

# **Public Hospital Gas Management System: Health, Risk, Economic Implication – A Practical Experience 2015-2020**

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## **Abstract**

In this work is described a practical experience related a managerial performance related hospital gas management System. After an introduction related some normative rules involved are provided a description of activities. Then an analyses of results obtained is reported. Result founded: Related this specific experience of 5 years all endpoint was obtained: clinical, economic and risk.

## **Clarifications**

According Italian normative rules to obtain basis management certification for DIRECTORSHIP of COMPLEX HEALTH STRUCTURE is needed to produce a final courses PROJECT WORK Of about 20 hour of work. (DPR 484/1997 Art. 5, DGR EMIL. ROMAGN .1561/2013, DGR REG. EMIL ROMAGN. 644/2020). This project work was performed in about 20 working - formative hours like; time for get the data, to write this document, to write the scientific article in reference and to perform all activity need.

## **Introduction**

The management of hospital medicinal gas system need various management skills. This kind of specialty need to respect various normative rules: European, Italian, regionals, technical and safety prescription as well as economic budget law oblige. The medical gases are under MEDICINAL RULES, MEDICAL DEVICES RULES OR GALENIC ONES. The pharmacopeia EUROPEAN and ITALIAN: provide prescription of quality but also many other technical normative ( ISO-EN-UNI international, European, or Italian ) are involved in .So The management of this complex world for assure oxigenotherapy of patient, ventilation in ICU or for imaging, med lab or for some kind of surgery need an HIGH LEVEL OF MANAGERIAL COMPETENCIES [1-31].

This managerial competencies are also required to DIRECTORS OF COMPLEX HEALTHCARE STRUCTURE IN HOSPITAL and to do this is necessary to add management basis courses and a project work related. The basis management course for DIRECTORSHIP OF HEALTH COMPLEX STRUCTURE in Italy must cover this.

## **Area**

- Organizzazione e gestione dei servizi sanitari HEALTH CARE SERVICES ORGANIZATION
- Indicatori di qualità dei servizi e delle prestazioni TOTAL QUALITY MANAGEMENT
- Gestione delle risorse umane e organizzazione del lavoro HUMAN RESOURCE MANGEMENT AND WORK ORGANIZATION
- Criteri di finanziamento e bilanci HEALTH CARE PUBLIC FINANCIAL SYSTEM and FINANCIAL REPORTS

This courses must follow: Active Didactics Methodology, Frontal Lessons, Practical Cases Discussion, Incident Analysis, Role Playing, Simulations, Analysis of Data, and Focus Groups. At the end it must be presented a written Related PROJECT WORK. According this rules it is submitted a project work named involved in Hospital Medicinal Gases Management.

## **Methods**

With and prospectic (From 2015 to 20120) and observational (in retrospective way from 2020 to 2015) way many data related medicinal gas management in pc hospital was recorded to produce completive data for the final analysis.

## **Source of Data**

Official applicative program of hospital, database, albo praetorium for economic data, regional healthcare data for gas product use.

## **Description of Experience and Results**

**Location-settings:** PC AREA 3 public hospital and 2 other structure linked in the same provincial network.

About more than 700 beds

**Organization:** Departmental, wards, complex units, simple units

**Central Organization:** General Director, Health Directors, Administrative Director, HR Director, Other Technical Office, SPP prevention protection service

**Staff:** ICT, Budget Control, Economy Buying Office and other

**Many Wards:** Emergencies, ICU, medical and surgical, ambulatory

**Different kind of medical specialty:** Surgery, hematology, oncology, infectious disease, cardiology, nephrology Obstetrics-gynecology, pediatrics, trauma, orthopedic, neurology, psychiatry, Otorino, oculistic, allergology, imaging, med lab and, addictions services and many other. Also transplant are performed (staminal cells- molecular biology and other)

**Time of Observation:** from 2015 – 2020

**Kind of service managed:** Public Hospital Gas Management

**Position Observed:** Hospital pharmacist involved officially in medicinal gas management

**Role:** Execution Director of Hospital Medical Gases Contract with External Provider- Quality Control of Medical Gases Officially – Pharmacist Responsible for Gas Management

**Title of Observed Position:** Applied Pharmacologist, Ward Clinical Pharmacist University Title, Hospital Pharmacist Manager

**Director of Execution Contract Dec:** Medical Gases Providing System and Dec for Contract Internal Transport of Mobile Container of Gases.

**Qualified As:** Hospital pharmacist and territorial manager level, Complex Structure Directship Level (Idoneita Alle Funzioni) 2020 Public Selection Cremona Hosp.

**Updating and Formative Management Courses Followed**

**During 2015 – 2020:** Several courses relate management topics like: strategic management project management, TQM, Risk management, MBO, problem solving, time management, budget analysis, economic and financial, Healthcare economy, pharmaco-economy, economic analysis, ICT, gas medical management - regional level courses), communication technique, team building topics, SWOT analysis, DATA management and many other COMPLETE LIST is reported after reference).

**Risk Analysis:** In the observed period from 2014 – 2020 NO adverse event or incident or other relevant was observed

**Analysis:** During the period 2016-2020 THE MEDICINAL GASES BUDGET WAS APPROVED BY GENERAL MANAGER, and monitoring of the amount ordered was performed and no overload of ordered products. The cost of medicinal gases was according the rules accepted in official buying procedure of AREA VASTA. No any kind of official contrast between hospitals direction ship and external private gas Provider Company.

**Clinical Results:** In the observed period NO ANY CLINICAL ADVERSE EVENT WAS OBSERVED AND REGISTERED about medicinal gases used in this hospital.

**Quality Control:** In the observed period NO any periodic analysis on quality of gases provided was out of OFFICIAL ITALIAN PHARMACOPEIA specific. Only 1 cases related medical air due to also pre-analytical problem but solved in few time.

**Control of Documentation:** In the observed period all documentation for archive was done. Certificate of analysis, written memorandum, contract, recall, communications and all related.

**Revision of Documentation:** During this period was introduced DGO operative gestional document or medicinal gases system (in collaboration with TECHNICAL OFFICE AND PREVENTION PROTECTION SYSTEM OFFICE AND MEDICAL DIRECTOS) officially adopted on going the producing of other related procedure but cited in the DGO.

**Emergency Management:** Related COVID-19 emergency it was needed to increase the availability of medical gases like oxygen introducing other new TANK near the poli-chirurgic

of the HOSPITAL and to add to the central system VARIOUS PACKS UNITS. All this measure added to a great increase in provided medical gases mobile container. And liquid oxygen or concentrators make possible to overcome the great emergencies.

**Decription of Role Observed:** According Italian rule named CODICE DEGLI APPALTI there is a specific position named DEC EXECUTION DIRECTOR OF CONTRACTS that have a substantial PROJECT MANAGER ROLE. This figure is a real link between the extern provider of medical gases and the hospital management. This figure must EXECUTE the official contract with the winner of the buying procedure of AREA VASTA (an association of various provincial hospital). All this according principle of transparency, equal condition, celerity, under economic and risk evaluation. With the aim to keep the continuity of patient therapy for their need of medical gases and oxigenotherapy. This figure is related so whit buying office, the hospital general managers, directors of clinical units, technical offices, prevention protection service and external provider.

**Other Function Officially Played:** QUALITY CONTROL OF PROVIDED GASES. Analysis was performed every 6 month for OXIGEN and medical air and AZOTE. The sample was sended to officially recognized laboratory and the final report was accepted and then under archive procedure.

**Updating Procedure:** It was organized a FIRST COURSE for TOP MANAGERS OF HOSPITAL, Related medicinal gases management (co-organized whit technical office engineer and director of prevention protection system) this future also performed as: HOSPITAL PHARMACIST MANAGER RESPONSIBLE FOR MEDICINAL GASES. (Ordering procedure, buying procedure, internal transport of mobile tanks of oxygen. Recall, tracing system of mobile tanks and other related activity). In the first phase of this last contract of providing gases it was needed to change all the big tanks of criogenic oxygen in the 3 principal hospital. It was officially assigned an ENGINEER to DEC medical gases as technical support for system problems. After this complex change procedure was written and signed officially a report for CENTRAL OFFICE OF HOSPITAL. To adequately manage this systems it was needed a 24/24 HOURS every day and for all the year to cover the emergencies. A rapid communication system was adopted to communicate with all the players.

**Control Activities:** During this period was centrally and peripherically controlled the amount of gases provides also using Informatic on distance system named TELEMETRIE: in this way by REMOTO was possible to verify the data about the tank level added.

**Day By Day Activity:** contacts with clinical wards, external provider, buying office, medical ventral office, technical office and other related. Verify or ADR adverse event reaction due by medical gases before send it to pharmacology-vigilance center of the hospital. Recall activity according the alert provided by authorities or by manufactures industries.

**Official Visit:** Activity with written report to verify correct condition of stoking of mobile containers in wards and in central storage.

**Cost Managed:** About 350.000 euro by year related cost of provide gases (1.750 .000 EUROS BY 5 YEARS), about more the 50.000 euro by year for internal transport by year of mobile container. Other service managed as dec mobile tanks verify and expiration data for 2020 about 40.000 euros. Total costs

managed in 5 year: about 2.200.000 euro. But it must be added also cost avoided due by a safety use of medical gases management system without risks (explosion, burn and other are very expensive and difficult to evaluate before).

**Gases Managed:** Oxygen (compressed, liquid and cryogenic), Medical air (produced inside hospital with compressor, AZOTE liq, argon, CO<sub>2</sub>, NO, helio. Kind of physical gases COMPRESSED for mobile tanks for acute therapy or transport LIQUID for chronic therapy CIOGENIC: for central system of providing

**Use:** therapeutic (oxygen, NO, medical air), imaging HELIO for RM, Laboratory Co<sub>2</sub>, Surgery (Argon), Criocconservation of Sample N<sub>2</sub>, Mixture Of Gases For Otorino And Spirometry, Oxigenoterapy, Ventilation In ICU, Diagnostic And Surgery Procedure (Criocconservation, Laparoscopic Procedure), Motor Gases For Instruments, To Refrigerate Magnete Resonance, Medicine Laboratory.

For all this Activates was used Various Managerial Techniques Like: Project management, Time management, HR MANAGEMENT, Budget analysis, Risk analysis, ICT management, MBO, TQM, Soft Skills Management, Communication Management and many management techniques : like problem solving, brainstorming, what if analysis, zero vision, Heisenower matrix, FMECA, ishikawa diagram , critical path methods. Using not also an historic way but also a prospective approach.

**Financial Aspect:** This practical experience is related a public setting of a provincial hospital PC AREA and related other presidium so the patient involved are under the cover of public financial providing.

**Reimbursement Policy:** According national Italian RULES a national system regulate LEA essential level of cure for all patient and then from national level was decide level of financialy cost reimbursed to the single regions. The regional institution provide to the local hospital the amount needed of money.

**Monitoring Activity:** During observed period was performed various activity

- Monitoring of Amount Provided of Gases
- Monitoring of Quality of Gases
- Monitoring of Total Costs Of Gases- Economic Evaluation- Budget Impact
- Monitoring of Adr
- Monitoring of Recall and Non Conformty
- Monitoring of Official Documents
- Monitoring of Revision Of Procedure
- Monitoring of Official Data Flux for Region
- Monitoring of Correct Informatics Codify of Products
- Reimbursement Procedure

**Periodic Management Evaluation:** In the global period observe: every year POSITIVE EVALUATED BY THE CENTRAL HOSPITAL MANAGEMENT OF HR.

**The Budged:** For medicinal gases was respected. NO any controversy with external providers. NO ANY written report related ADR on near miss event and other.

## Results and Discussion

The experience presented cover a long period of time like 5 year and during this period all endpoints was obtained. (clinical , economic, risk)

- The continuity of cure was guaranteed.
- Risk was controlled

- NO ADR, near miss event or other (only 1 cases related expiration time for some mobile tanks linked to the central pipeline – tertiary source , rapidly resolved)
- No controversy between external provider and hospital management
- No problems of security with patient, healthcare professionals, technical and caregivers.
- In the first phase of this was necessary to create a team multi-professional and for this reason many managerial technique was used.
- In emergency settings was introduced a TASK FORCE multi-professional to manage it.
- All communication activity was correctly performed.
- Risk analysis was performed for all activity with PREVENTION PROTECTION SERVICE
- Actually under evaluation also the new BIG TANKS for cryogenic oxygen introduced during emergency COVID-19

## Conclusion

USING correctly deep management techniques was obtained all kind of endpoint in the period observed. Date 6 July 2020 and signed the original version by the author.

## Value

This Project Work is produced to be submitted for international evaluation for “BASIS COURSE OF MANAGEMENT OF HEALTH CARE COMPLEX UNIT DIRECTORSCHIP”

## Reference Documents

- DGO officially adopted PC AREA HOSP
- Quality Control Officially Adopted Pc Area Hosp
- Hospital Medicine Gas Management System: The Pharmacist Role in a Pharmaceutical-Chemistry Setting-Results of a Practical Experience in an Advanced Country Adv Bioeng Biomed Sci Res, 2019 Volume 2 | Issue 3 | 1 of 10 Opast editor
- Annually official economic report PC area hosp. as officially published
- Official report Of ADR related medical gases uses PC AREA HOSP
- LEA according national Italy legislative government program
- Regional annual health care budget EMILIA ROM RER
- Official written agreement for providing medical gases
- Internal procedure related medical gases management
- Official designation DEC medical gases providing
- Official designation of quality control manager hosp PC
- European official CV of observed role 2020
- ALBO PREAETORIUM of institution cited
- Research article management instrument in pharmaceutical care and clinical pharmacy m.luisetto et al 2016 Intern. journal of economics and management sciences Luisetto et al., Int J Econ Manag Sci 2016,5:5Indexed by Harvard University Digital Library
- Research article Attitudes and Skills in Business Working Settings: A HR Management Tool Business and Economics Journal Mauro, Bus Eco J 2017, 8:1 Indexed By Oxford University Digital Library Solo Catalog Indexed By Peking University Library
- Poster Abstract Co-Author Pharmaceutical Care E High Risk Situations Il Farmacista Ospedaliero E Le Metodologia Hta Applicata Alla Logistica Antidotica Nei Medi-

- cal Teams Autori Confalonieri c, luissetto m et al 2017 CONGRESSO SIFO ROMA societa' italiana Farmacia Ospedaliera
- Official VIDEO of updating course hospital gas management systems for hospital top managers. Scientific organizer for official Formation course Hospital Gases Management Pc Hosp 2019 (in progress and soon next publication)
  - Official communication Eletcronic Pec related formative managerial pattern followed by LUISETTO M July 2020
  - European and Italian normative rules For DRUGS, MEDICAL DEVICES, HOSPITAL MANAGEMENT
  - Hospital gas management , technical rules , economic – financialy healthcare rules
  - Pharmacovigilance and Medical Devices vigilances rules
  - Recall rules
  - Preventing and risk containment rules
  - Official disaster plan of hospital – official plan for fire containment
  - Official technical and risk schedule of the single gases
  - Official pharmacopeia
  - Normative rules for gas assay and analytical technique – specific of methods
  - Official quality manual of hospital
  - Official hospital organization system and roles
  - Official ATTO AZIENDALE hosp with mission and vision
  - Official performance evaluation of managers of hospital: annual and every 5 year.

### Formative – Updating Courses Followed

With final verify of learned concept and written certificate

- Master In Project Management Provider Sole 24 H Business School Org. 2015
- Project Management as Innovation Instrument inside Healthcare Org. Provider Az. Pc Hosp 2015
- Total Quality Management Sitems 1996 Ass. Industriali A.M.M.A. Torino
- Management In Helathcare Institutions Provider Fipes Group 2014
- Time Management and Mbo 2014, Provider Sole-24 Ore Milano.
- Provider Trio Regione Toscana :
- Strategic Management: Pain 2018
- Change Management in Public Administration 2015
- Strategic Management: Analysis And Choose 2015
- Pain and Budget Control: The Business Plan 2015
- Principles of Di Economy And E Business Organization 2015
- Plan and Budget Control: Budget 2015
- Basis of Analytic Accountability and Budget Control 2015
- Management of Information Technology Project 2015
- Management Information System 2015
- Knowledge Management in Organizations 2015
- Communication Technique 2015 And Advanced Course
- Problem Solving Instruments 2015
- Stress and Conflict Management 2015
- Organizational Wellness And Human Governance 2015
- Strategic Marketing 2015
- Customer Satisfaction Methods And Instruments 2015
- Financial Strategy 2015
- Benchmark Analysis And Analisi Swot 2015

- Market- Economic Analysis 2017
- Working Plan Management 2015
- Basis of Industrial Plan Integrated 2017
- Project Management – Constraints And Risks In The Project 2015
- Work Flow Management 2015
- Businessman and Company 2015
- Economic- Financier Of Business Activity 2015
- Cooperative Management And Negotiation Technique 2015
- Performance: Statistic And Methodology 2015
- Working Team for Administrative And Public Mangers 2015
- Delegate Abilities In The Public Administration 2015
- Fmeca Methodology 2015
- Social Balance: Comunication with Company 2015
- Productive Organization Knowledge 2015
- Value Measure Of Information Technology Solution: Ethical Aspect Legal And Economic Implications 2016
- Basis of Information Communication Technology 2016
- Strategic Management – Plan Activity 2019
- Project Management- Time Management 2019
- Dlgs 81/08 For Managers Hosp Pc ( Prevention Security Course In Working Settings)
- Working Meeting Management 2007 Provider Aou Molinette Torino
- Healthcare Economy Provider Sfera
- Basis of Healthcare Quality Management 2005 Provider I.E.M.S.S.Geie
- Healthcare Plan Activity Provider Euromediform Srl 2020
- Change and Flexibility Provider Pc Hosp 2019
- Conflict Management and Negotiation Provider Pc Hosp 2015
- Emotional Management Provider Pc Hosp 2019
- Hta Health Technology Assessment Modelas and Applications Provider Mayaidee 2016
- Health Care Manager and Vaccinations Provider Mayaid-ee 2017
- Il Nuovo Codice Degli Appalti Provider Mayaidee 2017
- Aifa Register 2016 Provider Sanitanova Srl
- Plan Activity and Budget Control Industrial Accountability And Reporting Provider Trio 2017 Regione Toscana
- Healthcare Technology and Economic Assessment 2017 Provider Gimb
- Helathcare Logistic 2014 Provider Intern Instit. of Research
- English Languages 2012 Provider Ggallery Srl
- New Public Buying Code , Healthcare Management , Innovation and New Organizative 2017 Provider Maya Idee

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3. Luissetto M. The Medical Devices Pharmacists Management Role and Pharmaceutical Care. J App Pharm 2016;8:e113.
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  13. R.D. 9 January 1927, n. 147.
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  15. UNI EN ISO 7396-1: 2013 and modifications and other related updating rules.
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  17. <https://www.slideshare.net/MLuisettoWebsiteFARM/request-to-miur-for-official-opinion-related-some-chemists-competencies-an-historical-normative-review-1928-2009-pharmaceutical-university-course-mluisetto-m-fidani>.
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  19. [www.CodiceAppalti.it](http://www.CodiceAppalti.it) Legislative Decree 18 April 2016, N. 50 Code of public contracts. (Official Journal No. 91 of 19-4-2016 - s.o. n.10) and modifications.
  20. PMBOK Guide and Standards law 81/08 on safety at work (workers security) and modifications Italian official pharmacopea XII edit. NBP european pharmacopea, art. 19 R.D. 1 March 1928 n. 842 Chemistry and Pharmacy Degree: (admitted for State Exam Profession of Chemist and Pharmacist) see Table L attached to R.D. n. 1592 1933.
  21. Degree in C.T.F. V.O. Table XXVII BIS introduced with Law in 1967 n.1037, (and subsequent modifications) relating to the establishment of the CTF degree course at the University of Pavia. Not admitted to State Examination for Chemistry Degree in Pharmacy V.O. Table XXVII attached to Royal Education Degree Superior of 1938: Only access to State Examination for Pharmacist.
  22. Decree 16 May 96 n. 413 Regulation concerning the regulation of national suitability exams to perform management functions. (GU n.185 dated 8-8-1996 - Ordinary Supplement n. 132) cites graduates in Pharmaceutical Chemistry in addition to graduates in Chemistry and Pharmaceutical Technologies for analytical chemistry and clinical biochemistry. Published in the Gazz. Uff. October 20, 1982, n. 289. Admission of graduates in chemistry and pharmaceutical technology to competitions for which a degree in chemistry and pharmacy or pharmacy is prescribed.
  23. Table L attached to Article 173 of the R.D. 31 August 1933, n. 1592 (Published in the Gazz. Office 7 December 1933, n. 283.) provides for access to graduates in Chemistry and Pharmacy at
  24. Interministerial Decree 5 May 2004 and modifications Published in the Official Journal of 21 August 2004 n. 196 Equalization of degree diplomas (DL) according to the old regulations to the new classes of specialist degrees (LS), for the purposes of participation in public competitions.
  25. Interministerial Decree 9 July 2009 and modifications Published in the Official Journal of 7 October 2009 n. 233 Art. 3: This decree replaces the interministerial decree 5 May 2004 and subsequent amendments and additions. Equalization of degree diplomas (DL) according to the old regulations to the new graduate degrees (LS), and to the master's degrees (LM) of participation in public competitions.
  26. Decree of the President of the Republic June 5, 2001, n.328 and modifications. Published in the Official Gazette 17 August 2001 n.190 - Ordinary Supplement n.212 / L Modifications and additions to the discipline of the requirements for admission to the State exam and of the relative tests for the exercise of certain professions, as well as of the discipline of related regulations.
  27. DPR 328/2001 art 37.
  28. Regulation (Eu) 2017/745 of The European Parliament and of the Council of 5 April 2017.
  29. GMP of Medicinal Gases, GDP Good Distribution Procedure.
  30. Directorate-General Health and Social Policies Lines of Address on Management of Medicinal Gases: Organizational System and Rer Controls 2011.
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