Patient–Provider Communication and Health Outcomes Among Individuals With Atherosclerotic Cardiovascular Disease in the United States

Medical Expenditure Panel Survey 2010 to 2013

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Background—Consumer-reported patient–provider communication (PPC) assessed by Consumer Assessment of Health Plans Survey in ambulatory settings is incorporated as a complementary value metric for patient-centered care of chronic conditions in pay-for-performance programs. In this study, we examine the relationship of PPC with select indicators of patient-centered care in a nationally representative US adult population with established atherosclerotic cardiovascular disease.

Methods and Results—The study population consisted of a nationally representative sample of 6810 individuals (aged ≥18 years), representing 18.3 million adults with established atherosclerotic cardiovascular disease (self-reported or International Classification of Diseases, Ninth Edition diagnosis) reporting a usual source of care in the 2010 to 2013 pooled Medical Expenditure Panel Survey cohort. Participants responded to questions from Consumer Assessment of Health Plans Survey that assessed PPC, and we developed a weighted PPC composite score using their responses, categorized as 1 (poor), 2 (average), and 3 (optimal). Outcomes of interest were (1) patient-reported outcomes: 12-item Short Form physical/mental health status, (2) quality of care measures: statin and ASA use, (3) healthcare resource utilization: emergency room visits and hospital stays, and (4) total annual and out-of-pocket healthcare expenditures. Atherosclerotic cardiovascular disease patients reporting poor versus optimal were over 2-fold more likely to report poor outcomes; 52% and 26% more likely to report that they are not on statin and aspirin, respectively, had a significantly greater utilization of health resources (odds ratio≥2 emergency room visit, 1.41 [95% confidence interval, 1.09–1.81]; odds ratio≥2 hospitalization, 1.36 [95% confidence interval, 1.04–1.79]), as well as an estimated $1243 ($127–$2359) higher annual healthcare expenditure.

Conclusions—This study reveals a strong relationship between PPC and patient-reported outcomes, utilization of evidence-based therapies, healthcare resource utilization, and expenditures among those with established atherosclerotic cardiovascular disease. (Circ Cardiovasc Qual Outcomes. 2017;10:e003635. DOI: 10.1161/CIRCOUTCOMES.117.003635.)

Key Words: adult □ American Heart Association □ cardiovascular diseases □ health status □ patient-centered care

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WHAT IS KNOWN

- PPC serves as a complementary value metric for patient-centered care in existing pay-for-performance programs.
- Previous literature suggests that an optimal PPC is associated with more adherence to medication, lower healthcare expenditure, and higher consumer satisfaction.

WHAT THE STUDY ADDS

- This study provides association between an optimal PPC and a wide spectrum of healthcare outcomes, including patient-reported outcomes, quality of care processes, healthcare resource utilization, and expenditures high-risk patients with established ASCVD in a representative US population.
- These results should stimulate patient-centered research to further explore potential factors that will facilitate effective communication between patients and their healthcare providers and incorporation into the routine healthcare delivery process.

Atherosclerotic cardiovascular disease (ASCVD) is one of the leading causes of mortality and morbidity and a leading contributor to healthcare expenditure in the United States.\(^1\)\(^2\) Despite improvement in outcomes, significant variation in the quality of healthcare processes among patients with ASCVD is well documented.\(^1\) Patient-centered care supported by effective communication between healthcare providers and consumers is one of the fundamental components of the robust strategy identified by the National Quality Strategy, paramount to the improvement of healthcare delivery and outcomes.\(^3\) In fact, consumer-reported patient–provider communication (PPC) assessed by the Consumer Assessment of Healthcare Providers and Systems (CAHPS) survey in ambulatory settings is incorporated as a complementary value metric for patient-centered care of chronic conditions in various pay-for-performance programs. In lieu of being a key component of assessing physicians’ performance and health outcomes, coupled with the mounting financial impact thereof, has in recent years sparked interest in exploring relationships between patient-reported experiences, such as PPC and a wide range of healthcare processes and outcomes.

Previous literature has suggested the effectiveness of the PPC as one of the key factors for certain elements of care processes related to outcomes, such as adherence to prescribed medications among patients with ASCVD.\(^3\)\(^4\) However, to date, there is little information on its relationship with a wide range of healthcare outcomes of interest. In this study, we determine the association of PPC on patient-reported health status, measures of quality of care, healthcare resource utilization, and spending for a nationally representative sample of adults with established ASCVD in the United States. These results could provide support for PPC as a target for future quality improvement interventions in optimizing patient-centered care among high-risk patient cohorts.

Methods

The Medical Expenditure Panel Survey (MEPS), a publicly available database sponsored by the Agency for Healthcare Research and Quality, was used for this study. MEPS is a national survey of individuals and families, their medical providers and employers for medical conditions, healthcare resource utilization, and costs. The MEPS database contains deidentified information on sociodemographic characteristics, utilization of health services, patient-reported health care experiences and outcomes, insurance coverage, medical expenditures, and sources of payment. Each year, the MEPS Household Component sample is drawn from respondents of the previous year’s National Health Interview Survey. It is a complex survey design with overlapping panels, where each panel is composed of randomly sampled, noninstitutionalized US civilians. Participants are interviewed every 6 months over a period of 30 months, and their responses are reported annually to provide nationally representative estimates of sociodemographic characteristics, medical conditions, healthcare utilization, and costs.\(^7\) Interviews are conducted over the telephone, and further information is obtained from physicians, hospitals, and pharmacies to supply additional information on healthcare utilization and cost data. After data collection, AHRQ researchers assign person weights and variance estimation stratum to reflect survey nonresponse and population totals from the participants’ surveyed.\(^8\) To increase the sample size, we pooled 4 years of data from MEPS (2010–2013) and merged the full-year consolidated file, medical conditions file, and prescribed medicines file using the unique person-level identification numbers. We applied the assigned person-level weight accordingly to reflect the estimation of US population mean sample size from the sampled observation. Individuals included in our analysis were those with ASCVD (self-reported or ICD-9 diagnosis of coronary heart disease, peripheral arterial disease, or cerebrovascular disease), 18 years of age at the time of survey, with a body mass index ≥18.5 kg/m\(^2\) (underweight individuals generally represent a sicker population), reporting a usual source of care, and with a final survey person weight >0 to be a representative of the national population at the time of survey (Figure). Furthermore, individuals with missing or inapplicable responses to the communications-related questions (Table IA in the Data Supplement) from the CAHPS survey were excluded from the final sample size used in this study. Because MEPS is a deidentified publicly available data set, according to the US Department of Health and Human Services guidelines, institutional review board approval was not required for this study.

Dependent Variables

MEPS contains information about utilization of health service such as inpatient hospitalizations and prescription drug use. It also contains information on healthcare expenditure and patients’ self-rating of their overall health. We evaluated the influence of PPC on these indicators. All the questions used from the survey in this evaluation are listed in Table IA in the Data Supplement.

Patient-Reported Outcomes

To assess the physical and mental health status of participants, MEPS constructed physical and mental health summary scores using responses to the questions adopted from the 12-item Short Form version 2 survey. The physical health component score and the mental health component score ranged from 0 (worst health status possible) to 100 (best health status possible). We divided each summary score into quartiles, with the lowest quartile reflecting poor physical/mental health score.

Quality of Care Indicators

We chose statins and aspirin as a quality of care indicator for this population because they are among the established management therapies and processes of care among patients with ASCVD.\(^9\) During the data collection, respondents provided the names of prescribed medicine they obtained or purchased within the reference period, and a written consent was sought from these participants to obtain payment information, drug name, national drug code, date and dosage from the drug stores and pharmacies.\(^10\) AHRQ researchers conducted...
multiple imputations for individuals with missing data, by imputing the payment information for another person’s purchase of the same drug from the pharmacy data. Information on drug prescription is contained in the MEPS Prescribed Medicine Files. We coded 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors and lipid-lowering combinations that contained a 3-hydroxy-3-methylglutaryl coenzyme A agent as statins. The response to the question from the MEPS data does the person take aspirin frequently? was used to ascertain aspirin use.

**Health Resource Utilization**

The MEPS full-year consolidated file contains variables that represent the total count of all emergency room visits reported and the total number of hospital discharges for the survey year. We used the variable that represented the total number of discharges to reflect the total number of times a participant had an inpatient hospital stay. Any emergency room visit and hospitalization, as well as ≥2 emergency room visits and hospital discharges, were used as indicators of increased health resource utilization. Overall, self-reported healthcare utilization is validated and verified by standardized medical record abstraction in a subsample of the respondents; studies have shown excellent overall agreement.

**Healthcare Expenditure**

We used the information obtained from the MEPS full-year consolidated file to evaluate the annual healthcare expenditure among the MEPS respondents with ASCVD. Expenditures refer to the sum of payments for health care which includes out-of-pocket payments and payments made by insurance companies and other sources. Information on healthcare expenditure and the source of payment was collected for every participant for each medical event experienced during the year. Data for this variable included expenditures from all payer groups and out-of-pocket spending, including information from hospitalizations, prescribed medications, outpatient visits (hospital outpatient visits and office-based visits), emergency department visits, and other expenditures (dental visits, vision aid, home health care, and other medical supplies). We estimated the mean and marginal per capita expenditures (the difference between a reference category and other categories, with respondents who always had a good PPC as the reference category) by using the margins–post and margins–dydx commands, respectively, after the twopm regression command.

**Independent Variables**

**Patient–Provider Communication**

At the midpoint of surveys each year, MEPS participants respond to questionnaires assessing PPC derived from the CAHPS survey. The responses to the following questions related to PPC was used as primary predictor variable in the study: (1) how often healthcare providers explained things in a way that was easy to understand? (2) how often providers showed respect for what you had to say? (3) how often providers spent enough time with you? (4) how often providers listened carefully to you? The responses were provided on 4-point Likert scale: 1-never, 2-sometimes, 3-usually, and 4-always. After CAHPS recommendations, never and sometimes were combined to give a single variable labeled never/sometimes. The responses were therefore recoded and labeled as 1-never/sometimes, 2-usually, and 3-always. We added the responses to these 4 questions which yielded a total score ranging from 4 to 12 and subsequently developed a

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![Flow chart of study participant selection process. ASCVD indicates atherosclerotic cardiovascular disease; and PPC, patient–provider communication.](http://circoutcomes.ahajournals.org/doi/figure/10.1161/CIRCOUTCOMES.117.002908)
weighted average response from 1 to 3 with 1-indicating poor PPC, 2-indicating an average PPC, and 3-indicating optimal PPC). These 4 questions from the CAHPS survey have been recommended by the CAHPS consortium as a measure of patient experience on how well they communicate with their healthcare providers, and these are also components of the ALERT model (Always, Listen Carefully, Explain Things Understandably, Respect What the Patient Has to Say, Time Management), designed to help physicians recall the CAHPS questions.12

Covariates
Sociodemographic information was also obtained from the MEPS full-year consolidated file. Some of the variables accounted for in our adjusted analyses included age, sex, race/ethnicity, insurance coverage, level of income, region, cardiovascular modifiable risk factors, and comorbid conditions. Income level was based on family income level as proportion of federal poverty level (FPL): poor (<100 to <125% FPL), low income (125% to <200% FPL), middle income (200% to <400% FPL), and high income (≥400% of FPL). We defined modifiable risk factors for cardiovascular diseases by using the self-reported responses of participants to the communications-related questions from the CAHPS survey and the overall composite score for PPC developed from these responses, the χ² test was used to examine differences in outcomes of these persons with ASCVD. Because data on expenditure are usually right skewed (ie, most expenditures are seen in just a fraction of the population), we used 2-part models to study the healthcare expenditures. Two-part models are often used to model healthcare expenditures. They are the product of the mean expenditure and the probability that any given individual had any expenditures. Just as the name implies, this model has 2 parts: the first part of the model consists of a probabilistic regression model (probit), which provides an estimate of the probability of zero versus positive expenditures. Relying on the probability of having a positive annual healthcare expenditure, a generalized linear model with gamma distribution and a logarithmic link function extrapolate the average expenditure per capita. The distribution of the generalized linear model is determined by using the modified park test. We conducted 2 models of regression analysis using each of the various outcomes of interest as a binary variable and the composite score for PPC as the primary predictor. Model 1 was a univariate regression analysis, and in model 2, we included adjustments for age, sex, race, region, level of income, health insurance, comorbidities, and modifiable risk factors of ASCVD. We used a 2-part model to analyze the difference in healthcare expenditure with respect to the PPC composite scores among the respondents. We used 95% confidence intervals (CIs), odds ratios (OR), and a 2-sided P value <0.05 to estimate the level of statistical significance.

Results
The total study sample consisted of 6810 participants ≥18 years of age (65±14 years, 46% female), which translates to about 18 million US adults with ASCVD reporting access to usual source of care. Overall, 43%, 32%, and 25% of study participants reported efficient, intermediate, and poor PPC, respectively. As shown in Table 1, lower PPC was significantly associated with younger age, ethnic minority race/ethnicity, and absence of health insurance coverage.

Patient-Reported Outcomes
According to the physical and mental health component score derived from the 12-item Short Form version 2, 58.9% of ASCVD patients who communicated efficiently with their healthcare providers and 74.3% of those who reported poor PPC had a poor physical health component score (P<0.01). About 26.4% of the participants who reported good PPC and 48.3% of those reporting poor PPC had a poor mental health component score (P<0.01; Table 2). As shown in Table 3, both univariate and multivariate regression analyses reveal an inverse relationship between the effectiveness of PPC and the likelihood of reporting a poor physical and mental health among ASCVD patients. When compared with individuals reporting optimal PPC, those who reported an average PPC had a 44% higher likelihood of reporting a poor state of physical health (OR, 1.46; 95% CI, 1.24–1.72). Furthermore, those with poor PPC were twice more likely to rate their state of physical health as poor (OR, 2.28; 95% CI, 1.86–2.79). A similar trend is also seen with PPC and mental health score (Table 3). In addition, Figures I through IV in the Data Supplement demonstrate comparable results across all individual PPC responses. Table IB in the Data Supplement shows the correlation across all PPC responses, the strongest being between the responses to the questions how often providers listened carefully to you? and how often providers showed respect for what you had to say? (R²=0.64).

Quality of Care Indicators
Overall, 58% and 64% of ASCVD patients reported utilization of statins and aspirin, respectively. Poor PPC was inversely related to use of statins/aspirin among patients with ASCVD (Table 3). After adjustments for other covariates, compared with ASCVD patients reporting optimal PPC, those reporting poor PPC were at least 50% (OR, 1.52; 95% CI, 1.26–1.83) more likely to report that they had not been prescribed or using statins. They were also less likely to report aspirin usage (Table 3).

Health Resource Utilization and Expenditures
In a similar fashion, patients reporting poor PPC were more likely to report higher rates of emergency department visits and hospitalization. As shown in Table 3, in the unadjusted model (model 1), ASCVD patients had a 46% (OR, 1.46; 95% CI, 1.15–1.84) higher chance of visiting the emergency room at least twice in the study year and a 42% (OR, 1.42; 95% CI, 1.08–1.87) higher likelihood of being hospitalized ≥2× if they reported a poor PPC relative to those with optimal communication with their providers. The effect was attenuated after adjustments for other covariates (model 2) to 41% (OR, 1.41; 95% CI, 1.09–1.81) and 36% (OR, 1.36; 95% CI, 1.04–1.79), respectively. Also, ASCVD participants reporting poor PPC tend to spend more on health care annually. Accounting for confounding variables, those with poor PPC spent an average of $1243 (95% CI, $127–$2359) more on health care annually.
Using data representing over 18 million US civilian noninstitutionalized adults with ASCVD, we were able to describe the relationship between PPC and a wide range of health outcomes. After the growing interest in patient engagement and how this affects the delivery of quality and affordable health care, as well as its influence on healthcare outcomes, mounting evidence suggests that patient engagement tends to be associated with better health outcomes and the use of less expensive but effective health interventions. Given the study population, this study which is to the best of knowledge the first of its kind suggests the likely effects of PPC on an array of health outcomes, including healthcare expenditure and resource utilization and the use of evidence-based therapies, quality of care, and patient physical/mental health rating among ASCVD patients.

Some studies have suggested that the overall patient-centered care has a positive impact on a patient’s physical health, mental health, and overall health outcome. This is consistent with the results in our study because we demonstrated that effective communication between patients and providers was associated with an improved perception of physical and mental health among ASCVD patients. This may be as a result of mutual participation and control between patients and healthcare providers, as well as the provision of an enabling environment where the patients feel empowered, respected, and heard, hence influencing their health outcomes positively. However, the differences in health outcomes that could be attributed to PPC may be difficult to determine because there could be other underlying factors contributing to these observed differences.

With the growing amount of evidence suggesting an association between patient–provider relationship and adherence to medication, the results from this study further bolster this point by demonstrating an association between utilization of standard of care treatment regimens (statins and aspirin) among ASCVD patients and PPC. Beach et al. also described similar findings in a cross-sectional study exploring patient–provider relationship and its possible influence on medication adherence and health outcomes. These findings highlight the potential role PPC can impart on improving the quality of care and the health outcomes of patients. Efficient patient care is a holistic approach, and an improvement in the communication between patients and healthcare providers now seems to be very pertinent in the attainment of positive health outcomes.

Our results show an increased health resource utilization among patients who communicated poorly with their healthcare providers. Although this observation was attenuated when we considered the relationship between PPC and any emergency visit or inpatient hospitalization (Table II in the Data Supplement), the association of poor PPC was significant with higher levels of resource utilizations (Table 3). There was also a higher annual healthcare expenditure among patients who reported poor communication with their healthcare providers. Similar findings in a randomized trial of patients and physicians, examining the physician practice styles, the patient–provider interaction, and the associated health outcomes. This revealed a significantly reduced number of annual specialist care visits and hospitalizations, fewer use of diagnostic and laboratory procedures, and a decrease in the total medical charges among patients with better interaction with their healthcare providers. The lower healthcare resource
utilization with optimal PPC was also reflected in terms of annual healthcare expenditures. Although we were unable to study the possible mechanisms that could be responsible for this association, it is suggested in literature that optimal PPC by enhancing better exchange of pertinent information, emphasizing shared decision making processes, and by mitigating uncertainties on patients underlying conditions may potentially lower unnecessary health resource utilization and ultimately healthcare expenditure.18 Our findings slightly differ from an earlier report by Fenton et al19 that suggested that although patient satisfaction was related with lower healthcare utilization, it was also associated with slightly higher annual healthcare expenditures. It is important to recognize that though PPC may correlate to provider satisfaction, they are likely distinct domains of patient-reported healthcare experiences. Although patient satisfaction can be enhanced with better PPC, it also correlates with unrelated processes such as the extent to which the clinician fulfills the patients’ respects. Although patient satisfaction can be enhanced with better PPC, it also correlates with unrelated processes such as the extent to which the clinician fulfills the patients’ respects.

Although previous studies have shown a relationship between PPC and patient health outcomes, little explanation of the key factors responsible for this association was given probably because it is still largely poorly understood.16,21–25 Heisler et al26 reported an association between an effective PPC and better self-management of diabetes mellitus among the geriatric population, likely related to improved patient’s understanding and subsequently motivation to follow recommendations provided by their physicians. Pivotal studies in recent years have also highlighted an association between PPC and medication refill adherence and the effect of PPC and shared decision making on blood pressure control among diabetic patients.27–28 Despite the extensive body of literature geared toward promoting an effective patient–provider interaction as a measure to improve overall medical care and outcomes,29–31 some unanswered questions surrounding the precise mechanism for this phenomenon still remain. Recently, Street et al25 attempted to provide some plausible explanations for this reported association via direct and indirect pathways between PPC and health-reported outcomes. The more likely explanation is that an effective PPC could yield better patient understanding of their medication condition, trust and confidence in their healthcare providers, mutual agreement, and thus motivation, adherence to medication and commitment to treatment.25 These could lead to potential improvements in the health status of the patients and a better perception of their health, hence reduce the need for unnecessary investigations, downstream resource utilization, and ultimately lowering healthcare expenditure.

This study findings need to be interpreted in the context of the following limitations. The data from MEPS were collected from noninstitutionalized US adult population hence the results reported here only represent this population. The cross-sectional design of MEPS makes it impossible to establish a cause and effect relationship between PPC and health outcomes. It is also important to note that our sample population included participants with a self-reported diagnosis of ASCVD, hence there is a risk of underestimation of the cohort size. Although self-reported measures of patient-reported experiences and outcomes have been shown to have a high internal validity, there is a chance of recall bias, and the veracity of all self-reported information cannot be confirmed. Although we accounted for factors that may impact PPC, including sociodemographic characteristics,
Table 3. Odds Ratios for Health Outcomes Using PPC and Other Covariates as Explanatory Variables, Among US Adults Aged 18 Years and Older With Established Atherosclerotic Cardiovascular Disease, Medical Expenditure Panel Survey 2010 to 2013

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<th>PPC</th>
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<td>Average</td>
<td>Poor</td>
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<td>Patient-reported outcomes</td>
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<td>SF-12 Physical health score (OR of poor PHS [95% CI])</td>
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<td>1.46 (1.24–1.72)</td>
<td>2.28 (1.86–2.79)</td>
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<tr>
<td>SF-12 Mental health score (OR of poor MHS [95% CI])</td>
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<tr>
<td>Model 1 Ref</td>
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<td>OR of no statin use (95% CI)</td>
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<td>Model 1 Ref</td>
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<td>OR of no aspirin use (95% CI)</td>
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<tr>
<td>OR of ≥2 emergency room visits (95% CI)</td>
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<td>OR of ≥2 inpatient hospital stay (95% CI)</td>
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<td>Annual healthcare expenditures</td>
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<td>$1243 (127 to 2359)</td>
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<tr>
<td>Model 2 Ref</td>
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Model 1: Unadjusted OR. Model 2: OR adjusted for age, sex, race, health insurance, income level, region, modified Charlson comorbidity index, and modifiable risk factors. CI indicates confidence interval; MHS, Mental Health Score; OR, odds ratio; PHS, Physical Health Score; PPC, patient–provider communication; and SF-12, 12-item Short Form.

Conclusions

To summarize, this study explores the potential influences of PPC on a wide spectrum of health outcomes among a representative adult population with established ASCVD in the United States. These findings further contribute to the growing body of evidence, suggesting that an effective interaction between patients and their healthcare providers is associated with better health outcomes and the use of more cost-effective health interventions. These results should stimulate patient-centered research to further explore potential factors that will facilitate effective communication between patients and their healthcare providers and incorporation into the routine healthcare delivery process.

Disclosures

Dr Nasir is on the advisory board for Quest Diagnostic and a consultant for Regeneron. Mr. Keeley is the President & Chief Executive Officer of Baptist Health South Florida. Dr Krumholz has research agreements with Medtronic and Johnson & Johnson through his institution; is a member of the scientific advisory board for UnitedHealth; and is founder of Hugo.

References

4. Remmers C, Hibbard J, Mosen DM, Wagenfeld M, Heye RE, Jones C. Is patient activation associated with future health outcomes and socioeconomic status, and comorbidities, we cannot rule out residual confounding secondary to other additional determinants. Furthermore, as a measure of the quality of care among ASCVD patients, we were limited to self-reported use of statins and aspirin. We could not account for possible contraindications to the use of these medications among non-users and because of paucity of information, in addition to other well-defined clinical performance and quality of care indicators that may impact the health-reported outcomes. It is also paramount to note that the use of the CAHPS survey as a measure of patient-reported experience of PPC is not devoid of limitations. The accuracy of its application and survey design may raise questions concerning the credibility of the feedbacks provided by the respondents. This is because the timeliness of the survey may affect the responses provided by the participants, and the possibility of recall bias cannot be excluded. Conversely, some individuals may report their healthcare experience based on the perception of their health status rather than an objective evaluation of the interaction they had with their healthcare providers. However, the association between PPC and health outcomes among the studied population persisted even accounting for underlying CVD risk factors and burden of comorbid conditions. Finally, our study findings may not apply to about 8% of ASCVD patients who responded to the PPC-related questions but did not report a usual source of care. They were excluded from the analysis to limit recall bias related to the PPC questions. It is important to note that including these individuals in a subanalysis did not impact the overall results (Table III in the Data Supplement).
Patient–Provider Communication and Health Outcomes Among Individuals With Atherosclerotic Cardiovascular Disease in the United States: Medical Expenditure Panel Survey 2010 to 2013


Circ Cardiovasc Qual Outcomes. 2017;10:
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Data Supplement (unedited) at:
http://circoutcomes.ahajournals.org/content/suppl/2017/04/03/CIRCOUTCOMES.117.003635.DC1

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SUPPLEMENTAL MATERIAL
**Supplementary table 1a: Communications related questions from CAHPS used in MEPS.**

<table>
<thead>
<tr>
<th>PATIENT-PROVIDER COMMUNICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How often healthcare providers explained things in a way that was easy to understand? 1-never, 2-sometimes, 3-usually, 4-always</td>
</tr>
<tr>
<td>2. How often providers showed respect for what you had to say? 1-never, 2-sometimes, 3-usually, 4-always</td>
</tr>
<tr>
<td>3. How often providers spent enough time with you? 1-never, 2-sometimes, 3-usually, 4-always</td>
</tr>
<tr>
<td>4. How often providers listened carefully to you? 1-never, 2-sometimes, 3-usually, 4-always</td>
</tr>
</tbody>
</table>

**Supplementary table 1b: Correlation ($R^2$) between responses to communications related questions provided by US adults aged 18 years and older with established ASCVD, MEPS 2010-2013**

<table>
<thead>
<tr>
<th>Explained things</th>
<th>Showed respect</th>
<th>Spent enough time</th>
<th>Listened carefully</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explained things</td>
<td>1 X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Showed respect</td>
<td>0.63 1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Spent enough time</td>
<td>0.60 0.63 1</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Listened carefully</td>
<td>0.62 0.64 0.60</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
**Supp. Table 2: Variations (including Odds ratios) in health resource utilization, using patient provider communication and other covariates as explanatory variables, among US adults aged 18 years and older with established ASCVD, MEPS 2010-2013**

<table>
<thead>
<tr>
<th>PATIENT-PROVIDER COMMUNICATION</th>
<th>Optimal</th>
<th>Average</th>
<th>Poor</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Healthcare resource utilization (HRU)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any emergency room visits [Yes % (95% CI)]</td>
<td>27.2 (25.19-29.33)</td>
<td>28.6 (26.18-31.12)</td>
<td>31.8 (29.28-34.43)</td>
<td>0.02</td>
</tr>
<tr>
<td>OR for any emergency room visits [Yes vs No (95% CI)] *</td>
<td>Ref</td>
<td>1.07 (0.92-1.24)</td>
<td>1.25 (1.06-1.46)</td>
<td></td>
</tr>
<tr>
<td>OR for any emergency room visits [Yes vs No (95% CI)] **</td>
<td>Ref</td>
<td>1.05 (0.90-1.22)</td>
<td>1.19 (1.01-1.43)</td>
<td></td>
</tr>
<tr>
<td>Any Inpatient Hospital Stay [Yes % (95% CI)]</td>
<td>24.0 (21.91-26.24)</td>
<td>24.4 (22.19-26.72)</td>
<td>26.7 (24.38-29.25)</td>
<td>0.23</td>
</tr>
<tr>
<td>OR for any Inpatient Hospital Stay [Yes vs No (95% CI)]*</td>
<td>Ref</td>
<td>1.02 (0.87-1.19)</td>
<td>1.16 (0.97-1.38)</td>
<td></td>
</tr>
<tr>
<td>OR for any Inpatient Hospital Stay [Yes vs No (95% CI)]**</td>
<td>Ref</td>
<td>1.01 (0.86-1.18)</td>
<td>1.12 (0.93-1.35)</td>
<td></td>
</tr>
</tbody>
</table>

OR: Odds Ratio  
* unadjusted  
** adjusted for age, sex, race, health insurance, level of income, region, modified charlson comorbidity index, modifiable risk factors
### Supp. Table 3: Odds ratios for health outcomes using patient provider communication and other covariates as explanatory variables, among US adults aged 18 years and older with established ASCVD with and without a usual source of care, MEPS 2010-2013

<table>
<thead>
<tr>
<th>PATIENT-PROVIDER COMMUNICATION</th>
<th>Optimal</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient reported outcomes (PRO)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SF-12 Physical health score [OR of poor PHS(95% CI)]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.34 (1.14-1.52)</td>
<td>2.05 (1.74-2.44)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.45 (1.23-1.70)</td>
<td>2.35 (1.92-2.86)</td>
</tr>
<tr>
<td><strong>SF-12 Mental health score [OR of poor MHS(95% CI)]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.45 (1.27-1.66)</td>
<td>2.70 (2.29-3.19)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.56 (1.34-1.81)</td>
<td>2.58 (2.16-3.09)</td>
</tr>
<tr>
<td><strong>Quality of care Indicators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OR of no Statin use (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.03 (0.88-1.19)</td>
<td>1.57 (1.34-1.85)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.05 (0.90-1.23)</td>
<td>1.49 (1.25-1.77)</td>
</tr>
<tr>
<td><strong>OR of no Aspirin use (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.02 (0.86-1.19)</td>
<td>1.42 (1.22-1.67)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.04 (0.88-1.23)</td>
<td>1.28 (1.09-1.49)</td>
</tr>
<tr>
<td><strong>Healthcare resource utilization (HRU)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OR of ≥ 2 emergency room visits (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.35 (1.08-1.69)</td>
<td>1.43 (1.14-1.79)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.35 (1.07-1.69)</td>
<td>1.37 (1.08-1.74)</td>
</tr>
<tr>
<td><strong>OR of ≥ 2 Inpatient Hospital Stay (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>1.18 (0.92-1.52)</td>
<td>1.34 (1.03-1.75)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>1.14 (0.87-1.49)</td>
<td>1.29 (1.00-1.68)</td>
</tr>
<tr>
<td><strong>Annual Healthcare Expenditures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>mean annual healthcare expenditures in dollars (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>$1661 (382 to 2941)</td>
<td>$2241 (269 to 4213)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>$1071 (190 to 1,952)</td>
<td>$1,183 (114 to 2252)</td>
</tr>
<tr>
<td><strong>Annual Out of pocket Healthcare Expenditures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean difference in cost in dollars (95% CI)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td>Ref</td>
<td>$112 (-58 to 282)</td>
<td>$129 (-184 to 442)</td>
</tr>
<tr>
<td>Model 2</td>
<td>Ref</td>
<td>$74 (-73 to 222)</td>
<td>$100 (-115 to 315)</td>
</tr>
</tbody>
</table>

SF-12: short form version 12
Model 1: Unadjusted odds ratio
Model 2: Odds ratio adjusted for age, sex, race, health insurance, income level, region, modified charlson comorbidity index, modifiable risk factors
Fig 2: Showed respect

- **Poor Physical Health Component Score**
  - Never/sometimes: 70%
  - Usually: 70%
  - Always: 62%

- **Poor Mental Health Component Score**
  - Never/sometimes: 98%
  - Usually: 40%
  - Always: 29%

- **Frequent Use of Statins: No**
  - Never/sometimes: 63%
  - Usually: 46%
  - Always: 39%

- **Frequent Use of Aspirin: No**
  - Never/sometimes: 40%
  - Usually: 41%
  - Always: 34%

- **2 or More Emergency Room Visits**
  - Never/sometimes: 15%
  - Usually: 11%
  - Always: 9%

- **2 or More in Patient Admissions**
  - Never/sometimes: 11%
  - Usually: 8%
  - Always: 7%

- **Mean Annual Healthcare Expenditure (US Dollars)**
  - Never/sometimes: 14,975
  - Usually: 15,923
  - Always: 13,779

- **Mean Annual Healthcare Out of Pocket Expenditure (US Dollars)**
  - Never/sometimes: 1286
  - Usually: 1628
  - Always: 1416
**POOR PHYSICAL HEALTH COMPONENT SCORE**

- Never/sometimes: 78%
- Usually: 69%
- Always: 60%

**POOR MENTAL HEALTH COMPONENT SCORE**

- Never/sometimes: 39%
- Usually: 37%
- Always: 29%

**Fig 3: Spent enough time**

**2 OR MORE EMERGENCY ROOM VISITS**

- Never/sometimes: 15%
- Usually: 10%
- Always: 9%

**2 OR MORE IN PATIENT ADMISSIONS**

- Never/sometimes: 12%
- Usually: 7%
- Always: 7%

**FREQUENT USE OF STATINS: No**

- Never/sometimes: 62%
- Usually: 45%
- Always: 39%

**MEAN ANNUAL HEALTHCARE EXPENDITURE (US DOLLARS)**

- Never/sometimes: $16388$
- Usually: $14822$
- Always: $13889$

**MEAN ANNUAL HEALTHCARE OUT OF POCKET EXPENDITURE (US DOLLARS)**

- Never/sometimes: $1417$
- Usually: $1488$
- Always: $1463$
Fig 4: Listened carefully

POOR PHYSICAL HEALTH COMPONENT SCORE

- Never/sometimes: 75%
- Usually: 71%
- Always: 62%

POOR MENTAL HEALTH COMPONENT SCORE

- Never/sometimes: 62%
- Usually: 40%
- Always: 29%

FREQUENT USE OF STATINS: No

- Never/sometimes: 54%
- Usually: 45%
- Always: 39%

FREQUENT USE OF ASPIRIN: No

- Never/sometimes: 37%
- Usually: 40%
- Always: 34%

2 OR MORE EMERGENCY ROOM VISITS

- Never/sometimes: 15%
- Usually: 11%
- Always: 9%

2 OR MORE IN-PATIENT ADMISSIONS

- Never/sometimes: 10%
- Usually: 9%
- Always: 7%

MEAN ANNUAL HEALTHCARE EXPENDITURE (US DOLLARS)

- Never/sometimes: 16025
- Usually: 16051
- Always: 13727

MEAN ANNUAL HEALTHCARE OUT OF POCKET EXPENDITURE (US DOLLARS)

- Never/sometimes: 1500
- Usually: 1588
- Always: 1419
KEY/LEGEND FOR SUPPLEMENTAL FIGURES

Figure 1: Variation in health reported outcomes by the responses to the question “how often healthcare providers explained things in a way that was easy to understand?”, among US adults aged 18 years and older with established ASCVD, MEPS 2010-2013.

Figure 2: Variation in health reported outcomes by the responses to the question “how often providers showed respect for what you had to say?” among US adults aged 18 years and older with established ASCVD, MEPS 2010-2013.

Figure 3: Variation in health reported outcomes by the responses to the question “how often providers spent enough time with you?” among US adults aged 18 years and older with established ASCVD, MEPS 2010-2013.

Figure 4: Variation in health reported outcomes by the responses to the question “how often providers listened carefully to you?” among US adults aged 18 years and older with established ASCVD, MEPS 2010-2013.