21 Hoffmann K, Stein KV, Maier M, et al. Access points to the different levels of health care and demographic predictors in a country without a gatekeeping system. Results of a cross-sectional study from Austria. *Eur J Public Health* 2013;23:933–9.

22 Haidinger G, Eckert-Graf L, Wirgler PE, et al. Selbstzuweiser im Spital – wie viele könnten im primär-medizinischen Bereich behandelt werden? [Patients with self-referral to the hospital – how many could have been treated by the primary sector?] *Z Allgemeinmed* 2013;89:41–6.

23 Hoffmann K, Stein KV, Dorner TE. Differences in access points to the ambulatory health care system across Austrian federal states. *Wiener Med Wochenschr* 2014;164:152–9.

Hospital, local palliative care network and public health: how do they involve terminally ill patients?

Gianlorenzo Scaccabarozzi,[1] Fabrizio Limonta,[2] Emanuele Amodio[2]

1 Dipartimento Interaziendale della Fragilità (DIFRA) of the Health Local Unit of Lecco, Lecco, Italy
2 Servizio di Epidemiologia e Programmazione, Dipartimento Programmazione, Acquisto e Controllo of the Health Local Unit of Lecco, Lecco, Italy

Correspondence: Emanuele Amodio, Corso Carlo Alberto 120, CAP 23900, Lecco, Italy. Tel: +390341482270; Fax: +390341482521, e-mail: emanuele.amodio@ats-brianza.it

Background: Over one quarter of the health care expenditures is estimated to be spent for patients in the last year of life (LYL). For these patients, palliative care (PC) has been suggested as a response for improving the standards of care and reducing health costs. The aim of this study was to analyze a cohort of LYL people, in terms of comparing hospitalised patients who had been referred for PC to patients receiving usual care (UC). **Methods:** Retrospective study carried out on patients resident in Lecco (Italy) who died between 2012 and 2013. Records of patients were obtained from the Death certificate registry and cross-linked with Regional Healthcare Information System, Hospital Discharge Records and Palliative Care Registry. A total of 5830 patients were analyzed. **Results:** At least one hospitalization was reported by 2586 (44.3%) patients in the last month of life and 3957 (67.9%) patients in the last year of life. A total of 1114 (19.1%) patients were referred to palliative care with median duration of enrollment of 31 days (IQR = 11–69). PC was found to decrease the risk of hospital admission (adj-OR = 0.21; 95% CI = 0.18–0.26) and dying in hospital (adj-OR = 0.03; 95% CI = 0.02–0.04). **Conclusions:** Patients in the last year of life show a high risk of hospitalization, which represents a substantial component of health-care costs. Our study suggests that home PC consultation could represent an important public health strategy in order to lower hospital costs for LYL patients and reduce the probability of dying in hospital.

Introduction

During the last decades, populations living in developed countries such as Italy and their health systems have been subject to several challenges. The principal challenge has been the demographic transition to an increasingly aging population and a steadily growing number of patients suffering from chronic illnesses.[1] It has been estimated that by 2043, 32% of the Italian population will be aged over 65 years.[2]

A second challenge has been associated with the international economic crisis that has highlighted the need for a spending review which also involve national health care costs. In particular, it has been observed that over one quarter of the entire health care expenditure is spent on patients in the last year of life which represents about 1% of the entire population. It has been suggested that the use of the acute hospital system, in particular critical care services (such as intensive care units) and associated invasive tests and procedures for patients with end-stage chronic conditions may have limited potential benefit for patients' quality of life.[3,4] Therefore, for these patients spending more money would not be associated with improved results and some spending in this area might reasonably be reconsidered.[5]

In this context, home palliative care (PC) has been suggested as a response to the previously reported challenges through enhancing the 'quality of death', improving the standards of LYL care and providing services to enable people to be cared for and die in their home if that is their wish.[6]

Despite the fact that PC is generally accepted to improve the quality of life of terminal patients, there are still some concerns about its impact on reducing the cost of care attributable to hospital use. This information could be important for planning and optimizing the availability and appropriateness of healthcare services.

In order to address these issues the main aim of the present study was to analyse a cohort of terminally ill patients comparing hospital use in patients who were referred to PC with patients receiving usual care (UC).

Methods

Retrospective population-based study carried out on 6171 patients resident in Lecco (Italy) who died between 1st January 2012 and 31st December 2013. Decedents were identified using the Cause of Death Registry of the Health Unit of Lecco which receives certificates of all persons resident in Lecco and deceased in Italy.

We considered to be resident in Lecco all those subjects who were living in and were enrolled on municipal population registers of Lecco during the study period. These subjects were provided with free or at least low-cost healthcare that includes access to general

practitioners, treatment at public hospitals, subsidized medicines, lab services, ambulance services and certain specialist care. The registry collects information about demographics (birthplace, residence, gender, date of birth and date of death), the place of death (categorized as 'home', 'hospital', 'nursing home', 'hospice' and 'other places') and cause of death coded according to the International Classification of Diseases version 10 (categorized as 'Cancer' and 'Non cancer').

Causes of death were categorized into five major groups: 'Cancer' (C00.X to D48.X), 'Diseases of the circulatory system' (I00.X to I99.X), 'Diseases of the nervous system' (G00.X to G99.X), 'Diseases of the respiratory system' (J00.X to J99.0) and 'Other causes' (all the other ICD-10 codes). According to other authors, cause of death was established for people for whom the primary diagnosis recorded on the death certificate was a condition considered amenable to palliative care.[7] Thus, 264 (4.3%) patients who died for injuries and trauma were excluded from the statistical analysis.

Records of eligible patients were then cross-linked with three different sources:

(1) Regional Healthcare Information System: containing all subjects registered to the National System Service (SSN) who are guaranteed full health assistance.
(2) Hospital Discharge Records (HDRs): collecting all hospitalizations of patients resident in Lecco who were admitted to public and private hospitals present in Italy. For the aim of this study the following information was used: admission and discharge dates, diagnosis related group (DRG) tariffs which represent the reimbursement levels of the Italian National Health System to healthcare providers which were used to estimate hospitalization costs.
(3) Palliative Care Registry of Lecco: the registry is a database used by the home palliative care team (HPCT) of the Frailty Department (DIFRA) of the Health Unit of Lecco in cooperation with the General Hospital of Lecco. The DIFRA includes the following health settings: home geriatric care with increasing levels of assistance, home post-acute care and rehabilitation, hospital palliative care consultation, home palliative care assistance as basic or advances assistance, hospice and discharge planning from hospital to home. The DIFRA uses a modern information communication technology (ICT) platform that enhances communication between inpatient and outpatient settings. Every year, about 3000 patients are cared from by the DIFRA, including 1200 patients with rehabilitation/geriatric health needs and 800 patients with palliative care assistance. The HCPT involves clinical members such as physicians, nurses and fellows. The HPCT registry records demographics, treatment parameters, clinical conditions, Karnofsky performance status, activities of daily living (ADL), health needs and PC interventions performed on each patient. ADL is an appropriate instrument to assess independent living skills (eating, bathing, dressing, toileting, walking and continence). In this study, we considered 'highly dependent' all patients who required assistance in at least five skills.[8]

The cross-linkage was performed by a deterministic linkage of fiscal code that is an alphanumeric code of 16 characters that identifies individuals residing in Italy unambiguously. The cross-linkage between sources was not successful for 86 (1.4%) patients who were thus excluded from the analysis (Supplementary Figure S1).

All data were analyzed using the R statistical software package. The significance level was set at $P < 0.05$ (two-tailed). Absolute and relative frequencies were calculated for qualitative variables. while quantitative variables were summarized as mean (standard deviation; SD) when normally distributed or otherwise as median (interquartile range; IQR). Data normality was verified by the Shapiro–Wilk test for normality. Categorical variables were analysed using chi-squared test (Mantel-Haenszel) or Fisher's exact test. Medians were compared by using the Mann–Whitney or

Wilcoxon tests as appropriate. Hospitalization rate was calculated by dividing the number of hospitalized cases by the total number of cases rate whereas 95% confidence intervals (95% CI) were computed using the Byar's approximation of the exact interval for the Poisson distribution.[9] Two different multivariable logistic regression models were constructed to examine predictors of having at least one hospitalization in the last month before death and death in hospital.

Neither ethics approval nor individual written consent by patients was requested according to Italian law on observational studies that use administrative aggregate data.

Results

The general characteristics of 5830 patients included in the statistical analysis are summarized in table 1. A large number of patients died because of diseases of the circulatory system (36.3%) or neoplasms (34.1%). Overall, at least one hospitalization was reported by 2586 (44.3%) patients in the last month of life and 3957 (67.9%) patients in the last year of life. Hospitalization costs accounted for a mean of 3037 euros per patient during the last month of life and 7608.9 euros per patient during the last year of life. The last month of life were characterized by a mean of 0.54 (SD = 0.69) hospital admissions per patient whereas hospitalization rate during the last year of life was 1541 (95% CI = 1510–1574) per 1000 patients per year.

During the study period a total of 1114 (19.1%) patients resident in Lecco were referred to palliative care with median duration of PC enrollment of 31 days (IQR = 11–69 days). PC patients had a mean Karnofsky score at PC admission of 30 (SD = 12.8) and 614 (55.1%) were classified as highly dependent according to ADL score. Figure 1 depicts the distribution of hospital costs stratified by cause of death. In figure 1, the cumulative percentage of home palliative care assistance in the last year before death was also reported. Both hospital costs and PC assistance were found to have a higher impact in the last month of life.

Table 2 shows socio-demographics, health information and utilization of hospital services of patients referring or not to PC. PC group had higher percentage of males (56.5% in PC group vs. 44.9% in UC group; $P < 0.001$), lower median age (76 years in PC group vs. 84 years in UC group; $P < 0.001$) and higher prevalence of patients with cancer-related conditions (96.5% in PC group vs. 19.4% in UC group; $P < 0.001$). In the last month of life, hospitalization costs, hospital stay and number of hospital admissions were significantly lower in PC patients compared with UC patients ($P < 0.001$ in all cases). Conversely, from 2 to 12 months before death hospitalization costs, hospital stay and number of hospital admissions were significantly higher in PC patients compared with UC patients ($P < 0.001$ in all cases).

As reported in table 3 in the logistic regression analysis, after adjustment for age, sex and major cause of death, PC was found to significantly decrease the risk of having at least one hospital admission in the last month of life (adj-OR = 0.21; 95% CI = 0.18–0.26). Similarly, death in hospital was significantly less frequent among patients referred to PC (adj-OR= 0.03; 95% CI= 0.02–0.04).

Discussion

In 1998, the World Health Organization (WHO) adopted the 'WHO Health 21' policy document with the aim of encouraging health development in the 51 Member States of the world health community.[10] Among several proposed issues, there were three targets that could be considered the basis of the present study. The first two targets were dedicated to the importance of managing for quality in health outcomes, and, funding and allocation of resources for health services and care. In a third target the WHO highlighted that each subject should be allowed to die in dignity, reducing the time that people spend in social

and emotional isolation in hospital, surrounded by people of their own choosing, and as free from pain and distress as possible.

According to the previous statements, in this study we have analysed the last year of life of about 6000 patients, measuring outcomes (e.g. place of death) and process indicators (e.g. number of hospitalization, hospital stay) that could be strongly informative about the health needs of patients in the last year of life and the different impact of health care, including palliative care.

A first important message of our results is that patients in the last months of life account for an exponential increase in hospitalizations, which is well known to represent a substantial component of total health-care costs. In this sense, in our geographical area, hospital costs for patients in the last month of life accounted for about 9 million euros per year, representing more than 6% of the annual hospitalization expenditures of the entire population. Estimates from the United States indicate that 25% of health-care expenditure is related to patients in their last year of life.[11] In the United Kingdom, it is estimated that approximately 20% of hospital bed days are taken up by end-of-life care.[12] Hospitalization rate observed in our terminally ill patients were more than ten-fold higher than that reported in the general population (1541/1000 per year vs. 136.1/1000 per year, respectively).

Unfortunately, considering that about 30% of our patients died in hospital after a mean stay of more than 10 days, it is evident that these huge health care efforts could be sufficient to ensure quality of life and achieve better outcomes only in some of the patients. Our data should also be considered lower than that reported by other authors in Italy (75% of deceased with at least one hospitalization in the last year of life; 42.1% of patients died in hospital) and in other countries as well as Sweden (42.1% of all deaths occurred in hospitals), Portugal (54.5% of all deaths in hospital) and Canada (73.4% died in hospital).[13–16] Moreover, a further study carried out in the New South Wales in 2002 found that people aged 65 years and over who were in their last year of life used an estimated 10.3% of all hospital days and 8.9% of total hospital inpatient costs, of which more than 40% was spent in the last month of life.[17] One explanation for the reduced hospitalization of patients in our area in the last part of life could be, at least in part, attributed to the role played by PC. In our population 19.1% of decedents were referred to PC which we have found to significantly reduce the risk of hospitalization in the last month of life. We have considered this short period (1 month) since PC assistance is usually offered on average 30 days before death.
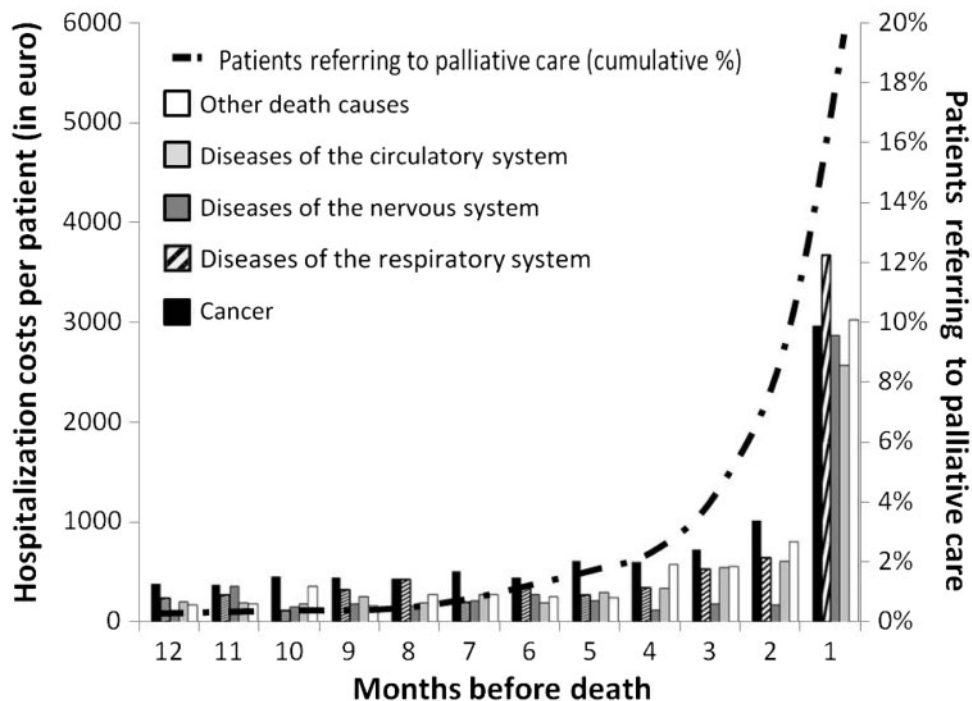
Table 1 General characteristics of 5830 patients resident of Lecco and died between 1st January 2012 and 31st December 2013

Total, *N* (%)	5830	(100.0)
Year of death, *N* (%)		
2012	2863	(49.1)
2013	2967	(50.9)
Gender, *N* (%)		
Female	3082	(52.9)
Male	2748	(47.1)
Age in years, median (IQR)	83	(74–89)
Major causes of death, *N* (%)		
Diseases of the circulatory system	2116	(36.3)
Cancers	1911	(34.1)
Diseases of the respiratory system	406	(7.0)
Diseases of the nervous system	235	(4.1)
Others	1082	(18.6)
At least one hospitalization, *N* (%)		
In the last month of life	2586	(44.3)
In the last year of life	3957	(67.9)
Total costs for hospitalization in euro		
In the last month of life	17 702 865	
In the last year of life	44 359 114	
Total hospital stay in days		
In the last month of life	39 736	
In the last year of life	93 660	
Place of death, *N* (%)∗		
Hospital	1767	(30.3)
Home	2387	(40.9)
Nursing home	1038	(17.8)
Hospice	362	(6.2)
Other	86	(1.5)

Figure 1 Costs of hospitalization for patients in their last year of life (*N* = 5830) and percentage of patients referring to home palliative care (*N* = 1114) by month before death.

Table 2 Socio-demographic, health information and utilization of hospital services within the last year of life in the home palliative care group and in usual care group

	Home palliative group (*N* = 1114; 19.1%)	Usual care group (*N* = 4716; 80.9%)	*P* values
Sex, *n* (%)			
Males	629 (56.5)	2119 (44.9)	<0.001
Females	485 (43.5)	2597 (55.1)	
Age in years, median (IQR)	76 (68-84)	84 (76-90)	<0.001
Major cause of death, *n* (%)			
Cancer	1075 (96.5)	916 (19.52)	<0.001
Diseases of the circulatory system	10 (0.90)	2106 (44.9)	
Diseases of the respiratory system	4 (0.36)	402 (8.57)	
Diseases of the nervous system	14 (1.26)	221 (4.71)	
Others	11 (0.99)	1047 (22.31)	
Hospitalization in the last month of life			
Hospitalization per person, median (SD)	0.34 (0.57)	0.58 (0.71)	<0.001
Costs per person, mean (SD)	1471.8 (4471.4)	3406.1 (9359.7)	<0.001
Hospital stay in days, mean (SD)	4.2 (9.4)	7.4 (13.9)	<0.001
Hospitalization from 2 to 12 months before death			
Hospitalization per person, mean (SD)	1.63 (1.8)	0.85 (1.4)	<0.001
Costs per person, mean (SD)	6410.5 (7662.9)	4138.2 (10 301.7)	<0.001
Hospital stay in days, mean (SD)	11.9 (17.9)	8.6 (19.9)	<0.001
Place of death, *n* (%)			
Hospital	23 (2.1)	1744 (36.9)	<0.001
Others	1091 (97.9)	2972 (63.1)	

Table 3 Logistic regression analysis on risk factors for having at least one hospital admission in the last month of life and dying in hospital (the two models excluded 41 patients because of missing data)

	Having at least one hospital admission in the last month of life[1]		Dying in hospital[2]	
	Adj OR	95% CI	Adj OR	95% CI
Sex ('Female' as reference)	1.28[c]	1.14–1.42	0.99	0.87–1.11
Age in years (per year increment)	0.98[c]	0.97–0.99	0.98[c]	0.97–0.99
Home palliative care ('Usual care' as reference)	0.20[c]	0.17–0.24	0.03[c]	0.02–0.04
Major cause of death ('Other causes' as reference)				
Diseases of the circulatory system	0.98	0.85–1.13	0.64[c]	0.55–0.75
Diseases of the nervous system	0.66[b]	0.49–0.9	0.77	0.56–1.04
Diseases of the respiratory system	1.75[c]	1.39–2.21	1.24	0.95–1.61
Cancer	2.01[c]	1.68–2.39	1.26[c]	1.03–1.55
Hospitalizations from 2 to 12 months before death (per unit increment)	1.23[c]	1.19–1.29	1.09[c]	1.05–1.14

1: Pseudo-R^2 = 0.227; 2: Pseudo-R^2 = 0.349. a: $P < 0.05$; b: $P < 0.01$; c: $P < 0.001$.

The lower risk of hospitalization of PC patients was statistically significant also after adjustment for potential confounding factors as well as age, sex and major cause of death that significantly differed in PC and UC group. Reducing the hospitalization risk in terminally ill patients should be considered of huge importance for Public Health for two different reasons. Firstly, previous studies have found that patients prefer to remain at home whenever possible, both for treatment of an acute illness and near the end of life.[18,19] In this sense, the observed reduction in hospital admissions suggests that home palliative care programs may have the potential to improve patient-centered outcomes increasing, as reported by other authors, quality of life.[20]

Secondly, it should be highlighted that home PC could contribute to significantly reduce the costs of hospitalization by lowering them by an average of 1934.3 euros per patient. In particular, home PC seems to reduce the chance of hospitalization in patients who have a higher risk of hospitalization in the previous months (2–12 months before death). Noteworthy, in this latter period, patients were usually still not admitted for palliative care and, thus, the higher risk of hospitalization can be considered as a proxy of more complex health needs of PC patients. All these findings are consistent with several international experiences showing that PC

seems to reduce hospitalization costs and days passed far from home and families, increasing the probability of the patient dying in a place they themselves prefer such as their own home.[21]

In particular, a recent meta-analysis including pooled data from seven studies showed that those receiving home PC had statistically significantly higher odds of dying at home than those receiving usual care (OR = 2.21; 95% CI = 1.31–3.71).[21] Similarly, a systematic review published in 2014 reported that PC is most frequently found to be less costly relative to other comparator groups, and in most cases, the difference in cost was statistically significant.[22] For the previously reported considerations, in our context home Palliative Care seems to be strictly correlated with local Public Health programs since both of them aim to improve quality of care for a particular group of patients and to allow a proper allocation of health expenditure.[23,24] According to these considerations, in Italy, the Consensus Conference held in Florence on June 2015 stated that all the people with advanced and/or progressive chronic conditions, complex care needs and limited life-expectancy may benefit from a palliative approach or palliative care.[25] Moreover, early patient identification could be important in order to provide better needs assessment and proactively plan gradual, flexible and shared care pathways. Unfortunately, it

should be also considered that in Italy to date there are no enough PC infrastructures and well trained healthcare personnel for providing PC to all patients with needs. The WHO has estimated that in the EURO region about 562 adults/100 000 could benefit from PC.[26] This means that Italy about 300 000 patients (0.56% of the total) every year should be taken care from palliative care whereas in 2014 not more than 80 000 patients (0.15% of the total) have received palliative care services (unpublished data).

Unfortunately, this study may have some limitations due to its retrospective observational design and we cannot exclude the possibility that other variables (e.g. patients' case mix, indirect costs, other direct health costs) may have played a role in confounding our results. Moreover, we were unable to include information regarding other health outcomes such as quality of life, patient satisfaction, patient preferences or clinical details which might further explain cost-related differences. However, to date, in Italy, data collected by the Regional Health Care System do not routinely include clinical information and co-morbidities for all patients. Similarly, data on home care services outside of palliative care are usually not collected with high level of accuracy/precision. For these reasons, since these data would be available only for selected groups of patients (e.g. those hospitalized), including such information could increase the risk of determining misclassification/detection biases. Moreover, we have voluntarily excluded other direct health costs such as ambulatory care expenditure since some authors have showed that they represent only a marginal part of total health care cost (less than 1%).[27] Other authors have evaluated the distribution of healthcare costs during the last year of life and have found that inpatient care account for the majority (41%) of medical costs followed by facility (23%), medical provider (17%), institution (6%), outpatient hospital (5%), home health (5%), prescription drugs (2%) and hospice (2%).[28]

Finally, the generalizability of this study may be limited since it considers only patients living in a relatively small area of Italy.

Although further investigations may be required for excluding these possible limits, our study suggests that palliative care consultation can lower hospital costs for patients with serious and advanced illnesses and reduce the probability of dying in hospital. These findings support a progressive shift of the economic burden of end-of-life care from the hospital sector to the long-term care sector, with consequent implications for the supply, organization and funding of both these sectors.

Key points

- Several authors highlighted that over one quarter of the entire health care expenditure is spent on patients in the last year of life that represent about 1% of the entire population.
- Overall, in our experience about half the patients underwent at least one hospitalization in the last month of life accounting for mean hospitalization costs of 3037 euros per patient.
- Hospitalization costs, hospital stay and number of hospital admissions were significantly lower in patients referred to palliative care compared with patients who underwent usual care.
- Palliative care consultation seems to lower hospital costs for patients with serious and advanced illnesses and reduce the probability of dying in hospital.
- Our findings support a progressive shift of the economic burden of end-of-life care from the hospital sector to the long-term care sector, with consequent implications for the supply, organization and funding of both these sectors.

Supplementary data

Supplementary data are available at *EURPUB* online.

References

1 De Flora S, Quaglia A, Bennicelli C, Vercelli M. The epidemiological revolution of the 20th century. *FASEB J* 2005;19:892–7.

2 ISTAT. Il futuro demografico del paese. Previsioni regionali della popolazione residente al 2065. Available at: http://www.istat.it/it/archivio/48875 (15 June 2015, date last accessed).

3 Unroe KT, Greiner MA, Hernandez AF, et al. Resource use in the last 6 months of life among medicare beneficiaries with heart failure, 2000-2007. *Arch Intern Med* 2011;171:196–203.

4 van den Block L, Deschepper R, Drieskens K, et al. Hospitalisations at the end of life: using a sentinel surveillance network to study hospital use and associated patient, disease and healthcare factors. *BMC Health Serv Res* 2007;7:69.

5 Fine RL. The imperative for hospital-based palliative care: patient, institutional, and societal benefits. *Proc (Bayl Univ Med Cent)* 2004;17:259–64.

6 Economist Intelligence Unit. The quality of death: ranking end-of-life care across the world. London: EIU, 2010.

7 McNamara B, Rosenwax L. Which carers of family members at the end of life need more support from health services and why? *Soc Sci Med* 2010;70:1035–41.

8 Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged. The index of ADL: A standardized measure of biological and psychosocial function. *JAMA* 1963;185:914–9.

9 Rothman JJ, Boice JD. *Epidemiologic Analysis with a Programmable Calculator*. NIH Publication, 76–1649. US Government Printing Office, Washington DC, 1979.

10 Health21: the health for all policy framework for the WHO European Region. Available at: http://www.euro.who.int/__data/assets/pdf_file/0010/98398/wa540ga199heeng.pdf (22 July 2015, date last accessed).

11 Riley GF, Lubitz JD. Long-term trends in Medicare payments in the last year of life. *Health Serv Res* 2010; 45:565–76.

12 Hatziandreu E, Archontakis F, Daly A. in conjunction with the National Audit Office. *The Potential Cost Savings of Greater Use of Home- and Hospice-Based End of Life Care in England*. Cambridge, UK: The Rand Corporation, 2008.

13 Rodella S, Serraino D, Benocci S, et al. End-of-life and palliative care: the experience of the Tuscany region, Italy. *Epidemiol Prev* 2007;31:225–31.

14 Håkanson C, Öhlén J, Morin L, Cohen J. A population-level study of place of death and associated factors in Sweden. *Scand J Public Health* 2015.

15 Sarmento VP, Higginson IJ, Ferreira PL, et al. Past trends and projections of hospital deaths to inform the integration of palliative care in one of the most ageing countries in the world. *Palliat Med* 2015.

16 Lavergne MR, Lethbridge L, Johnston G, et al. Examining palliative care program use and place of death in rural and urban contexts: a Canadian population-based study using linked data. *Rural Remote Health* 2015;15:3134.

17 Kardamanidis K, Lim K, Da Cunha C, et al. Hospital costs of older people in New South Wales in the last year of life. *Med J Aust* 2007;187:383–6.

18 Fried TR, van Doorn C, O'Leary JR, et al. Older persons' preferences for home vs hospital care in the treatment of acute illness. *Arch Intern Med* 2000;160:1501–6.

19 Higginson IJ, Sen-Gupta GJ. Place of care in advanced cancer: A qualitative systematic literature review of patient preferences. *J Palliat Med* 2000;3:287–300.

20 Bakitas M, Lyons KD, Hegel MT, et al., Effects of a palliative care intervention on clinical outcomes in patients with advanced cancer: the Project ENABLE II randomized controlled trial. *JAMA* 2009;302:741–9.

21 Gomes B, Calanzani N, Curiale V, McCrone P, Higginson IJ. Effectiveness and cost-effectiveness of home palliative care services for adults with advanced illness and their caregivers. *Cochrane Database Syst Rev* 2013.

22 Smith S, Brick A, O'Hara S, et al. Evidence on the cost and cost-effectiveness of palliative care: a literature review. *Palliat Med* 2014;28:130–50.

23 Nathaniel JD, Garrido MM, Chai EJ, et al. Cost savings associated with an inpatient palliative care unit: results from the first two years. *J Pain Symptom Manage* 2015;50:147–54.

24 Serra-Prat M, Gallo P, Picaza JM. Home palliative care as a cost-saving alternative: evidence from Catalonia. *Palliat Med* 2001;15:271–8.

25 Consensus Conference. Integrated path to take care for the person in chronic complex and advanced conditions in need of palliative care. A model of clinical governance for the development of Local Networks of Palliative Care. Florence, 27 June, 2015. Available at: http://progettodemetra.it/index.php/it/consensus-document-recommendations-2015/file

26 Connor S, Sepulveda C. Global Atlas of Palliative Care at the End-of-Life. 2014. Available at: http://www.thewpca.org/resources/global-atlas-of-palliative-care/

27 Bremner KE, Krahn MD, Warren JL, et al., An international comparison of costs of end-of-life care for advanced lung cancer patients using health administrative data. *Palliat Med* 2015;29:918–28.

28 Donald RH, Stephen C, Rizie K, et al., Medical Expenditures during the Last Year of Life: Findings from the 1992–1996 Medicare Current Beneficiary Survey. *Health Serv Res* 2002; 37:1625–42.

Use of telemedicine in the European penitentiaries: current scenario and best practices

Maria R. Gualano[1], Fabrizio Bert[1], Violetta Andriolo[1], Marco Grosso,[2] Davide Minniti[3], Roberta Siliquini[1]

1 Department of Public Health, University of Torino, Via Santena 5 bis, Torino, 10126, Italy
2 Radiology Department, Azienda Ospedaliera Città della Salute e della Scienza, Torino, Italy
3 Local Health Unit, ASL TO 3, Piedmont, Italy

Correspondence: Maria Rosaria Gualano, Department of Public Health, University of Turin, Via Santena 5 bis, 10126 Turin, Italy, Tel: +390116705809, Fax: +390116705889, e-mail: mariarosaria.gualano@unito.it

Background: Telemedicine has demonstrated to improve access and quality of health services in underserved area, curtailing the costs, therefore its application to the delivery of health care in prison would be desirable. Little is known about its use across European penal institutions. Our study aimed to assess the state of telemedicine within the European jails. **Methods:** To maximize data availability, we used two different approaches. A bottom-up approach was used by gathering information directly from prison directors of every single penal establishment of the 28 European members. A top-down approach was used to collect information from persons involved in prison administration or project leaders at national level. In both approaches questions were sent by mail. Results: Information gathered directly by contacting prison directors and/or persons in charge come from all the 28 EU members. In total, we contacted 211 prison directors and 116 persons in charge, with a total response rate of 67%. We have found that telemedicine, as additional healthcare delivery model, is used only in 11 countries, especially among members of Northern and Western Europe. Only Romania showed to have a pilot project for a nationwide program of telemedicine. **Conclusions:** Telemedicine services among European penitentiaries appear still poorly developed. Given the numerous and demonstrated advantages of this technology, it would be desirable to implement its utilization in penal healthcare and to integrate it in the routine services, as benefit not only for prison environments but also for the whole community of each country.

Introduction

Prison health is a critical public health issue in many Countries, since 'It is increasingly being recognized that good prison health is good public health' (Dr. Nata Menabde Deputy Regional Director, WHO Regional Office for Europe) and a very large number of inmates requiring health assistance is registered worldwide.[1] The confinement in jails is burdened with several problems, especially for health and financial sectors. The recent growth of inmate population aggravates both, and unfortunately, as reported by the Committee of Ministers of the Council of Europe,[2] prison over-crowding is a common problem for most of the European penitentiary administrations. According to the report issued by the Council of Europe on 29 April 2014, European States are still failing to sig-nificantly reduce it.[3] Overcrowding is a risk for mental and physical health of prisoners, and at the same time, it makes harder to guarantee a proper healthcare for every inmate. This is damaging for both the prison environments and the whole community since the prisoners, who are healthy on entry, have a considerable risk of leaving prison with HIV, tuberculosis, drug problem or poor mental health.[4,5] Many diseases have a higher prevalence within the prison environment in comparison to the general population, especially infectious diseases and mental disorders.[6–14] Consequently, the demand for care is considerably greater than it is for the general population. In the UK and in Belgium, prisoners require medical consultations, on average, three-four times more often than a demo-graphically equivalent population in the community.[15] However, despite the healthcare given to prisoners should be equivalent to that obtained outside prison, currently the majority of prisoners receive a standard of health care very far below the one afforded to patients in the community or hospital, with the risk to increase the rates of morbidity and mortality in the prison population.[16–18]