first-fill rates. Gender, race, age, comorbidity score, number of office visits, and number of medications prescribed had no association ($P < 0.05$). **Conclusions:** Adherence relates directly to higher A1c levels and is associated with therapeutic drug class, higher number of refills, and lower co-pay. As expected, patients with higher adherence exhibited greater change in A1c levels. Patients with relatively lower baseline A1c levels, while at lower risk for diabetes complications, are at higher risk of not adhering to diabetes medications.

Abstract C-C1-06

Identifying Depression Among Diabetes Patients Using Natural Language Processing of Office Notes

Lucy R. Fischer, PhD, *HealthPartners Research Foundation*; William A. Rush, PhD, *HealthPartners Research Foundation*; John C. Kluznik, PhD, *HealthPartners Research Foundation*; Patrick J. O'Connor, MD MPH, *HealthPartners Research Foundation*; Ann M. Hanson, BS, *HealthPartners Research Foundation*

Purpose: To compare two methods for identifying depression among health plan enrollees with diabetes—administrative data base codes versus natural language processing (NLP) of office note verbal narratives. **Background:** In research studies in health care systems, depression cases can be identified through coded data in the health plan administrative data system, including diagnosis (ICD-9) codes and pharmacy codes. However, depression is often

under-coded. Clinician notes offer an alternative source for identifying depression. Natural language processing tools can be used to enhance case identification where clinician notes are available in electronic form.

Methods: The sample was comprised of 2680 health plan enrollees that had received a new diabetes diagnosis within the previous two years. Using phrases that included the embedded term 'depress', two reviewers coded all cases with an appropriate indication of depression, excluding inappropriate uses of the term ('denies depression'; 'depressed fracture'; 'no history of depression'). On cases where there was disagreement, the two reviewers looked at the full note to determine the appropriate decision. The depression cases identified through the administrative database were compared to those identified through NLP in terms of clinical and demographic characteristics.

Results: Of the 2680 incident diabetes patients, 260 (10%) were identified through both methods, and an additional 141 were identified with depression through NLP only. There were 37 depression cases identified through administrative codes with no NLP evidence of depression. There were no significant differences between NLP versus administrative data criteria in terms of gender, age, comorbidity, or A1c of those identified with depression. However, patients identified through the administrative system had more primary care visits and had longer continuous enrollment in the health plan.

Conclusions: Use of NLP increased numbers of identified depression cases by almost a third. The NLP tool provides an efficient way to enhance the identification of depression cases, both for research and population-based quality improvement efforts. As more and more medical providers establish paperless offices, NLP will be an increasingly useful and efficient tool that can be used by both clinicians and researchers for a variety of purposes. This study was funded by NIH/NIDDK: Grant #DK066050.

Quality Improvement

Abstract C-C2-01

Guided Care: The Translation of Research Into Cost-Effective Primary Care for Persons With Chronic Conditions

Carol Groves, RN, MPA, *Kaiser Permanente Mid-Atlantic States*; Lya Karm, MD, *Mid-Atlantic Permanente Medical Group*; Chad Boulton, MD, MPH, MBA, *Johns Hopkins Bloomberg School of Public Health*; Lisa Reider, MHS, *Johns Hopkins Bloomberg School of Public Health*; Katherine Frey, MPH, *Johns Hopkins Bloomberg School of Public Health*

Background: 'Guided Care' (GC) is primary care into which several successful innovations in chronic care have been translated, in accord with the 'chronic care model.' This study examines the effect of GC on the quality of medically complex older adults' health care. A registered nurse based in a primary care practice and supported by a web-accessible, evidence-based electronic health record, works closely with 2-4 physicians in caring for 50-60 of their multi-morbid older patients. For each patient the nurse performs a comprehensive assessment at home and then collaborates with the physician, the patient and the caregiver to customize an evidence-based 'Care Guide' for healthcare professionals and a personal health 'Action Plan' for the patient and caregiver. Thereafter, the nurse monitors the patient's chronic conditions proactively, coaches the patient in self-management, smoothes transitions between settings of care, coordinates multiple providers, educates and supports caregivers, and facilitates access to community resources.

Methods: Using claims-based predictive modeling, we identified the top 25% chronically ill older patients at highest risk for health care utilization in the subsequent year within three Kaiser Permanente practices. A total of six primary care teams representing 20 primary care physicians and 403 of their patients consented to participate in the trial of which three teams were randomized to receive a GC nurse. We assessed quality of care after 6 months using the Patient Assessment of Chronic Illness Care (PACIC), an instrument which measures self-reported quality of care in five domains. **Results:** Eighty-six percent of GC patients (n=204) and controls (n=199) responded to baseline and follow-up interviews. Patients receiving GC were two times more likely to rate the quality of their care as 'highest quality' compared to patients in the control group after adjusting for baseline sociodemographic characteristics, health status, functional ability, practice site, satisfaction with healthcare and PACIC score (OR, 1.99, P=0.054). GC patients had a significantly higher rating of care within the following domains: goal setting (OR, 2.55, P=0.003), coordination of care (OR, 3.09, P=0.006), and decision support (OR, 1.73, P=0.026). **Conclusion:** Preliminary results suggest GC improves the quality of care for complex, chronically ill older adults.

Abstract C-C2-02

iList (Intervention List) – Planning Care for a Large Population

Ellen Vanderboom, RN, MSN, *Marshfield Clinic*; Theodore Praxel, MD, MMM, FACP, *Marshfield Clinic*; Marilyn Follen, RN, MSN, *Marshfield Clinic*; Daniel Erickson, MD, *Marshfield Clinic*; Thomas Gabert, MD, MPH, *Marshfield Clinic*; Kori Krueger, MD, *Marshfield Clinic*; Eric Penniman, DO, *Marshfield Clinic*; Mary Beth Dickinson, RN, BSN, *Marshfield Clinic*; Trina Ford, MSN, NP, RD, *Marshfield Clinic*

Background: Improvement of diabetes care for a population of 17,993 has been a system-wide initiative since 2004. Multiple strategies have been implemented to meet this aim. The Intervention List, also known as iList, is a software application that was introduced to help physicians and staff plan interventions at the individual patient level to improve care. iList contains lists of patients with diabetes who are not meeting quality metrics and may lack a follow-up appointment. **Methods:** Algorithms to identify high-risk patients who are not at goal for diabetes quality metrics and link them to personal care providers were developed by the Data Warehouse. iList was deployed to all primary care practices in the system. Standing orders were developed for staff to use in conjunction with iList to schedule necessary test or office visits. Training was held to assist staff and physicians in improving care through iList, a defect recovery list. In addition, the process of diabetic foot exams was standardized and support staff was trained to perform foot exams. **Results:** Significant improvement in diabetes care has been demonstrated by the improvement in the composite diabetes process and outcome measures. The percent of patients who have met all diabetes process measures has increased from 13.4% prior to iList implementation to 42.4%. The percent of patients who have met all diabetes outcome measures has increased from 10.1% to 19.1%. **Conclusions:** iList has helped physicians and staff to attach names to those patients in their practice who are not meeting all of the quality metrics and take action to improve care where there may be gaps. Awareness of the need to plan chronic care is not necessarily self evident and education of providers and staff has been helpful. Planning care builds trust with patients. Use of the application has emphasized the staffs' ability to help patients improve their health. Standing orders have facilitated the process of planning care. Planning care saves time and physicians recognize the efficiencies. Adaptive change needs to accompany technical change for successful implementation.

Abstract C-C2-05

Taking Advantage of Natural Experiments for Implementation Research: a DIAMOND Opportunity

Leif I. Solberg, MD, *HealthPartners Research Foundation*; A. Lauren Crain, PhD, *HealthPartners Research Foundation*; Russell E. Glasgow, PhD, *Kaiser Permanente Colorado CRU*; Jurgen Unutzer, MD MPH, *University of Washington*; Robin R. Whitebird, PhD, *HealthPartners Research Foundation*; Michael V. Maciosek, PhD, *HealthPartners Research Foundation*; Lisa V. Rubenstein, MD, *RAND Corporation*

Background: Faced with the challenge of how research can help medical care cross the quality chasm separating what we think we know and what we actually do, new approaches and designs for research are needed. We especially need research that helps us understand problems in implementation and how to improve care. Since care and financing changes occur at an increasingly rapid pace, they provide huge opportunities for learning if we can only build and fund appropriate parallel research studies. This paper will describe such a study of a major statewide initiative to change the financing and care for depression in Minnesota. **Methods:** The DIAMOND (Depression Improvement Across Minnesota – Offering a New Direction) study proposal was developed in conjunction with a similarly named collaborative plan for changing the way all health plans and the state paid for primary care of depression and for facilitating care changes that would implement evidence-based care. The implementation was planned in a way that would be most feasible for stakeholders while also being compatible with a sophisticated quasi-experimental research design that involved staggered implementation with multiple baseline measures of practice systems, care processes, and patient outcomes. It also featured evaluation of changes in worker productivity and in healthcare utilization/costs while also measuring the extent of penetration through the RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, and Maintenance). **Results:** The research proposal to NIMH