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SUPPLEMENTARY MATERIAL

Pulmonary rehabilitation facilities and expertise in Italy: the role of cardiorespiratory physiotherapists. A national survey endorsed by ARIR and AIPO

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Supplementary Paragraph S1. Survey methodology

S1.1. Ethical and Methodological Framework

Both surveys were conducted in accordance with the CHERRIES guidelines, ensuring adherence to methodological standards for the design, conduct, and reporting of electronic surveys. Participation was voluntary, without sponsorship or incentives, and all collected data were handled anonymously; therefore, ethics committee approval was not required.

S1.2. Recruitment and Contact Procedures

Participants were contacted exclusively via publicly available email addresses on the official websites of the respective institutions. The emails included a presentation outlining the study's aims, the identity of the research coordinators, the estimated time to complete the questionnaires, and a guarantee of anonymous handling of the collected data.

To enable nationwide dissemination, ARIR (Associazione Riabilitatori dell'Insufficienza Respiratoria) and AIPO (Associazione Italiana Pneumologi Ospedalieri) compiled a comprehensive dataset of all public and accredited facilities within the Italian National Health System, including geographic location, public/private status, university affiliations, and the presence of relevant departments or services. Because no such detailed registry existed (particularly one including direct contact information for each department) the two associations reconstructed it starting from the Ministry of Health's institutional registry and integrating it with information retrieved from institutional websites:

1. Ministry of Health. Elenco Aziende sanitarie locali e Strutture di ricovero. https://www.salute.gov.it/portale/documentazione/p6_2_8_1_1.jsp?id=13
2. Open Data - Aziende Ospedaliere, Aziende Ospedaliere Universitarie e IRCCS pubblici (anche costituiti in fondazione). https://www.dati.salute.gov.it/it/dataset/aziende-ospedaliere-aziende-ospedaliere-universitarie-e-irccs-pubblici-anche-costituiti/
3. Open Data - Strutture di ricovero pubbliche e equiparate presenti nel territorio della ASL. https://www.dati.salute.gov.it/it/dataset/strutture-di-ricovero-pubbliche-e-equiparate-presenti-nel-territorio-della-asl/
4. Open Data - Case di cura accreditate presenti nel territorio della ASL. https://www.dati.salute.gov.it/it/dataset/case-di-cura-accreditate-presenti-nel-territorio-della-asl/

5. Open Data - Dati di struttura e di attività dei reparti presenti in ciascuna struttura di ricovero pubblica ed equiparata. https://www.dati.salute.gov.it/it/dataset/dati-di-struttura-e-di-attivita-dei-reparti-presenti-ciascuna-struttura-di-ricovero/

To maximize outreach and participation, ARIR and AIPO disseminated the questionnaire through their institutional communication channels, and the initiative was therefore implemented as an open survey.

S1.3. Data Collection Platform and Access Control

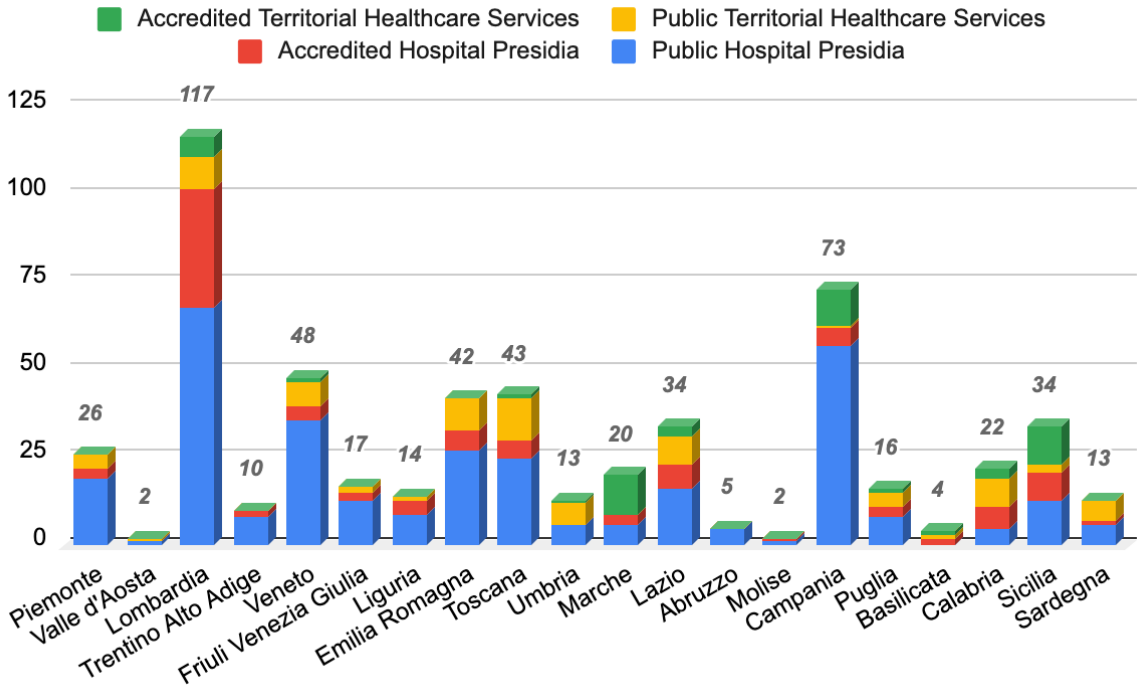
Responses were collected through a secure web application (Google Forms, Mountain View, California, USA). Access to the platform was restricted to the research team to ensure data protection and anonymity. Each respondent could complete the questionnaire only once, without registration or login. Participants could review and modify their responses until final submission.

S1.4. Data Validation and Quality Control

An ad hoc dataset was created to record all public and accredited private healthcare institutions in Italy. The first questions in the survey required respondents to identify the facility for which they were answering, ensuring accurate classification and minimizing variability.

Only one response per facility was accepted. In cases of conflicting answers, facilities were contacted by phone to verify the correct information.

Questions were not randomized. Some items were adaptive, meaning that subsequent questions appeared based on previous responses.



Supplementary Figure 1. Distribution of Survey 1 respondents (n=555) across Italian regions, stratified by setting (public vs accredited) and by care context (hospital- vs community-based). Accredited facilities: private providers accredited by the Italian National Health Service (SSN). Community-based facilities: services delivered outside hospital settings (territorial/community care).

Survey 2

Supplementary Table 1. Weekly and shift coverage by cardiorespiratory physiotherapists – combined cardiac and respiratory settings.

	Respiratory (n=71)						Cardiac (n=20)					
Facility Type (n Respiratory / n Cardiac)	**S**	**D**	**H**	**Sat G**	**Sun G**	**Hol G**	**S**	**D**	**H**	**Sat G**	**Sun G**	**Hol G**
Public (33/4)	82%	18%	0%	42%	6%	3%	100%	0%	0%	25%	0%	0%
Public + University (17/6)	94%	6%	0%	65%	6%	18%	67%	33%	0%	83%	0%	0%
Accredited (11/5)	73%	27%	0%	64%	0%	0%	60%	40%	0%	100%	0%	0%
Accredited + University (10/5)	60%	40%	0%	100%	20%	20%	80%	20%	0%	100%	20%	60%
Total Public (50/10)	86%	14%	0%	50%	6%	8%	80%	20%	0%	60%	0%	0%
Total Accredited (21/10)	67%	33%	0%	81%	10%	10%	70%	30%	0%	100%	10%	30%
Overall Total (71/20)	80%	20%	0%	59%	7%	8%	75%	25%	0%	80%	5%	15%

S,single shift; D, double shift; H, 24h coverage; G, guaranteed presence; R, respiratory; C, cardiac; Sat, Saturday; Sun, Sunday; Hol, holidays.

Supplementary Table 2. Main work environments where cardiorespiratory physiotherapists deliver clinical activities, reported separately for respiratory and cardiac pathways. Values indicate the percentage of respondent facilities in which activities were performed in each setting; percentages are shown for respiratory and cardiac services, respectively.

	WORK ENVIRONMENT	Respiratory	Cardiac
1	Emergency Department	11%	0%
2	Intensive Care Unit	55%	40%
3	Neonatal Intensive Care Unit	20%	5%
4	Emergency Medicine	23%	0%
5	Spinal Unit	8%	0%
6	Cardiac Surgery	25%	25%
7	Thoracic Surgery	32%	15%
8	General Surgery	37%	10%
9	Pulmonology	49%	15%
10	Pediatrics	24%	5%
11	Geriatrics	13%	0%
12	Cardiac Rehabilitation	31%	75%
13	Respiratory Rehabilitation	48%	25%
14	Neurorehabilitation	17%	0%
15	Functional Recovery Rehabilitation (FRR)	27%	10%
16	Outpatient Respiratory Physiopathology	31%	5%
17	Sleep Medicine Outpatient Clinic	21%	0%
18	Home Care	15%	0%
19	Outpatient Respiratory Rehabilitation	65%	40%
20	Outpatient Cardiorespiratory Rehabilitation	25%	55%

Supplementary Table 3. Functional assessment activities performed by cardiorespiratory physiotherapists during patient functional assessment, reported separately for respiratory and cardiac pathways. Values indicate the percentage of respondent facilities in which each assessment activity is routinely performed.

	FUNCTIONAL ASSESSMENT	Respiratory	Cardiac
1	Physical examination of the chest and abdomen	82%	60%
2	Measurement of vital signs	93%	85%
3	Peripheral oxygen saturation	92%	100%
4	Auscultation	73%	45%
5	Dyspnea (using specific scales)	90%	80%
6	Pain (using specific scales)	75%	70%
7	Cough (clinical assessment)	90%	55%
8	Cough (instrumental assessment)	55%	15%
9	Swallowing	30%	10%
10	Muscle strength	79%	55%
11	Review of ongoing drug therapy	85%	60%
12	Review of laboratory test results	72%	55%
13	Review of radiological examinations	80%	70%
14	Pulmonary Function Tests (review)	66%	35%
15	Pulmonary Function Tests (execution)	66%	35%
16	Chest ultrasound (lung/diaphragm)	20%	10%
17	Muscle ultrasound	7%	0%
18	Arterial blood gas analysis (execution)	7%	5%
19	Arterial blood gas analysis (review)	86%	60%
20	Assessment of surgical device function (e.g. chest drains)	31%	20%
21	Electrocardiogram (review)	45%	60%
22	Cardiopulmonary exercise test	15%	15%
23	Walking test (Six-Minute Walking Test – 6MWT)	85%	90%
24	No activity listed	0%	0%

Supplementary Table 4. Types of interventions delivered as core domains of daily clinical practice, by rehabilitation area.

Domain	Clinical Intervention	Respiratory (n=71)	Cardiac (n=20)
1. Mobilization and early activity	Early mobilization	94%	93%
	Postural re-education	74%	43%
	Balance training	79%	74%
	Activities of daily living (ADL) training	81%	78%
	Physical training (endurance, strength, etc.)	90%	88%
	Use of ergometers / cycle ergometers	72%	71%
2. Airway clearance and hygiene	Mechanical cough assistance / bronchial clearance (e.g., PEP, mechanical devices)	93%	64%
	Chest physiotherapy techniques (manual or with devices)	71%	35%
	Positioning techniques for secretion drainage	68%	30%
	Use of mechanical devices for airway clearance	70%	39%
	Airway suction (invasive/non-invasive)	74%	26%
3. Breathing & respiratory training	Breathing retraining	72%	44%
	Inspiratory muscle training	66%	40%
	Education on breathing techniques and energy conservation	83%	53%
	Airway clearance education	81%	48%
4. Clinical monitoring & assessment	Monitoring of vital signs	93%	91%
	6-minute walk test	85%	90%
	Respiratory muscle strength testing (MIP/MEP)	41%	22%
	Peak expiratory flow measurement	53%	—
	Objective cough measurement	55%	15%
5. Ventilation & oxygen therapy	Non-invasive ventilation management	54%	43%
	Tracheostomy decannulation / weaning from mechanical ventilation	52%	36%
	Oxygen therapy management	87%	74%
6. Imaging & instrumental tools	Thoracic ultrasound	20%	11%
	Muscle ultrasound	7%	—
7. Education & care coordination	Therapeutic education (risk factor management, self-management, etc.)	84%	84%
	Discharge planning and continuity of care (handover to home/community services)	83%	83%

ADL, activities of daily living; PEP, positive expiratory pressure; MIP/MEP, maximal inspiratory/expiratory pressure.

Supplementary Table 5. Referral source for physiotherapy intake, by rehabilitation area (R: Respiratory and C: Cardiac)

Facility Type	Rehab Area	1	2	3	4	5	6
Public	R (n=33)	52%	48%	18%	39%	15%	21%
	C (n=4)	25%	0%	75%	50%	0%	25%
Public + University	R (n=17)	29%	41%	12%	41%	24%	47%
	C (n=6)	17%	33%	100%	17%	0%	17%
Accredited	R (n=11)	55%	73%	55%	45%	18%	55%
	C (n=5)	0%	0%	100%	40%	0%	0%
Accredited + University	R (n=10)	20%	80%	40%	10%	0%	10%
	C (n=5)	0%	40%	60%	0%	40%	20%
Total Public	R (n=50)	44%	46%	16%	40%	18%	30%
	C (n=10)	20%	20%	90%	30%	0%	20%
Total Accredited	R (n=21)	38%	76%	48%	29%	10%	33%
	C (n=10)	0%	20%	80%	20%	20%	10%
Overall Total	R (n=71)	42%	55%	25%	37%	15%	31%
	C (n=20)	10%	20%	85%	25%	10%	15%

1: After assessment by a Physical Medicine and Rehabilitation specialist; 2: After assessment by a Pulmonologist; 3: After assessment by a Cardiologist; 4: After assessment by a ward physician; 5: Direct referral following a nurse's or other professional's notification; 6: Direct patient intake by the Physiotherapist. R, respiratory; C, cardiac.