The HealthLink Wellness Approach: A Test of the Patient-Centered Medical Home

Final Report

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I. HEALTHLINK WELLNESS OVERVIEW

According to the 2010 Annual Medicare Report, the Medicare Hospital Trust Fund is expected to pay more in benefits than it receives in Medicare taxes and dedicated revenues. With the difference being made by general revenues, it is anticipated that the Medicare Hospital Trust Fund will be exhausted by 2017, at which time, the aging population in the United States will be almost double of what it is today. In fact, it is projected that 1 out of every 5 Americans will be 65 years of age or older.

Further, a recent article in the *New England Journal of Medicine* (Volume number 360, issue number 14) reported that 1 in 5 Medicare patients were readmitted to inpatient hospital settings within a month of discharge. This was partly because of the fact that patients who had more complex health histories and had chronic conditions were not receiving adequate education, outreach, and support to manage conditions such as diabetes, high blood pressure, and high cholesterol on a daily basis.

Therefore, it is critical to begin to devise a long-term solution in order to change the current disease/treatment health care delivery system to a proactive preventive model of care. In order to achieve this, a community-based model of care must be developed in order to facilitate health education, outreach, and health awareness among our aging population. This network would involve primary care physicians interacting with community-based resources to reach populations outside of traditional health care settings in an effort to transfer critical health-related information in a setting that is familiar and comfortable for the patient. In this way, a culture of prevention can be developed in which the home, community, and medical office work together as a team.

A. Background

The goal of the project outlined in this report was to build on the past success of the HealthLink Wellness project, which is a partnership between the Rhode Island Alliance for Retired Americans and Boston University. It is a model of prevention and early detection for senior citizens that can be implemented in a variety of community settings, including labor union halls and senior citizen centers. Project interventions focus on increasing social support through consistent contact, ongoing support, and regular screening, follow-up, and feedback. As in the past, labor union retiree chapters and other senior citizen activist groups were recruited to help promote this prevention program.

A Centers for Disease Control and Prevention (CDC)-funded project conducted between 2001 and 2004 documented improvement in several risk factors for heart disease and diabetes. The measures recorded were blood glucose levels, cholesterol levels, and hypertension. Table 1 below is a statistical summary of the 624 individuals who participated in that screening and wellness program. The category “at risk” represents the proportion of those individuals who were screened that warranted the designation as at risk for coronary heart disease (CHD) as determined by a mathematical model developed by the Framingham Heart Study (FHS). As the table shows, all risk categories experienced a substantial improvement between the first screening and the final screening 3 years later.

Table 1. Statistical Summary of Individuals (n = 624) Participating in the CDC Screening and Wellness Program

	Blood glucose	Cholesterol	Blood pressure
1. At risk at the beginning of the program	49%	52%	61%
2. At risk at end of program	25%	29%	48%
3. Percent improvement	24%	23%	13%

Table 1 indicates there was a 24% improvement in blood glucose, 23% improvement in cholesterol, and 13% improvement in blood pressure. This was actual documented improvement reported to the CDC in measures that are strongly associated with diabetes and heart disease. Since that initial phase, the project had been operating with funds from the Pharmaceutical Industry Labor Management Association (PILMA) and the Pharmaceutical Research and Manufacturers of America (PhRMA) Community Partnership Program, and is currently funded by the CDC Healthy Aging Program. The funding for this version of HealthLink Wellness is for testing new features and incentives to push the potential for net improvement in the health of our membership even further.

One new feature reported here was to test an expansion of HealthLink Wellness's model of community-based longitudinal health promotion and disease prevention. It introduced an approach to cardiovascular risk reduction endorsed by the American College of Physicians (ACP), the American Academy of Family Physicians (AAFP), and the American Osteopathic Association (AOA) called the Patient-Centered Medical Home. As leading organizations in primary care, the ACP, AAFP, and AOA have defined the Patient-Centered Medical Home as a physician-directed multidisciplinary team providing longitudinal management of health promotion and disease prevention by focusing on behavior change, screening tests, and individualized risk reduction interventions. The methodology embodied in that definition is identical to HealthLink Wellness's agenda, except HealthLink Wellness operates in community settings and not the medical office.

The goal was to test the feasibility of recruiting primary care physicians as part of a partnership that links medical office clinical guidance with the backup support of HealthLink Wellness's community-based wellness approach. The Rhode Island Alliance for Retired Americans (ARA), with the assistance of Boston University, supplied the administrative backup for public health screening, health education services, community networking, and communication links to retiree social networks, including retiree clubs and senior citizen centers. The primary care physician's office supplied the appropriate referral network and medical follow-up. The intent was that HealthLink Wellness's community- and physician-based wellness efforts would evolve into a comprehensive community/physician partnership in health care.

B. Project purpose

First initiated by the New England Association of Labor Retirees and Boston University in 2000, the HealthLink Wellness program created a process of providing public health screenings, health education, early detection, and counseling for the aging population of Southern New England. HealthLink Wellness originally was designed to develop a community-based culture of prevention that could:

- Support health education efforts, and increase health literacy among the retiree population
- Engage retirees in health monitoring and health promotional activities in an effort to reduce further health complications and risk
- Develop a network of partnerships that would further promote the program and engage retirees in health-related screening and wellness activities in a community-based setting, such as union halls, senior centers, and church halls

This 3-pronged approach was developed in an effort to further the goals of HealthLink Wellness, while also utilizing social networking opportunities through community-based settings, so that retirees could derive additional support from within their peer groups.

HealthLink Wellness has received enthusiastic response from its participating members throughout the past decade; however, analysis indicated that HealthLink Wellness needed further programmatic refinement in order to fully achieve its primary goal of establishing a healthier population. One refinement was to include primary care physicians into the HealthLink Wellness community network. The intention was to bridge HealthLink Wellness's prevention and wellness efforts with the primary and specialty care services available within the physician community. This, in effect, was to be HealthLink Wellness's version of the Patient-Centered Medical Home. It was hypothesized that there would be a synergy that would improve health outcomes beyond what could be achieved by each resource alone.

It is important to note that the scope of the current project in terms of resources and time available was not sufficient to fully test measurable improvements in health outcomes. Improvements in health outcomes were achieved in past-funded implementations because the time allowed and funds available for program design, outreach, and follow-up were on a much larger scale. The previous CDC-funded project monitored retiree progress for 3 years and included 2 full-time staff members. Given current time and staffing constraints, this phase's primary objective was to be focused on the feasibility of creating and administering HealthLink Wellness's version of the Patient-Centered Medical Home.

II. A NEW WELLNESS MODEL

The goal of this project was 2 pronged. One was to continue with our traditional community-based approach to wellness activities, but to also introduce the Patient-Centered Medical Home. Starting in the fall of 2009 to the spring of 2011, HealthLink Wellness maintained its regular schedule of community-based screenings. At the same time, it started the process of reaching out to the physician community.

A. Community-based screenings

One goal of this project was to continue with the current community-based screenings and health education and counseling. The communities HealthLink Wellness has served since 2000 included 6 locations in Rhode Island and 1 in central Massachusetts.

HealthLink's regional centers:

- Providence, Rhode Island: United Commercial and Food Workers Local 328 Union Hall
- Cranston, Rhode Island: VFW Post 2812
- Warwick, Rhode Island: BPO Elk's Lodge 2196
- Smithfield, Rhode Island: BPO Elk's Lodge 2359
- East Providence, Rhode Island: Teamsters Local 251 Union Hall
- North Providence, Rhode Island: Saint Anthony's Church Hall
- Worcester, Massachusetts: Teamsters Local 170 Union Hall

Since the current initiative intended to incorporate the physician into the wellness approach, it was decided to reduce the number of community screening centers during this phase from the 7 above to 3. This was done to help assure a smooth coordination of community and physician office efforts, and to be within the parameters of available resources.

From September 2009 to August 2011, a series of 4 medical screenings were conducted at 3 regional screening centers in Rhode Island. The screenings included fasting blood glucose, total cholesterol (TC), high-density lipoprotein (HDL) cholesterol, blood pressure, smoking status, and body mass index (BMI). During the screening session, height and weight were measured, and BMI (kg/m^2) was calculated. Blood pressure determination was made, and hypertension was categorized according to blood pressure standards by the National Institutes of Health (NIH) National Heart, Lung and Blood Institute (NHLBI) definitions: normal (systolic <120 mm Hg and diastolic <80 mm Hg), prehypertension (systolic 120–139 mm Hg or diastolic 80–89 mm Hg), and hypertension (systolic ≥140 or diastolic ≥90 mm Hg). Cutoffs for TC were <200 mg/dl (normal), 200–239 mg/dl (borderline), and ≥240 mg/dl (elevated), and cutoffs for HDL were <40 mg/dl (below normal) and >40 mg/dl (normal). Fasting blood glucose was broken down into ≤100 mg/dl (ideal), 100–124 mg/dl (pre-diabetes), and >125 mg/dl (diabetes).

Each of HealthLink Wellness's screenings was promoted throughout the HealthLink Wellness community to engage retirees in a proactive approach in improving their health status. The community HealthLink Wellness screenings provided baseline data for the assessment of the

community-based approach. Further education, outreach, and individual counseling were also provided by health professionals to help participants understand the health risks associated with their personal screening results.

The data collected at the community screening centers were recorded and analyzed as detailed in the performance measures as described in Appendix I and Appendix II. Participants were encouraged to discuss the results of their screenings with their primary care physicians. Throughout the project period, additional health education and outreach were provided to the participants through targeted mailings, publications, newsletters, and local cable network television programming.

B. Medical office–based screenings

Our second goal was to recruit primary care physicians to participate in a Patient-Centered Medical Home program as endorsed by the American Academy of Family Practice (AAFP). The intent was to have them collaborate as seamlessly as possible with the community program. HealthLink Wellness has spent 10 years building up a support environment through various retiree social networks. In this phase, the goal was to build an additional support environment within the physician professional community.

Screening expenses were minimal when compared to most health care services, but medical office participation did involve a commitment of both the doctor and staff time. The CDC budget did include funding allocated to provide financial resources for medical office based administration.

The essential features of the medical office based approach were:

- Physicians participated by recruiting patients as HealthLink Wellness members both to screen patients in their offices and where needed, and to refer them to HealthLink Wellness's social network for community support. Given the amount of resources available, the target number of medical offices was 3, with each enrolling 200 members

- The goal in this approach was to focus on in-office prevention and wellness screening. This included the medical office submitting screening data to HealthLink Wellness that was identical to the community-based screenings. The intention was to maintain a consistent reporting of comparable measurement of health outcomes, both at the community level and at the medical office

- Both the physician and patients were encouraged to also participate in the community screenings. The community screening locations were selected in geographic proximity to the medical office. A significant outcome was that a number of medical office–recruited patients began to also participate in the community screenings. On several occasions, the physicians also stopped by to help in providing participants feedback on their screening outcomes

- Physicians were provided administrative payments for in-office screenings at a unit cost identical to the cost of a community-based screening

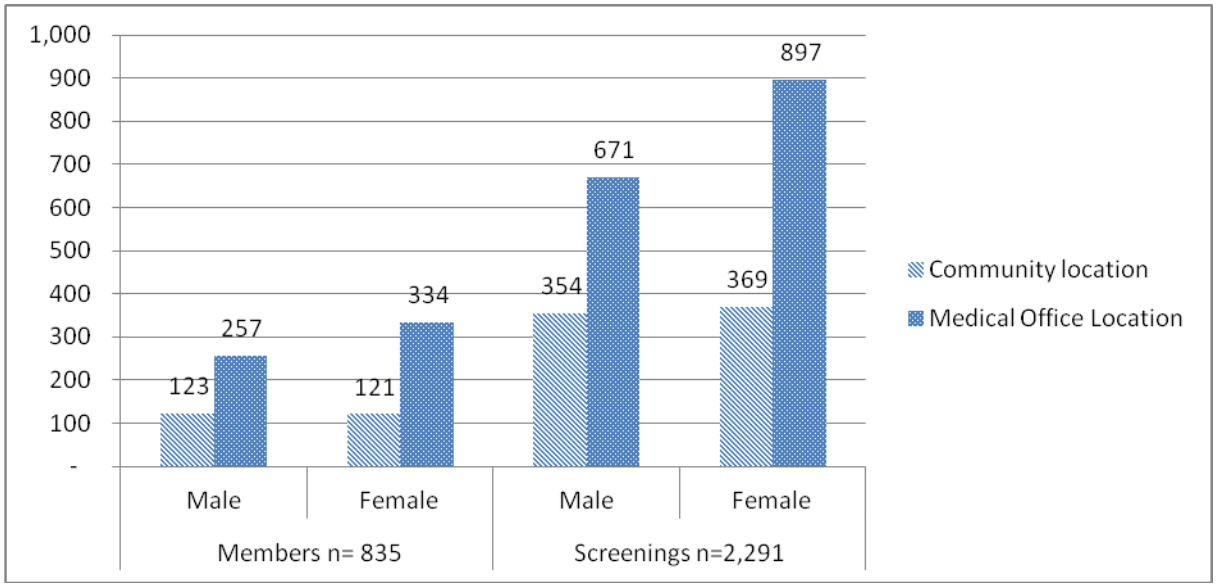
- Other administrative support was in the form of computer-based data entry software and online evidence-based diagnostic tools.

III. PROGRAM OUTCOMES

A. Participants

Exhibit 1. Membership Enrollment and Screenings Performed, Broken Down by Location and Sex

	Members (n = 835)		Screenings (n = 2,291)	
	Male	Female	Male	Female
Community location	123 (51%)	121 (49%)	354 (48%)	369 (52%)
Medical office location	257 (43%)	334 (57%)	671 (40%)	897 (60%)



The total number of individuals who signed up with the screening sessions both from the community and medical offices was 835. For the community-based screenings, the initial data collection started in April 2009. For the medical office–based screening, the starting date for enrollment and screenings was September 2009. The disparity in starting date was because community locations were still operating under an older funding source dedicated to the community setting. The latter date for the medical office screenings was chosen because the Patient-Centered Medical Home started with the current CDC funding, which started in September 2009. Over the 2-year period that ended August 31, 2011, a total of 2,291 screenings

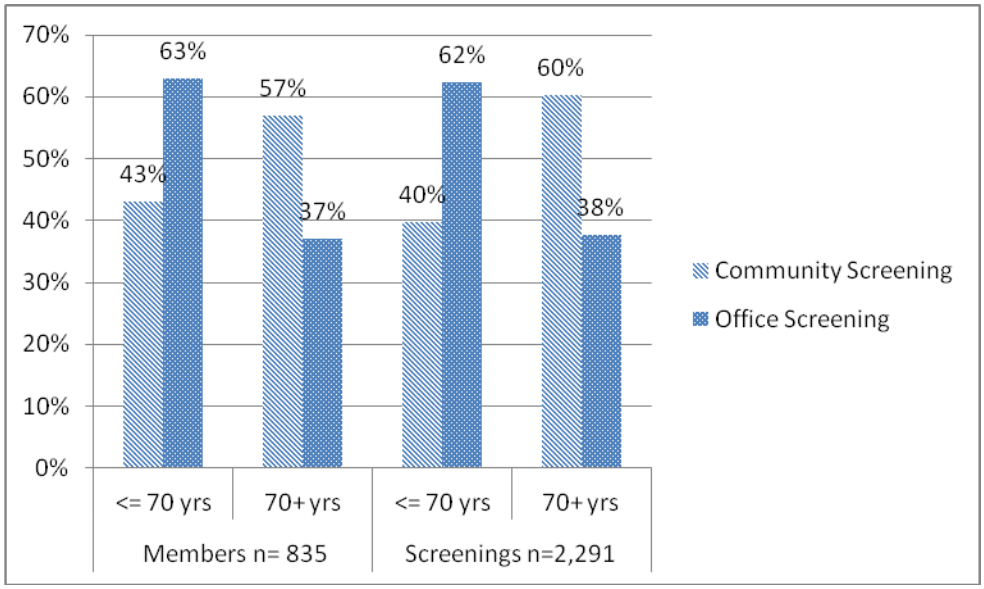
were recorded. The effective time period of observation for the community screenings was 18 months, and for medical office screenings was 13 months.

As also can be seen in Exhibit 1, the community-enrolled participant breakdown by sex was 51% men and 49% women. This was largely because that, in promoting HealthLink Wellness among the various retiree clubs, it was strongly emphasized that membership was open to members and spouses. The medical office location included more women, with a breakdown by sex of 43% men and 57% women. Though it was stated to medical office administrative staff that a spouse is also included, the enrollment process was more clinically oriented to a specific patient. The sex mix of the screenings generated did seem to approximately coincide with the same breakdown as exhibited in the membership breakdown. This indicates that there was not a pronounced disparity in utilization of services between males and females.

Exhibit 2. Age Breakdown by Location*

	Members (n = 835)		Screenings (n = 2,291)	
	≤70 years	>70 years	≤70 years	>70 years
Community screening	43%	57%	40%	60%
Medical office screening	63%	37%	62%	38%

***P* < 0.05**



As Exhibit 2 shows, new members recruited through the medical office were statistically different in terms of age. Sixty-three percent of the medical office–recruited members were ≤70 years of age, while only 43% of the community-based members were ≤70. Once again, there did not seem to be much of a disparity in the utilization of services. The age differential was expected because a significant portion of the community recruitment had been primarily word of mouth passed on by existing members. We do have a fairly large cohort of existing members who have been enrolled since 2001.The sex and age differentials do pose some analytical issues.

Direct statistical comparisons between location of recruitment will have to take into account both sex and age adjustment.

Of the 2,291 screenings recorded, not all were for medical screenings. Also recorded was a screening of each member's self-perception of their physical and mental health. The instrument used was the Short Form 12 (SF-12), which provides a way of comparing an individual's results with population norms. The validity of the SF-12 has been confirmed in more than 3 dozen studies in the United States and other countries. The reliability of its scales and summary measures has been estimated to be at a high level. Unfortunately, because of a time constraint, it was not fully implemented in all of the medical office locations. All subsequent analysis in this report is limited to only medical screenings.

B. Screening results

1. Blood glucose

Exhibit 3. Blood Glucose Screening Results, Broken Down by Initial versus Follow-up and Medical Office Location

	Baseline n = 834			Follow-up n = 1,456		
	Normal	Pre-diabetes	Diabetes	Normal	Pre-diabetes	Diabetes
Community screening*	49%	30%	21%	61%	28%	12%
Medical office screening†	53%	31%	17%	50%	33%	17%

***P* < 0.05**
†*P* = not significant

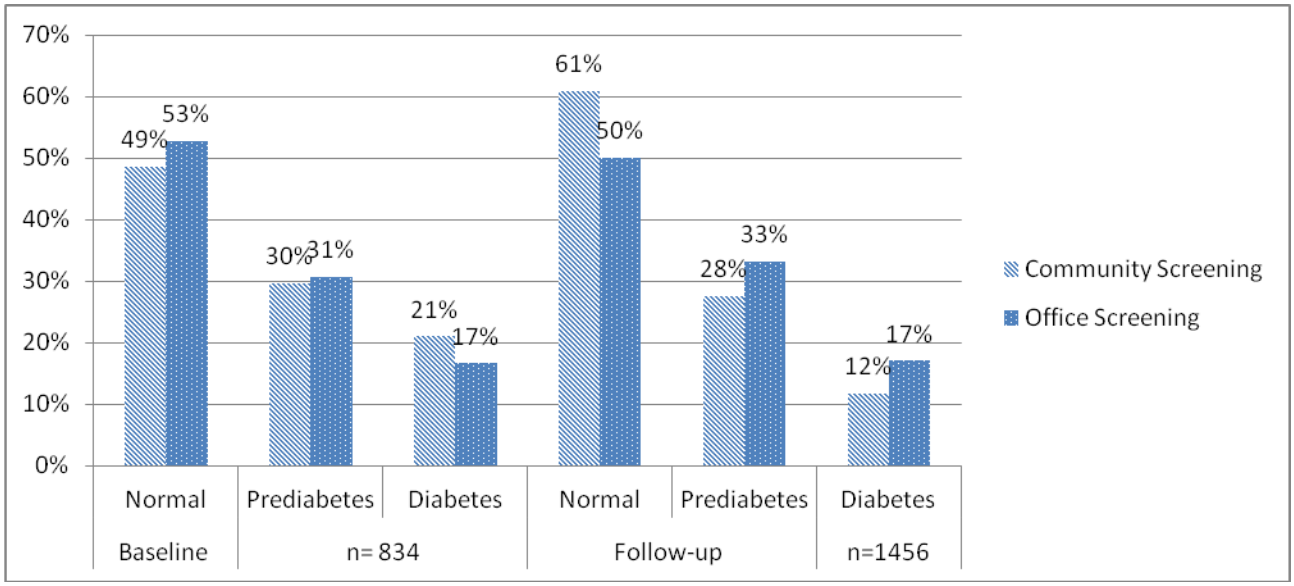


Exhibit 3 outlines the screening results for the community and medical office locations. The screenings are broken down into 2 types: initial baseline screenings and subsequent follow-up

screenings. Baseline represents the first recorded screening for each member, with the total being 834. After the baseline screening, each individual was then followed up with subsequent screenings, which could vary in number from 1 to 3. The follow-up screenings displayed in Exhibit 3 are a composite of all follow-up medical screenings. For example, if a person had 3 screenings, the first was baseline, and the 2 subsequent screenings were used in the follow-up analysis. The average number of screenings per individual was 2.6.

It should be noted that the main reason for the number of individuals with 1 screening was because of time constraints. The time for physician recruitment, and the lag in setting up the administrative procedures, and then recruiting patients cut considerably into the available time to perform both baseline and follow-up screenings.

As Exhibit 3 shows, 49% of community and 53% of medical office baseline screenings were classified as normal and not statistically different. This did take into account whether the blood glucose reading was fasting or not. The vast majority (93%) of the blood glucose readings were at fasting levels. The follow-up screenings for the community-based setting did show a statistical increase of those who were classified as normal, an improvement of 12%.

2. Total cholesterol

Exhibit 4. Total Cholesterol Screening Results, Broken Down by Initial Versus Follow-up and Medical Office Location

	Baseline* (n = 834)			**Follow-up* (n = 1,456)**		
	Normal	Above average	Elevated	Normal	Above average	Elevated
Community screening	78%	17%	5%	81%	15%	4%
Medical office screening	70%	23%	7%	68%	27%	5%

***P* < 0.05**

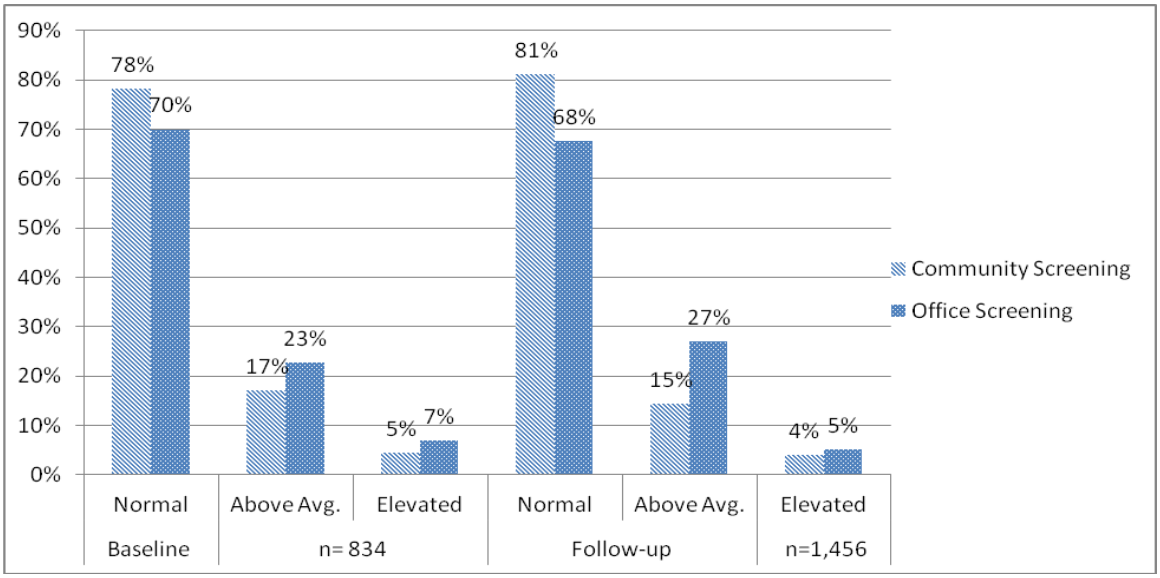


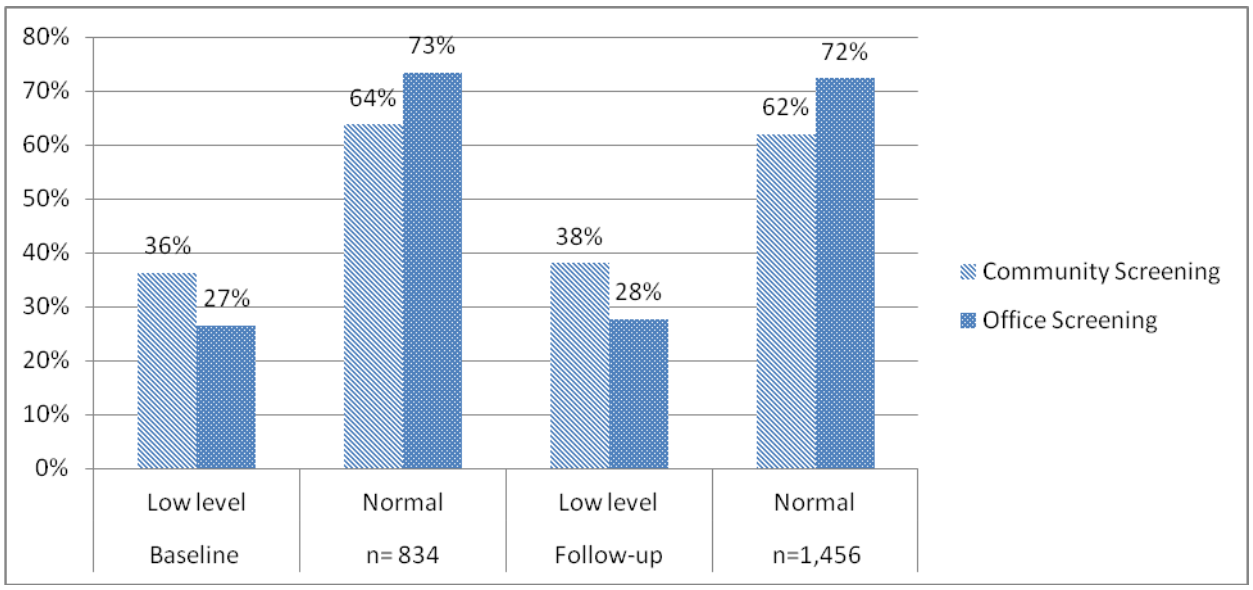
Exhibit 4 shows that there was no statistical change in TC levels between baseline and follow-up; however, there was a statistical difference in cholesterol level based on location. Community-screened members consistently, at baseline and follow-up, scored higher TC levels when compared to medical office–screened members. Of course, this may be caused by the confounding of age with medical office location. These are the raw percentages, and, in themselves, they are valuable for administrative, resource allocation, and targeting purposes.

3. HDL cholesterol

Exhibit 5. HDL Cholesterol Screening Results, Broken Down by Initial Versus Follow-up and Medical Office Location

	Baseline* (n = 834)		**Follow-up* (n = 1,456)**	
	Low level	Normal level	Low level	Normal level
Community screening	36%	64%	38%	62%
Medical office screening	27%	73%	28%	72%

***P* <0.05**



As with TC, HDL cholesterol levels did not change from baseline to follow-up. In this measure, there was also a difference between locations, with medical office locations showing a higher percentage of individuals at baseline as normal (73%) when compared to community locations at baseline (64%). The follow-up screenings exhibited the same differential between medical office locations (72%) and community locations (62%).

From a follow-up perspective, HDL is a difficult blood value to change. It is amenable to exercise and diet, but unlike blood glucose and TC, there is not a specific drug that can target that particular level of lipoprotein. Therefore, it is not unusual to observe a little difference between baseline and follow-up.

4. Hypertension

Exhibit 6. HDL Cholesterol Screening Results, Broken Down by Initial Versus Follow-up and Medical Office Location

	Baseline* (n = 834)			**Follow-up* (n = 1,456)**		
	Normal	Pre-hypertension	Hypertension	Normal	Pre-hypertension	Hypertension
Community screening	10%	46%	44%	12%	48%	41%
Medical office screening*	18%	52%	30%	25%	52%	23%

***P* = 0.05**

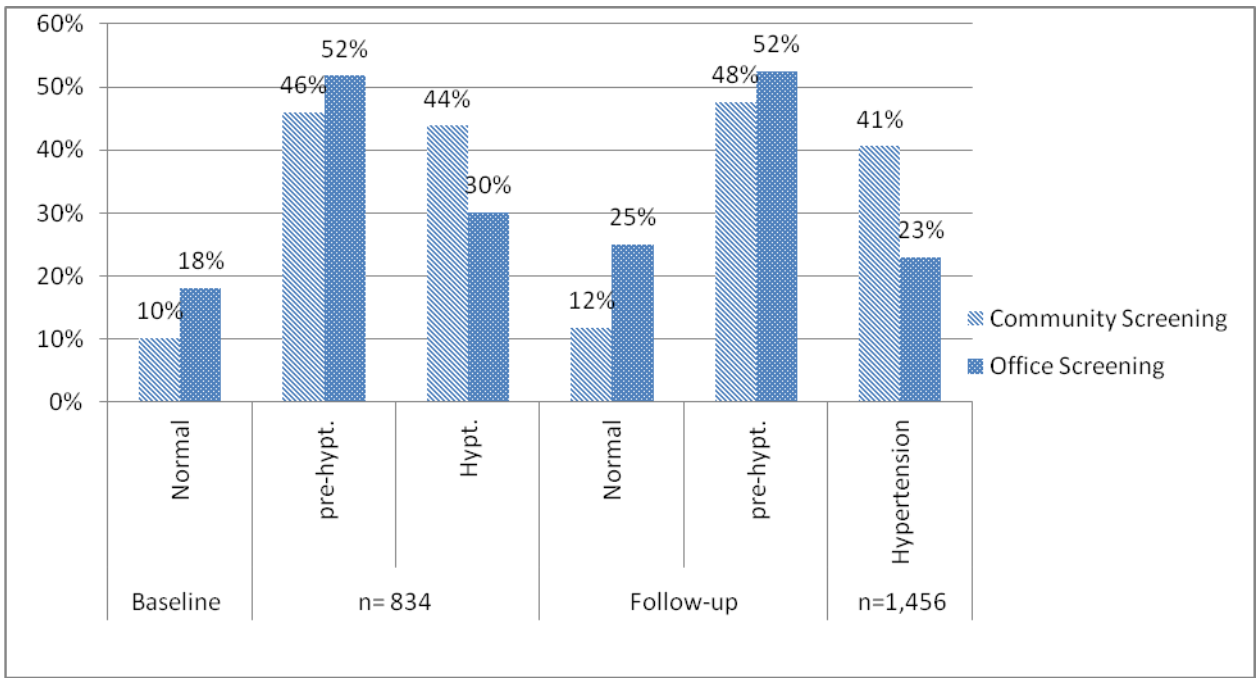


Exhibit 6 indicates there were statistical differences in 2 dimensions. Like the cholesterol measures, there was a statistical difference between the medical office and community location blood pressure results. However, there was also a statistically discernible difference in the number of individuals who exhibited normal blood pressure between baseline and follow-up. This was only for the medical office group, where, at baseline, 18% recorded normal blood pressure and, at follow-up, this increased to 25%. The alpha error for this difference was 5%, which is at the cutoff point.

C. Risk assessment

1. Cardiac risk model

The screening results are, in themselves, very informative, and provide valuable feedback to the participants. How do these results compare to any national norms as they relate to possible disease outcomes? Blood glucose and blood pressure appeared to have worked differently between the medical office and community locations. This makes it important to examine all risk factors collectively. The Framingham Heart Study (FHS) reported on the development of a statistically derived mathematical risk model of Coronary Heart Disease (CHD). The model was derived from a population-based sample that included 2,489 men and 2,856 women 30–74 years of age at the time of their FHS examination from 1971–1974. Participants attended either the 11th examination of the original FHS cohort, or the initial examination of the FHS Offspring Study. Similar research protocols were used in each study. Individuals with overt CHD at the baseline examination were excluded. The statistical tests employed included age-adjusted linear regression or logistic regression to test for trends across blood pressure, TC, low-density lipoprotein cholesterol, and HDL cholesterol categories. Age-adjusted Cox proportional hazards regression and its accompanying C statistic were used to test for the relation between the independent variables listed above and the CHD outcome, and to evaluate the discriminatory

ability of their prediction model. A 12-year follow-up was used in the Cox proportional hazards models, and results were adapted to provide 10-year CHD incidence estimates.

Two sex-specific risk models were developed:

Men: Risk (t) = Risk (0) $e^{(\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots)}$

Women: Risk (t) = Risk (0) $e^{(\beta_1 X_1 + \beta_1 X^2_1 + \beta_2 X_2 \ldots)}$

Formula coefficients ($\beta_1 \ldots \beta_n$) and baseline survival function risk (0) were derived from the FHS risk assessment data. Each risk model was very similar, with the exception those for women. The exponential risk formula contained a square term for age. The exponential component for men was a straightforward linear additive function for all risk factors, while for women, age was a quadratic function and the rest was linear.

HealthLink Wellness collected all the input risk factors required for the FHS CHD risk assessment model using TC as the cholesterol input factor. With this, there was the ability to compare HealthLink Wellness screening–derived CHD risk assessment with a nationally known long-term cohort study as a basis of comparison. The input variables supplied by HealthLink Wellness were:

- X_1: age
- X_1^2: age^2 (for women only)
- X_2: hypertension
- X_3: TC
- X_4: HDLs
- X_5: fasting blood glucose
- X_6: smoking status

The above formula was intended as a diagnostic tool for physicians to use in their practice. The formula calculates a 10-year probability of CHD, and also can be used to calculate an individual patient's relative risk for CHD. HealthLink Wellness analysts stress that what is also needed is a more user-friendly summary of formula results that is easily understandable by our retiree members. One of the purposes of the Risk Profile Index (RPI) was to develop a composite score that retirees can use to monitor their progress. It is very difficult for the lay public to readily assess relative risk measures intertwined with probability estimates. HealthLink Wellness analysts developed a more consumer-friendly index called the Risk Profile Index (RPI). A more complete description of the RPI can be found in Appendix II.

2. RPI results

The previously discussed individual blood and blood pressure screening helped target specific areas of concern, but to determine the overall health status of the membership, the RPI provided a comprehensive health impact measure based on an individual's blood screening and blood pressure measures. The FHS Cox hazard ratio and the RPI did not take into account BMI, which also is a documented health risk factor. HealthLink Wellness assessments were expanded from the original FHS model to include BMI. Below is a regression of the RPI score as the dependent

variable, with location of screening, age of member, BMI, sex, and smoking status as input variables.

Exhibit 7. Multiple Regression Model of Cardiac Risk (RPI)

Dependent variable: **Risk Profile Index**	R = 73% R^2 = 53%			
	Coefficient	**SE**	**t**	***P****
Medical Office **Community -Referent**	–0.0620955	0.00486	–12.79	< 0.001
Age	0.0069195	0.00024	29.4	< 0.001
BMI	0.0036817	0.00038	9.63	< 0.001
Female **Male- Referent**	-0.1680229	0.00445	–37.78	< 0.001
Smoker **Non-Smoker -Referent**	0.1257478	0.00936	13.44	< 0.001

***All input factors are statistically significant**

Exhibit 7 indicates that all input factors (medical office versus community screening, age, BMI, sex, and smoking status) were all statistically associated with cardiac health risk as measured by the RPI. In addition to the significant individual inputs, the overall goodness of fit of the model was also fairly good. A Pearson's correlation of 73% indicated that 53% of the variability of cardiac risk (RPI) is explained by the 5 input factors. The direction of the inputs for Age BMI is consistent with the direction of effect expected, as they increase so does RPI. Medical office and female exhibit lower risk while smoker higher risk.

Exhibit 8. RPI by Location

	Baseline* (n = 834)			**Follow-up* (n = 1,456)**		
	Normal	Above average	Elevated	Normal	Above average	Elevated
Community screening†	48%	27%	26%	50%	25%	25%
Medical office screening*	56%	26%	18%	62%	22%	16%

***P* < 0.05**

†*P* = not significant

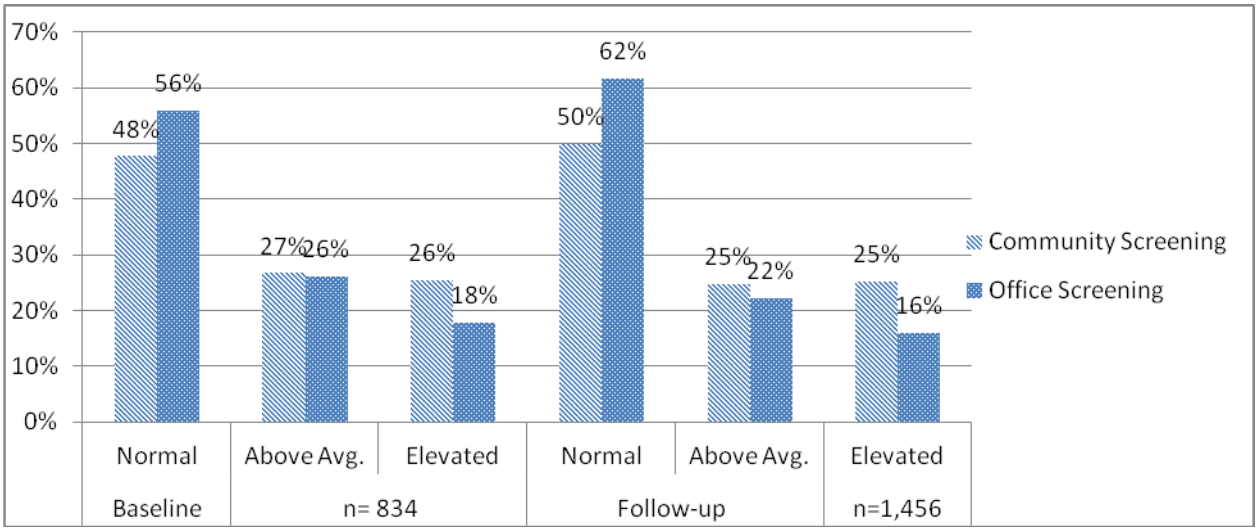


Exhibit 8 examines health status as measured by the HealthLink Wellness RPI. It is important to note that these are raw percentages, so the percentages as displayed are not adjusted for the difference between medical office and community demographic factors, such as age and sex. From an administrative perspective, these values are a guide to the amount of underlying morbidity. This type of knowledge is important to determine where to marshal resources for targeted improvement. As shown, the medical office setting had a statistically higher proportion of individuals in the normal category; however, this can be explained by the fact that members recruited through the medical office tended to be younger than those recruited through the community setting. The difference observed could likely be a function of a difference in age. There was also a statistical improvement in health status from baseline to follow-up, but only for the medical office screenings. This can also be confounded with a differential in demographic and age utilization patterns.

3. Is there a medical office treatment effect?

Is the medical office more efficient in improving risk scores than the community setting? Exhibit 8 seems to show that is the case, but as is shown in Exhibit 2, the observed differences may be caused by a difference in demographics and not based on a more efficient medical office treatment effect. The proper technique to examine changes in risk between the medical office and community settings is to do an age- and sex-adjusted rate comparison.

Age- and sex-adjusted rate analysis began with a redefining of RPI as a dichotomous variable. Any RPI that was above average or elevated was coded as 0 (unhealthy risk scores) and a normal RPI score was coded as 1. Therefore, there was a new dichotomous (0 = unhealthy, 1 = healthy) score for each participant's RPI:

$RPI_{(0,1)}$ ===> 0 = unhealthy (elevated level of risk)
1 = healthy (normal level of risk)

Input variables were:

- X_1: age
- X_2: BMI
- X_3: sex
- X_4: smoking status
- X_5: screening number; 1 = baseline, >1 = follow-up
- X_6: community/medical office location

With the $RPI_{(0,1)}$ dichotomous variable as a dependent variable, there were data available to build a logit probability model of risk with the variables ($X_{1...}X_6$) as independent variables. Listed below in Table 2 are the odds ratios of the logit model's input variables. The model's odds ratios indicated the impact of each factor on the probability of being in the healthy category.

Table 2. Odds Ratios of the Logit Probability Model's Input Variables

Input	Odds ratio
Medical office	1.1241428
Age	0.9869019
BMI	0.924126
Sex	1.7495608
Smoking status	0.0083045
Screening number	1.0532888

The odds ratios indicated the relative impact on risk of each of the independent variables. For example, as age increased, the probability of being in the healthy category decreased; this was also the case for BMI. With sex coded as 0 = male and 1 = female, the odds ratio indicated women had a higher probability of being in the healthy category.

In order to visualize the model, a sex- and age-adjusted tabulation of the RPI was generated. Age was adjusted by keeping it constant to the average age of the total sample of men and women. The tabulation of projected probability of health status was based on the logit prediction model, as indicated by the formula:

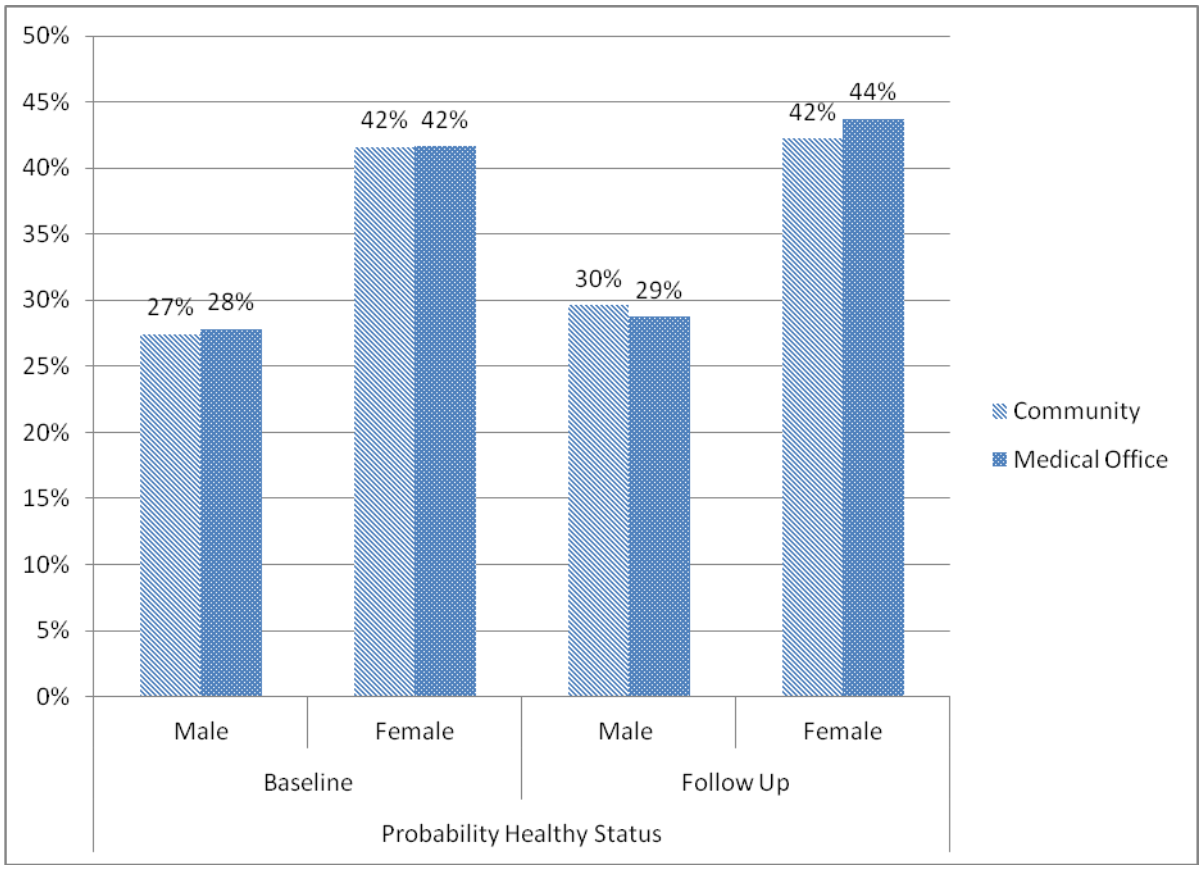
$$\mathbf{P=1 / (1+e^{-Z})}$$

P = probability of healthy RPI
e = base of natural log
Z = linear function of all of the input (X) variables

Exhibit 9. Age- and Sex-Adjusted Probability of Healthy Status

	Probability of healthy status			
	Baseline		Follow-up	
	Male*	Female	Male*	Female
Community screening	27%	42%	30%	42%
Medical office screening	28%	42%	29%	44%

***P* < 0.05**



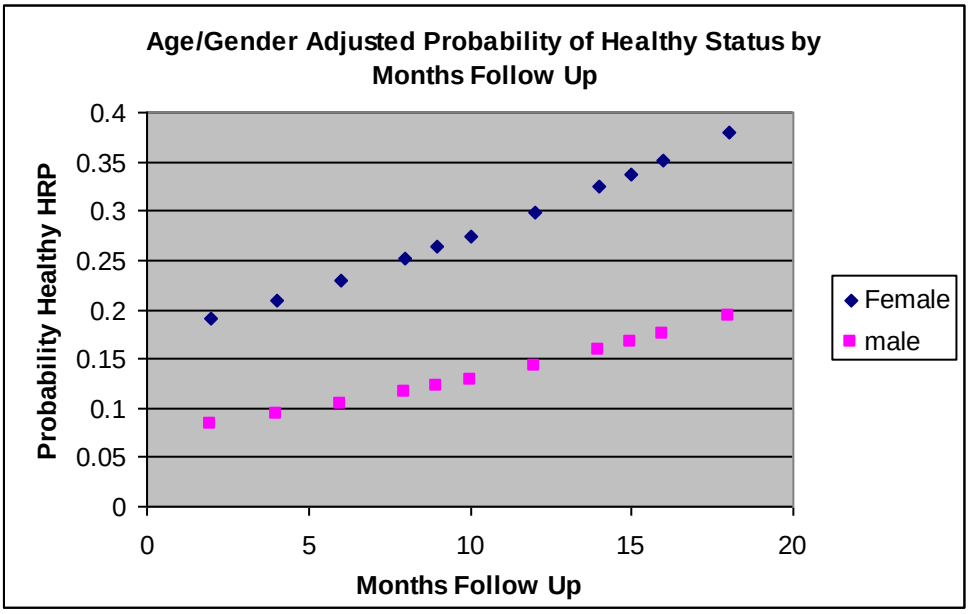
As Exhibit 9 shows, the probability of healthy status between baseline and follow-up was not statistically different when one controlled for age and sex. A statistically significant difference between men and women was observed at both baseline and follow-up. This was not an unusual finding, in that national norms indicate men have a higher prevalence of CHD than women.

IV. CONCLUSION

HealthLink Wellness has completed multiple rounds of screenings. The results were quite informative, in that the level of elevated screenings and, consequently, disease morbidity was quite high and explains why 70% of the United States health care dollars are spent on chronic diseases. True reduction in disease morbidity and, in turn, health care costs can only be realized when our senior citizens make wellness issues a mainstay of their daily lives. In that regard, we

have recorded some successes to date. In our original CDC-funded program, conducted from 2001–2004 with over 4 rounds of screenings, there were observed statistically significant reductions in average TC, glucose levels, and hypertension. The same measure of "probability of healthy status" was also used in that original study. Over a 20-month period, there was an observable improvement in health status as indicated by Figure 1 below.

Figure 1. Age- and Sex-Adjusted Probability of Healthy Status*



* HRP = HealthLink Risk Profile

As Figure 1 shows, for both men and women, the probability of being in the healthy relative risk category went up as a function of months of follow-up. The follow-up period was a surrogate measure for exposure to HealthLink Wellness interventions. Therefore, there was evidence that exposure to HealthLink Wellness interventions was what generated health status improvement. Figure 1 also shows that men registered a lower probability of recording healthy RPI relative risk measures as compared to women at all levels of exposure, which is consistent with our current findings. When examining sex differences in RPI improvement, men started at 9% normal (healthy RPI) and ended at 27% normal at the fourth screening. On the other hand, women started at 25% normal HealthLink Risk Profile, and by the fourth screening, that number increased to 45%. Women had a higher starting point, and exhibited a 20% improvement, while males exhibited an 18% improvement.

Those results were not exhibited in the current study because there were major differences in the goals and scope of the current program. The prior study had 3 years of program interventions. The RPI index was not implemented until the second year of the project. There was a different hospital partner that supplied the experienced staff to proceed with a full range of interventions. Very early in the program, a walking club was implemented at 3 area locations (the Lincoln and Warwick malls, and the East Providence Senior Center Walking Path). In addition, those who walked at other locations called in their activity on a monthly basis. These individuals

maintained their own walking program.

In addition to the walking clubs, a Dietary Approaches to Stop Hypertension (DASH) workshop was started to help deal with the issue of hypertension. It was based on an NIH study that found that an eating plan that included 4–5 servings each of fruits and vegetables, with limited amounts of fats and sodium, could help lower blood pressure in some individuals. A registered dietitian presented a 2-session workshop at 3 of the 6 HealthLink Wellness locations. Participants had their blood pressure taken at the initial session. If they followed the DASH eating plan, they were reviewed again at the second session to see if there was a reduction in their blood pressure. Response to the workshop was encouraging; 160 individuals attended at least 1 session, and 120 individuals attended both sessions. Of the individuals who attended both sessions, 34% saw a decrease in their blood pressure (13% moved into the normal range). Additionally, results of the next community screening, which followed the DASH workshop, did show an improvement in blood pressure results.

The scope of the current program was much narrower in focus both in terms of available resources and length of follow-up, and this, coupled with the primary objective to determine the feasibility of recruiting physicians as part of the HealthLink Wellness process, made the dynamic of the current project different. The initial phase of this project was an outreach to practicing physicians in the Providence, Rhode Island area. Our target of 3 medical offices was met within the first quarter of the project, but the enrollment process took additional time to build a large enough base for statistical analysis. That did cut into the follow-up time for program interventions.

The recruitment of physicians did proceed smoothly, but there was a natural lag before each medical office could get up to speed. Once the physicians were on board, we were able to recruit approximately 600 new members in 4 months. Recruiting that same number through our usual community linkages would require 3–4 times the amount of time. It was an extremely efficient way of outreach, and, in fact, we had to terminate recruiting new enrollees after 4 months because of concerns that our population base would grow well beyond our available resources.

There was another inherent efficiency worth mentioning. When we conducted our community-based screenings, we provided 2 copies of each individual's RPI results, 1 for themselves and the other for their primary care physician. When the physicians submitted the screenings electronically from their office, they were immediately alerted to the patients' RPI score. In addition, on a semiannual basis, we also mail to each member a summary report of their screenings to date.

Exhibit 10. Sample HealthLink Risk Profile Cumulative Report

HealthLink Risk Profile

Partnership for Prevention

Statement of screening results to date

June 2004

John Doe
12 Anywhere Street **HealthLink # 000000000**
Any Place, RI 00000

Date	Location	Systolic BP	Diastolic BP	Blood Glucose	Total Cholesterol	HDL	BMI	Smoker	RPI
11/3/09	Comm.	163	96	107	173	43	28	0	3
5/1/11	Office	157	89	108	165	36	28	0	2
11/5/11	Comm.	140	84	86	153	39	28	0	1

Average Risk for all Screenings = => 2.00

The screening tests you have participated in were selected to help you monitor your health and track your progress. HealthLink has developed an "Overall Risk" scale that ranges from 0 to 4. The scale is the number in the last column of this report. It is a summary of all of your screening results and is an indicator of your risk of heart disease. The classification is as follows:

0 - Normal Risk
1 - Above Average Risk
2 - Elevated Risk
3 - Elevated Risk, Moderate
4 - Elevated Risk, Severe

Your goal should be to improve your risk category so that eventually at every screening your risk category is 0. If you are there, don't become complacent; you still need to be diligent. If you are in the high-risk category then contact us so we can help plan your wellness efforts.

There have been many occasions when our findings required follow-up care. In the past, it was primarily left to the member to contact their physician, except in the case of a member exhibiting elevated measures that were of concern. Our medical director would then follow-up at least with a phone call to inquire whether the member is seeking help. The cumulative reports were mailed to the member, and they in turn were urged to bring them to their next screening. With our medical office–recruited members, we mailed the cumulative reports directly to the physician so

they would include it in the patient's record. This process eliminated what could have become a serious breakdown in communication. It also has the advantage that, since all medical offices are computerized, future iterations can involve an encrypted electronic transfer in a form that can be incorporated into a patient's electronic medical record. This would truly create an environment where patient, physician, and community resources can act as a single team.

V. DISCUSSION

Medicare is a broad-based program that must meet the diverse needs of United States senior citizens. Programmatic shifts that adapt to developing economic and demographic realities of an aging population will require a citizenry more involved in health and health promotion, not just passive recipients of care after the occurrence of disease. This is especially true if change in health orientation requires an active and involved citizenry to adopt preventive and early detection behaviors. It is our contention that broad-based implementation of Medicare change will require the input of many constituencies. It was the intent of HealthLink Wellness to create a model for planning and implementing this change by combining the efforts of medical community resources, universities, and senior citizen advocacy groups.

The specific Federal initiatives upon which this project was based involved both health and prevention. The US Preventive Services Task Force has recently published an extensive review and guide for prevention programs as cost effective alternatives to disease treatment. The guidelines from this comprehensive review formed the foundation for our wellness activity, along with the stated priorities of the Healthy People 2010 initiative.

How well this project met the above guidelines will be determined by assessing improvement in key health measures, such as blood pressure, weight, cholesterol levels, fasting blood glucose, and exercise level. These measures are all alterable risk factors for chronic diseases, and reductions in these risk factors would lead to a healthier population.

HealthLink Wellness's health assessment is of concern and reflects what many national surveys have shown; namely, that conditions such as obesity and hypertension are almost epidemic. Our initial screening results indicated retirees exhibited a high rate of hypertension, and elevated blood glucose and cholesterol levels. Approximately 76% of those initially screened exhibited 1 or more elevated screening results that would warrant physician follow-up. Those with severely elevated measures were strongly urged to see their physician, but with the incorporation of the Patient-Centered Medical Home, hopefully the gap between initial diagnosis and effective intervention can be steadily narrowed.

Despite over a decade of educational interventions by the National Cholesterol Education Program (NCEP, started in 1985) and the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC, established in 1972), the analysis of our population's initial medical screening results showed a significant gap between the optimal risk factor and our population's observed screening results. This gap suggests that additional innovations, like this project, are needed to bridge the gap between guidelines of the NCEP and the JNC and the high proportion of elevated risk factors in our senior citizen population. This project was an effort of working directly within the patient's social network to link the NCEP

and JNC guidelines with the clinical care delivered by the patient's physician. This project focused on behavioral interventions targeted at the patient's stage of readiness to change. By translating the NCEP and JNC guidelines into patient-specific recommendations, HealthLink Wellness efforts should improve upon the untargeted, broad-based interventions that limit the effectiveness of traditional public health–based programs or medical office alone–based programs.

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