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A National Survey of Autopsy Cost and Workload

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ABSTRACT: We mailed survey questionnaires to a random sample of medicolegal offices throughout the USA. The survey asked how many forensic pathologists were used, their American Board of Pathology forensic examination (Board) status, how many autopsies they performed, and, if payment were fee-for-service, what fees were paid for medicolegal autopsies.

Response rate was 61%, with 188 offices returning questionnaires. The average fee, was $518 with a standard error of $27. The number of fee-for-service autopsies was split evenly between Board qualified and Board ineligible pathologists, accounting for about one-third of medicolegal autopsies nationwide. Although smaller offices used more pathologists ineligible for forensic Boards, they paid a premium for such qualification. Larger offices used more forensic Board qualified pathologists, but paid them less than those ineligible to take the examination! Overall there was no significant premium paid for Board qualification.

The average fee paid is far less than the published estimates of the cost of an autopsy. The low fees paid may reflect: (1) the value of the teaching experience supplied to medical students and/or residents; (2) pathologists performing medico-legal examinations as community service; and (3) the lower marginal cost of additional autopsies.

KEYWORDS: forensic science, autopsy, costs and cost analysis, forensic medicine, coroners and medical examiners

A growing workforce shortage appears to be overtaking forensic pathology. It has been said fewer physicians are being qualified in this specialty than are retiring (1). Complaints have been raised about the quality of the work done and working conditions (2). However, no comprehensive survey of fees paid for medicolegal autopsies or utilization of forensic pathologists has been published. In order to replace impressions and guesswork with data, we have surveyed the medicolegal offices in the United States.

Methods

Our list of all medicolegal offices in the USA came from the Centers for Disease Control (CDC) (3). For each office the listing included the 1990 census population served by the office. The entire pool of medico-legal offices in the USA was prestratified by size of the population served (jurisdiction size). A sample of offices in each of four population size groups was selected and surveyed.

Population size prestratification was accomplished by categorizing all county-based offices into one of three size groups based on population served: Less than 200,000; 200,000 to 600,000; and greater than 600,000. For this study, Texas, with 254 counties, almost all with medico-legal jurisdictions headed by a precinct Justice of the Peace, was treated somewhat differently. For Texas, the 11 largest offices, whose heads were styled "Chief Medical Examiner," were placed in the county pools in their respective population groups on the assumption that they performed many of the autopsies for surrounding counties. A fourth category of statewide offices contained clearly centralized state medical examiners offices. All of the statewide offices served populations greater than 600,000 except Vermont and Alaska, with a populations of 570,000 and 510,000 respectively.

Table 1 lists the 50 states plus the District of Columbia and classifies the offices as state-wide or county. All geographic regions were represented and all 50 states were sent questionnaires. For county offices, the number of counties in each state and the number of those counties sent questionnaires are listed. The sample included all state-wide offices, county offices serving populations greater than 200,000, and about 6% of county offices serving populations less than 200,000. The latter sample of offices was selected randomly. A total of 308 offices were sent questionnaires. Identical questionnaires were sent in two waves, successive mailings not being sent to those who had already responded.

Our questionnaire asked for each jurisdiction to give: The number of autopsies performed in 1993; categorization of pathologists by forensic pathology Board examination status and form of remuneration; categorization of autopsies by the prosector's forensic pathology Board examination status and form of remuneration; and for categories of autopsies done fee-for-service, the fee paid to each category of pathologist.

Results

Of the 308 offices sampled, a total of 188 or 61% eventually responded. The response rates for the population strata are shown in Table 2. We found no significant relationship between wave of the survey but did find that in the smallest population county stratum, the responders served a significantly larger population than the nonresponders. However, no correlation was found between population size and fee paid per autopsy. Hence the responders were deemed representative of the population in that stratum.

The average amount paid to fee-for-service pathologists per autopsy along with its standard error is shown in Table 3, analyzed by population stratum and forensic board status. The overall average fee in 1993 was $518. The statistical methods used to derive these population weighted figures is given in the appendix. No correlation was found between fees paid in a jurisdiction and the mean family income in that jurisdiction.

Because we asked for the number of autopsies performed in the jurisdiction, broken down by the forensic board status of the prosector, we were able to derive a prevalence estimate for the

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TABLE 1—*Distribution of questionnaires.*

State	Classification	Jurisdictions	Jurisdictions Queried
Alabama	State	1	1
Alaska	State	1	1
Arizona	County	15	3
Arkansas	State	1	1
California	County	58	27
Colorado	County	63	12
Connecticut	State	1	1
Delaware	State	1	1
District of Columbia	County	1	1
Florida	County (District)	24	20
Georgia	County	159	11
Hawaii	County	5	2
Idaho	County	44	4
Illinois	County	102	16
Indiana	County	92	7
Iowa	County	99	12
Kansas	County (District)	31	6
Kentucky	State	1	1
Louisiana	County (Parish)	64	6
Maine	State	1	1
Maryland	State	1	1
Massachusetts	State	1	1
Michigan	County	83	12
Minnesota	County	87	11
Mississippi	State	1	1
Missouri	County	115	7
Montana	State	1	1
Nebraska	County	93	7
Nevada	County	17	3
New Hampshire	State	1	1
New Jersey	County	21	15
New Mexico	State	1	1
New York	County	58	17
North Carolina	State	1	1
North Dakota	County	53	5
Ohio	County	88	17
Oklahoma	State	1	1
Oregon	County	36	10
Pennsylvania	County	67	18
Rhode Island	State	1	1
South Carolina	County	46	5
South Dakota	County	66	3
Tennessee	County	95	11
Texas	County (Selected)	11	9
Utah	State	1	1
Vermont	State	1	1
Virginia	State	1	1
Washington	County	39	6
West Virginia	State	1	1
Wisconsin	County	72	4
Wyoming	County	23	1

number of medicolegal autopsies per 100,000 population. These data are shown in Table 4. Combining this with the population data for the various strata allows computation of the incidence of medicolegal autopsies, shown in Table 5. Of note is the significantly lower autopsy rate in state-wide offices relative to county offices.

Discussion

Our results shed light on three important areas regarding forensic pathology: The autopsy fees paid to fee-for-service pathologists; the characteristics of the workforce performing such autopsies; and the future of the medicolegal autopsy in the USA.

We have derived an estimate of the market price for a medicolegal autopsy. In addition to using these data to compare one's own jurisdiction with others, inspection discloses some interesting relationships. State offices and the smallest counties paid more, whereas the larger counties paid less. In the smallest counties, with populations less than 200,000, those qualified in forensic pathology commanded a $150 higher autopsy fee than those not so qualified. In the larger counties, however, the opposite held true, with qualified forensic pathologists earning about $132 less on the average. Also remarkable is the observation that the smallest counties tended to use pathologists not qualified in forensic pathology whereas those in larger counties tended to use board qualified forensic pathologists. Linking this to the fee differential suggests that the marketplace favors the pathologist able to bid lower, regardless of forensic board status!

We were able to examine the workforce performing medicolegal autopsies. We have produced an estimate in Table 5 of the number of forensic autopsies performed in the USA, with analysis of the Board status of the prosectors. Over 87,000, about 49%, of the approximately 178,000 autopsies performed for coroners or medical examiners are by salaried, Board qualified forensic pathologists. But over 66,000, or more than one-third, are purchased fee-for-service, and about half of these are by pathologists not qualified in forensic pathology by the Board. This substantial number of fee-for-service autopsies are, as might be expected, primarily done in the smallest county systems.

Because we did not inquire into the full workload of the pathologists in our study, we cannot estimate accurately the number of doctors performing official medicolegal autopsies. However, if one assumes that salaried Board qualified individuals are practicing full-time, this represents about 380 forensic pathologists. Because of the inefficiencies caused by geographic distribution of the population, the remaining 51% of cases would require more, perhaps many more, pathologists. Figure 1 shows the number of doctors qualified each year in forensic pathology, along with the number 25 years or less out from such qualification. It can be seen that the latter number has continued to increase over the years to over 700. Our figures show that this would not be enough to do the job, even if all were actually employed in forensic pathology. In order to approach full coverage by Board qualified practitioners, the current trend of increasing the Board qualified workforce must continue.

A closer look is needed at the relationship between forensic pathology fees and workload and the trends in autopsy pathology in general. If one extrapolates the number of autopsies performed from 1980 through 1990 (4) to 1993 and subtracts the estimate of medicolegal autopsies derived from our survey, the remaining hospital autopsies in 1993 are only 21% of the total. The number of autopsies of deaths due to external causes, which should all be performed by coroner's or medical examiner systems, is also available from 1980 through 1990. Extrapolation to 1993 allows calculation of the proportion of medicolegal autopsies that are on those who have died of external causes. If one assumes that the proportion of natural to externally caused deaths in the medicolegal autopsy cases was the same in prior years, the number of such autopsies can be estimated for 1980 through 1992. Subtracting these from the total number of autopsies results in the data depicted in Fig. 2. This data shows that the decried continuing decrease in the autopsy from 15% in 1980 to 11% in 1990 actually was due to a drop by half of the number of hospital autopsies. This has continued to where the 1993 number is only 37% of that in 1980.

TABLE 2—*Number of offices, total population and average population for jurisdiction size strata in USA, sample queried and responders.*

Jurisdiction size		Total USA	Queried (% of Total)	Responders (% of Queried)
State				
	# offices	20	20 (100%)	16 (80%)
	Total Population	53,747,444	53,747,444 (100%)	43,555,698 (81%)
	Average Population	2,687,372	2,687,372	2,722,231
>600,000	# offices	57	57 (100%)	41 (72%)
	Total Population	82,463,863	82,463,863 (100%)	55,115,265 (67%)
	Average Population	1,446,734	1,446,734	1,344,275
200,000–600,000	# offices	130	130 (100%)	89 (68%)
	Total Population	45,521,161	45,521,161 (100%)	31,862,545 (70%)
	Average Population	350,163	350,163	358,006
<200,000	# offices	1,640	101 (6.2%)	42 (42%)
	Total Population	59,150,490	3,388,808 (5.7%)	1,925,224 (57%)
	Average Population	36,067	33,553	45,839

TABLE 3—*Average autopsy fees paid ± standard error (in dollars) analyzed by population size of jurisdiction and pathologists' Board status.*

Board Status	Not Qualified	Eligible*	Qualified	Total
Jurisdiction size				
Overall	483 ± 16	562 ± 25	543 ± 37	518 ± 27
State	516 ± 16	ND†	548 ± 21	525 ± 14
>600,000	466 ± 33	600 ± 54	411 ± 48	440 ± 44
200,000–600,000	580 ± 33	532 ± 24	448 ± 27	488 ± 20
<200,000	474 ± 18	607 ± 72	623 ± 63	536 ± 39

*Although the American Board of Pathology neither recognizes nor uses the term "board eligible," an applicant is declared qualified for examination only after a formal application has been received and approved by the credentials committee. It is this qualification to sit for the examination that was referred to in the questionnaire and is here called "eligible."

†ND—Not determinable due to no autopsies observed.

TABLE 4—*Prevalence estimate ± standard error for number of autopsies per 100,000 population.*

Jurisdiction size		Fee-for-Service	Salaried	Total
Overall				
	Not Qualified	12.8 ± 7.5	4.6 ± 0.5	17.3 ± 8.8
	Eligible	1.8 ± 0.5	5.6 ± 0.6	7.4 ± 0.8
	Qualified	12.9 ± 2.7	36.3 ± 3.2	49.2 ± 3.9
	Total	27.5 ± 8.3	46.4 ± 3.8	73.9 ± 7.9
State				
	Not Qualified	3.5 ± 1.3	3.7 ± 1.1	7.2 ± 1.5
	Eligible	—	4.0 ± 1.0	4.0 ± 1.0
	Qualified	1.4 ± 0.5	30.8 ± 2.1	32.1 ± 2.2
	Total	4.8 ± 1.4	38.5 ± 2.4	43.4 ± 2.1
>600,000				
	Not Qualified	0.9 ± 0.3	8.2 ± 1.1	9.2 ± 1.1
	Eligible	0.8 ± .03	10.0 ± 1.5	10.8 ± 1.5
	Qualified	5.1 ± 1.0	61.5 ± 2.4	66.6 ± 2.5
	Total	19.6 ± 2.0	79.8 ± 3.2	86.6 ± 2.9
200,000–600,000				
	Not Qualified	5.9 ± 0.8	4.7 ± 1.2	10.6 ± 1.4
	Eligible	5.6 ± 1.0	6.5 ± 1.3	12.1 ± 1.5
	Qualified	19.6 ± 2.0	30.6 ± 2.8	50.2 ± 2.9
	Total	31.1 ± 2.4	41.8 ± 3.5	72.9 ± 2.9
<200,000				
	Not Qualified	42.9 ± 30.5	0.05 ± 0.07	43.0 ± 35.9
	Eligible	2.0 ± 1.7	—	2.0 ± 2.0
	Qualified	29.3 ± 10.6	10.4 ± 12.3	39.7 ± 15.2
	Total	74.2 ± 33.8	10.5 ± 14.4	84.7 ± 31.6

Some years ago, when the autopsy was noted to be in the decline, numerous publications appeared documenting the cost of the autopsy (5,6,7,8,9). These costs generally included both professional and non-professional fees, but excluded costs ascribed to education. These are the same costs that must be covered by the fee-for-service allotments requested in our survey. Estimates ranged from $730 to $1,900. These costs are obviously far higher than the amount paid in all but the highest range of offices responding to our inquiry. Adjustment for over a decade of inflation would substantially increase the gap. Why are pathologists willing to perform medicolegal autopsies at a loss? It is the authors' personal experience, with some support from personal communications and published work (10), that this paradox involves one or more of the following motives: The educational value of medicolegal autopsies, particularly for residents and forensic pathology fellows; a desire to perform community service; and the fact that the marginal cost of the autopsy is far less than the apportioned cost (6). In the coming era of managed care and capitation, where the pathology department is no longer a revenue, but rather a cost center, each procedure will have to be justified as cost effective. It is unlikely that either the desire to create more pathologists when the job market is tightening, good citizenship, or the parasitic relationship of the medicolegal to the rapidly shrinking number of hospital autopsies will be convincing to those interested in the "bottom line."

TABLE 5—*Incidence estimate ± standard error for number of autopsies in 1993.*

Jurisdiction size		Fee-for-Service	Salaried	Total
Overall				
	Not Qualified	30,833 ± 18,066	11,081 ± 1,204	41,673 ± 21,198
	Eligible Qualified	4,336 ± 1,204	13,489 ± 1,445	17,825 ± 1,927
	Total	31,074 ± 6,504	87,441 ± 7,708	118,514 ± 9,394
		66,243 ± 19,993	111,770 ± 9,154	178,013 ± 19,030
State				
	Not Qualified	1,881 ± 699	1,989 ± 591	3,870 ± 806
	Eligible Qualified	—	2,150 ± 537	2,150 ± 537
	Total	752 ± 269	16,554 ± 1,129	17,253 ± 1,182
		2,580 ± 752	20,693 ± 1,290	23,326 ± 1,129
>600,000				
	Not Qualified	742 ± 247	6,762 ± 907	7,587 ± 907
	Eligible Qualified	660 ± 247	8,246 ± 1,237	8,906 ± 1,237
	Total	4,206 ± 1,072	50,715 ± 1,979	54,921 ± 2,062
		5,608 ± 1,237	65,806 ± 2,639	71,414 ± 2,391
200,000–600,000				
	Not Qualified	2,686 ± 364	2,139 ± 546	4,825 ± 637
	Eligible Qualified	2,549 ± 455	2,959 ± 592	5,508 ± 683
	Total	8,922 ± 956	13,929 ± 1,275	22,852 ± 1,320
		14,157 ± 1,093	19,028 ± 1,593	33,185 ± 1,320
<200,000				
	Not Qualified	25,376 ± 18,041	30 ± 41	25,435 ± 6,270
	Eligible Qualified	1,183 ± 1,006	—	1,183 ± 1,183
	Total	17,331 ± 6,270	6,152 ± 7,276	23,483 ± 8,991
		43,890 ± 19,993	6,211 ± 8,518	50,100 ± 18,692

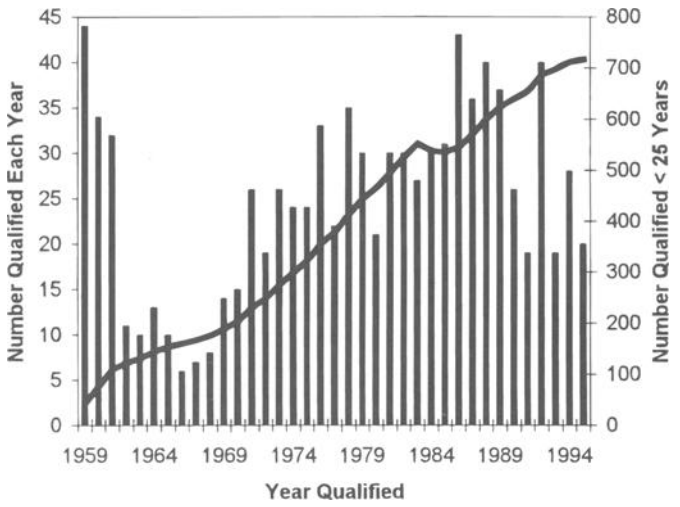

FIG. 1—*Doctors qualified in forensic pathology. Bars are number qualified in each year; line is number qualified less than 25 years.*

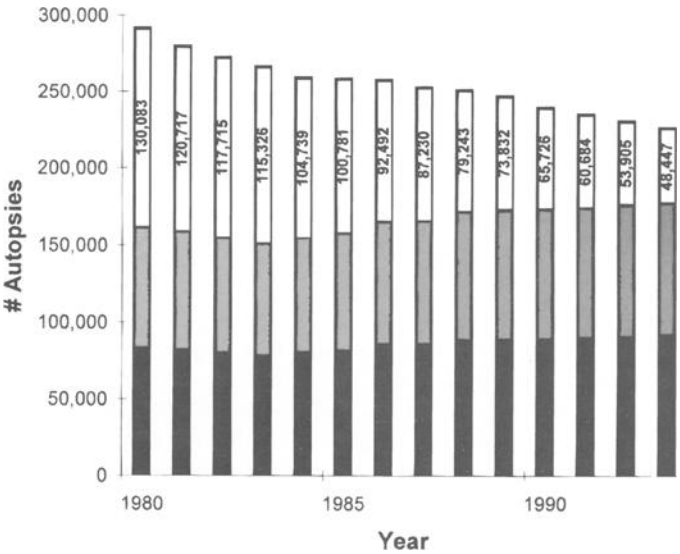

FIG. 2—*Autopsies, 1980–1993. Black bar equals medico legal autopsies, external cause of death; gray bar equals medico legal autopsies, natural cause of death; white bar equals hospital autopsies.*

Many new hospitals are being built with no autopsy suites (11). The few remaining hospital autopsies will be concentrated in regional facilities which, through market forces, will charge a rate that will more than cover costs. Medicolegal autopsies will have to pay their own way, requiring a substantial increase in the rate paid by coroners and medical examiner systems. In fact, this has already begun, as evidenced by a newspaper article from Springfield, Illinois (12) in Sangamon County, 1990 population 178,386. The article documents the coroner's contracting with a private practice pathologist, as yet not Board qualified, to handle cases at $600 per autopsy. Hospital and morgue fees would bring the cost to about $1,000. Previously, they had been done by hospital staff for a total cost of $700 each. "The hospitals weren't overly fond of doing outside work," noted the coroner.

Obviously, the cost of medicolegal autopsies needs to rise. Whether or not there is success in convincing the public of the

TABLE 6—*Average number of autopsies ± standard error per pathologist.*

Jurisdiction size		Fee-for-Service	Salaried
Overall			
	Not Qualified	26.1 ± 10.5	197.0 ± 10.7*
	Eligible	ND†	208.0 ± 10.7*
	Qualified	29.9 ± 4.0	228.9 ± 6.2*
	Total	56.3 ± 5.9	222.4 ± 5.7*
State			
	Not Qualified	51.6 ± 8.2	324.2 ± 56.3
	Eligible	ND†	352.4 ± 29.9
	Qualified	24.9 ± 5.2	227.1 ± 8.0
	Total	43.1 ± 7.2	243.2 ± 9.2
>600,000			
	Not Qualified	63.8 ± 19.7	252.6 ± 10.5
	Eligible	38.9 ± 12.9	230.8 ± 15.0
	Qualified	139.3 ± 20.1	256.9 ± 9.8
	Total	95.5 ± 15.9	43.1 ± 7.2
200,000–600,000			
	Not Qualified	22.5 ± 2.3	95.4 ± 18.0
	Eligible	61.0 ± 10.6	131.1 ± 17.7
	Qualified	83.7 ± 8.2	165.6 ± 10.5
	Total	52.9 ± 4.6	147.4 ± 9.3
<200,000			
	Not Qualified	22.3 ± 13.0	1.0 ± ND†
	Eligible	3.5 ± 0.7	ND†
	Qualified	14.5 ± 4.6	100.5 ± 70.3
	Total	16.4 ± 6.2	67.3 ± 54.1

†ND—not determinable.
*Weighted average of stratums > 200,000 population.

necessity of this in offices across the country will dictate forensic pathology's future.

APPENDIX

National estimates of the prevalence of autopsies (#cases/100,000 population), the average number of autopsies per pathologist, the average amount of money paid per autopsy, and the corresponding standard errors are weighted estimates. For each measure, sample estimates for the four population strata are weighted as described below, in proportion to their share of the estimated number of forensic pathologists or population in the country. Sample estimates are provided for the six types of pathologists as given by their training, not eligible, eligible or qualified, and whether they are fee-for-service or salaried.

Individual stratum estimates of the three measures above are computed as ratio estimates, $\hat{r}_{jk}$, for the kth pathologist type and the jth stratum (jurisdiction size). The corresponding stratum variances are denoted $\hat{\sigma}^2_{jk}$. Notation and formulae are described below.

N_j = national total of offices in the jth stratum.

where j = 1 or 2 or 3 or 4 represents the four population size groups

P_j = national total of population in the jth stratum

N_j and P_j are shown in Table 2.

s_j = number of offices sampled from the jth stratum

n_j = number of sampled offices from jth stratum which responded.

$n_j/s_j \times 100$ = percent response from jth stratum as shown in Table 2.

For each jurisdiction define:

a_{ijk} = number of autopsies performed by pathologists of type k in the ith jurisdiction in stratum j.

m_{ijk} = number of pathologists of type k used by the ith jurisdiction in stratum j.

d_{ijk} = total amount of money spent for autopsies performed by pathologists of type k in the ith jurisdiction in stratum j.

p_{ij} = population served in the ith jurisdiction in stratum j, divided by 100,000.

The ratio estimate of the prevalence of autopsies performed by pathologists of type k in the jth stratum is:

$$\hat{r}_{jk} = \left(\sum_{i=1}^{n_j} a_{ijk} \Big/ \sum_{i=1}^{n_j} m_{ijk}\right)$$

= [number of autopsies by pathologists of type k in stratum j]

÷ [sum of population for all responding offices in jth stratum/100,000].

Similarly, the ratio estimate of the average number of autopsies performed by a pathologist is

$$\left(\sum_{i=1}^{n_j} a_{ijk} \Big/ \sum_{i=1}^{n_j} m_{ijk}\right)$$

and the ratio estimate of the average amount paid per autopsy is:

$$\left(\sum_{i=1}^{n_j} d_{ijk} \Big/ \sum_{i=1}^{n_j} a_{ijk}\right)$$

for pathologists of type k in the jth stratum.

The variance of $\hat{r}_{jk}$ is given by (13)

$$\hat{\sigma}^2_{jk} = \frac{(N_j - n_j)}{N_j(n_j - 1)n_j\bar{p}_j^2}\left(\sum a^2_{ijk} + \hat{r}^2_{jk}\sum p^2_{ij} - 2\hat{r}_{jk}\sum a_{ijk}p_{ij}\right)$$

where $\bar{p}_j$ is the average of the jurisdiction populations in the national population for the jth stratum, and where the summations are over all jurisdictions in the sample responding in the jth stratum. Note that $(N_j - n_j)/N_j$ is the finite population correction factor.

The variance of $\hat{r}_{jk}$ is calculated in a similar fashion for the estimate of the average number of autopsies per pathologist and the average amount spent per autopsy. In the formula for $\hat{\sigma}^2_{jk}$ above, $\bar{p}_j$ is replaced by appropriate sample estimates: For the former, with the estimated average number of pathologists of type k used by offices in the jth stratum, and in the latter, with the estimated average number of autopsies performed by pathologists of type k by offices in the jth stratum.

The weighted estimated prevalence of autopsies for pathologists of type k given as "overall" in Table 4 is

$$r_{.k} = \sum_{j=1}^{4} w_j r_{jk} \qquad \text{where } w_j = P_j \Big/ \sum_{j=1}^{4} P_j$$

The stratum weights, wj, are the proportion of the national population covered by that stratum and equal

$$w_1 = 0.246,\ w_2 = 0.189,\ w_3 = 0.342, \text{ and } w_4 = 0.223.$$

The overall estimate for the average amount paid per autopsy (Table 3) uses these same weights.

The average number of autopsies performed per pathologist Table 6, however uses weights in proportion to their share of the number of pathologists performing autopsies in the country, which is estimated as

$$M_j = \frac{N_j}{n_j} \times \left(\sum_{i=1}^{n_j} \sum_{k=1}^{6} m_{ijk} \right)$$

The weights, $M_j / \Sigma_{j=1}^{4} M_j$ then equal

$$w_1 = 0.805,\ w_2 = 0.095,\ w_3 = 0.068, \text{ and } w_4 = 0.032.$$

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