ORIGINAL PAPER

Effect of body mass and physical activity at younger age on the risk of prostatic enlargement and erectile dysfunction: Results from the 2018 #Controllati survey

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Summary
Objective: Overweight and low physical activity (PA) increase the risk of prostatic enlargement and erectile dysfunction (ED). Less clear is the role of these factors at young age on the lifelong risk.

Materials and methods: During June 2018 the Italian Society of Urologists organized the month of Male Urologic Prevention “#Controllati.” Men aged 18 years or more were invited to attend urologic centers for a visit and counselling about urologic and sexual conditions. Each participating man underwent a physical examination and was asked about urologic symptoms, sexual activity and possible related problems.

Results: We analyzed data from 2786 men, aged 53.1 years (SD 10.9, range 19-97). A total of 710 (25.5%) subjects had a diagnosis of prostatic enlargement and 632 (22.7%) of DE. Overweight/obese men were at increased risk of prostatic enlargement and ED with corresponding odds ratio (OR) in comparison with normal or underweight men, being respectively 1.18 (95% Confidence Interval (CI) 1.00-1.44) and 1.69 (95% CI 1.39-2.05). The OR of prostatic enlargement in comparison with men reporting at age 25 a BMI < 25.0 was 1.22 (95% CI 1.01-1.51) for men with a BMI at 25 years of age ≥ 25; the corresponding OR value for ED was 1.17 (0.92-1.48). Considering total PA at diagnosis, the OR of prostatic enlargement in comparison with no or low PA, was 0.69 (95%CI 0.53-0.86) for men reporting moderate PA and 0.75 (95%CI 0.58-0.98) for those reporting intense PA. When we considered PA at 25 years of age, the OR of subsequent diagnosis of prostatic enlargement, in comparison with men reporting no/low PA at 25 years of age was 0.61 (95%CI 0.63-1.04) for men reporting moderate PA and 0.70 (95%CI 0.52-0.99) for those reporting intense PA.

Conclusions: These findings underline the utility of encouraging healthy lifestyle habits among young men in order to reduce the subsequent risk of prostatic enlargement and ED.

Key Words: Benign prostatic enlargement; Hypertension; Diabetes; Heart disease; Body mass index; Physical activity.

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Methods
During June 2018, men aged 18 year or more were invited to attend the participating urologic centers for a free of charge visit and counselling about urologic and andrologic conditions. A pamphlet inviting men for check-up was distributed in chemists and general practitioners’ waiting rooms. An advertising campaign was also set on media.

At visit, general data were recorded using a simple questionnaire. The first section of the questionnaire, including data on age, life habits height and weight, was completed by the patient. The section on PA included questions on self-reported intensity of PA (‘none’, ‘low’, ‘moderate’,‘intense’) at work and in leisure time separately. History of hypertension, diabetes, cardiopathy, hyperglycemia and hypercholesterolemia were checked by the urologist. Information was also collected on body mass index (BMI) and total PA at age 25 year among men aged 30 year or more.

No conflict of interest declared.
Each participating man underwent a physical examination, including digital rectal examination (DRE), and was asked by the urologist about urologic symptoms, sexual activity and possible related problems. Diagnosis of prostatic enlargement was made by the urologist by DRE. Erectile function was assessed by asking men about their sexual performance: ED was diagnosed, according to the definition of the NIH Consensus Development Panel (10), when a man was consistently unable to attain or maintain a penile erection sufficient for satisfactory sexual performance.

The 2002 ICS definitions were used for frequency, nocturia, urgency, dysuria (intermittency, slow stream, straining, terminal dribble, postmicturition dribble) incomplete emptying (11).

A man was considered a smoker if he had smoked more than one cigarette/day for at least one year; ex-smoker if he had smoked more than one cigarette/day for at least one year, but had stopped more than one year before the interview, and non-smoker if he had never smoked more than one cigarette/day.

Total PA was evaluated combining occupational and leisure time PA. Frequencies (%) were computed as appropriate. Odds ratios (OR), and the corresponding 95% confidence intervals (CI), adjusted for age were derived using unconditional multiple logistic regression, fitted by the method of maximum likelihood, in which the dependent variable was the presence (case) or absence (control) of the condition and the independent ones were the exposures considered in the analysis. We included in the model age considered as categorical variable (12).

**Results**

During the 2018 campaign a total of 3092 men entered the study. After exclusion of men who underwent previous surgery for partial or complete prostatectomy and those who did not answer at least one of two questions about PA, we analyzed data from 2786 men, aged 55.1 years (SD 10.9, range 19-97). The reason for visit was urinary symptoms in 504 (18.1%), sexual problems in 270 (9.7%), renal disease in 68 (2.4%) and prostatic problems in 429 (15.4%) (more than one reason was allowed). Prevention was the only reason for consultation in 1776 subjects (63.8%). A total of 710 (25.5%) subjects had a diagnosis of prostatic enlargement and 632 (22.7%) of DE. Table 1 shows the distribution, and the corresponding OR, of study subjects according to the diagnosis of prostatic enlargement, ED and age, smoking habits and BMI.

The risk of prostatic enlargement and ED increased with age: in comparison with men aged <=40 years or less, the risk of prostatic enlargement was 2.57, 7.22, 17.97 and 39.1 in the age classes 41-50, 51-60, 61-70 and =>71, respectively. The corresponding values for ED were 1.15, 1.63, 3.06 and 4.87.

Smoking increased the risk of ED: in comparison with never smokers, ex-smokers had an increased risk of ED of 1.38 (95%CI 1.11-1.69) and current smokers of 1.92 (95%CI 1.49-2.48).

Overweight/obese men were at increased risk of prostatic enlargement and ED the corresponding OR, in comparison with normal or underweight men, being respectively 1.18 (95%CI 1.00-1.44) and 1.69 (95%CI 1.30-2.05). We have also considered (among men aged 30 years or more) the role of overweight/obesity at 25 years of age on the subsequent risk of prostatic enlargement and ED. In comparison with men reporting at age 25 a BMI < 25.0, the OR of prostatic enlargement was for men with a BMI at 25 years of age ≥ 25, 1.22 (95%CI 1.01-1.51); the corresponding value for ED was 1.17 (95%CI 0.92-1.48).

Table 2 considers the relation between prostatic enlargement and DE and urinary symptoms, hypertension, diabetes, cardiopathy, hypertriglyceridemia and hypercholesterolemia.

| Table 1. |
| Odds ratios (and corresponding 95% confidence intervals) of BPE and erectile dysfunction according to selected factors. |

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Benign prostatic enlargement</th>
<th>Erectile dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>&lt; 40</td>
<td>166</td>
<td>7.8</td>
</tr>
<tr>
<td>41-50</td>
<td>792</td>
<td>36.8</td>
</tr>
<tr>
<td>51-60</td>
<td>718</td>
<td>33.8</td>
</tr>
<tr>
<td>61-70</td>
<td>359</td>
<td>16.0</td>
</tr>
<tr>
<td>≥ 71</td>
<td>118</td>
<td>5.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smoking habits</th>
<th>Benign prostatic enlargement</th>
<th>Erectile dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>1131</td>
<td>53.3</td>
</tr>
<tr>
<td>Ex smokers</td>
<td>624</td>
<td>29.4</td>
</tr>
<tr>
<td>Current smokers</td>
<td>343</td>
<td>16.2</td>
</tr>
<tr>
<td>&lt; 10 cig/day</td>
<td>127</td>
<td>8.5</td>
</tr>
<tr>
<td>≥ 10 cig/day</td>
<td>922</td>
<td>12.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Benign prostatic enlargement</th>
<th>Erectile dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 25.0</td>
<td>891</td>
<td>43.2</td>
</tr>
<tr>
<td>≥ 25.0</td>
<td>1172</td>
<td>56.8</td>
</tr>
</tbody>
</table>

*Sometimes, the sums do not add up to the total due to missing values; **reference category OR; odds ratio; CI: confidence interval.
Table 2.
Odds ratios (and corresponding 95% confidence intervals) of BPE and erectile dysfunction according to medical history.

<table>
<thead>
<tr>
<th></th>
<th>Benign prostatic enlargement</th>
<th>Erectile dysfunction</th>
<th>adj OR (95%CI)</th>
<th>adj OR (95%CI)</th>
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<tbody>
<tr>
<td></td>
<td>No. % (%)</td>
<td>Yes. % (%)</td>
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<td>Yes. % (%)</td>
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<tr>
<td><strong>Urinary symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1136 53.5</td>
<td>658 86.7</td>
<td>1.54 (1.5-1.6)</td>
<td>1.54 (1.5-1.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>134 1.1</td>
<td>75 1.8</td>
<td>1.61 (1.3-2.0)</td>
<td>1.61 (1.3-2.0)</td>
</tr>
<tr>
<td><strong>Erectile dysfunction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1698 80.0</td>
<td>518 68.2</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
<tr>
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<td>425 20.0</td>
<td>241 31.8</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
<tr>
<td><strong>Cardiac history</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1136 53.5</td>
<td>658 86.7</td>
<td>1.54 (1.5-1.6)</td>
<td>1.54 (1.5-1.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>134 1.1</td>
<td>75 1.8</td>
<td>1.61 (1.3-2.0)</td>
<td>1.61 (1.3-2.0)</td>
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<tr>
<td><strong>Hypertension</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>No</td>
<td>1698 80.0</td>
<td>518 68.2</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
<tr>
<td>Yes</td>
<td>425 20.0</td>
<td>241 31.8</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
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<tr>
<td><strong>Hypertrofied prostate</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1698 80.0</td>
<td>518 68.2</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
<tr>
<td>Yes</td>
<td>425 20.0</td>
<td>241 31.8</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
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<tr>
<td><strong>Diabetes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1698 80.0</td>
<td>518 68.2</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
<tr>
<td>Yes</td>
<td>425 20.0</td>
<td>241 31.8</td>
<td>1.27 (1.03-1.57)</td>
<td>1.27 (1.03-1.57)</td>
</tr>
</tbody>
</table>

*Sometimes, the sum of the data due to missing values; **one or more of the following: nocturia, urgency, dysuria (intermittent), slow stream, straining, terminal dribble, post-micturition dribble; incomplete emptying. *reference category, adjOR: adjusted odds ratio, CI: confidence interval.

Table 3.
Odds ratios (and corresponding 95% confidence intervals) of premature ejaculation and erectile dysfunction according to physical activity.

<table>
<thead>
<tr>
<th></th>
<th>Benign prostatic enlargement</th>
<th>Erectile dysfunction</th>
<th>adj OR (95%CI)</th>
<th>adj OR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. % (%)</td>
<td>Yes. % (%)</td>
<td>No. % (%)</td>
<td>Yes. % (%)</td>
</tr>
<tr>
<td><strong>Occupational PA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/Low</td>
<td>1002 48.3</td>
<td>354 49.9</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>631 30.4</td>
<td>198 27.9</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>(0.7-1.1)</td>
<td>657 30.5</td>
<td>172 27.2</td>
<td>0.80 (0.69-1.08)</td>
<td>0.80 (0.69-1.08)</td>
</tr>
<tr>
<td>Intense</td>
<td>283 13.6</td>
<td>80 11.3</td>
<td>0.97 (0.72-1.31)</td>
<td>0.97 (0.72-1.31)</td>
</tr>
<tr>
<td>Missing</td>
<td>160 7.7</td>
<td>78 11.0</td>
<td>1.33 (1.04-1.69)</td>
<td>1.33 (1.04-1.69)</td>
</tr>
<tr>
<td><strong>Leisure PA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>767 36.9</td>
<td>317 44.6</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>893 43.0</td>
<td>272 38.3</td>
<td>0.67 (0.55-0.83)</td>
<td>0.67 (0.55-0.83)</td>
</tr>
<tr>
<td>Intense</td>
<td>339 15.4</td>
<td>84 11.8</td>
<td>0.84 (0.51-0.91)</td>
<td>0.84 (0.51-0.91)</td>
</tr>
<tr>
<td>Missing</td>
<td>97 4.7</td>
<td>37 5.2</td>
<td>1.33 (1.04-1.69)</td>
<td>1.33 (1.04-1.69)</td>
</tr>
<tr>
<td><strong>Total PA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>537 25.9</td>
<td>228 32.1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>960 46.2</td>
<td>308 43.4</td>
<td>0.69 (0.55-0.86)</td>
<td>0.69 (0.55-0.86)</td>
</tr>
<tr>
<td>Intense</td>
<td>515 24.8</td>
<td>144 20.3</td>
<td>0.75 (0.58-0.98)</td>
<td>0.75 (0.58-0.98)</td>
</tr>
<tr>
<td>Missing</td>
<td>64 3.1</td>
<td>30 4.2</td>
<td>1.0</td>
<td>1.0</td>
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<tr>
<td>PA at 25 years of age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>401 19.3</td>
<td>160 22.5</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>820 39.5</td>
<td>273 38.5</td>
<td>0.81 (0.63-1.04)</td>
<td>0.81 (0.63-1.04)</td>
</tr>
<tr>
<td>Intense</td>
<td>773 37.2</td>
<td>244 34.4</td>
<td>0.70 (0.52-0.99)</td>
<td>0.70 (0.52-0.99)</td>
</tr>
<tr>
<td>Missing</td>
<td>82 3.9</td>
<td>33 4.6</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Sometimes, the sum of the data due to missing values; **reference category, adjOR: adjusted odds ratio, CI: confidence interval.

A history of hypertension, diabetes, cardiopathy, high cholesterol levels were significantly associated to an increased risk of prostatic enlargement in the total series. Likewise, hypertension, diabetes, cardiopathy, high triglyceride and cholesterol levels were significantly associated to an increased risk of ED.
PA was significantly associated with a decreased risk of prostatic enlargement: considering the total PA at diagnosis, the OR of prostatic enlargement, in comparison with men reporting no or low PA, was 0.69 (95% CI 0.55-0.86) among men reporting moderate PA and 0.75 (95% CI 0.58-0.98) among those reporting intense PA. The OR of subsequent diagnosis of prostatic enlargement were, in comparison with men reporting no/low PA at 25 years of age 0.81 (95% CI 0.63-1.04) for men reporting moderate PA and 0.70 (95% CI 0.52-0.99) for those reporting intense PA at 25 years of age. Similar findings emerged when we considered ED risk.

**DISCUSSION**

The general results of this analysis show that low PA, high BMI and a history of hypertension, diabetes, hypercholesterolemia, cardiopathy increase the risk of prostatic enlargement. High BMI and low PA at 25 year of age increase the risk of prostatic enlargement at older ages. Similar results emerged also for the risk profile of ED.

**Limitations**

As already discussed in the papers presenting the results of 2016 and 2017 initiative (8, 9), the major flaw of this study is that the study population were men voluntarily presenting to the participating centers. The participating centers were not randomly identified among all Italian urologic centers, so they cannot be considered representative of all Italian centers. However, they were well distributed over the main areas of the country. In any case, any inference from the present analysis must be made in strict comparative terms and strictly referred to men attending urologic services. The diagnosis of PE was based on DRE that tends to underestimate the prostatic volume (2). Any misclassification of men with or without BPE or should lower the observed associations. With regard to the diagnosis of DE, it was reported by the men and checked for standard criteria by the physician. The results of this study confirm data from different populations that have reported that high BMI, low PA and a history of hypertension, diabetes, hypercholesterolemia, increase the risk of BPE at all ages (13, 14). All these findings underline that benign BPE shares similar risk factors with metabolic syndrome and cardiovascular diseases. The etiological mechanisms that links these risk factors and prostatic growth are not completely understood. However, it has been shown that lipids (oxidized low-density lipoproteins) increase in vitro the secretion of growth and pro-inflammatory factors by human stromal BPE cells in culture (15). Along this line, in a clinical perspective, the addition of statins to standard therapy for benign PE lowered prostate volume (16). Further, alteration of sex steroid hormone metabolism caused by both obesity and diabetes could lead to ‘pro-inflammatory’ conditions, causing release of chemokines potentially associated with prostate enlargement (17). Regular PA has been consistently reported to decrease the risk of BPE. A meta-analysis has shown that moderate-to-vigorous physical activity was associated with up to a 25% decreased risk of benign prostatic enlargement, with the magnitude of the protective effect increasing with the higher levels of activity (18).

An interesting finding from the present study is the observation that the OR of BPE and ED associated with none/low PA and high BMI at 25 years were higher than unity. Few data have been published on the role of PA at younger ages on the lifetime risk of BPE. A previous Italian case control study have reported that moderate/intense recreational physical activity (> 2 hours week) at age 30-39 decrease the risk of benign BPE of about 30%. The Authors concluded that avoidance of sedentary lifestyle through a moderate recreational PA at any age may help preventing a sizeable number (e.g., approximately 20%) of BPE cases (7).

With regard to erectile dysfunction, the risk profile of ED was largely similar with that observed for prostatic enlargement. In particular, the present analysis confirms that smoking, overweight, low PA and history of diabetes, hypertension, cardiopathy, hypercholesterolemia, hypertriglyceridemia, all increased the risk of ED. All these findings underline the role of encouraging healthy lifestyle habits among young men in order to reduce the subsequent risk of prostatic enlargement and ED.

**REFERENCES**

Lifestyle habits and prostatic enlargement


*Participating centers:
A.O.U. Città della salute e della scienza - Ospedale Molinette, Torino (Gontero Paolo)
Arcispedale Sant'Anna Ferrara (Ippolito Carmelo)
ASL Reggio Calabria (De Martin Michele)
P.O. Umberto I, Nocera Inferiore (Sanseverino Roberto)
ASL Presidio Ospedaliero Carmagnola, Chieri (Marino Gaetano)
ASST Francia corta - Ospedale M. Mellini (Chiari Tracle Luigi)
Ospedale Mater Salute Lugano (Curti Pierpaolo)
Aurelia Hospital, Roma (Cusumano Roberto)
Azienda Ospedaliera Universitaria di Sassari (Madonia Massimo)
Azienda Ospedaliera "Umberto I" Siracusa (Lentini Bartolomeo)
Azienda Ospedaliera Universitaria, Parma (Mastromonti Umberto Vittorio)
Azienda Ospedaliera, Padova (Zattoni Filiberto)
Azienda Ospedaliera Gaetalet Rummo Benevento (Salzano Luigi)
Azienda Ospedaliera Ospedali Riuniti Papardo Piemonte, Messina (Mastroeni Francesco)
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Azienda Ospedaliera Policlinico di Bari (Barbaglia Michele)
Azienda Ospedaliera Pugliese Ciaccio Catanarbo (Pirritono Domenico)
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Azienda Ospedaliera S. Boruto, Vicenza (Ferrarese Paolo)
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Azienda Ospedaliera Santa Maria Teri (Elisabetta Costantini)
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Azienda Ospedaliera Universitaria Integrata Verona (Antnari Walter)
Azienda Ospedaliera Mater Domini di Catanarbo (Damiano Rocco)
Azienda Ospedaliera Universitaria Policlinico G. Martino Messina (Ficarra Vincenzo)
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Azienda Ospedaliera Universitaria S. Luigi Gonzaga Orbassano (Portiglia Francesco)
Azienda Ospedaliera Universitaria Maggiore della Carità, Novara (Volpe Alessandro)
Azienda Ospedaliera Universitaria Pisana - Stabilimento di Cianellino (Selli Cesare)
Azienda Ospedaliera Universitaria Sant' Andrea, Roma (Tubaro Andrea)
Ospedale Civile di Voghiera (Mensi Mario)
Azienda Socio Sanitaria Territoriale Sant Paolo e Carlo, Milano (Dormia Guido)
Campus Università degli Studi "Gabriele d'Annunzio" Chieti (Raffaele Tenergola)
 Casa di Cura Ambrosiana Cesano Boscone (Catanarco Francesco)
 Casa di Cura Gibino Catania (Ranno Christian)
 Casa di Cura Giovanni XXIII, Monastier di Treviso (Morana Carmelo)
 Casa di Cura Gaurmier, Roma (Di Marco Massimiliano)
 Casa di Cura Luigi Cobellis Vallo della Lucania (Cavallere Aniello)
 Casa di Cura Malatesta Novello Cesena (Czucozero Diego)
 Casa di Cura Munsuemi Cecas Gravina di Catania (Leonardi Rosario)
 Casa di Cura Nuova Clinica Santa Rita Benevento (Coscone Mario)
 Casa di Cura Nuova Villa Claudia, Roma (Giulianelli Roberto)
 Casa di Cura Regina Pacis, San Cataldo (Cammarata Carla)
 Casa di Cura Romolo Hospital Rocca di Neto (Cappa Manlio)
 Casa di Cura S. Rita, Attinapalo De Simone Elia Virginio.
 Casa di Cura San Camillo Messina (Bruschetta Sebastiano)
 Casa di Cura Santa Lucia San Giuseppe Vesuviano (Casoli Eugenio)
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 Casa Di Cura Villa Betania, Roma (Buscarini Maurizio)
 Casa di Cura Villa dei Fioni, Mogno di Napoli (Jangano Renato)
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 Casa di Cura Villa Igea, Ancona (Cafarelli Angelo)
 Casa di Cura Villa Maria, Mirabella Eclano (Morelli Emilio)
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