

WORKSHOP IN POLITICAL THEORY  
& POLICY ANALYSIS

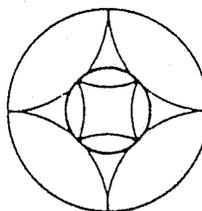
**Police Services Study  
Technical Report**

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POLICE PATROL IN METROPOLITAN AREAS --  
IMPLICATIONS FOR RESTRUCTURING THE POLICE

by

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Police Patrol in Metropolitan Areas --  
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Implications for Restructuring the Police

For many years, critics of American policing have argued that its fragmented nature leads to poor performance. They have argued that massive restructuring, principally the consolidation of the many smaller local police agencies found in metropolitan areas into one or a few large units, is necessary to improve police performance in metropolitan areas.<sup>2</sup> In spite of this consensus among the critics,<sup>3</sup> most local communities have resisted consolidation efforts. The critics have seen this as an example of the irrationality of residents of those communities. However, recent research has provided evidence that the levels of police service provided to citizens in areas served by small to medium-sized police agencies may be higher than the levels of service provided to residents of similar areas served by larger police agencies.<sup>4</sup> If this is the case, citizens who resist attempts to consolidate their police forces may not be irrational, but rather may simply wish to preserve the levels of service they currently receive.

What are the relationships between the multiplicity and/or the fragmentation of a metropolitan police industry and how well police agencies perform? A commonly recommended reform, consolidation of all or some of the police agencies serving a metropolitan area, would result in the dominance of the area's police industry by a single producer.<sup>5</sup> What is the relationship between the degree of police industry domination and police performance? Specialized

production of auxiliary services is frequently suggested as a means of capturing possible economies of scale in the production of such services.<sup>6</sup> What relationships exist between the specialization of auxiliary service production in metropolitan areas and the performance of police agencies in those areas?

To answer such questions, several types of data are required. First, comparative measures of metropolitan police industry structure are needed to determine which metropolitan areas have higher levels of multiplicity, which are more fragmented, and which are more dominated by a single producer. Relative measurement of the specialization of auxiliary service production is also necessary. Second, one needs measures of the service conditions affecting the demand for police services in metropolitan areas in order to compare areas where such conditions are relatively similar. Most importantly, comparative measures of the performance of police agencies are needed for metropolitan areas exhibiting similarities and differences in police industry structure and service conditions.

Collecting and organizing such information is not a simple task. Service condition data for metropolitan areas and units within them are available from Census Bureau and other agencies' publications. But questions of data currency and the levels of data aggregation still present problems. Also, factors affecting the demand for police service are not clearly identified. Considerably less data are available for characterizing the structure of the police industries that serve various metropolitan areas. There are virtually no data upon which to base a comparison of the performance of police agencies within single metropolitan areas or across metropolitan areas<sup>7</sup> having different industry structures or service conditions.

In this chapter, data from a recent comparative study of the organization of police service delivery in small and medium-sized metropolitan areas are marshalled to provide a preliminary exploration of some of these important relationships. A number of comparative measures of metropolitan structure are presented and employed in the analyses. The research project collecting these data was, by design, a descriptive exploration of the current state of policing in metropolitan areas. No attempt was made to collect comparable performance data. There is little agreement among scholars or the police on any measures of police performance that might be employed for such a wide-ranging comparison. Although the lack of performance data severely limits the depth of the analyses, this chapter will present some limited explorations using indicators of police activity levels as proxies for performance.

The analyses are based on data obtained in 80 metropolitan areas across the United States. <sup>8</sup> These 80 areas were randomly selected from the 200 metropolitan areas defined by the Census Bureau in 1970 having a population of less than 1.5 million persons and boundaries that did not cross state lines. The sample was stratified for each of the 10 regions used by the U.S. Department of Justice and other federal agencies.

The 80 metropolitan areas range in size from Meriden/Connecticut (population 55,959) to Paterson-Clifton-Passaic/New Jersey (population 1,357,930). They are located in 31 states. Population densities in the areas range from 31 to more than 3,000 persons per square mile. Over 23 million Americans resided in these 80 areas in 1970. More than 50,000 full-time sworn police officers are engaged in producing

police services in the areas. These officers are employed by over 1,400 police agencies. While the very largest metropolitan areas are excluded from consideration, the patterns found in these 80 metropolitan areas are perhaps typical of the range of variation in police service production in areas of the United States other than those few megalopoli.

#### POLICE INDUSTRY STRUCTURE IN METROPOLITAN AREAS

The 80 metropolitan areas vary quite dramatically in the ways that police are organized. In Meriden/Connecticut, only one agency produces patrol service. In Paterson-Clifton-Passaic/New Jersey, more than 90 agencies do so. The median metropolitan area has 13 patrol producers. But simple counts of numbers of patrol producers do not facilitate comparisons of different metropolitan areas. In order to accomplish the latter, a more complex means for characterizing the structure of the police industry serving each metropolitan area is required.

In the research project collecting the data reported in this chapter, a methodology for such characterization was developed. This methodology requires that each service produced by or for police agencies be considered separately. For a particular service, say the investigation of residential burglaries, the agencies which produce the service and those organized groups which consume the service are arrayed respectively as the rows and columns of a matrix. At the intersection of a row representing a given producer with the column representing a consuming group, any of a series of entries can be made to specify the type of relationship between producer and consumer. Manipulation of matrices generated in this fashion allows

the computation of a variety of measures of the structure of organizational arrangements in a metropolitan area for the production of the service in question.

Details of the methodology are presented in several publications that are currently available or that soon will be available.<sup>9</sup> Rather than attempting to spell out the intricacies here, a few of the measures that can be derived through use of the methodology will be presented, and used in the subsequent analyses.

As noted, each service produced by or for police agencies is treated separately. A distinction is made between direct police services -- services produced by police agencies directly for a citizen clientele -- and auxiliary services -- produced by a police or other agency for consumption by a police agency. In the case of auxiliary services, police agencies that produced direct services become the consuming units or columns in the matrices. Direct services studied were criminal investigation, further separated into investigation of homicides and investigation of residential burglaries, general area patrol, and traffic control, also separated into specific traffic patrol and traffic accident investigation services. Auxiliary services were radio communications, entry-level training, adult pre-trial detention, and chemical analysis. Matrices were prepared and structural measures computed for each of these services. The analyses presented here are focussed on the delivery of general area patrol service. Measures for the other direct services will not be included. But a measure of specialization of production for each of three auxiliary services will be included since specialized production of these services is often recommended as a means to improve direct service production.

Three measures of the structure of patrol service delivery will be important for analysis. These are multiplicity, dominance, and autonomy. Multiplicity is computed as the number of rows in the patrol matrix, or more simply, as the number of producers of general area patrol service in the metropolitan area. For the purpose of the analyses in this chapter, multiplicity will be stated in relative terms, as the number of producers of patrol service per 100,000 inhabitants of the metropolitan area. Dominance is the proportion of the metropolitan population which receives patrol service from the producer that has the largest "serviced population".<sup>10</sup> Autonomy is measured by the proportion of the metropolitan population in organized groups that receive patrol service exclusively from agencies that are bureaus of their local governing authorities.<sup>11</sup> More consolidated metropolitan areas have generally lower values of multiplicity and higher values of dominance. Areas where there is duplicate production of patrol service for the same organized groups have higher values of multiplicity and lower values of autonomy. Metropolitan areas that typify the situation most often criticized by advocates of reforming American police service delivery are those that have high values of multiplicity and autonomy, and a low value for dominance.

Specialization in the production of radio communications, entry-level training, and adult pre-trial detention is inversely measured by the relative multiplicity of service production. This is computed for each service as the number of producers of the auxiliary service divided by the number of direct service producers that consume the service. Metropolitan areas where the production of a given

auxiliary service is more specialized have lower values of relative multiplicity for that service.

With comparable measures of the structure of police service delivery in metropolitan areas, one can begin to explore the probably consequences of altering these structures. That is, one can compare areas where the structure more closely resembles that recommended to areas where the structure is more like that commonly criticized. Of course, one can only hypothesize that cross-sectional comparisons of this nature are reflective of results which might be obtained if the recommendations were accepted and structures were altered to conform to the reform model.

#### PATROL ACTIVITY LEVELS IN METROPOLITAN AREAS

Ideally, one would examine the relationships among measures of the structure of a metropolitan police industry and measures of the performance of the police agencies comprising the industry. By doing this in a comparative way, one could isolate those characteristics of metropolitan police organization which are associated with higher levels of police agency performance, and those characteristics associated with lower performance levels. This, in turn, would provide a grounding for recommendations to alter the structure of policing in metropolitan areas toward forms where higher performance levels can be expected, on the basis of evidence.

Unfortunately, comparative police agency performance data are not available across the 80 metropolitan areas. The problems of using the only available cross-jurisdictional statistics -- the annual

Uniform Crime Reports -- for comparative performance measurement have been documented in great detail.<sup>12</sup> They will not be repeated here. Suffice it to say that police chiefs themselves are quite adamant that such comparisons would be inappropriate.

Without performance measures, one cannot explore structure-performance linkages. But available comparative data do allow the exploration of the relationships between structure and police deployment patterns, and between structure and police patrol density. These latter measures are not performance indicators, but there is reason to believe that they are positively related to police performance.<sup>13</sup>

The specific indicator for police deployment patterns is the percentage of total police agency sworn personnel in a metropolitan area actually deployed for street duty on two separate shifts. The specific indicator for police patrol density is the number of sworn personnel on the street per 1,000 metropolitan inhabitants. Although these are not measures of police performance, they are closer, in a process sense, to police output than is the commonly used measure, total sworn officers per 1,000 inhabitants. The National Commission on Productivity recently emphasized the importance of deploying higher proportions of officers for street duty, arguing that this would increase police productivity.<sup>14</sup> To the extent that higher levels of on-street deployment result in increased availability of officers to respond to requests for service, the connection is plausible. But it is important to bear in mind that only limited evidence has linked higher levels of on-street deployment, higher densities of officers on the street, and higher levels of police performance.

Patrol deployment, measured by the percentage of full-time sworn officers actually on the street on the day shift (10 AM) and on the evening shift (10 PM), varied considerably across the 80 metropolitan areas. The average percentage of sworn officers on the street during the day shift was 11 percent; for the evening shift, 15 percent, on the average, were on the street. But patrol deployment on the day shift ranged from a low of five percent in one area to more than 18 percent in another. On the evening shift the range was from five percent to over 25 percent of total sworn officers actually on the street.

Patrol density, measured by the number of sworn officers on the street per 1,000 inhabitants, also exhibited wide variation. The average density on the day shift was 0.23, approximately one sworn officer on the street for every 4,000 inhabitants. One metropolitan area had less than one officer on the street for every 10,000 inhabitants; two others had at least one officer on the street for every 2,500 inhabitants. On the evening shift, the average patrol density was 0.29, about one officer for every 3,500 inhabitants. The least densely patrolled metropolitan area had one officer on the street for every 8,500 inhabitants.

Two points are important to remember in respect to these metropolitan area measures. First, metropolitan areas are typically composed of a number of individual police agency jurisdictions, with wide variation occurring within metropolitan areas as well as different metropolitan areas. Comparison of different metropolitan areas allows one to examine the relationships of metropolitan structure, overall metropolitan area deployment, and patrol density.

But, it does not reveal the deployment or patrol densities achieved by individual agencies within each metropolitan area. The second point, as noted earlier, is that patrol deployment and density levels are not performance indicators. At best, they measure a component of an agency's or a metropolitan police industry's capacity to perform certain services.

#### METROPOLITAN POLICE INDUSTRY STRUCTURE AND PATROL ACTIVITY LEVELS

Multiple regression analysis has been used to analyze the relationships among measures of metropolitan police industry structure, metropolitan police patrol deployment, and metropolitan police patrol density. Multiple regression analysis is a mathematical technique for fitting a series of observations: a linear combination of two or more variables (the "independent" variables) are related to a third variable (the "dependent" variable). Examination of the function fitted to the data points using this technique can often be used to describe the relationship between any one of the independent variables and the dependent variable while, in a sense, adjusting for the simultaneous relationships between the dependent variable and all of the other independent variables.<sup>15</sup>

In addition to the structural measures for patrol and auxiliary services, the metropolitan population, land area, and number of full-time sworn officers per 1,000 inhabitants are included as independent variables. The latter variable might be considered an indicator of the relative demand for police service in a metropolitan area, after controlling for population and land area requirements. Given two

areas with equivalent populations and land areas, the area having more difficult service demands would be expected to have more personnel employed in the production of police services.

Table 1 presents the bi-variate correlations among each of the independent variables, and between each of these and each of the dependent variables. No serious multi-collinearity problems appeared among the independent variables, at least at the simple bi-variate level.<sup>16</sup>

The regression analyses were performed using a step-wise regression procedure.<sup>17</sup> Metropolitan population, land area, and number of full-time sworn officers per 1,000 were entered into the analyses first, then the three measures of patrol structure were entered, and finally, the measures of other services were allowed to enter or not, depending on their additional contribution to explaining metropolitan area variation. This ordering seems intuitively appealing in the sense of adjusting for metropolitan characteristics that set the stage for patrol service delivery, then for the structure of organization of that delivery, and lastly for additional variables that might affect delivery at the margin, given the other influences.

Table 2 summarizes the regression results for patrol deployment. For each of the variables in the analyses (except metropolitan population and land area) three coefficients are presented. The first of these, b, represents the slope of a straight line relating the independent variable to the dependent variable after adjustment for the influences of the other variables. The second coefficient, s.e.,

TABLE 1. Bi-Variate Correlations Among Variables

	Popu- lation	Land Area	Full- Time Sworn per 1,000	Patrol Structure:			Multiplicity For:		
				Multi- pli- city	Domi- nance	Auto- nomy	Train- ing	Deten- tion	Radio Communi- cations
Population	1.00	0.35	0.13	-0.24	-0.40	-0.28	-0.32	-0.20	0.00
Land Area		1.00	0.18	-0.06	-0.04	-0.16	-0.07	0.11	0.01
Full-Time Sworn Per 1,000			1.00	-0.35	-0.02	-0.16	0.21	0.18	0.32
Patrol Structure									
Multiplicity				1.00	-0.28	-0.08	-0.39	-0.41	-0.55
Dominance					1.00	0.05	0.37	0.30	0.18
Autonomy						1.00	0.23	0.18	0.03
Structure of Other Services - Multiplicity:									
Training							1.00	0.40	0.19
Detention								1.00	0.38
Radio Communications									1.00
Patrol Force									
<u>10:00 AM</u>									
Percent of Sworn on Street	-0.08	-0.11	-0.27	0.43	-0.31	0.20	-0.33	-0.12	-0.20
Officers on Street per 1,000	0.08	0.07	0.63	-0.01	-0.26	0.07	-0.09	0.07	0.14
<u>10:00 PM</u>									
Percent of Sworn on Street	-0.17	-0.09	-0.46	0.57	-0.23	0.21	-0.27	-0.20	-0.45
Officers on Street per 1,000	0.00	0.12	0.50	0.14	-0.21	0.11	-0.06	0.02	-0.04

TABLE 2. Influences on Metropolitan Patrol Force Deployment - Regression Coefficients<sup>1</sup>

Variable	Percentage of Full-Time Sworn Officers on the Street - 10 AM			Percentage of Full-Time Sworn Officers on the Street - 10 PM		
	b	s.e.	beta	b	s.e.	beta
Full-Time Sworn Officers per 1,000 Inhabitants	-0.42	0.52	-0.09	-1.64	0.66	-0.25
Patrol Service Structure						
Multiplicity	0.28	0.12	0.32	0.39	0.16	0.32
Dominance	-3.12	1.80	-0.21	-2.74	2.23	-0.13
Autonomy	2.15	0.97	0.23	2.57	1.20	0.20
Other Service Structures						
Training - Relative Multiplicity	-3.04	1.59	-0.23	-1.49	1.97	-0.08
Detention - Relative Multiplicity	3.78	3.17	0.14	---	---	---
Radio Communications - Relative Multiplicity	---	---	---	-3.32	2.31	-0.15
Explained Variation (R <sup>2</sup> )	0.34			0.48		

<sup>1</sup>Metropolitan population and land area are also in the equation.

represents the extent of variability or uncertainty in the slope. The third, beta, is a measure of the relative influence of each independent variable in explaining the variation in the particular dependent variable under consideration.<sup>18</sup>

The slope coefficients have a relatively natural interpretation. The first coefficient, expressing the relationship between the number of full-time sworn officers per 1,000 inhabitants and the percentage of full-time officers on the street at 10 AM, indicates that a metropolitan area having one more full-time officer per 1,000 residents than another metropolitan area also has approximately four-tenths of one percent (-0.42 percent) fewer of its full-time sworn officers on the street at 10 AM, after adjusting for the influence of all other variables in the equation. The second coefficient, linking relative patrol multiplicity and patrol deployment on the day shift, indicates that metropolitan areas having one more patrol agency per 1,000 residents than other areas, also have approximately one-fourth of one percent (0.28 percent) more of their full-time sworn officers on the street on the day shift.

Dominance measures the proportion of the metropolitan area population served by the producer having the largest clientele, and can vary from close to zero in the most atomized area to 1.0 in a completely consolidated area. The coefficient, -3.12, indicates that a metropolitan area where 50 percent of the population is served by the dominant producer (a proportion of 0.5) will have 0.31 percent fewer of the total sworn officers in the area on the street at 10 AM than will an area where 40 percent of the population is served by

the dominant producer (a proportion of 0.40). The coefficient of autonomy must be similarly scaled to the zero to 1.0 range, and indicates a higher percentage of sworn officers on the street in metropolitan areas having higher levels of autonomy.

Relative training multiplicity and relative detention multiplicity are also based on ratios that vary from nearly zero to 1.0 or even higher. A smaller percentage of sworn officers are found on the street in areas where the ratio of training producers to police agencies requiring training is high ( $b = -3.04$ ). A higher percentage of sworn officers on the street are found in areas where the ratio of detention producers to police agencies requiring detention is high ( $b = +3.78$ ). Stated in terms of specialization, this means that specialization of training service production is positively associated with a higher percentage deployment of sworn officers for street duty, but that detention specialization is negatively associated with higher levels of patrol deployment, after adjustment for the influences of all other variables.

In all cases, metropolitan population and land area have little influence after adjustments for the influences of the other variables are made. In the case of patrol deployment on the day shift, radio communication multiplicity does not contribute to the analysis.

Looking at patrol deployment on the evening shift, the multiplicity for radio communications replaces the multiplicity of detention service in terms of relative contribution to the analysis.<sup>19</sup> Further, while the effect of metropolitan structure does not change markedly, the negative relationship between the total number of officers per 1,000 inhabitants and the percentage of sworn officers on the street becomes much stronger.

The beta coefficients for the variables in the analyses of patrol deployment show that the structural measures of patrol service delivery are generally the strongest contributors explaining variations in the percentage of sworn officers deployed for street duty. The structural measures for the other services contribute somewhat less, as does the number of full-time sworn officers per 1,000 residents of the metropolitan areas.

Summarizing the relationships between measures of patrol service structure and the deployment of full-time sworn officers for street duty in the 80 metropolitan areas, the percentage of the total sworn officers actually on the street during either the day or the evening shift is higher in metropolitan areas having higher values of patrol multiplicity, lower values of patrol dominance, and higher values of patrol autonomy. The metropolitan areas with lower patrol multiplicity and higher dominance (that is, those closer in structure to the form recommended by many contemporary police reform experts) generally have lower percentages of sworn officers deployed for street duty on either shift.

How does metropolitan patrol structure relate to the availability of patrol officers for citizens? Table 3 provides evidence on this question, with availability measured by the density of patrol service (the number of patrol officers on the street per 1,000 inhabitants of the metropolitan area). The strongest relationship is between the number of sworn officers in total per 1,000 inhabitants and the number of patrol officers on the street per 1,000. The slope coefficient ( $b = .099$ ) indicates that metropolitan areas having one

TABLE 3. Influences on Metropolitan Patrol Density - Regression Coefficients<sup>1</sup>  
 Density of Patrol Officers

Variable	Patrol Officers on the Street Per 1,000 Inhabitants - 10 AM			Patrol Officers on the Street Per 1,000 Inhabitants - 10 PM		
	b	s.e.	beta	b	s.e.	beta
Full-Time Sworn Officers Per 1,000 Inhabitants	.099	.011	.77	.096	.014	.67
Patrol Service Structure						
Multiplicity	.004	.003	.19	.009	.003	.36
Dominance	-.058	.039	-.15	-.033	.050	-.08
Autonomy	.058	.021	.24	.075	.027	.27
Other Service Structures						
Training - Relative Multiplicity	-.077	.035	-.22	-.048	.044	-.12
Detention - Relative Multiplicity	.079	.069	.11	.057	.087	.07
Radio Communications - Relative Multiplicity	---	---	---	---	---	---
Explained Variation (R <sup>2</sup> )	0.57			0.44		

<sup>1</sup> Metropolitan population and land area are also in the equation

more sworn officer per 1,000 inhabitants have one-tenth more patrol officers on the street per 1,000 residents. A difference of 10 sworn officers between two metropolitan areas where population and all else are the same would correspond to a difference of one patrol officer on the street on each shift.

The signs of the relationships between measures of patrol and other service structures and the density of patrol service provided in the 80 metropolitan areas are the same as the signs of the respective relationships with patrol deployment. Higher levels of patrol multiplicity and patrol autonomy, and lower levels of patrol dominance, are associated with higher densities of patrol service. Lower relative multiplicity in the production of training, and higher relative multiplicity in the production of adult pre-trial detention are also associated with higher patrol densities. Here, as with patrol deployment, the measures of patrol structure have relatively stronger influences on the variation in patrol density than do the measures of the structure of other services. Of more importance, the structure of service delivery for patrol and for the auxiliary services has an influence over and above the obvious influence of the number of sworn officers per 1,000 metropolitan inhabitants.

#### POLICE AGENCIES IN THE METROPOLITAN AREAS

In attempting to understand the relationships of the structure of patrol service delivery to the levels of patrol deployment and density in the metropolitan areas, a focus on the types of agencies found in the areas is useful. In Table 4, some of the characteristics of the local agencies producing patrol service are arrayed for

TABLE 4. Characteristics of Local Patrol Agencies in Metropolitan Areas

Metropolitan Patrol Structure	(N)	Size of Local Patrol Agencies - Number of Full-Time Sworn Officers		Percentage of Local Patrol Agencies Producing Their Own:				
		Median	Inter-Quartile Range	Burglary Investigation	Homicide Investigation	Entry-Level Training	Adult Detention	Radio Communications
All Local Patrol Agencies	1118	9	3 - 27	82	69	6	12	68
Multiplicity								
Low	233	17	6 - 54	85	76	8	14	71
Medium	423	13	5 - 30	86	74	7	11	75
High	462	5	1 - 23	77	60	4	13	59
Dominance								
Low	640	9	3 - 27	84	73	5	10	63
Medium	244	9	3 - 31	87	70	7	16	77
High	234	7	2 - 21	73	56	8	15	71
Autonomy								
Low	414	7	2 - 21	79	70	6	11	62
Medium	436	10	3 - 28	83	67	6	11	73
High	268	9	4 - 31	84	69	8	16	68

metropolitan areas that vary on the structural measures.<sup>20</sup> Looking at the variation in patrol multiplicity, the median size of the local patrol agencies in a metropolitan area decreases as the multiplicity of patrol service production increases. Median agency size also is lower in areas having higher levels of dominance and of autonomy in patrol service production. Local patrol agencies in areas having high patrol multiplicity are less likely to conduct their own homicide investigations or produce their own radio communications. This is due to reliance on specialized producers for these services by the smaller agencies.

The proportion of local patrol producers that produce their own radio communications is lower in areas exhibiting lower levels of dominance in patrol service production. In such areas, sharing of dispatch centers or contracting is often found among groups of agencies of similar size, or between groups of smaller agencies and a County Sheriff. In more dominated areas, the proportion of local agencies conducting homicide investigations is somewhat lower. In these areas, specialized investigators are often available from the dominant patrol producer, from a state agency, or from an organized area-wide major case squad.

Table 5 shows the relationship between local patrol agency size and propensity to produce additional services beyond general area patrol. Most local patrol agencies of any size also produce traffic control services -- traffic patrol and accident investigation. The smaller local patrol producers are less likely to produce their own residential burglary investigations. This is even more true for homicide investigations. Looking at the auxiliary services,

TABLE 5. Production of Additional Services: Local Patrol Agencies

Number of Full-Time Sworn Officers	(N)	Percentage of Local Patrol Agencies Producing:							
		Direct Police Services				Auxiliary Police Services			
		Traffic Patrol	Traffic Accident Investigation	Residential Burglary Investigation	Homicide Investigation	Radio Communications	Entry-Level Training	Adult Pre-Trial Detention	Chemical Analysis
All Local Patrol Agencies	1090	93	89	82	69	68	6	12	2
None: Part-Time Only	80	88	75	49	19	27	2	0	0
1 to 4	271	96	91	66	42	39	1	1	0
5 to 10	248	95	91	86	70	67	0	7	0
11 to 20	156	92	90	92	88	88	1	13	0
21 to 50	161	91	89	96	93	94	1	24	1
51 to 150	107	92	91	99	97	96	16	33	5
Over 150	67	94	91	99	99	93	61	34	19

a marked relationship between agency size and the production of these services appears.

What is interesting about the production of auxiliary services by local patrol agencies is the variation across services. Most local agencies having five or more sworn officers, and nearly all agencies having more than 10 full-time sworn officers, produce their own radio communications, either entirely or for at least one shift. On the other hand, only among the very largest local patrol producers does a majority produce its own entry-level training, and only a small fraction of local patrol producers of any size produce their own adult pre-trial detention and chemical analysis services. Chemical analysis, in particular, is the province of highly specialized laboratory producers.

By not producing a number of additional services, the smaller local patrol producers are able to achieve a higher level of patrol officer deployment and a higher density of patrol service. Table 6 shows the relationship between size of local patrol agency and patrol deployment. As agency size increases, a lower percentage of sworn officers are assigned to an agency's patrol division, a lower percentage of the patrol division is actually on the street during the day or evening shift, and thus, a lower percentage of an agency's sworn personnel are deployed for street duty at any given time.

In Table 7, the relationship of agency size and patrol density is shown. Smaller agencies deploy a higher proportion of their officers for duty on the street, and thus achieve a higher density of patrol service than do larger agencies. During the evening shift, the median local patrol agency of five to 10 full-time sworn

TABLE 6. Deployment of Sworn Officers: Local Patrol Agencies

Number of Full-Time Sworn Officers	Percentage Assigned to Patrol Division		Percentage of Patrol Division on the Street				Percentage of Sworn Officers on the Street			
			10 AM		10 PM		10 AM		10 PM	
	Median	Inter-Quartile Range	Median	Inter-Quartile Range	Median	Inter-Quartile Range	Median	Inter-Quartile Range	Median	Inter-Quartile Range
All Local Patrol Agencies	82	64 - 100	22	17 - 33	29	20 - 38	17	11 - 25	20	14 - 33
1 to 4	100	100 - 100	50	25 - 50	50	33 - 100	33	25 - 50	50	33 - 100
5 to 10	100	83 - 100	20	17 - 30	29	20 - 38	20	17 - 25	25	20 - 33
11 to 20	75	65 - 87	22	17 - 27	29	22 - 33	16	13 - 20	20	16 - 25
21 to 50	67	59 - 75	21	17 - 25	25	20 - 30	14	11 - 17	16	13 - 20
51 to 150	60	52 - 68	17	13 - 22	23	18 - 29	10	7 - 13	14	11 - 16
Over 150	53	45 - 59	16	13 - 21	21	16 - 28	9	7 - 11	12	8 - 15

TABLE 7. Density of Patrol Service: Local Patrol Agencies

Number of Full-Time Sworn Officers	(N)	Number of Patrol Officers on the Street per 1,000 Resident Served Population			
		Day Shift - 10 AM		Evening Shift - 10 PM	
		Median	Inter-Quartile Range	Median	Inter-Quartile Range
All Local Patrol Agencies	969	0.28	0.16 - 0.50	0.37	0.22 - 0.63
1 to 4	246	0.47	0.17 - 0.86	0.57	0.32 - 1.04
5 to 10	242	0.34	0.13 - 0.55	0.44	0.26 - 0.71
11 to 20	156	0.27	0.17 - 0.45	0.34	0.24 - 0.51
21 to 50	156	0.25	0.15 - 0.37	0.29	0.20 - 0.46
51 to 150	106	0.18	0.12 - 0.25	0.23	0.17 - 0.33
Over 150	63	0.19	0.11 - 0.26	0.23	0.16 - 0.29

officers has approximately one officer on the street for every 2,300 members of its serviced population, while the median local patrol agency of more than 50 full-time sworn officers has one officer on the street for every 4,300 citizens served. On the day shift, the corresponding figures are one officer per 3,000 served for the median smaller agency and one per 5,400 for the larger.

#### SPECIALIZATION AND RESTRUCTURING OF METROPOLITAN POLICE SERVICES

It may be useful to conceive of the many small agencies in metropolitan areas as specialists in the production of patrol, traffic control, and usually, burglary investigations. By specializing in the production of these services to the exclusion of others, these agencies are able to maintain a higher presence in the communities they serve. This does not say that citizens served by smaller police agencies do not receive specialized investigation services when necessary, nor that the smaller agencies do not have radio communications, entry-level training, detention, and chemical analysis services available to them. Indeed, a rich structure of interorganizational relationships in most metropolitan areas makes these services available to citizens and police agencies throughout the area. A focus such as that taken in this research, that goes beyond the enumeration of individual agencies, reveals these networks where critics have found a lack of capability for service production. It is true that most small police agencies (and many much larger ones) do not produce highly specialized technical services, but in all parts of the country there are producers who have such capability and make these services available as needed by other agencies.

National commissions and other experts concerned with restructuring police service delivery have often recommended that more specialization in the production of auxiliary services would be beneficial. Similar recommendations are made for the maintenance of qualified investigators to handle complex criminal cases involving homicide, rape, hard narcotics, organized crime, and the like.<sup>21</sup> At the same time, many of these commissions and experts have recommended the elimination of what we call here "patrol specialists" -- the smaller agencies that allocate most of their resources to on-street activities. The data presented in this chapter may be useful in attempting to analyze the implications of adopting the latter recommendations.

The relationships found indicate that a more consolidated structure of police service delivery in metropolitan areas may result in lower levels of on-street deployment of sworn police officers, and correspondingly lower levels of density of patrol service available to citizens. "May" is emphasized because it is dangerous to make causal or dynamic predictions with cross-sectional data such as these. But the metropolitan areas most closely resembling the model of police service delivery proposed by many reformers turn out to have lower deployment and patrol density levels.

As emphasized earlier, higher levels of on-street deployment and/or density of patrol service are not measures of higher police performance. But there is reason to believe that they are positively associated with police performance, other things equal. Thus, restructuring police service delivery along the recommended lines might well lead to lower levels of police performance, at least for the many functions carried out by the patrol force.

## NOTES

1. This chapter is an early report on data collected by the Police Services Study, a joint project of the Workshop in Political Theory and Policy Analysis at Indiana University and the Center for Urban and Regional Studies of the University of North Carolina. Extensive data analysis is continuing on the Study. The analyses reported here should be considered preliminary. They are presented at this time to stimulate comments and criticisms which will improve the on-going analytic efforts of the Study.
2. Many critics have argued these points. Some of the more well known statements include ACIR (1974: 24), CED (1972), Skoler and Hetler (1970), and President's Commission on Law Enforcement and Administration of Justice (1967: 301).
3. For lists of votes on this issue and their results, see Marando (1975) and National Association of Counties (1973).
4. A number of studies conducted by scholars associated with the Workshop in Political Theory and Policy Analysis have reported such findings. See, for example, Ostrom, et al. (1973), Ostrom and Parks (1973), Parks (1976), Ostrom (1976), and Rogers and Lipsey (1974).
5. The Committee for Economic Development is perhaps the strongest advocate of such consolidation (1972: 29-38). Nowhere in their recommendations do they provide any supporting evidence. Ostrom (1975) points out the need for such evidence prior to major reforms.
6. David L. Norrgard (1969) is an early advocate of specialization. The National Advisory Commission on Criminal Justice Standards and Goals recently reiterated support for this (1973).
7. The studies cited in note 4 do provide a basis for comparison of the performance of some police agencies in a limited number of metropolitan areas. There has been to date no comprehensive effort to collect comparable police performance data across a large number of metropolitan areas.
8. The initial phase of the Police Services Study, which has been completed, was intended to produce descriptive data on the current organization of police service delivery in the metropolitan areas studied. Two volumes reporting findings from the Study are currently in preparation, and will be available in mid-1976 (see Ostrom, Parks, and Whitaker, 1976a and 1976b).
9. An early statement of this methodology can be found in Ostrom, Parks, and Whitaker (1974). A revised version will be published in Ostrom, Parks, and Whitaker (1976b).

10. Serviced population for a given producer may differ significantly from the producer's nominal jurisdiction. For example, a County Sheriff usually has jurisdiction throughout a county, but in practice may only produce patrol service for residents of the unincorporated portion of the county. The latter population is what is referred to in this chapter as serviced population.
11. Military base commanders and college administrators are considered local governing authorities in this analysis.
12. Some of the better critiques of the use of crime statistics for comparative purposes are Biderman (1966), Ostrom (1971), and Maltz (1972).
13. Ostrom, et al. (1973) speculate that a difference in the type of production strategy adopted by police agencies may partially explain the differences in performance levels which they found. The smaller police agencies in that study allocated a much higher proportion of their resources to patrol activities than did the large police agency, and achieved a two to three times higher density of patrol service. The smaller police agencies were found to be providing equal or higher levels of performance across a wide range of indicators.
14. See the Commission's report, Opportunities for Improving Productivity in Police Services (1973). A statement by the Commission's chairman which makes this point also is Morgan (1975).
15. Draper and Smith (1966) and Wonnacott and Wonnacott (1970) contain readily accessible discussions of multiple regression analysis. The use of multiple regression as a technique for exploring and describing relationships among variables follows the suggestions of Tufte (1969) and Taylor (1974).
16. Van de Geer (1971: 109) points out that multicollinearity may be a multidimensional problem. Analyses beyond simple bi-variate correlations are necessary to determine the extent of any such problems. These have not yet been done with the current data.
17. The particular routine used is that of Nie, et al. (1975: 345-347). It consists of a forward selection procedure (Draper and Smith, 1966: 169-171) with no attempt to remove variables already in the equation.
18. Since the analyses presented here are intended to be broadly descriptive, variables are included in the equations which might originarily be dropped on statistical grounds. One widely used criterion would suggest dropping all variables where the value of  $b$  was not at least twice that of  $s.e.$  In the current analyses, variables were retained even though in some cases the value of  $s.e.$  equalled or exceeded that of  $b$ . With the exception of metropolitan population and land area (variables that were retained in all cases), a variable was dropped only if  $s.e.$  exceeded  $b$  by more than 50 percent.

19. The negative coefficients for relative multiplicity of training and radio communication production support arguments for specialized production of these services (Norrgard, 1969; National Advisory Commission on Criminal Justice Standards and Goals, 1973). The positive coefficient for relative multiplicity of detention production does not support the similar arguments for detention specialization.

20. Local agencies are municipal police departments, including those of New England towns and of townships in other states, county sheriffs and police departments, and other police agencies organized at a municipal or county level. Specifically excluded are state police or highway patrols, military police agencies, or other federal producers.

21. In a number of the metropolitan areas studied in this project, organized Major Case Squads were available to immediately assist local agencies with investigations of very serious crimes. Technical Reports describing a number of these are available from the project Publications Secretary, Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, IN 47401.

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