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Original Article

National survey of anatomical pathology centres in Italy: the questionnaire

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Summary

Objectives. To obtain a picture of the work done in Italian anatomical pathology centres in 2014, and evaluate differences between the various centres in terms of the workloads of medical and non-medical staff.

Methods. A self-administered questionnaire designed by a SIAPEC working group was e-mailed to 256 centres and subsequently collected by the Anatomical Pathology Service of Bolzano. QlikView software was used to prepare the final database and check the quality of the data, which were processed using version 18.0 of SPSS for Windows statistical software.

Results. The questionnaire was completed by 120 of the centres (46.9%), which were staffed by a mean number of 6.6 physicians (range 1-24), 1.6 biologists (range 0-7), 10.8 laboratory technicians (range 2-47) and 2.2 administrative personnel (range 0-9). During 2014, the centres carried out a mean of 15,000 histology examinations (range 3,215-50,680), almost 11,700 immunohistochemistry examinations (range 0-54,359), and a mean of 1,471 molecular biology examinations (range 0-31,322) relating to a mean of 704 patients (range 0-9,434), and a mean of 16,509 cytology examinations (range 0-150,000) relating to 13,383 patients (range 0-120,000). Each centre physician issued a mean of 2,444 histology examinations reports (range 613-11,000); the ratio between the number of immunohistochemistry examinations and the number of histology examinations was 0.8 (range 0-2.7); and each laboratory technician had a mean overall annual workload of 3,072 histology, molecular biology and cytology examinations (range 793-9,882/year). These values varied widely among the participating centres. The mean ratio between the number of histology examinations carried out and the number of physicians was 1,982.77:1 a year in the small centres (< 10,000 histology cases/year), 2,627:1 a year in the medium-sized centres (10-24,999 histology cases/year), and 2,881.34:1 in the large centres (> 25,000 histology cases/year). There were significant differences between the small and medium-sized centres ($p = 0.004$) and between the small and large centres ($p = 0.001$), but not between the medium-sized and large centres.

The ratio between the total number of histology, molecular biology and cytology examinations and the number of laboratory technicians was 1,963.34 in the small centres (< 10,000 examinations/year), 2,717.11 in the medium-sized centres (10,000-24,999 examinations/year), and 3,531.56 in the large centres (≥ 25,000 examinations/year). There were significant differences between the small and large centres ($p = 0.001$) and between the medium-sized and large centres ($p = 0.004$), but not between the small and medium-sized centres.

Conclusions. The data collected by means of this survey provide an important, albeit partial, point of reference concerning the status of Italian anatomical pathology centres and their recent, everyday working situation.

Key words

Questionnaire • National Survey • Pathology Centres • Italy

Introduction

In 2015, the Italian Society of Anatomical Pathology and Cytology (SIAPEC) and the Italian Confederation of Regional Healthcare Federations (*Federsanità*) promoted a survey of anatomical pathology centres in Italy with the aim of obtaining a picture of the work done throughout the country in 2014 and collecting data concerning differences between the various centres in terms of the workloads of medical and non-medical staff. In particular, it investigated the hospital medical and surgical departments making use of each cen-

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Tab. I. Survey questionnaire.

Items	Information collected
1. No. of inhabitants in catchment area	No. of residents
2. No. of hospitals referring to the centre	No. of hospitals
3. Presence of samples from neurosurgery departments	☐ Yes ☐ No
4. Presence of samples from chest surgery departments	☐ Yes ☐ No
5. Presence of samples from urology departments	☐ Yes ☐ No
6. Presence of samples from obstetrics/gynecology departments	☐ Yes ☐ No
7. Presence of samples from senology departments	☐ Yes ☐ No
8. Presence of samples from other hospital departments	☐ Yes ☐ No If yes, please specify in the notes
9. No. of physicians, including the director	No. of physicians
10. No. of biologists	No. of biologists
11. No. of laboratory technicians, including the co-ordinator	No. of laboratory technicians
12. No. of midwives/nurses	No. of midwives/nurses
13. No. of administrative personnel	No. of administrative personnel
14. No. of other personnel	No. of other personnel
15. No. of personnel on fixed-term contracts	No. of personnel on fixed-term contracts
16. No. of histological examinations/year (2014)	No. of histological examinations
17. No. of immunohistochemistry examinations/year (2014)	No. of immunohistochemistry examinations
18. No. of molecular biology examinations/year (2014)	No. of molecular biology examinations
19. No. of molecular biology cases (patients)/year (2014)	No. of molecular biology cases (patients)
20. No. of cytology examinations/year (2014)	No. of cytology examinations
21. No. of cytology cases (patients)/year (2014)	No. of cytology cases (patients)
22. Do the annual totals include samples related to screening programmes?	☐ Yes ☐ No If yes, which programmes? If yes, what percentage of the annual number of cases do they account for? If yes, are they examined by dedicated personnel?
23. Are autopsies carried out?	☐ Yes ☐ No If yes, how many were there in 2014?
24. Is a computerised management program used?	☐ Yes ☐ No If yes, is the software shared by the hospital departments referring to the centre? If yes, do the hospital departments request examinations on line? If yes, do the hospital departments receive examination reports on line? If yes, does the software track the sample throughout the process? Se yes, is the software shared at regional level?

tre, the number and types of working personnel, the referred patients/cases, the services provided, and workloads expressed as the ratio between the number of examinations carried out and the resident population (considering only the centres located in geographical areas with relatively stable populations such as mountain communities and Sardinia).

Materials and methods

During the recruitment phase, an e-mail was sent to the directors of all of the anatomical pathology centres in Italy in order to describe the aims of the survey, and the methods of administering the questionnaires, processing the data, and publishing the results.

Copies of the questionnaire, which was designed up by a SIAPEC working group and consisted of the 24 questions shown in Table I, were sent out and collected by the Anatomical Pathology Service of Bolzano. The contents of the completed forms were recorded and processed by the *Centro Explora-Ricerca ed Analisi Statistica* in Padua, which also drew up a summary report of the findings. QlikView software was used to check the quality of the data and prepare the final database, and the data were processed using version 18.0 of SPSS for Windows statistical software.

The results of the survey were described by calculating the absolute and relative frequencies of the individual variables, as well as their mean and median values and standard deviations. The various sub-groups analysed

Tab. II. Referring hospital departments.

Department	Percentages
Neurosurgery	48.3
Chest surgery	65.8
Senology	95.8
Obtetrics/gynecology	98.3
Urology	95.0

were compared using the Kruskal-Wallis non-parametric test (the usual parametric tests were not used because the data were not normally distributed).
In order to analyse the size of the centres in relation to the other variables covered by the questionnaire, they were divided into those carrying out < 10,000, 10,000-24,999 and ≥ 25,000 histological cases per year, or those with a total of < 10,000, 10,000-24,999 and ≥ 25,000 histological, molecular biology and cytology examinations per year, as appropriate.

Results

The questionnaire was completed by 120 of the 256 anatomical pathology centres contacted (46.9%): response rates were higher in northern Italy (61% in the north-west and 51% in the north-east) than in central Italy (38%) or southern Italy and the islands (33%).
Almost all of the responding centres declare that they collaborated with hospital departments of obstetrics/gynecology (98.3%), senology (95.8%) and urology (95.0%), but fewer handled samples coming from chest surgery (65.8%) and neurosugery departments (48.3%).
The responding centres were staffed by a mean number of 6.6 physicians, including the director (range 1-24).
In addition to the standard deviation of 3.995, the variability in the number of physicians can be evaluated by analysing Figure 1: it was 1-5 at 50.8% of the centres, 6-10 at 34.2%, 11-15 at 10.0%, and > 15 at 5.0%.
The mean number of biologists per centre was 1.6 (range 0-7).
A total of 33.3% of the centres had no biologist on the staff, 23.3% had only one, 20.0% had two, 12.5% had three, and 10.8% had four or more.
The mean number of laboratory technicians per centre was 10.8, including the coordinator (range 2-47).
The number was 1-10 at 61.3% of the centres, 11-20 at 28.6%, and > 20 at 10.1%.

Tab. III. Number of physicians working at the centres.

Mean	Median	Minimum	Maximum	Standard deviation
6.6	5.0	1	24	3.995

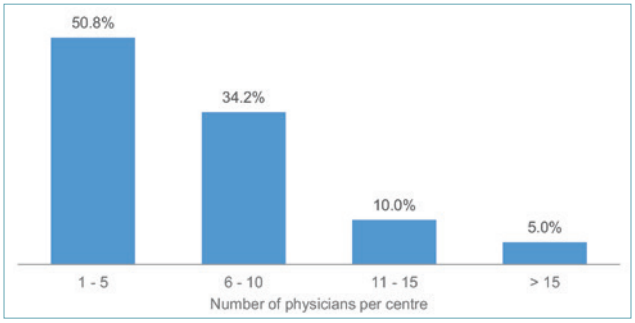

Fig. 1. Percentage distribution of centres by number of physicians (including the director).

Tab. IV. Number of biologists working at the centres.

Mean	Median	Minimum	Maximum	Standard deviation
1.6	1.0	0	7	1.629

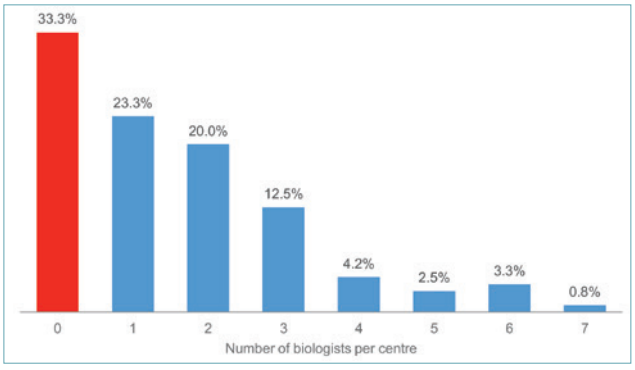

Fig. 2. Percentage distribution of centres by number of biologists.

Tab. V. Number of laboratory technicians (including the coordinator) working at the centres.

Mean	Median	Minimum	Maximim	Standard deviation
11.2	9.0	2	47	7.547

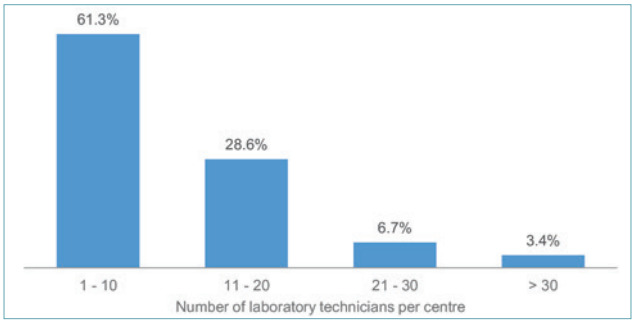

Fig. 3. Percentage distribution of centres by number of laboratory technicians (including the coordinator).

Tab. VI. Number of administrative personnel at the centres.

Mean	Median	Minimum	Maximum	Standard deviation
2.2	2.0	0	9	1.866

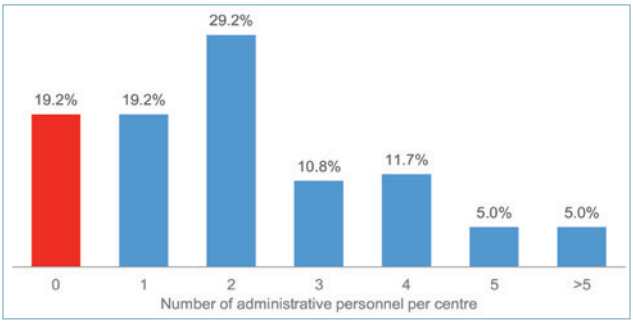

Fig. 4. Percentage distribution of centres by number of administrative personnel.

Tab. VII. Number of other personnel at the centres.

Mean	Median	Minimum	Maximum	Standard deviation
1.9	1.0	0	10.5	2.020

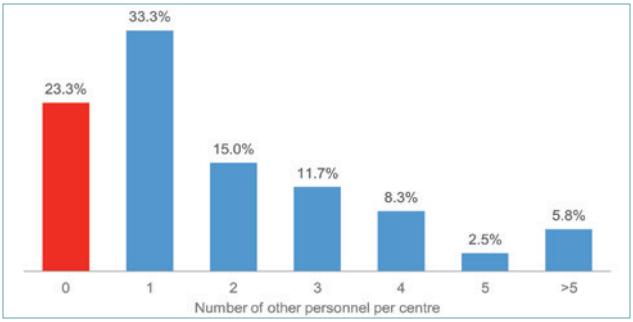

Fig. 5. Percentage distribution of centres by number of other personnel.

The mean number of administrative personnel per centre was 2.2 (range 0-9).
Almost 20% of the centres had no administrative personnel, and almost half had just one or two.
As many as 76.7% of the responding centres declared that they had other personnel: a mean number of 1.9 per centre.
During the course of 2014, the responding centres carried out a mean of 15,000 histology examinations (range 3,215-50,680) and almost 11,700 immunohistochemistry examinations (range 0-54,359): 58.3% of the centres declared that the total number of histology examinations carried out in 2014 was between 5,001 and 15,000, and 56.7% carried out between 4,001 and 16,000 immunohistochemistry examinations. It is worth noting that only one of the 120 centres declared that it did not carry out any immunohistochemistry examinations in 2014.
In 2014, the centres carried out a mean of 1,471 molecular biology examinations (range 0-31,322) relating to a mean of 704 patients (range 0-9,434); almost 32% of the centres indicated that it had not carried out any molecular biology examination during the course of the year.
Similarly, each centre carried out a mean of 16,509 cytology examinations (range 0-150,000) relating to

Tab. VIII. Number of histology examinations (cases/patients) carried out by the centres in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
14,782.6	12,000.0	3,215	50,680	8,939.155

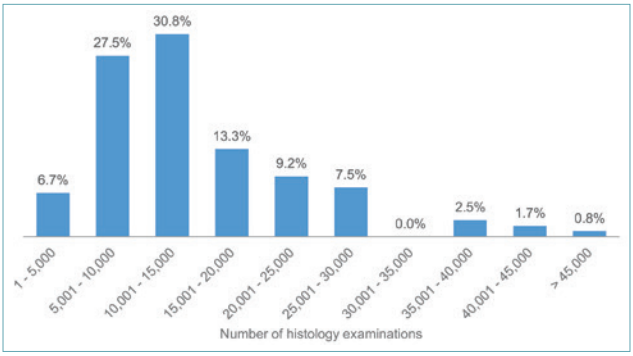

Fig. 6. Percentage distribution of centres by the number of histology examinations (cases/patients) carried out in 2014.

Tab. IX. Number of immunohistochemistry examinations carried out by the centres in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
11,680.4	8,236.0	0	54,359	10,446.904

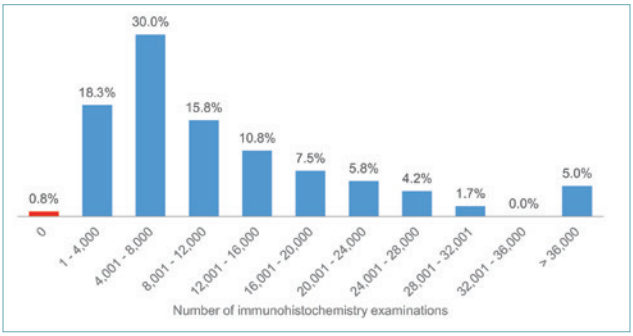

Fig. 7. Percentage distribution of centres by the number of immunohistochemistry examinations carried out in 2014.

Tab. X. Number of molecular biology examinations carried out by the centres in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
1,470.7	345.0	0	31,322	3,706.935

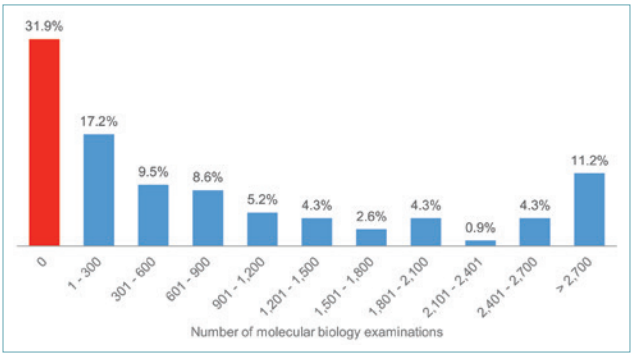

Fig. 8. Percentage distribution of centres by the number of molecular biology examinations carried out in 2014.

Tab. XI. Number of patients whose samples underwent molecular biology examinations in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
703.6	200.0	0	9,434	1,430.188

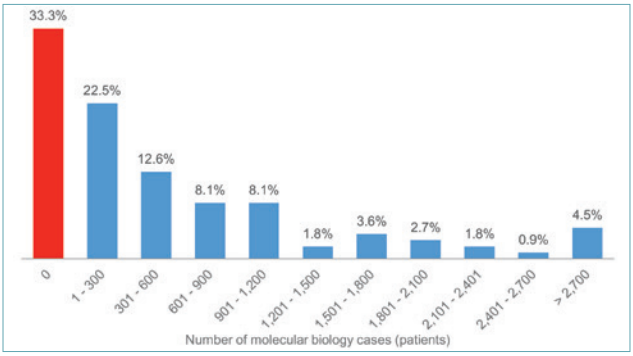

Fig. 9. Percentage distribution of centres by the number of patients whose samples underwent molecular biology examinations in 2014.

Tab. XII. Number of cytology examinations carried out by the centres in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
16,509.2	12,934.0	0	150,000	18,386.126

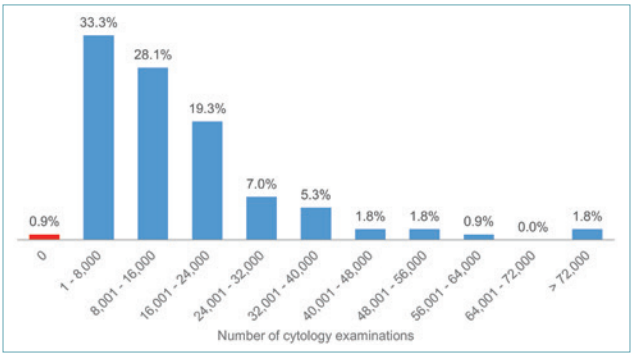

Fig. 10. Percentage distribution of centres by the number of cytology examinations carried out in 2014.

Tab. XIII. Number of patients whose samples underwent cytology examinations in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
13,383.4	8,640.0	0	120,000	16,275.578

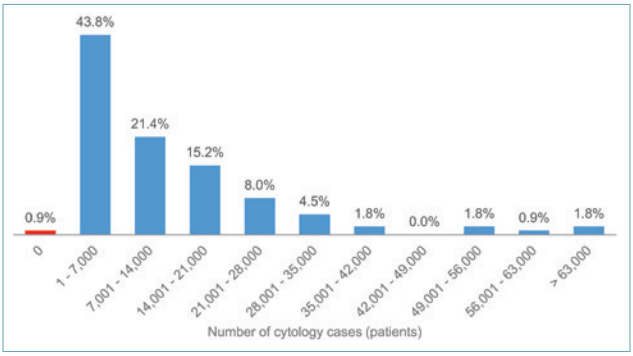

Fig. 11. Percentage distribution of centres by the number of patients whose samples underwent cytology examinations in 2014.

13,383 patients (range 0-120,000). However, it must be pointed out that the data on cytology examinations are not very reliable insofar as some centres included Pap tests and others did not.

The data concerning autopsies showed that the mean number of autopsies carried out at each centre in 2014 was nearly 47 (range 0-725), but almost 35% of the centres carried out fewer than 19.

On the basis of the collected data, it is possible to calculate some indicators that allow the centres to be compared with each other, including the number of histological case reports per physician, the number of immunohistochemical determinations made in relation to the total number of histological cases, and the extent to which the entire workload of a centre (histology, cytology and molecular biology examinations) weighs on the number of laboratory technicians. In 2014, each physician in the responding centres issued a mean of 2,444 histology examinations reports (range 613-11,000); the ratio between the number of

Tab. XIV. Number of autopsies carried out by the centres in 2014.

Mean	Median	Minimum	Maximum	Standard deviation
46.6	24.5	0	725	76.555

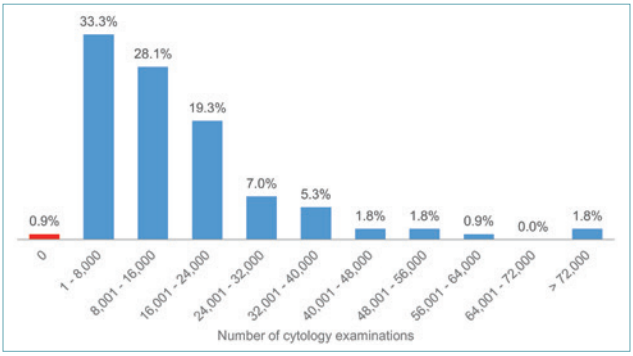

Fig. 12. Percentage distribution of centres by the number of autopsies carried out in 2014.

immunohistochemistry examinations and the number of histology examinations was 0.8 (range 0-2.7); and each laboratory technician had a mean overall annual workload of 3,072 histology, molecular biology and cytology examinations (range 793-9,882/year). The values of these three indicators varied widely among the centres (Figs. 13-15).

The centres were also compared on the basis of their workloads after classifying them by size (small < 10,000 histology cases/year; medium 10-24,999 histology cases/year; large ≥ 25,000 histology cases/year) in order to see whether there were any substantial differences between the three classes.

In the small centres, the mean ratio between the number of histology examinations carried out and the number of physicians was 1,982.77:1 a year, but the values increase with the size of the centre to 2,627:1

Tab. XV. Ratio between the number of histology examination reports (cases/patients) issued and the number of physicians (including the director) at the responding centres.

Mean	Median	Minimum	Maximum	Standard deviation
2,444.0	2,292.5	613.0	11,000.0	1,152.391

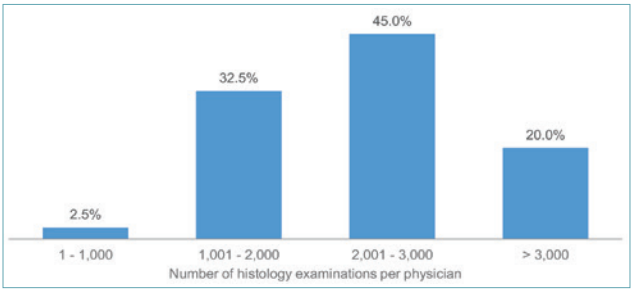

Fig. 13. Percentage distribution of centres by the number of histology examination reports (cases/patients) issued per physician.

Tab. XVI. Ratio between the number of immunohistochemistry examinations and the number of histology examinations (cases/patients).

Mean	Median	Minimum	Maximum	Standard deviation
0.8	0.7	0.0	2.7	0.487

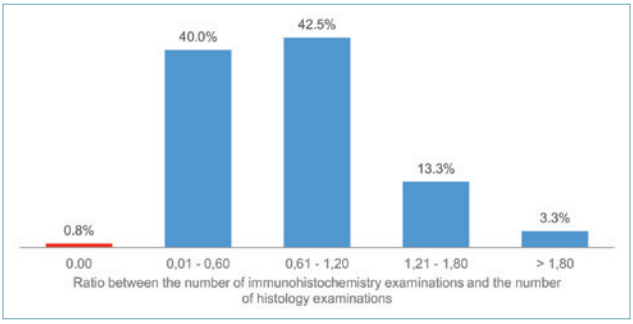

Fig. 14. Percentage distribution of centres by the ratio between the number of immunohistochemistry examinations and the number of histology examinations (cases/patients).

Tab. XVII. Ratio between the total number of histology, moleculat biology and cytology examinations carried and the number of laboratory technicians (including the coordinator) at the responding centres.

Mean	Median	Minimum	Maximum	Standard deviation
3,071.8	2,758.8	792.7	9,882.4	1,602.374

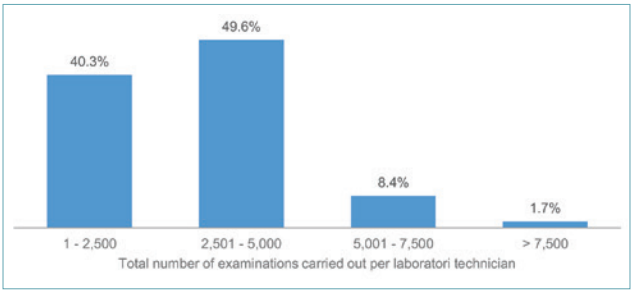

Fig. 15. Percentage distribution of centres by the total number of histology, molecular biology and cytology examinations carried out per laboratory technician.

a year in the medium-sized centres, and 2,881.34:1 in the large centres. The Kruskal-Wallis test revealed significant differences between the small and medium-sized centres (p = 0.004) and between the small and large centres (p = 0.001), but not between the medium-sized and large centres.
The ratio between the number of immunohistochemistry examinations and the number of histology examinations was very similar in the three classes: 0.85 in the small centres, 0.73 in the medium-sized centres, and 0.83 in the large centres. The Kruskal-Wallis test did not reveal any significant between-class difference in relation to this indicator (p = 0.349).
In order to compare the workloads of the laboratory technicians, three groups of centres were created on the basis of the total number of histology, molecular biology and cytology examinations carried out. The ratio between this number and the number of laboratory technicians was 1,963.34 per technician in the small centres (< 10,000 examinations/year), 2,717.11 per technician in the medium-sized centres (10,000-24,999 examinations/year), and 3,531.56 per technician in the large centres (≥ 25,000 examinations/year). The Kruskal-Wallis test revealed significant differences between the small and large centres (p = 0.001) and between the medium-sized and large centres (p = 0.004), but not between the small and medium-sized centres.
Finally, an attempt was made to evaluate the relationship between the number of histology examinations carried out and the population in the catchment area. In order to be able to estimate this indicator with a certain degree of accuracy, the analysis was limited to the centres located in mountain communities (Sondrio, Bolzano, Trento, Belluno, Aosta) and Sardinia (Sassari, Cagliari, Carbonia, Nuoro, Medio Campidano): i.e. relatively isolated areas in which inter-territorial healthcare mobility is more restricted. In the other parts of Italy covered by the survey, the co-presence of more than one anatomical pathology centre in the same area and greater healthcare mobility make it difficult to estimate the reference population accurately. However, in the mountain communities and Sardinia, 179,691 histology examination reports were issued during the course of 2014 which, when related to the 3,236,310 inhabitants in these areas, leads to a rate of 5.56%.

Discussion

In addition to the interesting data concerning the status of Italian anatomical pathology centres in 2014, the picture provided by the survey also allows extra information to be gleaned from the analysis of various indicators.
The figures concerning the hospital departments served (Tab. II) and the number of physicians, biologists, laboratory technicians, administrative staff and other personnel involved (Tabs. III-VII, Figs. 1-5) are very interesting in themselves and do not require further comment. The same can be said about the data concerning the number and type of laboratory examinations (Tabs. VIII-XIII, Figs. 6-11), and the number of autopsies.
We shall therefore concentrate on the indicators. The analyses of the first and third indicator respectively showed that the physicians had a mean workload of 2,444 cases (Tab. XV and the related figure), and that the laboratory technicians had a mean workload of 3,072 cases (Tab. XVII and the related figure). The second indicator showed that a mean of 0.8 immunohistochemistry examinations were made for every case (maximum value 2.7), regardless of the number of cases.
The data shown in Tables XVIIIa and XVIIIb (physicians) and Tables XXa and XXb (technicians) concern the differences between the small, medium-sized and large centres, and demonstrate that the workload per person (physicians and technicians) is lighter in the

Tab. XVIIIa. Ratios between the number of histology examination reports issued and the number of physicians in the responding centres classified on the basis of their size.

		Histology cases/year			
		< 10,000	10,000-24,999	≥ 25,000	Total
Histology cases/physician	No. of centres	40	65	15	120
	Minimum	613.00	929.92	1896.47	613.00
	Mean	1982.77	2627.00	2881.34	2444.05
	Maximum	4101.00	11000.00	4281.00	11000.00
	Standard deviation	753.37	1337.78	746.63	1152.39
	25th percentile.	1444.13	2000.00	2299.44	1776.64
	50th percentile.	1792.30	2443.29	2861.78	2292.47
	75th percentile.	2406.50	2920.33	3184.50	2859.46

Tab. XVIIIb. Results of the Kruskal-Wallis test used to verify the hypothesis of equality in the distribution of the ratio between the number of histological examination reports issued and the number of physicians in the responding centres classified on the basis of their size. The post hoc tests were carried out using Bonferroni's correction.

Group 1 - Group 2	Adjusted p-value
< 10,000 – 10.000-24,999	0.004
< 10,000 – ≥ 25,000	0.001
10.000-24,999 - ≥ 25,000	0.321

small centres (< 10,000 cases) than in the larger centres. This is in line with published data regard to the technical personnel, which indicate that the productivity of histology laboratories is greatest when they handle about 20,000 cases/year [1].

According to the College of American Pathologists, the mean workload of technical personnel is about 6,433 paraffin blocks/year, with a block/slide ratio of 1:1.8 (2,080 working hours/year) [2]. In the case of medical personnel, the Canadian Association of Pathologists considers it is necessary to have one anatomopathologist per approximately 25,000 inhabitants, with a weighted workload of 3,455 Level 4 equivalents (L4E: range 3,362-3,554) per full-time equivalent, and the same values are given by the Royal College of Pathologists and the Medical Group Management Association [3]. Some Italian regions have introduced workload regulations: in 2012, Tuscany converted published data into a resolution [4] according to which every pathologist should read up to 1,200 slides/year, corresponding to 2,000-2,500 cases/year; and, in 2013, the Veneto region issued a decree concerning workloads [5] laying down that every multi-specialty unit (UOC) should produce at least 15,200 diagnoses (2,700 histological diagnoses/pathologist or 3,700 cyto-histological diagnoses/pathologist).

The limitations of our questionnaire (which will be overcome in the next edition) are that it did not investigate the number of paraffin blocks produced by the centres or consider the heterogeneity of the weighted workloads, whereas the international literature describes workloads in terms of the number of blocks/year (rather than cases(year) and also evaluates the weight of the different activities carried out [1 6]. Furthermore, the attempt to analyse geographical differences was foiled by the simultaneous presence of more than one anatomical pathology centre in the same area, thus making it impossible to determine reference populations accurately.

Conclusions

The data collected by means of this survey provide an important, if partial, point of reference concerning the recent, everyday working situation in Italy.

As can be seen from the available national and international data, it is difficult to combine quality and quantity because there is no scientifically validated means of establishing the point at which these two

Tab. XIXa. Ratios between the number of immunohistochemistry examinations and the number of histology examinations in the responding centres classified on the basis of their size.

		Histology cases/year			
		< 10,000	10,000-24,999	≥ 25,000	Total
Immunohisto-chemistry/histology	No. of centres	40	65	15	120
	Minimum	0.00	0.04	0.35	0.00
	Mean	0.85	0.73	0.83	0.78
	Maximum	2.67	2.49	1.64	2.67
	Standard deviation	0.57	0.46	0.33	0.49
	25th percentile	0.45	0.41	0.61	0.43
	50th percentile perc.	0.69	0.68	0.74	0.68
	75th percentile perc.	1.07	0.89	1.08	0.96

Tab. XIXb. Results of the Kruskal-Wallis test used to verify the hypothesis of equality in the distribution of the ratio between the number of immunohistochemistry examinations and the number of histology examinations in the responding centres classified on the basis of their size.

Summary of hypothesis test				
	Null hypothesis	Test	Sig.	Decision
1	The distribution of the immuno-chemistry examinations: histology ratio is the same in all centre size categories	Kruskal-Wallis test for independent samples	0.349	Null hypothesis accepted

Tab. XXa. Ratios between the total number of histology, molecular biology and cytology examinations carried out and the number of the number of laboratory technicians in the responding centres classified on the basis of their size.

		Total number of examinations/year			
		< 10,000	10,000-24.999	≥ 25,000	Total
No. of examina tions/laboratory technicians	No. of centres	11	46	63	120
	Minimum	792.67	1016.45	1185.71	792.67
	Mean	1963.34	2717.11	3531.56	3071.77
	Maximum	4758.50	9850.00	9882.35	9882.35
	Standard deviation	1374.70	1534.35	1545.65	1602.37
	25th percentile	1180.86	1906.25	2505.58	1947.57
	50th percentile	1488.20	2374.56	3349.18	2758.82
	75th percentile	2171.67	3471.71	4132.11	3665.00

Tab. XXb. Results of the Kruskal-Wallis test used to verify the hypothesis of equality in the distribution of the ratio between the total number of histology, molecular biology and cytology examinations and the number of laboratory technicians in the responding centres classified on the basis of their size. The post hoc tests were carried out using Bonferroni's correction.

Group 1 - Group 2	Adjusted p-value
< 10,000 – 10,000-24,999	0.208
< 10,000 – ≥ 25,000	0.000
10,000-25,000 - ≥ 25,000	0.004

characteristics meet. Nevertheless, it is to be hoped that the two indicators of the number of cases per physician and per laboratory technician (Tabs. XV, XVII), which mirror other published findings, will begin to be applied nationally in a capillary manner.

The future will see the increasing consolidation of anatomical pathology centres, with the closure of smaller centres or their merger with larger centres, and it will be very interesting to assess how this will change the organisation of their work. For this reason, we hope that the second edition of the questionnaire will involve an even larger number of centres.

Conflict of interest statement

None declared.

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