

# Increased physical activity, physician recommendation, and senior center participation

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## ABSTRACT

**Physical activity is a recognized preventive health measure for seniors and an important focus for senior centers. This paper employs the Andersen Behavioral Model to explore increased physical activity and participation in three types of senior center activities: physical fitness, dance/aerobic classes, and chair exercises. Data were collected in 2006 on 798 and in 2007 on 742 participants at 21 multipurpose senior centers in a large urban county. Logistic regression analysis (PROC RLOGIST in SAS-callable SUDAAN) was employed to predict increased physical activity, with modes of center participation in physical activity as mediating factors. Predisposing and enabling factors predicted both engaging in center-based exercise programs and increases in physical activity; but the strongest predictors of increases in physical activity were needed factors: physician recommendations to increase exercise and to lose weight. Implications are that both SCs and healthcare providers are important to promote physical activity in the older population.**

**Keywords:** Physical Activity; Senior Centers; Physician Recommendations; Patient Compliance; Andersen Behavioral Model

## 1. INTRODUCTION

Physical activity is a recognized preventive health measure for elders [1]. Regular activity offers an opportunity to extend years of active independent living [2]. Promotion of physical activity is a major concern for

elders [3], hence is an important focus for senior centers (SCs). This paper explores physical activity at SCs in a metropolitan county, employing the Andersen Behavioral Model as a theoretical underpinning.

## 2. LITERATURE REVIEW

Older adults are at risk of sedentary lifestyles [4,5] with inadequate physical activity [6]. Benefits of physical activity, including lower risk of mortality [7], accrue into old age, declining only at advanced age [8]. Benefits flow from low levels of activity [9,10], particularly from “moderate” activity for one-half hour per day [11]. Even exercising 15 minutes a day can significantly lower mortality and increase life expectancy [12]. Moderate activity contributes to self-efficacy and satisfaction with physical functioning [13] and is the most-effective intervention to prevent falls [14]. Moderate activity includes walking [15,16]. Vigorous activity may be associated, however, with longer periods of uninterrupted sedentary behavior, which may suggest the need for physical-activity strategies to break up sedentary periods [5]. Physical activity contributes directly to successful aging [17] and quality of life [18]. The Centers for Disease Control and Prevention recommend a blending of moderate, vigorous, and strengthening activities [19].

Physical activity tends to decline with age [20-23]; particularly in the very old, where it is associated with decline in function [24]. Aside from this trend, there appears a tendency for each older cohort to be more likely to engage in physical activity [25], and in particular an increase may occur upon retirement [26]. The decline is more pronounced with vigorous activity than with moderate physical activity [21].

Senior centers (SCs) are important to the well-being of older Americans [27,28]. SCs need to find ways to best

promote attendee benefits and vary considerably in their ability to foster behavioral change [29,30]. Although SCs serve all people aged 60 years or over, SC participants are older, more likely to be rural, to have more social contacts, experience better mental health, and have fewer dependencies in activity of daily living [31]. More frequent users of SC programs tend to be more socially involved [32], more socially active, and non-isolated although many live alone [33,34]. In fact, SCs are particularly important as sources of socialization for older women who live alone [27]. Given the importance of social interaction in promoting physical activity [35], social interaction at SCs is critical.

The range of SC programs and activities is extensive, with core elements of: exercise, crafts, meals, information and assistance, opportunities to socialize, and transportation [36]. Choice to participate in physical activity can be seen in the context of presentation with an array of services, with varying physical-activity content. This can include SC participation in walking interventions [37]. Rohr and Lang [38] state: "individuals are choosing and seeking positive social experience, improving the fit of their social environment, and they counterbalance the risks of social contact."

Just as there are many barriers to physical activity in later life [39-41], there are varied models for encouraging physical activity at SCs [42] and elsewhere [3,40,43-47]. Efforts by senior centers to promote physical activity meet with mixed success [48], prompting concern over successful methods. In particular, factors such as elder expectations of health and quality of life influence their likelihood of engaging in physical activity [2], as are cultural competence, social support, and family involvement [49]. Marcus and associates [50] note, further, that methods best suited for fostering initiation of physical activity are not necessarily those best fit to enhance its maintenance.

Various means of counseling and prescribing physical activity by health care professionals are effective [51-55] (Sorensen *et al.*, 2007). Written prescriptions for physical activity have shown efficacy, especially when specifying form and level of activity [56], although the "evidence base" has been described as "thin" [57]. Nevertheless, collaboration between senior centers and primary care has shown success [58]. The issue is whether or not physicians and other health care professionals engage patients regarding physical activity, diet, and issues of overweight, although there is evidence that greater obesity, more chronic conditions, and more contact with providers increases the likelihood especially of the addressing of physical activity by such providers [59].

Women tend to be less involved in physical activity

than men [22,25,60]. Approximately 47 percent of White women age 75 or greater, 37 percent of older White men, 59 percent of older Black men and 61 percent of older Black women do not engage in regular exercise [61,62].

Racial/ethnic minorities tend to be less involved, in part because of socio-cultural barriers. Interventions should be attuned to specific cultural issues, particularly social interaction and support [25,49,63].

The Andersen Behavioral Model was developed to explain the use of healthcare services in terms of predisposing, enabling, and need factors [64-69]. It has been applied to other types of behavior, however [70], particularly involving organizational features as enabling factors [25,71,72].

### 3. METHODS

Data were collected through cross-sectional surveys in 2006 on 798 and in 2007 on 742 participants in a large urban county, via staff-administered interviews of program participants at 21 multipurpose senior centers supported by the Area Agency on Aging and a United Way partner agency, as part of an annual program evaluation. Although the data are "found data," collected for a different purpose, items include measures allowing consideration of a model explaining adoption of physical activity, providing wider insight beyond program evaluation.

The SCs, located throughout the county, are open to all people 60 years of age and older, with no income limits or restrictions, providing meals, as well as offering programs designed to ensure a well-balanced approach to physical and mental wellness. Services are provided on a contribution basis and are intended to combat social isolation and lack of proper nutrition. Since sample selection at each SC is not proportional to center size, weighting is used, based on annual participation in congregate meals programs. This measure is used because it is regularly measured and reported consistently across center and over time.

Measures include reported increased physical activity and participation in three types of activities at senior centers: physical fitness, dance/aerobic classes, and chair exercises. **Table 1** reports incidence. A little over half reported increasing physical activity in the previous twelve months. About half reported participating in physical fitness activities, and a like number in chair exercises; about one in three reported participation in dance and/or aerobics at the SC.

Predisposing factors address the tendency to use or undertake care, in this case to attend SC activities or to undertake physical activity. Predisposing factors employed were: age, race/ethnicity, gender, marital status, living situation, and feelings about the importance of

**Table 1.** Dependent and independent variable frequencies.

	Weighted Percentage Yes	Unweighted Percentage Yes	N
<i>Dependent Variables:</i>			
Increased Physical Activity in Past Year	58.2	57.3	1394
Participates in Physical Fitness at Center	53.5	54.6	1203
Participates in Dance/Aerobics at Center	36.0	37.2	1117
Participates in Chair Exercises at Center	53.2	55.5	1169
<i>Independent Variables:</i>			
<i>Predisposing</i>			
African American <sup>a</sup>	16.7	22.2	1534
Hispanic <sup>a</sup>	10.5	12.8	1534
Other Nonwhite <sup>a</sup>	4.2	3.3	1534
Aged 85 or Over	16.1	14.5	1482
Male	30.5	30.0	1531
Single <sup>b</sup>	8.5	9.5	1534
Widowed <sup>b</sup>	47.1	46.7	1534
Divorced <sup>b</sup>	12.8	12.2	1534
Live Alone	48.7	48.1	1517
At Least Agree Interactions Important	92.0	92.0	1504
Strongly Agree Interactions Important	35.3	34.4	1504
<i>Enabling</i>			
Needs Transit Help to Attend SeniorCenter	12.2	11.5	1474
Attended Center for at Least 1 Year	77.2	77.9	1519
Attended Center for at Least 5 Years	38.3	39.4	1519
Attended Center at Least 3x per Week	72.1	72.6	1520
Ctr. Only Interaction Source - Disagree	56.6	55.6	1487
Ctr. Only Interaction Source - Agree	31.7	32.7	1487
<i>Need</i>			
Physician Said to Increase Exercise	50.8	50.6	1411
Physician Said to Control/Lose Weight	46.4	46.8	1381
<i>Continuous Predisposing Variable:</i>			
	Weighted Mean/(Std. Dev.)	Unweighted Mean/(Std. Dev.)	Number of Cases
Age	75.1 (9.30)	74.9 (9.08)	1482

SOURCE: Tarrant county senior center survey.

social interactions. Physical activity may decline with age but may be more-prevalent in older cohorts, controlling for age [25]; further, propensity to participate at SCs may have complex relationships with age. Males may be more predisposed to physical activity. Nonwhites tend to have lower engagement in physical activity. Attitudes toward social interactions at SCs are here considered predisposing because of the importance of such interactions to SC participation and because peer interaction may influence behaviors such as physical activity.

Enabling factors are concerned with the ability to engage in activities once predisposed to do so. No data were available on income or health coverage. Transportation items were not measured consistently over time,

but allowed creating of a measure of whether the respondent needed transportation help in attendance. Other enabling factors included measures directly related to the centers: length and frequency of attendance, and seeing the SC as the major source of social interaction. Although data were not available on geographical or other access to SCs, reports of length of and frequency of attendance were used to represent such enabling factors.

Although physical activity is needed by everyone, levels of need differ. In this study, need is measured by an item on whether “a physician or healthcare professional” instructed respondents to undertake lifestyle changes: to increase exercise or to control or lose weight. Although it would be desirable to have data on recommendations by

other healthcare professionals, the available study asked only about physician recommendations. Analysis (not reported in tables) showed no significant change across years in physician recommendations to exercise and to control or lose weight. African American and Hispanic were more likely than were white respondents to report both types of recommendations. Reports of both types of physician recommendation decline with age. Males were less likely than females to report recommendations to increase exercise (see **Table 1**.)

Logistic regression analysis (PROC RLOGIST in SAS-callable SUDAAN) was employed to predict increased physical activity, with modes of center participation in physical activity as mediating factors. SUDAAN was used to adjust standard errors for the weighting scheme. First, the center-based activities were predicted by the independent factors. At the next stage, increase in physical activity was predicted by those independent variables in two equations, both including and excluding the three types of center-based physical-activity.

## 4. FINDINGS

Analysis proceeded in two stages. First, reports of participation in three types of activities at senior centers were separately regressed on the predisposing, enabling, and need factors. Then reports of increase in physical activity were regressed on these factors, both with and without control for participation in senior centers physical activities.

### 4.1. Predicting Senior Center Physical Activity

When center-based activities were regressed on the explanatory measures (**Table 2**), participants reported greater participation in 2007 than in 2006 in physical fitness and dance/aerobic classes. Predisposing factors in particular were found to be important.

Of special interest are the variations in different SC physical activities by elders of differing racial/ethnic groups. Compared to Whites, African Americans show greater participation in dance/aerobics and chair exercises, Hispanics lower involvement in physical fitness but greater involvement in dance/aerobic classes. These results for participation in SC activities are interesting in light of general tendencies of African American and Hispanic elders to be less involved in physical activity than are non-Hispanic white elders [25].

Males showed lower participation in all three types of SC activities, interesting in light of a greater tendency of males to undertake physical activity generally. Rather than reflecting male aversion to SC activity programs; this may reflect center success in reducing disparities by drawing more women into such activities. Participation

in chair exercise increased with age, likely because such exercises are more-amenable to participation by older center attendees.

Only one enabling factor predicted SC physical activities: those attending at least three times per week had higher participation in all three types of SC activities. That transportation did not appear as a predictor may be attributable to the fact that all of the SCs provide transportation.

Of the need factors, physician recommendations predicted greater likelihood of participation in SC physical fitness. Physician instructions to lose weight predicted greater participation in chair exercises. Respondents were not asked how their physicians recommended physical activity, nor weight-loss strategies. It is thus likely that general recommendations elicited a variety of type of patient responses, whether at SCs or elsewhere.

### 4.2. Predicting Overall Increase in Physical Activity

**Table 3** reports analyses predicting reported increase in physical activity, both including and excluding the center-based physical-activity measures. Controlling for the predisposing, enabling, and need factors, such reports were not significantly higher in 2007 than in 2006.

Predisposing factors predicting increased physical activity are Hispanic ethnicity and living alone, each showing lower likelihood. African American and other non-white respondents do not differ from White respondents on such activity. In light of the much-higher African American reports of participation in SC activities, this suggests that African American exercise through SCs may counteract a general tendency to less physical activity. Such findings might indicate success of SC programs at reducing some racial/ethnic disparities in physical activity among SC attendees.

When the three types of SC activities are controlled (Equation (2)), all three types of SC exercise offerings predict overall physical activity. Hispanic respondents show no lower likelihood of physical activity, suggesting that such a finding in Equation 1 is due to the much-lower likelihood of participating in SC physical fitness classes among SC attendees. Although unmarried respondents no longer show lower likelihood than married respondents, the odds ratio is basically unchanged, suggesting that the issue is lower power in the analysis. Males are more likely than females to report increased physical activity. In conjunction with lower participation by males in SC activities, this suggests that males tend to increase physical activity outside the SCs, females through SC programs. Similar results were obtained for those living alone: lower engagement in chair exercises but greater increases in physical activity when chair exercises and other SC physical activities are controlled,

**Table 2.** Logistic regression analysis: physical activities at the seniorcenter.

	Participates in Physical Fitness at Ctr.			Participates in Dance/Aerobics at Ctr			Participates in Chair Exercises at Center		
	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound
<i>Independent Variables:</i>									
<i>Predisposing</i>									
African American <sup>a</sup>	1.41	0.98	2.05	<b><u>1.70</u></b>	1.15	2.51	<b><u>3.01</u></b>	1.95	4.66
Hispanic <sup>a</sup>	<b><u>0.41</u></b>	0.25	0.66	<b><u>1.81</u></b>	1.16	1.83	1.14	0.69	1.71
Other Nonwhite <sup>a</sup>	2.00	0.75	5.04	1.38	0.61	3.16	0.72	0.36	1.89
Age	1.01	0.99	1.03	0.99	0.97	1.01	<b><u>1.02</u></b>	1.00	1.05
Aged 85 or Over <sup>b</sup>	0.64	0.38	1.09	1.18	0.68	2.04	0.74	0.42	1.29
Male	<b><u>0.63</u></b>	0.45	0.88	<b><u>0.63</u></b>	0.44	0.89	<b><u>0.30</u></b>	0.21	0.42
Single <sup>c</sup>	0.88	0.47	1.63	0.90	0.50	1.61	1.07	0.57	1.99
Widowed <sup>c</sup>	1.03	0.67	1.59	0.67	0.43	1.05	1.23	0.78	1.94
Divorced <sup>c</sup>	0.76	0.45	1.29	0.65	0.37	1.15	0.88	0.49	1.56
Live Alone	0.77	0.54	1.10	1.09	0.76	1.56	<b><u>0.48</u></b>	0.33	0.71
Agree Interactions Important	0.85	0.47	1.55	1.38	0.76	2.51	1.27	0.72	2.23
StrAgr Interactions Important	1.19	0.87	1.62	0.96	0.69	1.34	<b><u>1.49</u></b>	1.07	2.08
<i>Enabling</i>									
Needs Transit Help to Attend	1.04	0.66	1.63	0.71	0.44	1.15	1.49	0.93	2.39
AttendedSC for at Least 1 Yr	1.36	0.93	1.98	1.04	0.69	1.56	1.40	0.93	2.11
AttendedSC for at Least 5 Yrs	0.91	0.65	1.28	1.16	0.81	1.55	1.01	0.71	1.43
AttendedSC 3x per Week	<b><u>2.00</u></b>	1.42	2.82	<b><u>1.73</u></b>	1.18	2.52	<b><u>1.56</u></b>	1.10	2.21
Only Interaction Source: Disag	0.85	0.53	1.37	0.89	0.52	1.50	1.31	0.64	2.69
Only Interaction Source: Agree	0.88	0.52	1.47	0.76	0.43	1.35	1.24	0.73	2.09
<i>Need</i>									
MD Said Increase Exercise	<b><u>1.56</u></b>	1.10	2.23	1.30	0.90	1.87	0.88	0.55	1.41
MD Said Control/Lose Weight	1.23	0.86	1.75	1.16	0.80	1.69	<b><u>1.64</u></b>	1.13	2.36
<i>Time</i>									
2007 versus 2006	<b><u>1.56</u></b>	1.18	2.06	<b><u>1.71</u></b>	1.27	2.29	1.19	0.88	1.61
N =		996			958			983	
Degrees of Freedom =		21			21			21	
Percentage Yes(weighted) =		51.2			33.5			52.3	
Wald F =		<b><u>3.85</u></b>			<b><u>3.34</u></b>			<b><u>6.49</u></b>	

SOURCE: Tarrant County Senior Center Survey. NOTE: <sup>a</sup> White is the contrast category. <sup>b</sup> Under age 85 is the contrast category. <sup>c</sup> Married is the contrast category. LEGEND: Odds ratios in bold are significant at the .05 level, 2-tailed test. Underlined odds ratios in bold are significant at the .01 level, 2-tailed test.

result in no difference overall in overall activity, suggesting that those living alone are more likely to undertake physical activity outside the SCs.

Among enabling factors, only attendance at the center for at least a year showed any effect. Interestingly, those attending at least a year were about three-fifths as likely as those attending less than a year to report increased physical activity.

The strongest predictor of reported overall physical activity was physician recommendations. Those reporting being told by physicians to increase their exercise were three times as likely as others to report having done so. Those told by doctors to control or lose weight were also much-more likely to report increased physical activ-

ity in the prior year. Controlling for participation in SC physical activities (Equation (2)), the effect of physician instructions to exercise was found to be weaker but still strongly positive; but the effect of physician instructions to lose weight was no longer significant. Thus, it appears that physician instructions to lose weight resulted in increased physical activity in large part by way of participation in SC physical activities. By contrast, instructions to exercise are associated with greater increased physical activity whether or not respondents did so via participation in SC physical-activities. Thus, offering of physical activities at SCs and physician recommendations to increase exercise are both important to increasing physical activity among seniors.

**Table 3.** Logistic regression analysis: increased physical activity.

	Equation (1)			Equation (2)		
	Odds Ratio	Lower Bound	Upper Bound	Odds Ratio	Lower Bound	Upper Bound
<i>Independent Variables:</i>						
<i>Predisposing</i>						
African American <sup>a</sup>	1.07	0.74	1.54	1.05	0.68	1.62
Hispanic <sup>a</sup>	<b>0.59</b>	0.39	0.91	1.03	0.59	1.81
Other Nonwhite <sup>a</sup>	1.54	0.69	3.45	1.19	0.43	3.29
Age	0.98	0.96	1.01	0.98	0.95	1.01
Aged 85 or Over <sup>b</sup>	1.20	0.72	2.00	1.21	0.67	2.18
Male	1.31	0.95	1.80	<b><u>1.86</u></b>	1.25	2.77
Single <sup>c</sup>	<b>0.52</b>	0.29	0.92	0.51	0.25	1.02
Widowed <sup>c</sup>	0.82	0.54	1.24	0.85	0.51	1.42
Divorced <sup>c</sup>	1.07	0.63	1.82	1.31	0.72	2.30
Live Alone	1.38	0.97	1.95	<b>1.56</b>	1.04	2.36
Agree Interactions Important	1.11	0.65	1.90	1.11	0.57	2.15
Strongly Agree Interactions Important	1.32	0.98	1.80	1.24	0.86	1.78
<i>Enabling</i>						
Needs Transit Help to Attend SC	0.98	0.63	1.53	0.97	0.58	1.64
Attended Center for at Least 1 Year	<b>0.57</b>	0.39	0.84	<b>0.59</b>	0.38	0.91
Attended Center for at Least 5 Years	0.85	0.61	1.17	0.92	0.62	1.36
Attended Center at Least 3x per Week	1.13	0.82	1.55	0.90	0.61	1.33
Ctr. Only Interaction Source—Disagree	1.06	0.65	1.70	1.04	0.58	1.88
Ctr. Only Interaction Source—Agree	0.94	0.56	1.58	1.06	0.55	2.03
<i>Need</i>						
Physician Said to Increase Exercise	<b><u>3.13</u></b>	2.24	4.36	<b><u>2.78</u></b>	1.87	4.14
Physician Said to Control/Lose Weight	<b>1.43</b>	1.02	2.01	1.13	0.75	1.70
<i>Endogenous</i>						
Participates in Physical Fitness at Ctr.				<b><u>1.70</u></b>	1.13	2.54
Participates in Dance/Aerobics at Ctr.				<b>1.93</b>	1.28	2.92
Participates in Chair Exercises at Center				<b>1.67</b>	1.10	2.54
<i>Time</i>						
2007 versus 2006	1.31	0.99	1.72	1.21	0.88	1.69
N =		1167			898	
Degrees of Freedom =		21			24	
Percentage Yes =		57.1			56.7	
Model Chi-Square =		<b><u>7.13</u></b>			<b><u>5.76</u></b>	

SOURCE: Tarrant County Senior Center Survey. NOTE: <sup>a</sup> White is the contrast category. <sup>b</sup> Under age 85 is the contrast category. <sup>c</sup> Married is the contrast category. LEGEND: Odds ratios in bold are significant at the .05 level, 2-tailed test. Underlined odds ratios in bold are significant at the .01 level, 2-tailed test.

## 5. CONCLUSIONS

Many predisposing factors predicted participation in SC physical activities but not in overall increased physical activity. African Americans were more likely than whites to report SC physical activity and SC chair exercises. Hispanics were less likely to report SC physical activity but more likely to participate in dance/aerobics. In general, findings for African Americans and some for Hispanics contradict a general view of lower physical activity by racial/ethnic minorities, suggesting greater

utilization of SC programs to undertake activity, thereby overcoming the general tendency to less physical activity.

Age factors were not shown to influence participation in other SC physical activities, other than a greater likelihood for chair exercise participation to increase with age, nor overall physical activity. These findings are compatible with those found for national samples [25], showing a complex pattern of activity by age groups and by age in general.

Contrary to a general view of higher male physical ac-

tivity, sample males were less likely than females to report participation in SC physical-fitness and chair-exercise. Controlling for SC-specific activities, however, the coefficient for gender increased was not significant, suggesting that males might have been more likely than females to report increases in physical activity outside SCs. It could be that males tend to seek out other venues to increase physical activity; or it could be that males are more likely to report increased activity, even if they did not undertake it. Marital status was not shown to predict SC physical activity. However, those who lived alone were much less likely to participate in physical fitness programs and in chair exercises. No effects were found of individual enabling factors on increases in physical activity.

Longer tenure and more frequent participation at SCs both showed a higher likelihood of participation in SC physical activities; but controlling for such participation, those with longer tenure were less likely to report increased physical activity in the past year, perhaps reflecting ongoing SC physical activity. This underscores the importance of SCs in enabling as well as promoting physical activity among elders-in general, the SC appears important not only as a venue for physical activity but also as a social context for success in increasing such activity.

The findings for the need factors are most interesting. Physician recommendations to exercise did not predict SC physical activity but were among the strongest predictors of increases in physical activity. Physician instructions to lose weight were associated with greater participation in SC physical fitness programs as well as increases in physical activity, but the latter doesn't hold when participations in SC activities are controlled. Apparently, physician encouragement creates the perceived need and response to engage in physical activity, but in the case of weight-loss instructions are mediated by participation in SC activities.

### 5.1. Limitations

The analysis suffers from a number of common issues in research, especially program-assessment-based research: cross-sectional data, self-reporting by subjects, limited measures available to researchers from evaluation surveys, and questions of generalizability.

The cross-sectional nature of the data from the two yearly surveys is a major issue in light of the wish to consider causal effects. Nevertheless, reasonable assumptions allow feasible conclusions on causality. Although it is possible that subjects engaging in, or increasing, their physical activity requested physician comments, it is far more reasonable to assume rather that physician recommendations led to increased physical activity. Likewise, although possible that those who had

already increased their physical activity during a year subsequently sought SC exercise activities, it is far more reasonable to assume either that those increasing their activity were already participated in the SC programs or especially that the SC programs were among the modalities chosen in order to increase physical activity.

Although the factors available do not lend themselves to many health education models, they do allow use of a sociological model that emphasizes contextual as well as individual factors. In this respect, the Andersen model, especially with its emphasis on predisposing and enabling factors, fits well with available data. An unfortunate exception is the lack of consistent measures of transportation as an enabling factor. Although physical activity is a universal need, unlike the services for which the Andersen model was developed, its consideration of perceptions of need also lends itself to the specific measures available in the assessment surveys.

Self-reporting is an issue not just in evaluation research but in much research involving physical activity. This cannot be avoided without much more costly, intrusive approaches which were not undertaken for the assessments of SC programs in this case.

Generalizability issues arise both in sampling of subjects from among SC participants and the limitation of the study to a single county's system of SCs. Data collection was based on attempts to sample all participants on a given day at each SC, but such a daily census obviously cannot assure representation of all days in the year. Likewise, such a daily census does not ensure representativeness across centers, although we attempted to correct somewhat for this by weighting by yearly data on center size, based on yearly congregate meal participation. The overall samples deriving from a single large metropolitan county cannot be avoided, given the nature of research based on assessment surveys.

### 5.2. Implications for Practice

Physician recommendations are often successful in increasing physical activity which has been documented in the literature, as has been the success of SC programs in so doing. What is interesting here is the existence of self-reported data on both and the apparent linkages among physician recommendations, participation in SC programs, and overall increases in physical activity. This allows suggestions regarding the interplay of physician and senior center in promoting physical activity in the aged.

Physician recommendations and SC factors interact with each other in predicting increased physical activity among SC participants, implying that both SCs and physicians are important to promote physical activity in elders. Physicians should urge, particularly prescribe, physical activity [1,73]; but better is SC-physician collabora-

tion to encourage physical activity (see [57]). Such collaboration is not simple, given the disparate nature of SC attendance and choice of physicians. Nevertheless, development of collaboration among systems of SCs, medical societies, and local public health departments might allow generalizing community approaches to physical activity promotion. This would accord with the recommendations of Thurston and Green [56] and promotions of physical activity involving “understanding the social, cultural, physical, demographic and economic influences of individual action” rather than relying solely upon “personal action.” The SC, with its aim of enhancing interpersonal socialization, could enhance such more holistic health promotion.

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