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Does Medicaid Pay More to a Program of All-Inclusive Care for the Elderly (PACE) Than for Fee-for-Service Long-term Care?

Darryl Wieland,[1,2] Bruce Kinosian,[3,4] Eric Stallard,[5] and Rebecca Boland[1]

[1]Division of Geriatrics Services, Palmetto Health Richland and [2]Division of Geriatrics, University of South Carolina School of Medicine, Columbia.
[3]Center for Health Equity Research and Promotion, Philadelphia VA Medical Center and [4]Department of Medicine, University of Pennsylvania, Philadelphia.
[5]Center for Population Health and Aging, Duke Population Research Institute and Social Science Research Institute, Duke University, Durham, North Carolina.

Address correspondence to Darryl Wieland PhD, MPH, Division of Geriatrics Services, Palmetto Health Richland, 3010 Farrow Road, #300A, Columbia, SC 29203. Email: darryl.wieland@palmettohealth.org

Background. In rebalancing from nursing homes (NHs), states are increasing access of NH-certified dually eligible (Medicare/Medicaid) patients to community waiver programs and Programs of All-Inclusive Care for the Elderly (PACE). Prior evaluations suggest Medicaid's PACE capitation exceeds its spending for comparable admissions in alternative care, although the latter may be underestimated. We test whether Medicaid payments to PACE are lower than predicted fee-for-service outlays in a long-term care admission cohort.

Methods. Using grade-of-membership methods, we model health deficits for dual eligibles aged 55 or more entering waiver, PACE, and NH in South Carolina (n = 3,988). Clinical types, membership vectors, and program type prevalences are estimated. We calculate a blend, fitting PACE between fee-for-service cohorts, whose postadmission 1-year utilization was converted to attrition-adjusted outlays. PACE's capitation is compared with blend-based expenditure predictions.

Results. Four clinical types describe population health deficits/service needs. The waiver cohort is most represented in the least impaired type (1: 47.1%), NH entrants in the most disabled (4: 38.5%). Most prevalent in PACE was a dementia type, 3 (32.7%). PACE's blend was waiver: 0.5602 (95% CI: 0.5472, 0.5732) and NH: 0.4398 (0.4268, 0.4528). Average Medicaid attrition–adjusted 1-year payments for waiver and NH were $4,177 and $77,945. The mean predicted cost for PACE patients in alternative long-term care was $36,620 ($35,662 and $37,580). PACE's Medicaid capitation was $27,648—28% below the lower limit of predicted fee-for-service payments.

Conclusions. PACE's capitation was well under outlays for equivalent patients in alternative care—a substantial savings for Medicaid. Our methods provide a rate-setting element for PACE and other managed long-term care.

Key Words: Long-term care financing—Grade-of-membership analysis—Medicare/Medicaid dual eligibles—Managed long-term care—Latent structure models.

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COMMUNITY-BASED services are preferred to institutions for long-term care (LTC) by many prospective recipients and families. Given this preference, legal requirements, and cost-containment imperatives, states are increasing access of dually eligible (Medicaid/Medicare) patients certified as requiring a nursing home (NH) level of care to aged/disabled waiver programs (1,2). Also, Programs of All-Inclusive Care for the Elderly (PACE)—dually capitated, community-based comprehensive care—are available in 29 states (3). Little is known about selection among emerging alternatives in practice despite the putative role of client/family choice. Most "placement" studies focus on predicting NH entry, highlighting risk for those who lack adequate home environments, self-care efficacy, resilient informal care, and other resources, reflecting strong client/family disutilities for NHs (4,5). Yet, people qualified at NH level of care who enter community care share with NH entrants LTC needs related to their assessed conditions, impairments, and disabilities, net of routinely unobserved selection factors.

Serving dually eligible NH-certified patients is expensive—five times the per capita cost of the Medicare-only population (6). For these patients, the much greater per capita Medicaid costs for institutional compared with community care are far more due to NHs' high-cost inputs than their heavier-care case mix. It is difficult to address variability in program outlays specifically attributable to case mix or to predict payments for defined patients served in alternative care, without tools to synthesize the large number of clinical characteristics defining LTC needs (7). This becomes especially problematic when evaluating forms of community LTC like PACE, whose patient and service mixes are "intermediate" between waiver and institutional poles.

Researchers have found that PACE enrollment is associated with an improved care quality, less mortality, preservation of function, fewer unmet assistance needs, greater participant and caregiver satisfaction, less hospital and NH utilization, and lower Medicare costs (8–12). However, prior evaluations (unpublished in peer-reviewed literature) also suggest that PACE increases Medicaid expenditures. The earliest is a 1990's Centers for Medicare and Medicaid Services (CMS) study that found PACE Medicaid capitation was 82%–86% higher than projected fee-for-service (FFS) expenditures in the first enrollment year (10). In a Washington state evaluation, first-year PACE Medicaid outlays were estimated to exceed payments for home- and community-based care clients by 107%, roughly equaling Medicaid costs for an NH comparison group (11). Finally, Medicaid spending on PACE ranged from 130% to 180% of community-care comparison group spending during a 2-year postplacement period, in a more recent CMS study of PACE under provider status (13). In the CMS evaluations, matched controls were selected from people qualifying for PACE but served by other community resources; there was no direct comparison to NH admissions, although all were certified as eligible to enter institutions. The Washington study identified both community and NH programs as appropriate control conditions to assess Medicaid PACE outlays. For the Washington and later CMS evaluations, controls were assigned using multistep propensity methods, introducing limitations such as information loss with variable deletion and manipulation in regression, and classification and selection error inherent in propensity stratification and matching. For all three evaluations, attempts to balance covariates across treatments likely failed due to unmeasured selection factors; higher Medicaid costs for PACE may have been "baked in the cake" by their designs.

Our objectives are (a) to estimate and validate a multiattribute low-dimensional grade-of-membership (GoM) model of the health of a PACE-eligible LTC population admitted to aged/disabled waiver, NH, and PACE in South Carolina (SC); (b) to assess the postselection distribution of clinical types across programs; and (c) to test the hypothesis that PACE's Medicaid capitation is lower than total predicted payments for alternative LTC accounting for assessed health deficits/associated LTC needs. We identify and describe a small number of clinical types based upon measures of diseases, impairments, and disabilities obtained from the multidimensional LTC assessment used in SC's single point-of-entry system. Because GoM analysis partitions individuals based on their similarities to the clinical profiles (ie, assigns grades of membership), we report the distribution of individual membership vectors among the clinical types. Type prevalences (sums of membership grades) are reported, overall and in each program. We estimate the similarity of PACE participants to waiver and NH cohorts by calculating a blend index comprised of mean predicted probabilities of fit to NH admissions for the PACE cohort. The blend is used to compare the predicted 1-year standardized costs of PACE participants if admitted to FFS LTC to the actual 2005 PACE capitation.

Methods

Alternative Programs

PACE has operated in Richland and Lexington counties since 1988. PACE is a prepaid, dually capitated (Medicare and Medicaid) community-based model in which care for participants—state certified as eligible for NH—is integrated by day center–based interdisciplinary teams (3). Under full financial risk, PACE provides all necessary acute, primary, consultative, chronic, and palliative care, as well as supportive day center, home, institutional, transportation, and other services, including meals and caregiver support, to facilitate participants' remaining in the community. The SC aged/disabled waiver program began as one of several Medicaid community waiver programs. Like PACE, the waiver program is available for adults qualifying for Medicaid and certified as NH eligible but who prefer community services. Through case management and supportive care, it enables clients to remain home at a Medicaid cost substantially less than NH care. Over three quarters of spending is for personal, attendant and companion services, and adult day health care including skilled nursing (14). NHs provide nursing, therapy, and personal care to individuals not requiring acute care, whose mental or physical conditions require services above room and board level that are available in licensed, certified, and contracted institutions.

Study Population

The study population is comprised of dually eligible individuals entering LTC from the community between 1994 and 2005, all of whom were qualified to enter any of the three programs. LTC entrants outside the SC PACE two-county catchment are excluded. PACE may admit only persons aged 55 or more, thus, younger admissions were excluded, as were LTC "entrants" (the vast majority in NHs) who received services until "spending down" to meet Medicaid's financial requirements.

Single Point-of-Entry System and the Analytic Data set

Dual eligibles entering PACE, waiver, or NHs must be state certified as requiring an NH level of care. Teams conduct comprehensive preadmission assessments of applicants, including their medical, psychosocial, functional, environmental, and support system and service needs, as well as medical necessity for LTC, based upon meeting skilled or intermediate service and/or functional support criteria (15). We constructed a data set representing a dually eligible cohort admitted from the community. Data describing multidimensional entrant characteristics (Table 1 and Supplementary Table 1A) were extracted from state admission records (18). Individuals may receive several assessments

Table 1. Selected Subject Characteristics by Program Cohort, Overall, and by Clinical Type; Richland and Lexington Counties, SC, 1994–2005 (n = 3,988)

	Waiver (n = 1,683)	PACE (n = 948)	NH (n = 1,357)	Marginal Prevalence	Type 1 31.8%	Type 2 28.0%	Type 3 21.1%	Type 4 19.1%
Impairments					Internal Variables $\lambda_{kjl} \times 100$ (conditionally estimated probabilities as %)			
Expressive communication ($p < .0001$)§					H (GoM impact score)* = 1.2171			
Intact	962 (57.4%)	317 (34.5%)	313 (23.3%)	*42.23%*	100.0†	0.0	0.0‡	0.0
Usual	433 (25.8)	328 (35.7)	370 (27.6)	*26.60*	0.0†	100.0	0.0‡	0.0
Sometimes	201 (12)	224 (24.3)	411 (30.6)	*20.27*	0.0†	0.0	100.0‡	42.37
Rare	80 (4.8)	51 (5.5)	249 (18.5)	*10.90*	0.0†	0.0	0.0‡	57.63
Receptive communication ($p < .0001$)§					H* = 1.1794			
Intact	860 (51.3)	261 (28.2)	260 (19.4)	*37.10*	100.0	0.0	0.0†	0.0‡
Usual	450 (26.8)	294 (31.8)	321 (23.9)	*25.54*	0.0	100.0	0.0†	0.0‡
Sometimes	315 (18.8)	341 (36.9)	546 (40.7)	*28.52*	0.0	0.0	100.0†	50.01‡
Rare	53 (3.2)	28 (3.0)	214 (16.0)	*8.84*	0.0	0.0	0.0†	49.99‡
Short-term memory ($p < .0001$)§					H* = 0.7500			
Intact	763 (45.5)	175 (19.7)	236 (17.6)	*33.13*	100.0	0.0	0.0†	0.0
Minimal-severe impairment	839 (50)	698 (78.6)	884 (66.1)	*57.15*	0.0	100.0	100.0†	56.03
Unable to rate	75 (4.5)	15 (1.7)	218 (16.3)	*9.72*	0.0	0.0	0.0†	43.97
Daily decision making ($p < .0001$)§					H* = 1.0990			
Independent	227 (13.5)	76 (8.5)	51 (3.8)	*9.21*	30.26	0.0†	0.0	0.0‡
Modified independence	511 (30.4)	154 (17.3)	151 (11.3)	*21.94*	69.74	0.0†	0.0	0.0‡
Moderately impaired	625 (37.2)	314 (35.2)	431 (32.2)	*35.0*	0.0	100.0†	0.0	0.0‡
Severely impaired	316 (18.8)	348 (39.0)	705 (52.7)	*33.84*	0.0	0.0†	100.0	100.0‡
Behavioral problems								
Wandering ($p < .0001$)§					H* = .3855			
No/not in last week	1554 (93.7)	669 (76.7)	1071 (80.1)	*87.65*	100.0	100.0†	14.87‡	100.0
Less than daily	51 (3.1)	102 (11.7)	64 (4.8)	*3.84*	0.0	0.0†	32.24‡	0.0
Once daily or more	53 (3.2)	101 (11.6)	202 (15.1)	*8.51*	0.0	0.0†	52.89‡	0.0
Disabilities								
Bathing ($p < .0001$)§					H* = .5624			
Independent	16 (1.0)	5 (0.5)	3 (0.2)	*0.63*	1.24	0.0‡	1.28‡	0.0†
Supervision only	17 (1.0)	10 (1.1)	6 (0.4)	*0.76*	1.87	0.55‡	0.56‡	0.0†
Limited assistance	126 (7.5)	53 (5.7)	38 (2.8)	*5.41*	16.96	0.0‡	0.0‡	0.0†
Extensive assistance	1279 (76.1)	771 (82.3)	586 (43.3)	*61.51*	79.93	99.45‡	98.16‡	0.0†
Dependent	243 (14.5)	98 (10.5)	718 (53.1)	*31.70*	0.0	0.0‡	0.0‡	100.0†
Dressing ($p < .0001$)§					H* = .5549			
Independent	44 (2.6)	4 (0.4)	5 (0.4)	*1.62*	4.17	0.0	0.0‡	0.0†
Supervision only	26 (1.6)	7 (0.7)	7 (0.5)	*1.09*	2.20	0.24	1.26‡	0.0†
Limited assistance	207 (12.3)	59 (6.3)	59 (4.4)	*8.79*	21.68	4.56	0.0‡	0.0†
Extensive assistance	1234 (73.5)	795 (84.7)	647 (48.0)	*62.14*	71.95	95.20	98.74‡	0.0†
Dependent	169 (10.1)	74 (7.9)	629 (46.7)	*26.36*	0.0	0.0	0.0‡	100.0†
Transferring ($p < .0001$)§					H* = .7071			
Independent	88 (5.2)	113 (12.1)	107 (7.9)	*6.43*	0.0‡	0.0	29.46†	0.0‡
Supervision only	88 (5.2)	93 (9.9)	91 (6.7)	*5.90*	0.0‡	0.0	26.02†	0.0‡
Limited assistance	175 (10.4)	109 (11.7)	123 (9.1)	*9.83*	7.12‡	12.90	16.94†	0.0‡
Extensive assistance	1196 (71.2)	558 (59.7)	581 (43.0)	*58.61*	92.88‡	87.10	27.58†	0.0‡
Dependent	134 (8.0)	62 (6.6)	449 (33.2)	*19.23*	0.0‡	0.0	0.0†	100.0‡
Bladder continence ($p < .0001$)§					H* = .6116			
Continent	602 (35.9)	294 (31.6)	284 (21.0)	*29.24*	69.58	0.0‡	44.47	0.0†
Usually continent	127 (7.6)	57 (6.1)	94 (7.0)	*7.29*	5.71	16.49‡	7.46	0.0†
Occasional incontinence	196 (11.7)	101 (10.8)	84 (6.2)	*9.24*	10.45	17.34‡	12.43	0.0†
Frequent incontinence	470 (28.0)	336 (36.1)	248 (18.4)	*23.70*	14.25	66.17‡	35.64	0.0†
Incontinent	284 (16.9)	143 (15.4)	641 (47.4)	*30.53*	0.0	0.0‡	0.0	100.0†
Selected diseases/medical conditions					H* (range) = 0.1101–0.1778			
Alzheimer disease ($p < .0001$)§	112 (6.7)	182 (19.2)	231 (17.0)	*11.28*	0.0	0.0	52.66	12.79
Arthritis ($p < .0001$)§	1080 (64.2)	544 (57.4)	290 (21.4)	*45.07*	63.89	76.62	16.47	12.66
Cataracts ($p < .0001$)§	416 (24.7)	244 (25.7)	95 (7.0)	*16.81*	24.37	33.78	2.79	6.24
Non-AD dementia ($p < .0001$)§	200 (11.9)	330 (34.8)	498 (36.7)	*22.96*	0.0	25.39	54.61	36.91
Diabetes ($p < .0001$)§	635 (37.7)	307 (32.4)	368 (27.1)	*32.99*	41.26	49.43	0.0	29.68

Table 1. Continued

	Waiver (n = 1,683)	PACE (n = 948)	NH (n = 1,357)	Marginal Prevalence	Type 1 31.8%	Type 2 28.0%	Type 3 21.1%	Type 4 19.1%
Sociodemographics					External variables $\lambda_{kjl} \times 100$ (conditionally estimated probabilities as %)			
Age ($p < .0001$)§								
55–64	316 (18.8)	100 (10.6)	254 (18.7)	*18.75*	31.17	4.59	10.14	18.49
65–74	464 (27.6)	256 (27.0)	276 (20.3)	*24.34*	33.09	19.84	22.79	21.57
75–84	583 (34.6)	366 (38.6)	519 (38.3)	*36.25*	28.89	38.08	47.44	36.18
≥85	320 (19.0)	226 (23.8)	308 (22.7)	*20.66*	6.86	37.49	19.63	23.76
Female participant($p < .0001$)§	1282 (76.4)	712 (75.2%)	794 (63.1%)	*70.66*	77.22	76.77	64.53	62.89
Race/ethnicity ($p < .0001$)§								
White	825 (49.2)	251 (26.7)	677 (54.6)	*51.51*	52.61	42.94	38.01	45.30
African American	826 (49.3)	679 (72.2)	544 (43.9)	*46.98*	46.33	54.93	60.56	53.71
Other	25 (1.5)	11 (1.2)	19 (1.5)	*1.51*	1.06	2.13	1.43	1.00
Marital status ($p < .0001$)§								
Married	377 (22.5)	175 (18.6)	234 (19.1)	*21.07*	21.06	15.46	20.58	27.04
Widowed	928 (55.5)	606 (64.3)	600 (48.9)	*52.69*	47.93	71.43	53.88	45.88
Divorced/separated	214 (12.8)	101 (10.7)	172 (14.0)	*13.31*	20.03	7.85	10.78	9.64
Single	154 (9.2)	60 (6.4)	221 (18.0)	*12.93*	10.98	5.26	14.75	17.44
Education ($p < .0001$)§								
<Third grade	123 (7.6)	57 (6.2)	67 (7.4)	*7.51*	1.29	8.95	12.08	9.71
Grade 3–8	594 (36.5)	437 (47.3)	327 (36.2)	*36.40*	28.41	44.75	50.80	37.11
Grade 9–11	392 (24.1)	196 (21.2)	167 (18.5)	*22.09*	26.78	24.92	13.34	17.13
High school graduate	372 (22.9)	137 (14.8)	246 (27.2)	*24.43*	30.01	15.61	16.08	23.92
Some college	100 (6.1)	53 (5.7)	48 (5.3)	*5.85*	8.16	2.73	6.54	5.62
College graduate	46 (2.8)	43 (4.7)	48 (5.3)	*3.72*	5.36	3.05	1.16	6.50

* H is the GoM-weighted average over K classes of the discriminant information statistic. Values of H near zero indicate a lack of informativeness (ie, similar outcome frequencies for each set) and that—as far as values of the particular internal variable over a particular data set are concerned, a random model would fit equally well (16,17).

† Question relevance factor (QRF) 1.1 or more: The QRF indicates the relative contribution of each informative variable to the formation of each pure type; QRF values greater than 1 indicate a relatively greater contribution of the variable to formation of a particular pure type, while values less than 1 indicate the variable was relatively less informative (16).

‡ QRF less than 0.9.

§ p values for contingency tables (left columns), row (variable/variable level) by column (program).

before being certified, qualifying for Medicaid, or both; we extracted data from assessments closest to LTC-entry dates. SC's Medicaid Management Information System provided data for Medicaid services utilized (at the funding-code level), dates of use, and associated FFS provider payments (These data are unavailable for PACE—a managed care program in which the state pays a fixed capitation monthly at a rate negotiated annually.). Multidimensional health and management records were linked at the individual level to provide comprehensive health information at admission as well as comprehensive Medicaid utilization and payment information to 365 days postadmission into FFS LTC. Time in program was calculated for all FFS and PACE patients who completed the admission year or who died or were discharged prior to their anniversary.

The GoM Model

The GoM model was developed as a general multivariate procedure for analyzing high-dimensional discrete response data (19,20). The basic GoM model estimates two sets of parameters using maximum likelihood principles: (a) the probability (λ_{kjl}) of a particular response on a given variable j for $k = 1, \ldots K$ analytically defined types, where J is the number of variables and l is the response level for variable j and (b) an individual's degree of membership (g_{ik}) in each of the K types, where i is the individual subject (Supplementary Technical Appendix). In other words, each GoM analysis simultaneously generates K nosological types while quantifying an individual's membership in each type. It is not assumed that most individuals are fully classifiable into K discrete groups (crisp sets) given the hidden variable of interest (health status) and multiple measures that may be redundant, partly ambiguous, or incomplete. Rather, subjects are allowed to have partial membership in more than one type, reflecting the logic of fuzzy partitions, generated by convex geometrical sets (21,22).

The discreteness of the categorical measures induces a geometrical structure on the λ_{kjl}s, which is the direct (Cartesian) product of J regular simplexes (ie, line segments [0, 1], equilateral triangles, tetrahedrons, etc.), with the dimensionality of simplex j one less than the number of responses to variable j. Moreover, the probability structure for any individual, indexed by i, is a K-term convex combination of the extreme points ("profiles" or "pure types") of the induced λ-structure, with nonnegative weights (g_{ik}) that sum to one (19). It follows that the geometrical structure of the g_{ik}s (g-structure) is a (K−1)-dimensional regular simplex.

Models with $K < J/2$ are identifiable and, hence, estimable (19). For each such K, GoM employs iterative optimization of the g_{ik}s and λ_{kjl}s to locate individuals, first, near the vertices (extreme points) of the (K−1)-dimensional simplex and then successively further from the vertices, edges, or faces, moving into the interior of the simplex for those who cannot be completely classified in fewer dimensions. This requires GoM to simultaneously determine the g- and λ-structures of the model. The J variables used to define the g-structure are termed "internal" to distinguish them from other "external" variables that do not participate in defining the g-structure (23).

We used 75 measures of clinical conditions, impairments, and disabilities as internal variables. The external variables, which reveal associative and causal relationships that can validate the GoM typology, included sociodemographics and concurrent treatments (24,25).

Because higher dimensional manifolds become difficult to interpret (22), we set K = 4, the minimum number of types needed to adequately describe the admission mix in a state space comprised of medical conditions/diseases, impairments, and disabilities (26).

We used Bayesian information criterion (BIC) difference testing to determine that the λ-structure for PACE entrants was sufficiently similar to the λ-structure for waiver and NH entrants to allow the three programs to be pooled in a combined GoM model with a shared λ-structure. The combined model was then used to establish that PACE entrants comprise a "blend" of waiver and NH entrants in terms of a common underlying multidimensional health probability (λ_{kjl}) structure (27). GoM scores (g_{ik}) were aggregated for each type (k) to estimate their conditional prevalence overall and within LTC cohorts (28), allowing assessment of the distribution of clinical types among programs.

Finally, the GoM model was used to predict the probabilities of fit to the NH and waiver cohorts for all LTC admissions and to calculate the blend rate for PACE entrants. First, the cohort-grouping variable (ie, waiver, PACE, NH) was copied into the array of external variables whose predicted probabilities were estimated. PACE was recoded as a missing value, forcing estimation of cohort-fit into the two FFS alternatives (summing to 1.0 for each individual), in order to describe PACE admissions in terms of their blend of waiver and NH cohort characteristics. The probability of each individual [Prob(x_{ijl} = 1)] fitting a program cohort was based on her underlying health (ie, her g_{ik} scores) and the health characteristics associated with entry into alternative programs (ie, here, λ_{kjl} scores of the cohorts entering NH and waiver). The distribution of predicted cohort-fit probabilities is reported for each cohort using smoothed histograms, means, standard deviations, and ranges. The mean predicted waiver cohort-fit probability for PACE is (in percentage terms) 100% minus its mean predicted NH cohort-fit probability.

Formulation and Comparison of Medicaid Expenditures

Medicaid utilization was measured for waiver and NH entrants to 1 year, and per capita utilization was converted into $FY05 expenditures based on state fee data. Estimates of annual Medicaid expenditures for waiver and NH entrants were attrition adjusted. The mean program-blend estimate (and 95% CI) was used to locate a fee-for-service expenditure prediction for the PACE cohort between waiver and NH cohort estimates, adding the waiver base cost. The FY05 PACE capitation rate was compared with the point estimate and 95% CI of FY05 Medicaid expenditures for the PACE population if served by FFS LTC. We interpret PACE capitation outside the confidence limits of predicted Medicaid outlays as evidence of overpayment or savings.

Results

There were 3,988 dually eligible admissions. Waiver clients (n = 1,683) were the plurality (42.2%), followed by admissions to NHs (n = 1,357; 34%) and PACE (n = 948; 23.8%). Table 1 (left columns) provides selected cohort data (Supplementary Table 1A in the Supplementary Technical Appendix). PACE admissions were older (77.32 ± 0.31 vs waiver: 74.93 ± 0.25 and NH: 75.98 ± 0.28; $p < .01$), more likely widowed, African American, and less educated. NH admissions are more likely to be male. Waiver admissions were less likely than PACE or NH admissions to have dementia. Arthritis and cataracts were less frequently documented in NH than community programs. Greater activity-of-daily-living (ADL) dependency was observed in NH than in community admissions. Between community cohorts, PACE had lesser mobility dependency. Nurse-rated cognitive and communication impairment reflected the dementia distribution, with PACE and NH cohorts more impaired than waiver, but with PACE in the moderate versus NH in the severe range. PACE admissions had better sensory function but more behavioral problems. PACE admissions were more frequently incontinent than waiver but less so than NH admissions.

Four clinical types—differentiated chiefly by impairments and disability levels—were identified and validated, characterizing the variation in service needs. The Bayesian information criterion statistics strongly favored the four-type three-program model with a shared λ-structure over the corresponding model with separate λ-structures (Bayesian information criterion difference = 704.06, where any difference > 14 should be "decisive"). More impactful internal variables included expressive and receptive communication, short-term memory, daily decision making (*H:* 0.75–1.22) and basic ADLs, and continence status (0.55–0.71; Table 1 and Supplementary Table 1A, right-side columns). Medical conditions had lesser impact; the more impactful included Alzheimer disease (H = 0.18; sample prevalence 13.2%), arthritis (H = 0.17; 48%), and other dementias (H = 0.14; 25.8%).

Type 1 had the greatest prevalence (31.8% of sample g_{ik}) and was the least limited in ADLs (except for transferring and locomotion) and continence, reflecting a physically impaired, cognitively intact "model" patient. Conditionally estimated probabilities ($\lambda_{kjl} \times 100$) were 100% for communication and speech clarity, intact memory, and independence/modified independence in daily decision making. The probabilities of adequate hearing and vision were higher than the marginal rates. It had zero probability of dementia but greater than marginal probabilities of allergies and emphysema. Type 1 was least likely to receive concurrent continence care but most likely to receive oxygen. It was the youngest (probability of age ≤ 74 = 64.3% vs 43.1% sample prevalence) and heaviest (≥160 lbs = 54.1% vs 38.1%).

Type 2 was second in prevalence (28.0%), with higher than marginal likelihood of needing limited to extensive assistance with basic ADLs. It reflected a model patient who was physically disabled and cognitively impaired with primarily subcortical executive deficits. Its estimated probability of dementias and current behavioral problems was 0%, whereas the probabilities of "usual" communication abilities were 100%. Daily decision making was moderately impaired, and short-term memory impaired. It was the most hearing-impaired type. After Type 4, it had the most severe bladder incontinence. Like Type 1, Type 2 had more arthritis, cataracts and various cardiac, circulatory, and endocrine conditions (Supplementary Table 1A). It was most likely widowed (71.4% vs 52.7%) and the oldest (probability of age ≥ 85 = 37.5% vs 20.7%).

Type 3 (prevalence 21.1%) had the highest likelihoods of Alzheimer (52.7%) and other dementias (54.6%), with 100% probabilities of memory impairments and severely impaired daily decisional capacity. It reflected a model patient who was primarily cognitively impaired, with lesser levels of physical disability, as typically seen in advanced dementias. After Type 4, it manifested the most impaired communication ability. It also had the highest probabilities of behavioral problems. Type 3 required extensive assistance in most ADLs but had lesser levels of transferring and locomotion disability. It was also most likely to receive scheduled toileting and least likely to use incontinence pads/briefs or any skilled therapy or procedure (87% vs 51.4%). Type 3 was likely African American (probability 60.6% vs 47.0%) and least educated (<ninth grade 62.9% vs 43.9%).

Type 4 (19.1%) was the most disabled, with 100% probabilities of total ADL and continence dependency, reflecting a model patient with high levels of both physical and cognitive disability. It had the highest probabilities of impaired vision and communication. Although its dementia probabilities were not as high as Type 3, it was as likely to manifest memory and decisional impairments. Type 4 was likely to have an indwelling catheter and use incontinence pads/briefs and to receive decubitus care and nutritional support.

Only 12.8% of admissions were full members of any pure type. Of these, 214 Type 1 entrants were in the waiver

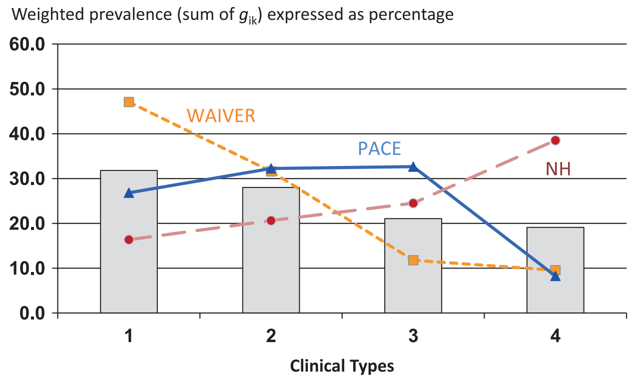

Figure 1. Weighted prevalence of four clinical types, aged/disabled waiver, Program of All-Inclusive Care for the Elderly (PACE) and nursing home (NH), and overall.

(12.7% of that cohort) and 164 Type 4 admissions were NH entrants (12.1% of NH admissions). In contrast, only 30 pure Type 1 individuals entered NHs (2.2% of NH admissions) and 22 Type 4 individuals entered waiver (1.3%). Nearly two thirds had distributed membership across contiguous types: notably, 29.1% of the waiver cohort were Type 1/2 members, 33.5% of PACE entrants were 1/2/3 members, and 18.9% of the NH cohort were 2/3/4 members (Supplementary Technical Appendix and Supplementary Figure 1A).

Waiver clients had the highest aggregate membership in the least impaired/disabled type (47.1% of the cohort's total membership or g_{ik}) and had successively decreasing membership in other types—Types 2 (31.6%), 3 (11.8%), and 4 (9.6%; Figure 1). In contrast, the NH cohort was most represented in the most impaired/disabled type (4: 38.5%), with successively decreasing aggregate memberships in Types 3 (24.3%), 2 (20.6%), and 1 (16.4%). PACE's weighted prevalences were: Types 3 (32.7%), 2 (32.3%), 1 (26.8%), and 4 (8.3%).

The average predicted probabilities of NH cohort-fit were 0.3005 ± (*SD*) 0.2139 and 0.6103 ± 0.2467 for waiver and NH admissions (Figure 2). Correspondingly, the mean probability of waiver cohort-fit for NH admissions was 0.3897. Across the population, the predicted probabilities of NH cohort-fit were 12.3%, 17.8%, 82.7%, and 89.7% for Types 1–4, respectively. The waiver/NH blend probabilities for the PACE cohort were waiver: 0.5602; 95% CI: 0.5472, 0.5732 and NH: 0.4398; 0.4268, 0.4528.

One-year follow-up status was available for all admissions. Unadjusted Medicaid expenditures for waiver and NH admissions were $3,667 and $65,944. Attrition was calculated as 1 minus the 1-year retention rate for each program, that is, 0.139 for waiver and 0.182 for NH (PACE attrition was 0.111). Total adjusted 1-year payments for waiver and NH cohorts were $4,177 and $77,945. The model's waiver/NH blend translates to 43.98% of the difference between waiver and NH payments atop the waiver base, that

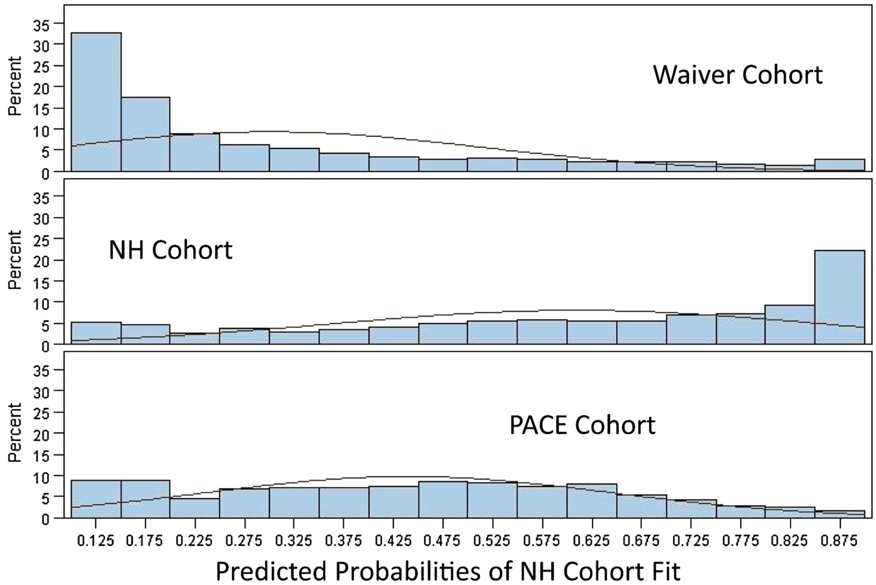

Figure 2. Distribution of predicted probabilities of fit to the nursing home (NH) program cohort, for aged/disabled waiver, Program of All-Inclusive Care for the Elderly (PACE), and NH admissions.

Program Cohort	Average of Predicted Probabilities	*SD*	Minimum Predicted Probability	Maximum Predicted Probability
Waiver	0.3005	0.2139	0.1231	0.8966
NH	0.6103	0.2467		
PACE	0.4398	0.2045		
Overall	0.4390	0.2608		

is, $73,769 × 0.4398 = $32,443; $32,443 + $4,177 = $36,620. The 95% CI was $35,662–$37,580. PACE full-year Medicaid capitation in FY05 was $27,648, 28% below the confidence limit for estimated PACE cohort payments in FFS LTC. In FY05 dollars, this comprised a savings of more than $8.5 million in the first year for patients admitted to PACE over 11 years.

Discussion

The three program GoM model of LTC population health achieved superior classificatory parsimony and transparency, integrating a large number of disease, impairment, and disability factors into relatively few dimensions (four types) with face and predictive validity. Bayesian information criterion testing established that PACE admissions comprised a “blend” of waiver and NH entrants, sharing a common underlying health deficit probability structure. Program type prevalences reflected a stepped progression of health deficits and associated service needs across LTC admission cohorts. That is, net of unobserved selection processes, aggregate health deficits were appropriately matched to the services provided by the different programs: NHs received a greater share of Type 4 vs community programs and waiver a greater share of Type 1. In contrast, PACE tended to serve Type 3 participants whose cognitive and behavioral impairments make around-the-clock familial care difficult or impossible but who are also difficult and expensive to care for in institutions; their better mobility helps make PACE’s transportation and day center–based services feasible.

Nevertheless, cohorts entering alternative programs clearly overlap in assessed health deficits. The overlap was quantified by a summary case mix measure—predicted probability of fit to the NH cohort: On average, waiver entrants had less than a one in three probability of NH cohort-fit, but the mean predicted probability among NH admissions of waiver cohort-fit was nearly 40%. The PACE cohort’s blend, 56% waiver/44% NH, was used to predict a standardized 1-year Medicaid payment for the PACE cohort in alternative care. PACE’s capitation was well below the confidence limit for case mix–adjusted payments in FFS LTC, providing Medicaid with significant savings in meeting the service needs of PACE participants.

The chief study limitations were that the composition of clinical types, their distribution across programs, the distribution to program cohorts of predicted NH cohort-fit probabilities including the PACE blend, and the association of PACE enrollment with Medicaid savings, were very specific to a time (1994–2005) and place (central SC), and may not generalize to other periods, states, populations, and programs. In 2010, PACE per member per month Medicaid rates varied nationally from $1,556 to $4,834. With expectations of similar cost variation in alternative LTC and varying blend rates, savings due to PACE enrollment would likely not be realized everywhere. However, it is impossible to determine where Medicaid's PACE capitation may be less or greater than predicted alternative payments without research. Further, we examined 1-year costs in an admission population. This required a long observation period (11 years) to build sample, during which FFS care may have varied, although FFS costs and PACE capitation were estimated in $FY05. The period preceded Medicare Part D, which transferred drug benefit coverage for dual eligibles from Medicaid. In contrast to using admissions, population cross-sections could yield reasonable samples in more current, relatively brief observation periods. In cross-section, PACE groups may more resemble NH groups (the blend being more convergent with NH groups), given greater survival and long-term retention of PACE versus waiver and NH patients (11,29,30). This would raise cost predictions of prevalent PACE groups in FFS care relative to fixed PACE capitation schedules, improving PACE's price performance.

Although the research question concerned the relative cost of PACE to Medicaid, our methods have obvious relevance for state rate setting, not only for PACE but for other managed LTC in which both patient acuity and input costs are "intermediate" between aged/disabled waiver and institutional care (eg, VNS CHOICE in New York, Minnesota Senior Health Options). States presently lack a sound actuarial basis for LTC capitation, employing various formal and informal methods to arrive at "fair" rates allowing programs to operate as mandated and bear risk, posed chiefly by use of institutional care (31). The ability to locate and price the community/institutional blend allows payers and providers to negotiate appropriate discounts to Medicaid, shared savings, and rate adjustments contingent on case mix changes, encouraging expansion and availability of these programs nationally.

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Supplementary Data

Supplementary material can be found at: http://biomedgerontology.oxfordjournals.org/.

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