

Supporting Information

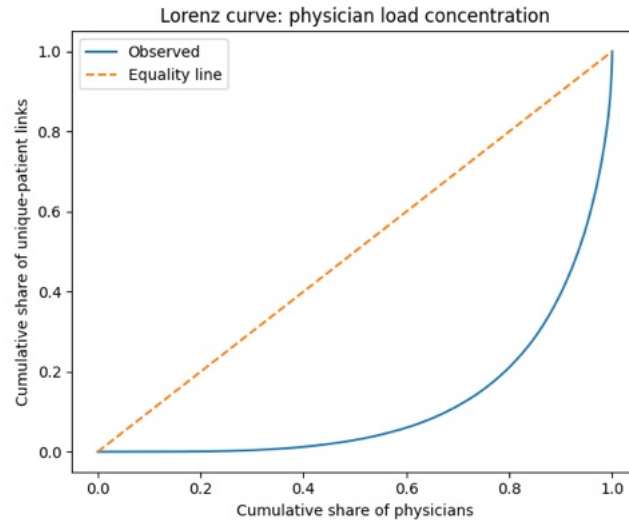


Fig. S1: Lorenz curve of physician workload. The curve plots the cumulative share of unique patient–physician links (y-axis) against the cumulative share of physicians (x-axis), ranked from least to most loaded. The dashed line represents perfect equality. The observed curve demonstrates strong workload concentration, with a small number of physicians managing a large share of patient interactions.

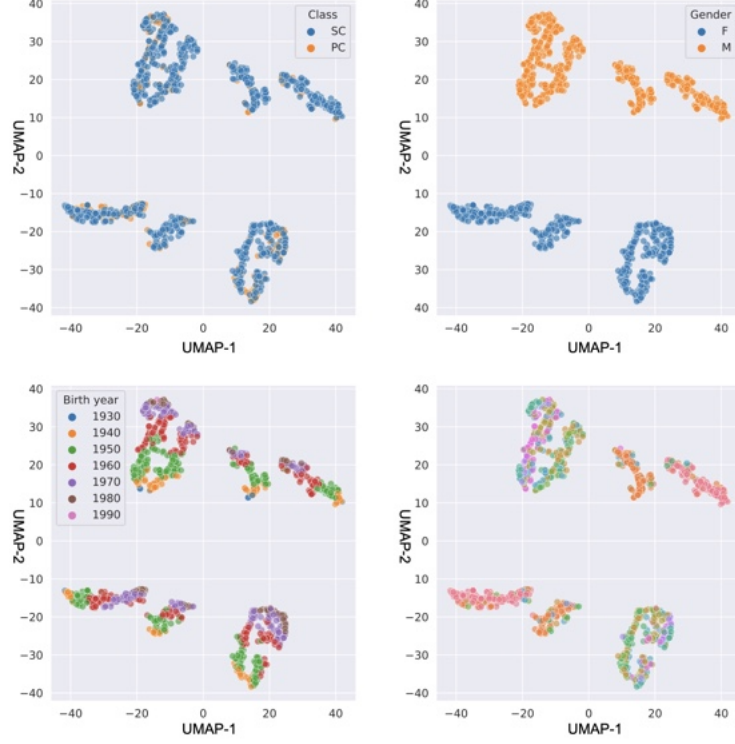


Fig. S2: Attri2Vec embeddings with professional-network features (t-SNE, perplexity = 40). Each point represents a physician. Top-left: separation between primary care (PC) and specialist care (SC) physicians. Top-right: gender-based coloring reveals gender stratification. Bottom-left: coloring by birth year shows modest age clustering. Bottom-right: hospital-based coloring reveals co-affiliation clustering, indicating that professional-network features encode institutional relationships.

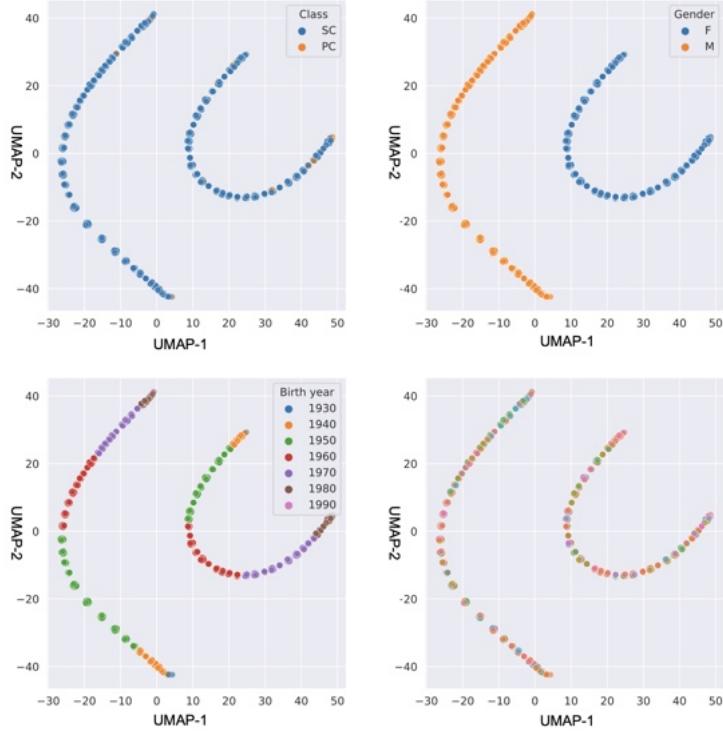


Fig. S3: Attri2Vec embeddings without professional-network features (t-SNE, perplexity = 40). The embeddings exhibit weaker structure and reduced cluster cohesion. Top-left: PC and SC separation persists but is diffuse. Top-right: gender becomes the dominant organizing dimension. Bottom panels: hospital and age colorings show limited differentiation, indicating reduced capture of organizational/co-affiliation structure without professional-network features.

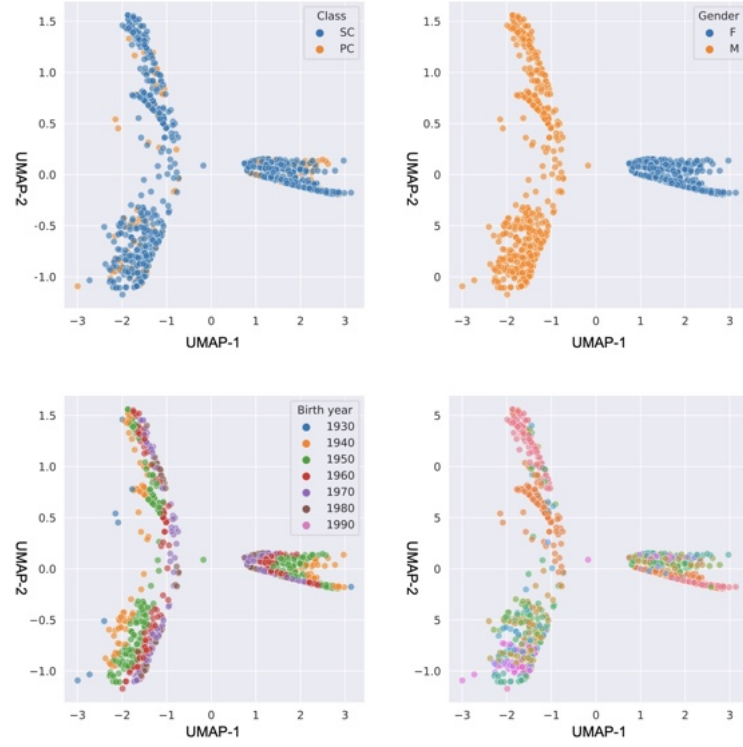


Fig. S4: Attri2Vec embeddings with professional-network features (ISOMAP, 100 neighbors). Top-left: clear distinction between PC and SC physicians. Top-right: gender-based clustering persists but is secondary to hospital-based patterns. Bottom-left and bottom-right: birth-decade and hospital-based colorings reveal institutional grouping, consistent with organizational proximity captured via professional-network features.

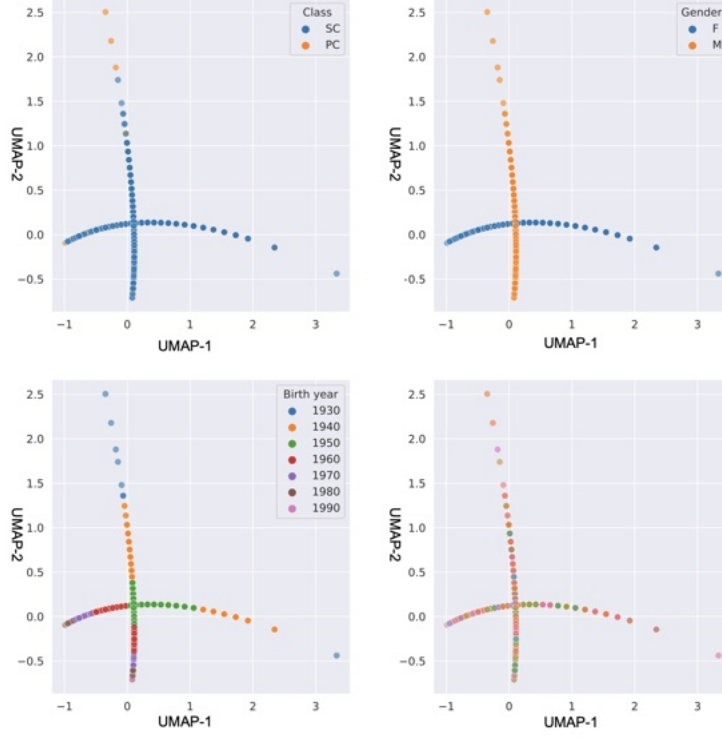


Fig. S5: Attri2Vec embeddings without professional-network features (ISOMAP, 100 neighbors). Top-left: PC-SC separation is minimal. Top-right: gender dominates the embedding structure. Bottom panels: age and hospital colorings reveal no consistent clustering, indicating reduced organizational coherence without relational information.

Table S1: Descriptive statistics of referral and professional networks. The referral network captures directional PC→SC patient transitions within a 30-day window. The professional network encodes shared institutional, educational, or co-affiliation ties among the same physicians.

Metric	Referral Network	Professional Network
Nodes	1,133	1,133
Edges	34,249 (directed PC→SC dyads)	118,756 (undirected ties)
Density	0.139	0.186
Mean degree	116.5 (PC); 40.8 (SC)	209.6
Mean edge weight	7.4 referrals per dyad	–
Largest connected component (%)	94.7% (weakly connected)	95.3%
Network type	Directed bipartite	Undirected affiliation

Table S2 reports demographic effects using observed referral data. Referrals were slightly more frequent between same-gender physicians (mean 6.2%) than between cross-gender pairs (5.7%), a small yet statistically significant difference ($p = 0.042$). Age difference effects were negligible, with referral probabilities declining only marginally for wider age gaps. These findings confirm weak demographic homophily relative to strong professional-network effects.

Table S2: Demographic effects on referral likelihood. Mean referral probabilities (row → column physician) are shown with standard errors. Gender comparisons are based on two-sample t -tests; age difference effects derive from a logit regression on observed referral pairs.

Category	Mean Referral Rate	Std. Error	Significance
<i>Gender Pair</i>			
Same gender (M→M or F→F)	0.062	(0.004)	$p = 0.042^*$
Cross gender (M→F or F→M)	0.057	(0.003)	
<i>Age Difference</i>			
$ \Delta a < 5$ years	0.061	(0.005)	n.s.
$5 \leq \Delta a < 15$ years	0.058	(0.004)	
$ \Delta a \geq 15$ years	0.055	(0.006)	
<i>Model-based estimates</i>			
Logit coefficient (same gender)	0.072 (0.028)		$p < 0.05$
Logit coefficient ($ \Delta a $ per decade)	−0.013 (0.009)		n.s.

Table S3: Continuity of care: summary of UPC and COCI indices. UPC (*Usual Provider of Care*) measures the proportion of visits to a patient’s most frequently seen physician, while COCI (*Continuity of Care Index*) captures dispersion of visits among multiple physicians. Higher values indicate greater continuity of care.

Metric	N	Median (IQR)	Mean (SD)	% ≥ 0.75 / 0.90
UPC (all patients)	1,477,066	0.500 (0.667)	0.618 (0.316)	38.9% / 35.4%
COCI (patients with $V_i \geq 2$)	1,065,692	0.105 (0.333)	0.234 (0.305)	–
Patients with $V_i = 1$ (UPC=1)	411,374	–	–	27.9% of all patients