Is medical perspective on clinical governance practices associated with clinical units' performance and mortality? A cross-sectional study through a record-linkage procedure

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Abstract

Objective: Assessment of the knowledge and application as well as perceived utility by doctors of clinical governance tools in order to explore their impact on clinical units' performance measured through mortality rates and efficiency indicators.
Methods: This research is a cross-sectional study with a deterministic record-linkage procedure. The sample includes n = 1250 doctors (n = 249 chiefs of clinical units; n = 1001 physicians) working in six public hospitals located in the Emilia-Romagna Region in Italy. Survey instruments include a checklist and a research-made questionnaire which were used for data collection about doctors' knowledge and application as well as perceived utility of clinical governance tools. The analysis was based on clinical units' performance indicators which include patients' mortality, extra-region active mobility rate, average hospital stay, bed occupancy, rotation and turnover rates, and the comparative performance index as efficiency indicators.
Results: The clinical governance tools are known and applied differently in all the considered clinical units. Significant differences emerged between roles and organizational levels at which the medical leadership is carried out. The levels of knowledge and application of clinical governance practices are correlated with the clinical units' efficiency indicators (bed occupancy rate, bed turnover interval, and extra-region mobility). These multiple linear regression analyses highlighted that the clinical governance knowledge and application is correlated with clinical units' mortality rates (odds ratio, −8.677; 95% confidence interval, −16.654, −0.700).
Conclusion: The knowledge and application, as well as perceived utility by medical professionals of clinical governance tools, are associated with the mortality rates of their units and with some efficiency indicators. However, the medical frontline staff seems to not consider homogeneously useful the clinical governance tools application on its own clinical practice.

Introduction

Clinical governance (CG) represents a framework, based on Donabedian's[1] classical approach to quality, through which healthcare organizations are accountable for continually improving the quality of their services and safeguarding high care standards.[2] This framework is designed to integrate the fragmented approaches to quality improvement, emphasizing new institutions, processes, and incentive structures. CG arrangements are intended to provide high-quality care and

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patient-centered delivery of clinical care and encourage clinical excellence. The National Health Service (NHS) in the United Kingdom has pioneered large-scale implementation of CG.[3] The Healthcare Commission identifies the main elements of CG as risk management, evidence-based practice, patient-focused care, training and development, information management, and staff management. These elements interact with each other to provide an organizational framework for continuous quality improvement.[3] However, there is a lack of clarity around CG's definition;[4–6] there is scarce evidence about the linkages among different aspects in which CG is divided into[7] and also about CG's impact on service quality.[8–11]

Some recent researches[12–14] explored the diffusion of CG concepts in order to determine the CG implementation level among healthcare professionals. However, among the various professional groups, it is necessary to consider that doctors provide a valuable contribution to the quality of patient care through diagnosis, treatment, and by taking crucial decisions regarding clinical care. "Since clinicians are at the core of clinical work, they must be at the heart of CG."[15] It is essential to engage clinicians in CG to achieve the quality improvements envisaged under the clinical management application.

Many studies have been conducted in the United Kingdom and other countries to understand doctors' responses to various important aspects of CG: audit,[16–18] clinical guidelines,[19–22] and incident reporting.[23] In addition, specific studies have been conducted to understand doctors' attitudes toward the CG system,[24–26] and they have shown that although some doctors view CG as essential, others are becoming increasingly disillusioned and some are skeptical about its benefits.[27]

In reality, however, excluding a few exceptions, there are no final results that explain the relationships among CG application and performance. Therefore, this relationship continues to be explored. For instance, some recent studies analyzed the relationship between CG's different aspects and patient outcomes, in particular for the specific area of risk management[28,29] and accreditation.[7] In the last decades, numerous researches have pointed out that the health workers' attitudes toward risk management (conceived as a CG dimension) can influence the patients' outcomes. Although a growing body of studies[30–39] supports a positive relationship between organizational safety culture and patient outcomes, these results are not always confirmed by the literature.[11,40]

Hypothesis

Hypothesis 1: CG tools are known/applied and perceived as useful differently at roles/organizational levels at which medical leadership is carried out (chief of clinical unit (CCU) and physician (Ph)).

Some researches demonstrated a marked division between clinicians and managers.[15,41] Most of the doctors have little involvement in management, perceiving that it conflicts with professional duties and adds unnecessary workload.[42] Other more recent studies showed that a significant variation in perceived safety climate does exist in working role.[34,38,39]

Hypothesis 2: The knowledge/application of CG tools is associated with a lower number of hours spent per week by physicians in clinical activities.

A recent Australian research focused only on the non-clinical activity of physicians' highlights that doctors spend only an average of just under 7 h/week (16% of their working time) on non-clinical activities.[43,44] Other studies have shown that the reduction in physicians' working hours in general, independently from the specific activity of physicians, seems to be favorable to patient safety.[45,46]

Hypothesis 3: The levels of declared knowledge/application and perceived utility of CG practices can impact on the clinical units' performance (in terms of mortality and efficiency indicators).

In recent years, there has been an increasing international interest in using mortality rates to monitor the quality of hospital care.[47–49] The CG programs have been associated with improved mortality outcomes despite increasing numbers of high-risk patients undergoing surgery.[29]

However, a study found no significant correlation between knowledge/attitude/performance and hospital scores for CG fulfillments.[12] In the literature, there is not much evidence about the connection between CG and efficiency indicators of clinical units' performance.[13] A recent Italian study[50] realized with 47 clinical units of a Teaching Hospital explored the association between level of implementation of CG, evaluated through the OPTIGOV© (Optimizing Health Care Governance) tool, and the percentage of inappropriate days of hospital stay. Evidence-based medicine (EBM) and clinical audit represented the CG dimensions which had the strongest association with organizational appropriateness. However, no studies explored the relationship between declared knowledge/application of CG tools by physicians and performance through the utilization of objective indicators of clinical units' mortality and efficiency indicators.

Methods

Sample and data collection

The study was conducted in six Italian public hospitals (n = 2 Teaching Hospitals and n = 4 Hospitals of Local Health Authorities) located in the Emilia-Romagna Region, between January and December 2013.

A census method was used to verify the real population of the sample with reference to different medical roles. The chiefs of all clinical units were contacted and through them n = 1712 physicians were involved in the research. The physicians who participated at the study had the following

specialties: "Emergency," "Maternity-Pediatric," "Surgical," and "Internal Medicine."

As a single and independent research, we introduced to them the paper surveys, along with a cover letter, and assured them of the confidentiality of their responses.

Measures

The data regarding the CG aspects and organizational performance of the clinical units were gathered by a questionnaire and by extracting data, at the end of the 2013 year, from the public website of the Regional Health Authority of Emilia-Romagna (hospital discharge records—HDR).[51]

The questionnaire has a socio-anagraphic section that describes the following physicians' characteristics: organizational role, age, gender, total number of working hours per week, number of working hours per week spent in care, organizational, didactic or research activities, and number of years spent within the actual health organization and into the same clinical unit; presence of working or studying experience in a foreign state.

The questionnaire includes a section dedicated to the knowledge/application and utility perception of doctors about different CG practices (full details are provided in Appendix 1) that has been designed by CG experts. Its ecological validity[52] (the extent to which the methods, materials, and setting of a study reflect the real-life situation that is under investigation) was checked through a pilot study with 38 polyclinic personnel. The reliability analysis for the "CG Utility scale" showed a good internal consistency.

CG practices

Checklist about claimed knowledge/application of CG tools. This includes nine items which assess the doctors' claimed knowledge about the real application of some CG tools in their working context. The answers have been considered as dichotomous variables. An affirmative response obtains 1 point (when the specific activity is known by the physician and implemented in his clinical unit); an "I don't know" option, or a missing answer, is considered as a negative response and obtains 0 points. The final sum of the collected scores (0=minimum point and 9=maximum point) was considered as a global index: the higher the obtained score by the physician, the greater his claimed knowledge/application level about the CG tools.

CG utility scale. It is a self-report scale that evaluates, on a Likert scale (from 1="little" to 6="very much"), the doctors' utility perception about the CG practices in their daily clinical activity (full details are provided in Appendix 1). An explorative analysis of the factorial structure of the scale, conducted through a Principal Components Analysis with a Varimax rotation, obtained a final solution that explained the 86.1% of the total variance. The four latent factors that emerged (Clinical Audit, Safety Perception, Quality, and Guidelines) have shown a strong loading on the theoretical components of the construct by respecting the included items as hypothesized for the questionnaire construction. No item has loaded on more than one dimension ($<|.22|$) and the weight of each item upon the meaningful factor is always $>.84$. Cronbach's α confirmed a good reliability (Clinical Audit $\alpha=.96$, Safety Perception $\alpha=.74$, Quality $\alpha=.93$, Guidelines $\alpha=.89$).

Clinical units' performance indicators

Clinical units' mortality rate. Mortality was defined as patient death in or out of the hospital from any cause within 30 days after admission to a specific ward. This indicator is considered as a typology of patient discharge. It is measured as the absolute value of deaths that the wards count in a 1-year period. The discharges from Day Hospital admissions and transfers from post-acute wards have not been calculated.

Clinical units' efficiency

- *Beds occupancy rate*: This is a measure of hospital utilization in terms of inpatients. It indicates the percentage of beds occupied by patients in a defined period of time. The rate is obtained by calculating the total number of inpatient days for a given period × 100/ available beds × number of days in the same period.
- *Bed rotation index*: This indicates the number of admissions made on the same bed in a specific time interval. The rate is obtained by calculating the number of admissions/number of beds.
- *Bed turnover interval*: This is a measure of hospital bed productivity and represents the average time (in days) between each discharge and the following admission (average time in which a bed remains free). It was calculated as (number of available days per bed − the number of busy days per bed)/number of admissions.
- *Average length stay*: This measure is obtained from the total occupied bed days at a given time and the number of patients discharged or dead in the hospital. It is calculated by using the following formula: inpatients days/discharged or dead.[51]
- *Comparative performance index (CPI)*: This allows the assessment of the operational efficiency of the wards (or disciplines), with hospitalization units, in terms of average length of stay standardized for case mix, as against values obtained by considering the entire Regional casuistry.[51,53]
- *Extra-regional active mobility*: This reflects the decision of patients to migrate toward healthcare organizations of the Emilia-Romagna Region to avail themselves of treatments. It is considered an important proxy indicator for hospital efficiency; in fact, the choice for a hospital structure that is far from home implies a lower opinion of the alternative healthcare supplier that is closer to the patient.[55]

Statistical analysis

The deterministic record-linkage procedure has made it possible to match the records coming from different sources (questionnaires and objective data).

Respondents' characteristics were summarized by using percentages for dichotomous variables and means with standard deviations (SDs) for continuous variables.

The first hypothesis was tested by keeping an individual level of analysis with a total sample of 1250 doctors. The t-test and χ^2 test have compared, respectively, the means and the response frequencies of doctors by considering their different medical roles. The Mann–Whitney U test confirmed systematic differences among the perceptions of CG tools utility.

The second hypothesis was tested through the Spearman correlation (ρ) by keeping the individual level of analysis.

The last hypothesis was evaluated by following the approach commonly used in unit-level research: the individual doctors' responses, relative to CG scales (total score of claimed knowledge about CG application checklist and the four sub-dimensions scores which compose the CG utility perception scale), were aggregated (average values) at the clinical unit level.[56,57] In order to justify this approach, we calculated the $r_{WG(j)}$ index for CG scales.[58] This index measures the within-group agreement for multiple-item measures. A value of .70 or above is considered good within-group interrater agreement.[59] Intra-class correlations (ICCs; two-way mixed effect model, single ICC1 and average measures ICC2) were calculated in order to examine the non-independence and determine the reliability of the aggregated group means. The Pearson r was calculated to explore the intercorrelations between variables and the Spearman rank order correlation (ρ) has been preferred when the variables were in an ordinal scale.

For each dependent variable or performance indicator (Mortality, CPI, Mortality rate, Bed Turnover interval, Extra-Regional Active Mobility, Average Length Stay, Bed Occupancy rate, Bed Rotation index), a multiple linear regression analysis (Enter method) has been conducted in order to verify the associations of CG practices, as perceived by doctors (independent variables), on their clinical units' performance indicators. This multivariate approach allowed the estimation of these effects by controlling the potential influence of the confounding aspect as clinical units' specialty.

The probability levels were set at <.05. SPSS version 19.0 was used for all analyses.

Results

Descriptive analysis

Questionnaires were administered with envelopes that all respondents had to close in order to guarantee their own privacy. This procedure has achieved high response rates in the healthcare context.[60] The final sample was composed of 1250 doctors who worked in 271 clinical units. Among these, 249 were CCUs (with a response rate of 93%), and the other 1001 were frontline physicians (Ph). All the completed surveys obtained a response rate of 73%. In the final sample, the average of physicians per clinical unit was 6.84 (SD = 5.2).

The participants in the study had the following specialties: Emergency (25.8%), Maternity-Pediatric (18.1%), Surgical (19.4%), and Internal Medicine (28.0%).

The respondents' mean age is 49.8 (SD = 9.6) years. The average tenure within the organization is 14.8 (SD = 10.4) years and 11.64 (SD = 9.1) years within the same clinical unit. In all, 39.3% of participants are women and 34% worked or studied in a foreign state. The doctors reported to spend an average (M) of 34.1 h/week (SD = 9.9) in care activities (M = 25.0 for CCUs and M = 36.3 for Phs), an average of 5.6 h/week (SD = 7.4) in organizational activities (M = 14.3 for CCUs and M = 3.4 for Phs), an average of 2.1 h/week (SD = 4.1) in research practices (M = 3.6 for CCUs and M = 1.7 for Phs), and a mean of 2 h/week (SD = 3.1) in didactic activities (M = 4.0 for CCUs and M = 1.5 for Phs).

The HDR system had identified the clinical units through specific codes to ensure the quality of the data; each HDR code that was not matched to a single clinical unit was excluded. In fact, the literature indicated that the most adequate indicator to assess the accuracy of probabilistic record linkage would be the percent of duplicated records.[61] We have obtained 115 units with CPI values (42.4% of the clinical units involved); 121 units (44.7%) with average weight and hospital stay values and also indexes of occupancy, rotation, and turnover of beds; 111 units (41.0%) with mortality index; and 119 units (47.8%) with extra-regional active mobility values. The exclusion of half of the clinical units may have introduced a sampling bias and a sample weakness.

> Hypothesis 1: CG tools are known/applied and perceived as useful differently at roles/organizational levels at which the medical leadership is carried out (CCU and Ph).

The t-test revealed a significant variation in mean levels of claimed knowledge/application of CG among different medical roles (CCU and Ph) (t = 17.546; p < .001). In particular, the physicians obtained lower scores and this result was constant for all CG aspects as Clinical Audit (p < .001), Incident Reporting (p < .001), Root Cause Analysis (p < .001), Accreditation (p < .01), Path Diagnostic and Therapeutic Care (PDTC) (p < .05), Quality (p < .01), Training Needs (p < .001), Research (p < .001), and Staff appraisal system (p < .001) (Table 1). The physicians have shown lower scores of perceived utility for Audit, Quality, and Guidelines (p < .001) as well as lower levels of Safety perception than their superiors (p < .01) (Table 2).

> Hypothesis 2: The knowledge/application of CG tools is associated with a lower number of hours spent per week by physicians in clinical activities.

Table 1. Descriptive analysis and comparison between medical role (CCU vs Ph) based on CG knowledge/application checklist scores (individual level of analysis).

CG knowledge/application checklist	Total sample (N = 1250)	CCU (n = 249)	Ph (n = 1001)	Statistical test	
Presence of CG tools in clinical unit (affirmative responses of doctors)	N (%)	n (%)	n (%)	χ^2	p value
1. Clinical audit	977 (79.7)	225 (93.4)	752 (76.4)	34.638	<.001
2. Incident reporting	903 (73.9)	216 (90.0)	687 (70.0)	40.155	<.001
3. Root cause analysis	81 (6.8)	39 (16.5)	42 (4.4)	43.206	<.001
4. Accreditation	1006 (82.9)	214 (88.8)	792 (81.5)	7.302	<.01
5. PDTC	527 (88.0)	162 (91.0)	365 (86.7)	2.201	<.05
6. Quality	715 (66.0)	175 (72.9)	540 (64.1)	6.537	<.01
7. Training needs	706 (58.6)	221 (91.3)	485 (50.4)	133.404	<.001
8. Research	662 (54.7)	181 (73.6)	481 (49.9)	44.357	<.001
9. Staff appraisal system	854 (70.3)	220 (90.9)	634 (65.2)	61.479	<.001
Overall level of knowledge/application about CG tools in the clinical unit (sum of affirmative responses of doctors)	M (SD)	M (SD)	M (SD)	Student's t-test	p value
Global index (min 0–max 9)	5.2 (±2.0)	6.7 ± 1.4	4.8 ± 1.9	17.546	<.001

CCU: chief of clinical unit; Ph: physicians CG: clinical governance; PDTC: path diagnostic and therapeutic care; M: mean; SD: standard deviation.

Table 2. Descriptive analysis and comparison between medical role (CCU vs Ph) based on CG utility perception (individual level of analysis).

CG Utility scale (1 = "little" to 6 = "very much")	Total sample (N = 1250)	CCU (n = 249)	Ph (n = 1001)	Statistical test	
Sub-areas	M (SD)	M (SD)	M (SD)	Mann–Whitney U test	p value
1. Audit	4.1 ± 1.34	4.59 ± 1.02	3.97 ± 1.38	U = 70183	<.001
2. Quality	3.49 ± 1.34	3.94 ± 1.23	3.37 ± 1.34	U = 81457	<.001
3. Guidelines	4.4 ± 1.26	3.75 ± 1.15	3.31 ± 1.27	U = 74463.5	<.001
4. Safety perception	4.63 ± 1.15	4.83 ± 1.07	4.58 ± 1.1	U = 102695	<.01

CCU: chief of clinical unit; Ph: physician; CG: clinical governance; M: mean; SD: standard deviation.

Both for CCUs (r=−.45, p<.00) and for Ph (r=−.47, p<.00), a negative relationship between the number of working hours per week spent in care activities and the number of working hours per week spent in organizational activities emerged (Table 3).

The doctors' professed knowledge of CG tools was associated with higher perception levels of the safety of their clinical units (ρ=.281, p<.000). Moreover, the higher the claimed knowledge/application of all CG practices by the doctors, the greater their utility perception, mainly for Quality (ρ=.149 p<.05), Guidelines (ρ=.132 p<.05), and Clinical Audit (ρ=.207, p<.001). A positive relationship between the total number of working hours per week and the claimed knowledge/application of CG by doctors emerged (r=.18, p<.001). An important inverse association between claimed knowledge/application of CG by doctors and the amount of hours per week spent in care activities (r=−.39, p<.001) emerged. There have also emerged positive correlations between claimed knowledge/application of CG by doctors and organizational activities (r=.36, p<.001), didactic activities (r=.23, p<.001), and research activities (r=.17, p<.05) emerged.

These associations are confirmed by another result: the higher the number of hours spent in assistance activities, the worse appeared to be the perception of utility about Clinical Audit (ρ=−.16, p<.01), Safety Perception (ρ=−.14, p<.05), Guidelines (ρ=−.18, p<.01), and Quality (ρ=−.23, p<.001). On the contrary, the amount of hours spent in organizational activities obtained positive associations with the perceived utility of Clinical Audit (ρ=.14, p<.01), Guidelines (ρ=.15, p<.05), Quality (ρ=.28, p<.001), and the Safety Perception (ρ=.11, p<.01). The working hours spent in research activities and didactic activities are associated with Guidelines (with a ρ=.15, p<.01 and ρ=.26, p<.001, respectively) (Table 3).

However, no correlations have emerged between the means of working hours, as declared by physicians, for each clinical unit and mortality. This result is also confirmed for

Table 3. Results of correlation between the levels of declared knowledge/application and perceived utility of CG practices and working hours spent per week by Ph sample (the individual variables are aggregated at the unit level of analysis) and CCU sample (individual variables and unit variables are at the same level of analysis).

		Number of working hours per week				
	Sample	Total hours	Care activities	Organization activities	Didactic activities	Research
1. Audit practices	Phs	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns
2. IR practices	Phs	$r=.07^*$	ns	$r=.10^{**}$	ns	ns
	CCUs	ns	ns	ns	ns	ns
3. RCA practices	Phs	ns	$r=-.08^*$	$r=.15^{**}$	ns	ns
	CCUs	ns	ns	ns	ns	ns
4. Accreditation practices	Phs	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns
5. PDTC practices	Phs	ns	ns	ns	$r=.11^*$	ns
	CCUs	ns	ns	ns	$r=.16^*$	ns
6. Quality practices	Phs	ns	ns	ns	$r=.14^{**}$	ns
	CCUs	ns	ns	ns	ns	ns
7. Training needs	Phs	ns	ns	ns	$r=.13^{**}$	ns
	CCUs	ns	ns	ns	ns	$r=-.22^{**}$
8. Research practices	Phs	$r=.19^{**}$	$r=-.16^{**}$	$r=.15^{**}$	$r=.12^{**}$	$r=.27^{**}$
	CCUs	ns	$r=-.30^{**}$	ns	$r=-.29^{**}$	$r=.33^{**}$
9. Staff appraisal system	Phs	ns	ns	ns	$r=.12^{**}$	ns
	CCUs	ns	ns	ns	ns	ns
CG global index	Phs	$r=.11^{**}$	ns	$r=.12^{**}$	$r=.48^{**}$	$r=.07^*$
	CCUs	ns	$r=-.13^*$	ns	ns	ns
1. Audit utility	Phs	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns
2. Quality	Phs	ns	ns	ns	ns	$\rho=.07^*$
	CCUs	$\rho=.15^*$	ns	$\rho=.16^*$	ns	ns
3. Guidelines	Phs	ns	ns	ns	ns	$\rho=.08^*$
	CCUs	ns	ns	ns	$\rho=.18^{**}$	ns
4. Safety perception	Phs	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	$\rho=.15^*$	$\rho=.21^{**}$

CCU: chief of clinical unit; Ph: physician; CG: clinical governance; IR: incident reporting; RCA: root cause analysis; PDTC: path diagnostic and therapeutic care; ns: not significant.
$^*p<.05$; $^{**}p<.01$.

the mean of hours that physicians have declared about each specific activity (care, organization, didactic and research).

> Hypothesis 3: The levels of knowledge/application and perceived utility of CG practices can impact on the clinical units' performance (in terms of mortality rates and efficiency indicators).

Preliminary ICCs[62] for each item of CG utility subscales have been calculated: Audit ($ICC_1=.89$; $ICC_2=.96$), Quality ($ICC_1=.76$; $ICC_2=.93$), Guidelines ($ICC_1=.80$; $ICC_2=.89$), and Safety Perception ($ICC_1=.59$; $ICC_2=.74$). Preliminary interrater agreement $r_{WG(j)}$[58] indexes were calculated for the total score of the CG Checklist. All the median values across the clinical units (.79 for CG Checklist; .74 for Audit, .77 for Quality, .81 for Guidelines, and .71 for Safety perception)

allow us to consider sufficiently homogeneous the data for within group aggregation.[59]

Due to the nested structure of the CG scales, a multi-level analysis has been applied and doctors' responses have been aggregated at the clinical unit level.

The lower the physicians subjective perception about clinical safety in their working context was, the higher the clinical units' mortality rate was ($\rho=-.23$, $p<.05$), even if no correlations emerged for CCUs. The safety perception seemed to decrease systematically with the increasing of bed occupancy (respectively $\rho=-.25$, $p<.05$ for CCUs; $\rho=-.26$, $p<.05$ for Phs) and turnover bed index (respectively $\rho=-.20$, $p<.05$ for CCUs; $\rho=-.22$, $p<.05$ for Phs). No correlations resulted between CPI and all CG scales and between the average tenure of doctors within their hospital structure and performance of their clinical units.

Table 4. Results of correlation between the levels of declared knowledge/application and perceived utility of CG practices and clinical units' performance indicators, by distinguishing Phs sample (the individual variables are aggregated at unit level of analysis) and CCUs sample (individual variables and unit variables are at the same level of analysis).

		Clinical Units' performance indicators						
	Sample	CPI	Mortality	Bed turnover interval	Extra-regional active mobility	Average length stay	Bed occupancy rate	Bed rotation index
1. Audit practices	Phs	ns	r=−.24*	ns	ns	ns	ns	ns
	CCUs	ns	Ns	ns	ns	ns	ns	ns
2. IR practices	Phs	ns	r=−.30**	ns	ns	ns	ns	r=.22*
	CCUs	ns	ns	ns	ns	r=.21*	ns	ns
3. RCA practices	Phs	ns	ns	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns	ns	ns
4. Accreditation practices	Phs	ns	r=−.25*	ns	ns	ns	ns	r=.26*
	CCUs	ns	ns	ns	r=21*	ns	ns	ns
5. PDTC practices	Phs	ns	ns	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns	ns	ns
6. Quality practices	Phs	ns	ns	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns	ns	ns
7. Training needs	Phs	ns	ns	ns	ns	r=−.28**	ns	r=.23*
	CCUs	ns	ns	ns	ns	ns	ns	ns
8. Research practices	Phs	ns	r=−.35**	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	r=.22*	ns	ns	ns
9. Staff appraisal system	Phs	ns	ns	r=−.22*	ns	ns	r=.30**	ns
	CCUs	ns	r=−.19*	r=−.30**	ns	ns	r=27**	ns
CG global index	Phs	ns	r=−.36**	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	r=.26**	ns	ns	ns
1. Audit utility	Phs	ns	ns	ns	ρ=−.24*	ns	ns	ns
	CCUs	ns	ns	ns	ns	ns	ns	ns
2. Quality	Phs	ns	ns	ns	ns	ns	ns	ns
	CCUs	ns	ns	ns	ns	ρ=.25*	ns	ns
3. Guidelines	Phs	ns	ns	ns	ns	ρ=−.25*	ns	ρ=.21*
	CCUs	ns	ns	ns	ns	ns	ns	ns
4. Safety perception	Phs	ns	ρ=−.23*	ρ=.22*	ns	ns	ρ=−.26*	ns
	CCUs	ns	ns	ρ=.20*	ns	ns	ρ=−.25*	ns

CCU: chief of clinical unit; Ph: physician; CPI: comparative performance index; CG: clinical governance; IR: incident reporting; RCA: root cause analysis; PDTC: path diagnostic and therapeutic care; ns: not significant.
*p<.05; **p<.01.

Significant correlations between the CG claimed knowledge/application global index, only of CCUs, and extra-regional active mobility emerged (r=.26; p<.01), between research, only as declared by physicians, and mortality rate (r=−.35; p<.01) and between research as declared by CCUs and extra-regional mobility (r=.22; p<.05); however, all these relationships disappeared on the use of a multivariate approach (Table 4).

Instead, significant associations between the Phs and CCUs claimed knowledge/application of CG and the mortality rate of their clinical units emerged (see Table 4).

A multiple regression analysis (Stepwise method) on data from 96 clinical units has been performed in order to predict the clinical units' mortality rate by controlling the potential confounding effects of the different clinical specialties involved (Emergency, Maternity-Pediatric, Surgical, and Internal Medicine) and the medical role. Preliminary analysis revealed the absence of colinearity issues. The analysis required two steps. In the first, the confounding effects of clinical specialties have been included in the model; in the second, the CG claimed knowledge/application global index and the four scales of perceived utility (the Audit Practices, Safety Perception, Guidelines, and Quality) have been included as predictors. No included variable has been excluded at the subsequent step (Probability of F to enter ⩽.050; Probability of F to remove ⩾.100). The final model explained only the 18% of the variability in clinical units' mortality rate (adjusted R^2=.183) and, at each step, the increase in R^2 was statistically significant (p<.02).

In this model, the CG global index of claimed knowledge/application confirmed a significant association with the reduction in the mortality rate of clinical units (odds ratio

Table 5. Linear regression model with dependent variable (mortality) and predictors: (constant), clinical specialties, safety perception, guidelines, audit practices, quality, and CG claimed knowledge/application global index.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	95% confidence interval for B	
		B	SE	Beta			Lower bound	Upper bound
1	Constant	5.299	15.647		.339	.736	−25.741	36.338
	Clinical specialties	9.587	4.264	.218	2.248	.027	1.129	18.046
2	Constant	131.746	64.951		2.028	.045	2.819	260.672
	Clinical specialties	14.932	4.491	.340	3.325	.001	6.019	23.846
	Audit practices	8.232	8.152	.111	1.010	.315	−7.950	24.413
	Safety perception	−20.479	16.979	−.145	−1.206	.231	−54.182	13.225
	Quality	−8.345	8.572	−.112	−.974	.333	−25.359	8.670
	Guidelines	−2.249	7.571	−.030	−.297	.767	−17.278	12.779
	CG claimed knowledge/ application global index	−8.677	4.019	−.251	−2.159	**.033**	−16.654	−.700

SE: standard error; CG: clinical governance.

(OR), −8.677; 95% confidence interval (CI), −16.654, −0.700) (Table 5, in bold). In the specific instance, each average point reached by its doctors on claimed knowledge/application of CG practices is associated with approximately eight fewer deaths per year in clinical units. The perceived utility by doctors about specific CG practices has not resulted in a reduction in the clinical units' mortality rate (Table 5).

Discussion

In line with the literature,[63] this study found varying levels of claimed knowledge/application for different CG aspects. Safety perception is the most considered aspect of CG by the entire sample, followed by Clinical Audit, Quality, and Guidelines.

The claimed knowledge/application of the CG tools and the physicians' perception of their utility in their daily clinical work are effectively associated with clinical units' mortality and efficiency indicators. However, not all the CG tools seem to be known/applied and evaluated as useful by doctors.

In line with the literature,[15,34,38,39,41,42] the physicians obtained lower scores than their superiors, both in Safety perception and in the claimed knowledge/application of all other CG tools. These scores are indicative of how doctors evaluated the safety level in their own units because the results have shown that mortality was highest in those units that received lower safety ratings by doctors.

Doctors also obtained the lowest utility perception levels about the Audit, Quality, and Guidelines' implementation.

In line with the literature,[64] the clinicians, compared with their directors, have shown less claimed knowledge and a less favorable attitude toward the CG practices. In coherence with the preceding results,[26,34,39] the professionals' perception, specifically for the safety climate, can vary by role. In

continuity with preceding studies,[13,14,63] the claimed knowledge/application of CG tools is associated with the physicians' perception of a greater Safety Perception in their clinical activities. Moreover, doctors who have applied more of the CG practices have also perceived a greater utility in areas, such as Quality, Guidelines, and Clinical Audit. However, these role differences are not clear: clinicians could have lower knowledge about what happens in their clinical unit, but also their CCUs could be overestimating the application of CG practices within the units.

With the increase in the total working hours per week spent by physicians comes an increase also in their total claimed knowledge/application of CG. We also found an important positive association between these CG tools application and hours of work spent in organizational activities. On the contrary, the more physicians claim to devote their time to care activities, the lower their level of claimed knowledge/application of CG tools appears to be. However, the results highlighted that the organizational and the clinical activities are in competition: the more time a doctor spends doing the first one, the less time he has for the other.

These results support the idea that the claimed knowledge/application of CG by the physicians could be related to possible overwork. However, differently from the literature, our results have shown no correlations between the total means of working hours, as declared by physicians, and the mortality rates of their clinical units.

The increase in doctors' claimed knowledge/application of CG is associated with a reduction in the mortality rate of clinical units. In particular, to each average point reached by a clinical unit, on the claimed knowledge/application of CG checklist compiled by its physicians, is associated an average of eight deaths per year. The application of a global CG system in a healthcare context, more than the implementation of specific isolated CG tools, seems to be associated

with clinical units' mortality rate. However, the explained variance of the model is low (18%), and we do not have longitudinal data about the real impact of CG on mortality rates reduction. Moreover, the other efficiency indicators are only correlated with CG claimed knowledge/application.

Our results have shown that the claimed application of CG tools in general and the perception of their utility by the doctors are negatively correlated, both with mortality rates and with hours spent in clinical activities. However, clinical hours were not directly associated with mortality rates. It is possible to speculate that the knowledge and application of CG tools by doctors, as well as their perceived utility, can play a mediating effect on the relationship between the amount of clinical work of physicians and the mortality outcomes into their clinical units. However, more studies are needed.

These results can enrich the scarce evidence about the connection between CG and clinical units' efficiency. In fact, we found some associations between CG practices and some productivity indicators (bed occupancy rate, bed turnover interval, and extra-region active mobility). However, these associations disappeared on the use of a multivariate approach. The results of a recent Italian study[50] that evaluated the level of implementation of CG through the OPTIGOV© (Optimizing Health Care Governance) tool have shown the strongest association, also through a multivariate approach, with organizational appropriateness.

This study suggests that the doctors' perceptions of their own units' level of safety are representative of the real clinical units' situations because doctors whose units had the higher mortality rates knew that their units were not safe. Nevertheless, the same doctors did not declare that CG activities are helpful. Perhaps further studies could further help comprehend if the high efficiency request (here measured with the high bed occupancy and bed turnover index) could interfere with the possibility of clinicians dedicating time to CG activities without perceiving this organizational activity as being in competition with their main work.

Limitations

The rigor of the deterministic record-linkage procedure and the nature of HDR indicators have required the exclusion of half of the clinical units' sample. The exclusion of half of the clinical units may have introduced a sampling bias to the study.

Furthermore, efficiency indicators are highly dependent on provider documentation quality (HDRs source).[65] In spite of that, these indicators can be considered objective measures not filtered by the respondents' opinion and then better proxy variables of the clinical units' performance.

A third limitation is that the research sample is focused on the medical staff and does not include other essential occupational groups related to clinical units' performance (such as nurses and midwives). This consideration may explain the low percentage of explained variance by the regression model that predicts the clinical units' mortality rates.

Another limitation of this study is that when doctors were asked about their own perception of CG practices, they did not see in the questionnaire a clear definition of each CG practice, leaving all clinicians to interpret the items' content according to their own personal idea/knowledge (e.g. "clinical audit" could have been interpreted as the daily joint discussion about the patients without structured peer review and explicit standards). The lack of clarity about the CG definition in Italy has prevented us from using the survey's other existing tools to measure the implementation of CG; in fact, the CG tools considered in the present survey are those more widespread in our National and Regional Healthcare Systems. Then the conclusions are limited to the specific roles which have been investigated and also to our Regional healthcare context, considering the fact that the record-linkage procedure used had introduced sample weaknesses and so limits to the results' generalizability.

Finally, it is useful to remember that the cross-sectional design allows researchers to compare many different variables at the same time but may not provide cause-and-effect relationships.

Conclusion

This study showed that the application of CG tools in clinical units is associated with the clinical units' mortality rate and with clinical units' efficiency indicators.

From a methodological point of view, a research based both on a survey (subjective indicators) and on objective performance indicators, with a record-linkage procedure, has demonstrated a further potential value to evaluate the CG impact. Further empirical analysis on the relationship of the CG implementation, efficiency indicators, and patient outcomes is important in order to prioritize initiatives and resource allocation.

Declaration of conflicting interests

Ethics approval

Approval of the ethics committee was not required for the study because the Italian legislation concerns only clinical research studies and does not provide statements on observational studies on aggregated data collected from administrative databases without the patient's involvement.

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Informed consent

Written informed consent was obtained from all subjects before the study.

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Appendix 1

Checklist about knowledge and application of CG practices

1. Are clinical audits carried out in your clinical unit?
2. Is the incident reporting tool used in your clinical unit?
3. Have you ever used the responsive analysis technique called root cause analysis (RCA) in your clinical unit?
4. Is your clinical unit accredited?

5. Are surveys about perceived quality carried out in your clinical unit?
6. How many periodic path diagnostic and therapeutic care (PDTC) do you have in your clinical unit?
7. An assessment about physicians' educational needs has been carried out in your clinical unit?
8. Are you participating in one or more research projects in your clinical unit?
9. There is an assessment system for managers of medical staff in your clinical unit?

Clinical governance utility questionnaire

Thinking about your work experience:

Audit practices:

1. Do you think that clinical audits are helpful in giving a boost to a change in the clinical-organizational behavior?
2. Do you think that clinical audits can improve performance?
3. Do you think that clinical audits can improve the teamwork?

Safety perception:

4. Do you think that your clinical unit is a safe environment compared with others which provide medical care for patients in hospital?
5. Do you think that drugs are safely managed in your ward?

Guidelines:

6. Do you think that the patients' PDTC are clear in your hospital?
7. Do you think that the patients' PDTC are shared in your hospital?

Quality:

8. Do you think that documents used for accreditation are useful for your clinical unit?
9. Do you think that quality tools can improve performance?
10. Do you think that quality tools can be useful for clinical tasks?
11. Do you think that quality tools can be perceived as an improvement opportunity by professionals?