

Institutional variability in vascular access device selection, dwell time and complications: a multicenter cohort study

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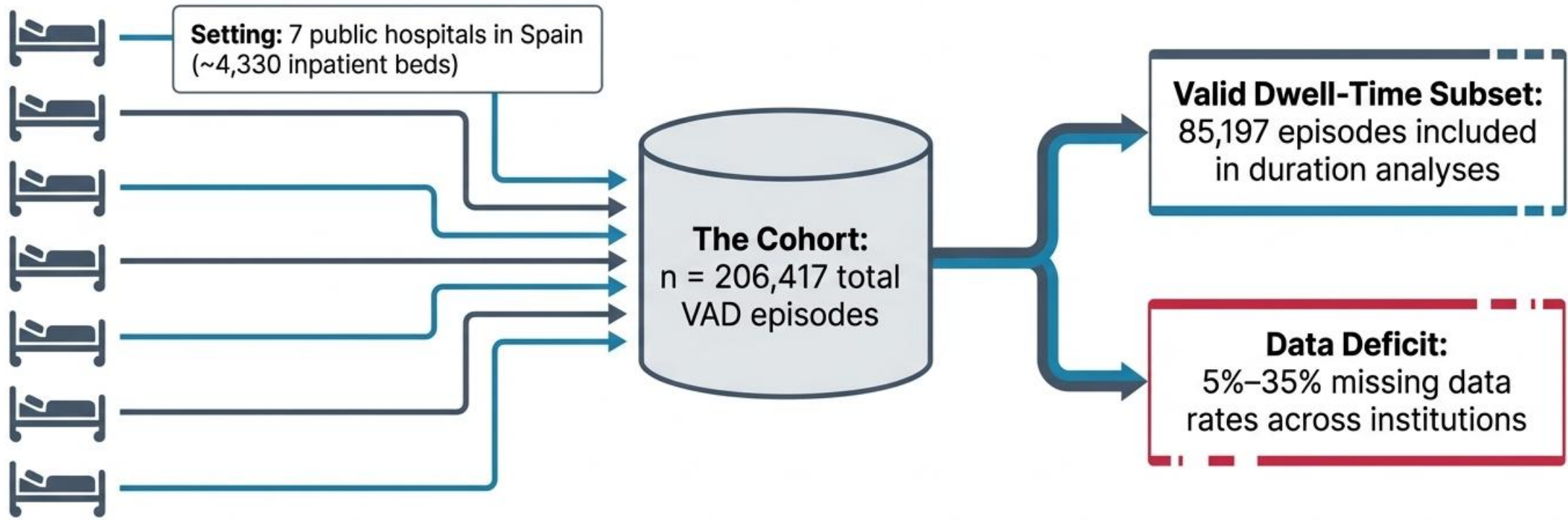
Introduction:

Vascular access devices (VADs) are widely used in hospitalized patients and are essential for intravenous therapy. However, suboptimal device selection and short dwell times contribute to avoidable complications, repeated insertions, and increased workload. Understanding real-world patterns of VAD use and outcomes across institutions is critical to inform quality improvement strategies.

Methods:

A retrospective multicenter cohort study was conducted in seven public hospitals in Spain during 2023. Hospitals differed in size, case mix, and availability of vascular access specialist teams (VASTs). All VADs inserted in adult hospitalized patients were included, with each device considered as the unit of analysis. Data were extracted from institutional vascular access registries. Outcomes included device type distribution, dwell time, complication rates, and variability between centers. Associations between dwell time, complications, and institutional characteristics were explored using descriptive and inferential analyses.

Mapping Vascular Access at Scale



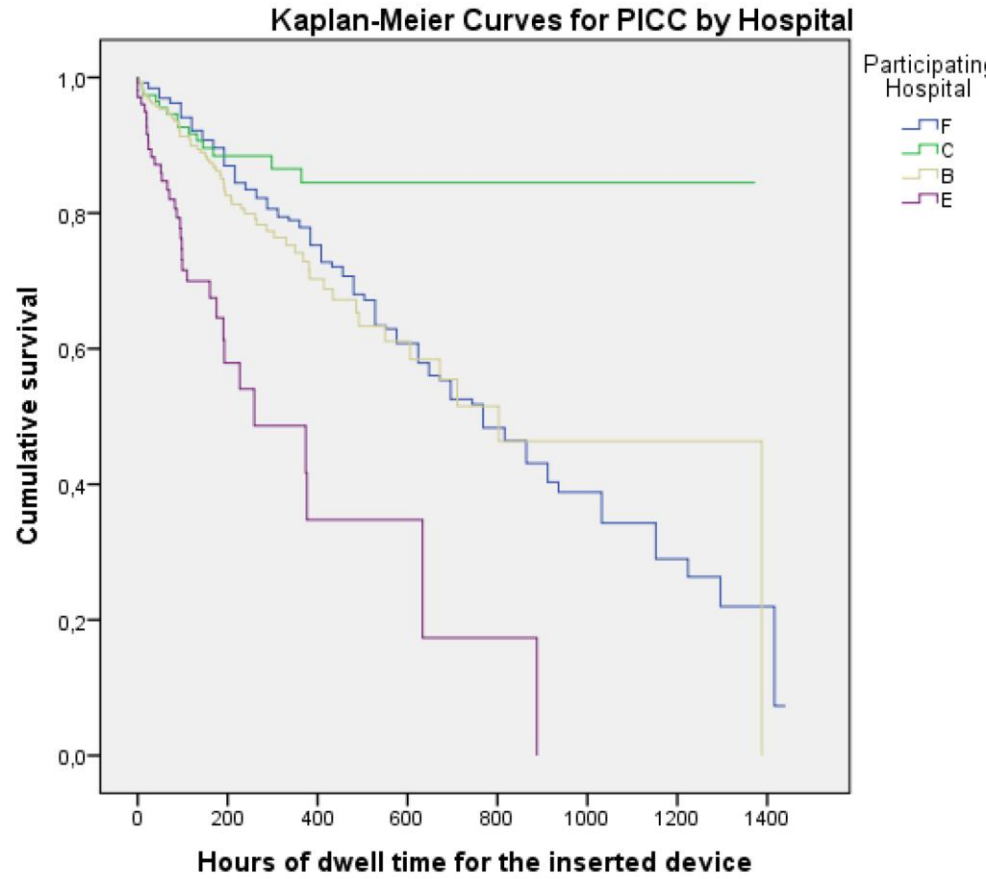
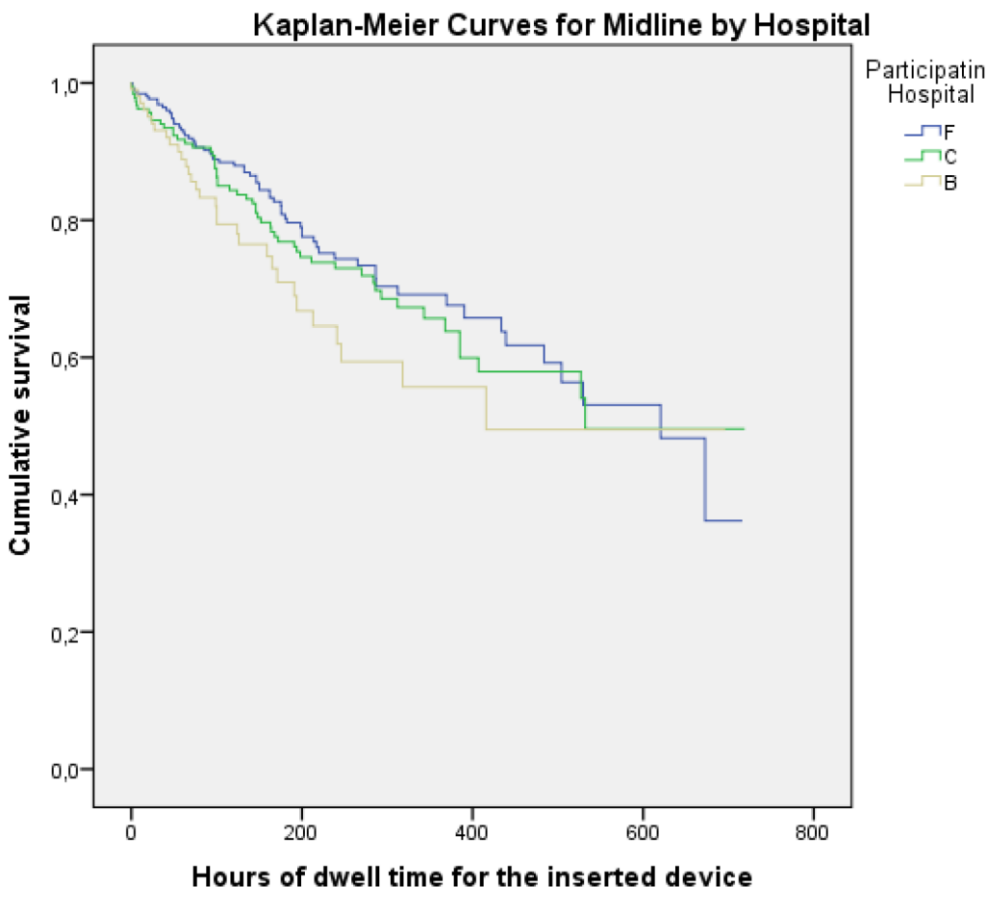
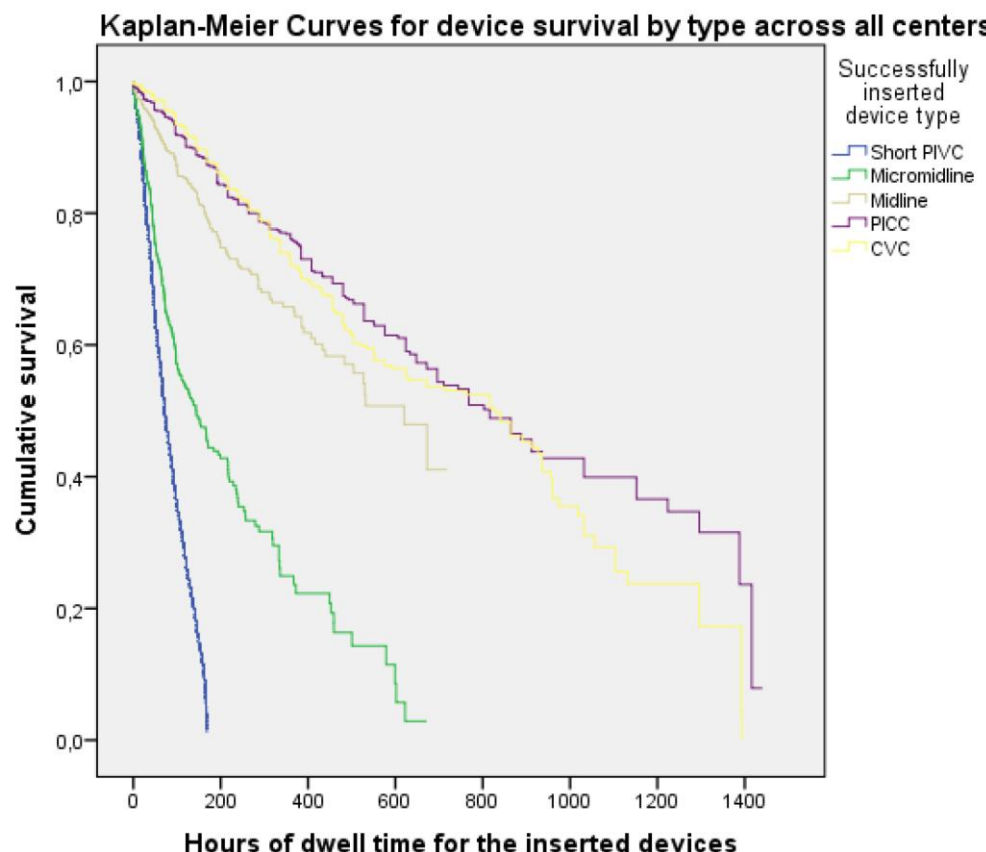
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Results:

A total of 206,417 devices analysed. Short peripheral intravenous catheters (PIVCs) represented approximately 90% of all devices inserted (mean dwell time was 2.3 days), with high rates of complications and frequent need for replacement. In contrast, midline catheters and peripherally inserted central catheters (PICCs) demonstrated longer dwell times and lower complication rates but were less frequently used. Across all device types, longer dwell time was associated with lower complication rates ($p < 0.001$). Substantial variability in device selection, dwell time, and complication rates was observed between hospitals. No consistent association was identified between VAST staffing levels and complication rates or device selection patterns.

		Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Hospital F	Hospital G	TOTAL	CHISQ / K-W
N		3183	7121	6723	NA	16273	28344	16253	77861	
ALL SHORT PIVC	Mean hours	2.51 (SD 14.8)	52.8 (SD 42.8)	57.4 (SD 43)	NA	47.5 (SD 36.7)	58.4 (SD 40)	70.8 (SD 42.7)	55.9 (SD 41.8)	
WITHOUT COMPLICATIONS	Mean hours	17 (SD 38.3)	53.2 (SD 44.4)	59.5 (SD 43)	NA	50.5 (SD 38.2)	60.7 (SD 40.4)	72.7 (SD 43.2)	59.7 (SD 42)	P<0.001
	Incidence	260 (8.2%)	3735 (52.4%)	3321 (49.4%)	NA	7428 (45.7%)	12232 (43.1%)	6977 (42.9%)	33953 (43.6%)	P<0.001
CATHETER FAILURE	Mean hours	1.3 (SD 9.8)	52.4 (SD 41)	55.3 (SD 40.6)	NA	44.9 (SD 35.1)	56.7 (SD 39.5)	69.5 (SD 42.3)	52.9 (SD 41.4)	P<0.001
	Incidence	2923 (91.8%)	3386 (47.5%)	3402 (50.6%)	NA	8809 (54.2%)	16112 (56.8%)	9276 (57%)	43908 (56.4%)	P<0.001
ALL MIDLINE	Mean hours	7.94 (SD 38)	170.6 (SD 144.4)	233.1 (SD 167.8)	NA	NA	221.5 (SD 161.9)	156.1 (SD 50.4)	196.8 (SD 140.8)	
WITHOUT COMPLICATIONS	Mean hours	NA	194.9 (SD 154.2)	265.1 (SD 170.4)	NA	NA	237.5 (SD 161.5)	158.6 (SD 46.5)	217 (SD 146.8)	P<0.001
	Incidence	NA	73 (70.2%)	134 (70.9%)	NA	NA	194 (74.9%)	151 (61.6%)	552 (69%)	P<0.001
CATHETER FAILURE	Mean hours	NA	113.6 (SD 98.8)	155.2 (SD 133.2)	NA	NA	173.8 (SD 155)	152 (SD 56.2)	151.8 (SD 114.3)	P<0.001
	Incidence	NA	31 (29.8%)	55 (29.1%)	NA	NA	65 (25.1%)	94 (38.4%)	245 (31%)	P<0.001
ALL PICC	Mean hours	NA	170.7 (SD 144.4)	233.1 (SD 167.8)	NA	53.2 (SD 47.9)	221.5 (SD 161.9)	156.1 (SD 50.4)	196.8 (SD 140.7)	
WITHOUT COMPLICATIONS	Mean hours	NA	194.9 (SD 154.2)	265.1 (SD 170.4)	NA	116.6	237.4 (SD 161.5)	158.6 (SD 46.5)	217 (SD 146.8)	P<0.001
	Incidence	NA	201 (77%)	103 (88%)	NA	70 (67.3%)	549 (72.5%)	175 (44%)	1098 (67.1%)	P<0.001
CATHETER FAILURE	Mean hours	NA	113.6 (SD 98.8)	155.2 (SD 133.2)	NA	137.8	173.8 (SD 155)	152 (SD 56.2)	151.8 (SD 114.3)	P<0.001
	Incidence	NA	60 (23%)	14 (12%)	NA	34 (32.7%)	208 (27.5%)	222 (56%)	538 (32.9%)	P<0.001



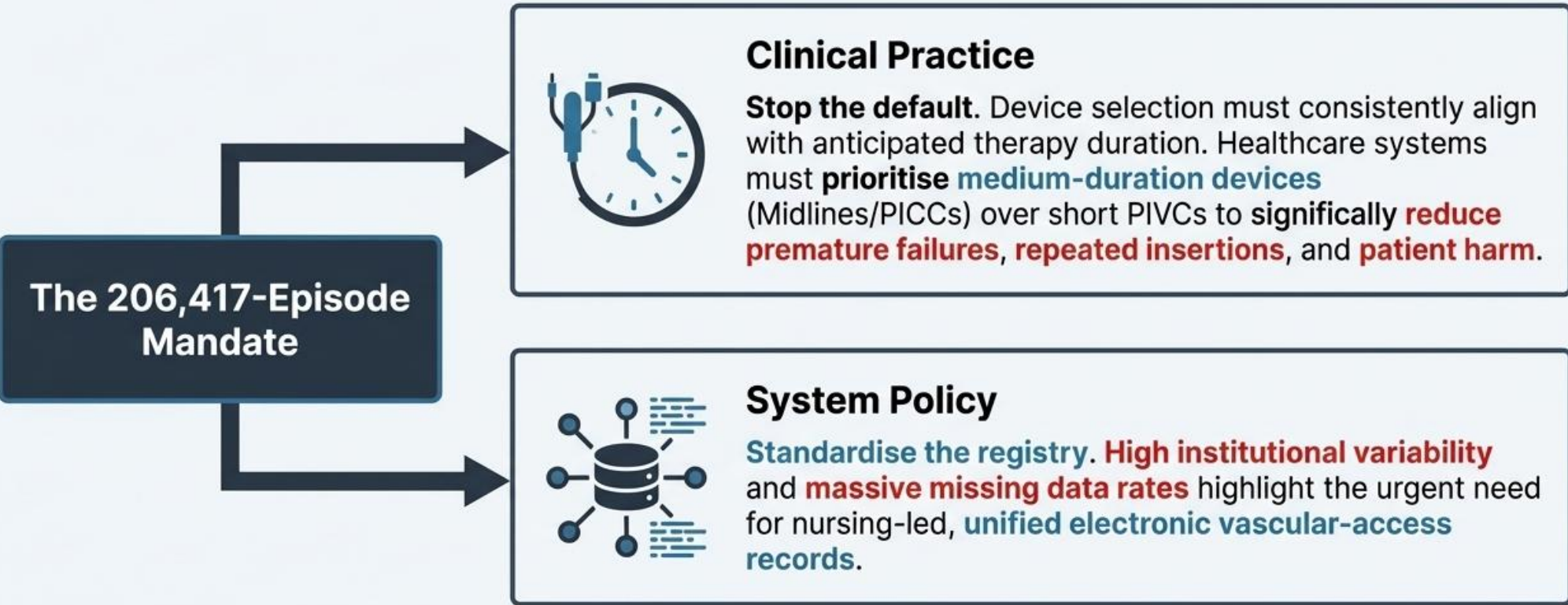
	Predominance	Failure Rate	Mean Dwell Time
PIVC	90%	Inter Regular 56.4%	Inter Regular 55.9 hours
Midline	~1%	Inter Regular 31.0%	Inter Regular ~197 hours
PICC	~2%	Inter Regular 32.9%	Inter Regular ~197 hours

Early Failure Warning: 61% of all PIVC failures occur within the first 24 hours. Medium-duration devices offer significantly longer complication-free survival.

Conclusions:

Marked institutional variability exists in vascular access practices in routine hospital care. The predominant reliance on short peripheral catheters, despite their short dwell time and higher complication burden, suggests opportunities to improve device selection based on anticipated therapy duration. Greater use of medium-duration devices may reduce unnecessary reinsertion and improve patient safety. Robust and standardized vascular access data systems are essential to support benchmarking and continuous improvement initiatives.

Realigning Practice and Policy



Data standardisation is the absolute prerequisite for reliable benchmarking and proving the value of specialist interventions.

Keywords: vascular access devices; real-world data; complication rates; device dwell time; hospital practice variation.