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Leadership competencies for medical education and healthcare professions: population based study

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Article Focus

- The major focus was to identify and empirically investigate the dimensions of leadership in medical education and healthcare professions
- A 63 item survey was developed and administered via electronic mail to 229 health care professional educators and leaders in six countries (Austria, Canada, Germany, Switzerland, the United Kingdom, and the United States of America)

Key Messages

- Exploratory principal component analyses yielded 5 dimensions of leadership: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation
- Social Responsibility was rated higher by other health professionals compared to physicians, as was Innovation, and Justice Orientation

Strengths and Limitations

- The results of the principal component analyses support the theoretical meaningfulness of these factors, their coherence, internal consistency and parsimony in explaining the variance of the data
- Our 5-factor leadership competency model needs to be replicated and extended with larger representative samples from other cultures
- Notwithstanding the limitations of the present study, it is one of the few that has explicitly defined and provided empirical evidence for leadership competencies considered to be the most important in medical education.

ABSTRACT

Objective: To identify and empirically investigate the dimensions of leadership in medical education and healthcare professions.

Design: A population based design with a focus group and a survey were used to identify the perceived competencies for effective leadership in medical education.

Setting: The focus group, consisting of 5 experts from three countries (Austria n=1; Germany n=2; Switzerland n=2), was conducted (all masters of medical education) and the survey was sent to health professionals from medical schools and teaching hospitals in six countries (Austria, Canada, Germany, Switzerland, the United Kingdom, and the United States of America).

Participants: The participants were educators, physicians, nurses, and other health professionals who held academic positions in medical education. A total of 229 completed the survey; 135 (59.0%) women (age M = 50.3 years) and 94 (41.0%) men (mean age = 51.0 years).

Measures: A 63 item survey measuring leadership competencies was developed and administered via electronic mail to participants.

Results: Exploratory principal component analyses yielded 5 factors accounting for 51.2% of the variance: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation. There were significant differences between physicians and other health professionals on some factors (Wilk`s lambda = 0.93, $p < 0.01$). Social Responsibility was rated higher by other health professionals (M=71.09) than by physicians (M=67.12), as was Innovation (health professionals M=80.83; physicians M=76.20), and Justice Orientation (health professionals M=21.27; physicians M=20.46).

Conclusions: The results of the principal component analyses support the theoretical meaningfulness of these factors, their coherence, internal consistency and parsimony in

explaining the variance of the data. Although there are some between-group differences, the competencies appear to be stable and coherent.

Leadership competencies for medical education and healthcare professions: population based study

According to Bennis[1] – an expert in the study of leadership – an important threat facing the world today is the lack of effective leadership of our human institutions. Indeed, Lipman-Blumen[2] has called attention to the failure of leadership in government, universities, healthcare and financial institutions. Health organizations and medical schools – like other human institutions – need competent and effective leaders now more than ever to face the threats and challenges of the modern world[3,4].

Long time scholars in the field of leadership, Vroom and Jago[5] defined leadership as a "process of motivating people to work together collaboratively to accomplish great things" (p. 18). Accordingly, leadership is a process, not a property of a person. It involves a particular form of influence called *motivating,* resulting in collaboration in pursuit of a common goal to achieve the great things that are in the minds of both leader and followers[5]. Identifying and defining the central competencies of leadership, however, remains elusive. The major purpose of the present study was to empirically investigate the core competencies for medical education leaders – an area that has not been systematically studied.

Leaders face many challenges in healthcare and medical education institutions[6,7,8]. Educational leaders are under scrutiny to achieve heightened expectations for improvement to teaching and learning. They are called to be educational visionaries, instructional and curriculum leaders, assessment experts, community builders, public relations experts, budget analysts, facility managers, special programs administrators, and expert overseers of legal, contractual, and policy mandates and initiatives. Yet, they encounter major challenges such as commercialization of the university's and medical school's central purpose, perceived lack of accountability of higher education, and heightened sensitivity of taxpayers toward ineffective and inefficient leadership in academia[9]. Medical school leaders, in addition, are confronted with many concerns such as financial stability, curriculum development, research

support, and accreditation standards. The ability to meet these demands may be compromised as a result of inadequate and inefficient leadership.

Leadership Theories

In a recent (2011) meta-analysis of trait and behavioral theories of leadership, Derue Nahrgang, Wellman and Humphrey[10] concluded that much of the research evidence fails to provide an integrated framework for understanding what constitutes leadership effectiveness. They did empirically identify some leader traits and behaviors that represent effective leadership, however. The concept of leadership overlaps with two similar terms, management and administration. The former is used widely in Europe and Africa, while the latter is preferred in the United States, Canada and Australia. Leadership is often of great contemporary interest in most countries in the developed world[11].

Some leadership researchers distinguish between leadership, administration and management. They suggest that leadership is synonymous with change while management and administration is considered as maintenance. All three dimensions are identified as critical functions of organizational activity. Taken together, leadership can be construed as a means of shaping the goals, motivations, and actions of others to initiate change or maintain stability[12]. Some researchers have adopted a social perspective to conceptualize leadership. Spillane, Halverson and Diamond[13], for example, argued that leadership activity is defined or constructed through the interaction of leaders and followers during the execution of leadership tasks.

The Importance of Effective Leadership

Many authors[14,15] have argued that high-quality leadership is imperative to the success of educational institutions. Many researchers have emphasized idealized personal characteristics such as educational visionaries, instructional and curriculum leaders, assessment experts, community builders, public relations experts, budget analysts, facility managers, special programs administrators, and expert overseers of legal, contractual, and

policy mandates and initiatives are thought to characterize effective leaders. The preponderance of empirical evidence, however, does not support this trait model of leadership effectiveness[10]. Although effective leaders can have a positive influence on achievement, poor leaders can have a marginal or even negative impact on success[14].

Waters and Grubb[14] in their meta-analytic study reported three major findings that support the notion that school-level leadership matters in student achievement. First, they found that principal leadership was correlated with student achievement; one standard deviation improvement in principal leadership was associated with a 10 percentile increase in student achievement. Second, they identified several leadership practices or processes required to fulfill a number of responsibilities that were significantly and directly related to student achievement. Third, they found a differential impact of leadership – just as leaders can have a positive impact on student's achievement, they also can have marginal or, worse, a negative impact on student's achievement.

Wagner and colleagues operationalized leadership competencies based on a systematic review of research in business practices, resulting in an inventory of over 107 specific competencies [17]. These were categorized to obtain five major competencies including self management that refers to personal insight and self-control; leading others involves motivating others to set and meet goals; task management includes effective and efficient completion of prioritized duties; innovation describes developing a vision and responding to opportunities; and social responsibility entails promoting integrity. It is not yet known whether these types of competencies are relevant to medical education. Indeed, only one study has examined leadership in this context. Violato and Cawthorpe[16] in a systematic review identified key competencies for scholars, teachers, researchers, and leaders in medical education. These include (1) medical education expert, (2) educational leadership, (3) curriculum designer, (4) teacher, (5) educational researcher and scholar, and (6) learner

assessor. They concluded that acquisition of these competencies requires systematic formal education such as graduate studies.

Leadership is a complex, multifaceted phenomena that is widely observed but poorly understood. In consonance with the conclusions of others[1,10] the foregoing review indicates that further empirical work in leadership – particularly in medical education – is required. Given that leadership is associated with student achievement, successful team functioning, and efficient institutional operations, it is critical that an empirically supported, comprehensive definition be developed in medical education. The major purpose of the present study, therefore, was to identify the core competencies for medical education leaders. Accordingly, we adapted a survey questionnaire based on the instrument from Wagner et al.[17] to present to medical education leaders to identify the primary competencies of medical education leadership. Specifically, we wished to address the following research questions: 1) what are the perceived competencies that characterize successful leadership in medical education? 2) Do these perceived leadership competencies in medical education vary by country or language groups or for men and women? 3) Do these desired leadership competencies in medical education differ between physicians and other health professions?

Methods

Participants

Experts

A focus group consisting of 5 medical education experts from three countries (Austria n=1; Germany n=2; Switzerland n=2) was conducted (Master of medical education graduates who earned their Masters degree at University of Bern in collaboration with University of Illinois at Chicago). Their specialization background was medicine (n=2) or health professions (n=3). The mean age of the focus group participants was 43.2 years. They had several years of clinical (M = 10.7 years) and teaching experience (M = 10.3 years), with a few years of medical education leadership (M = 2.4 years).

Survey Respondents

A final sample of 229 participants from six countries completed an electronic survey (338 had been contacted for a 67.8% response rate). Most participants were from Canada (n = 75; 32.8 %), followed by the USA (n = 59; 25.8%), Switzerland (n = 41; 17.9%), Germany (n = 25; 10.9%), Austria (n = 14; 6.6%), and the UK (n=14; 6.1%). The participants all held academic positions in medical education with different backgrounds including physicians (n = 91; 39.7%), nurses (n = 84; 36.7%), educators (n = 25; 10.9%), and other health professionals (n = 29; 12.7%).

There were 135 (59.0%) women and 94 (41.0%) men. The mean age for women was 50.3 years and for men was 51.0 years. There were 137 (59.8%; women = 90; men = 47) from countries with English as the predominant language, 88 (38.4%; women = 45; men = 43) from countries with German as the predominant language, and 4 from countries with various other identified predominant languages (2.2%; Netherlands = 2; Denmark = 1; South Africa = 1). Respondents indicated the following academic titles: Professor = 123 (53.7%); Associate Professor = 37 (16.2%); Assistant Professor = 28 (12.2%); Master degree teacher = 36 (15.7%); and Bachelor degree teacher = 5 (2.2%).

Compared to the 109 participants (32.2%) that did not complete the survey, those that had completed the survey had slightly more years of experience in leadership (M = 11.97(.58) versus M = 8.54 (8.39), $p < .05$), years of teaching experience (M = 17.34(10.81) versus M = 14.26 (10.43), $p < .05$) as they did years of clinical experience (M = 17.75 (12.22) versus M = 15.23(12.26), $p < .05$). There were no differences between the two groups, however, for sex composition, language group, and level of scholar.

Focus Group Procedures

Five experts in a focus group were asked to select the most appropriate competencies relevant for medical education from the Leadership Competency Model questionnaire developed by Wagner et al.[17]. To determine which competencies to retain from the 107 items

dealing with leadership in general, a consensus approach was used. At least four expert raters (80%) were required to independently agree that the competency was applicable to leadership in medical education for the competency to be retained. Based on this procedure the questionnaire was reduced to 63 items applicable to leadership in medical education.

Survey Procedures

Survey participants were from four medical schools in each country, which was randomly selected using the cluster sampling method (Austria, Canada, Germany, Switzerland, United Kingdom, and the USA). In cluster sampling, according to Gay et al.[18] intact groups rather than individuals are randomly selected. Cluster sampling was the only feasible method of selecting a sample because it was not possible to obtain a list of all members from the theoretical population. Gay et al.[18] suggest using this method when the population is very large and spread over a wide geographical area such as the present sample[±]. The 63-item survey was sent by email to professors, associate professors and assistant professors.

Data Analyses

Reliability of the survey scores was assessed using Cronbach's alpha. In addition to content validity, evidence of factorial validity was assessed using exploratory factor analysis. Specifically, principal components analysis with varimax rotation was utilized. Between group differences were analyzed using contingency tables (Fisher's Exact Test) and multivariate analyses of variance (MANOVAs). The study was approved by the Ethics Review Committee of the University Ambrosiana.

[±] Switzerland has only five medical schools and Austria has four. Switzerland has only four universities that offer academic nursing or health professions education. Austria has also only four such institutions.

Results

Descriptive Statistics of the Survey Items

Descriptive statistics of the items are summarized in Table 1. Most of the participants rated each item as important (4) or very important (5), but for many items the entire scale (1 – 5) was utilized (Table 1). The means of the items ranged from 3.85 (#18: Honesty and Integrity) to 4.76 (#3: Personnel Decision Quality). The standard deviations are typical (< 1.0) for 5-point items, indicating that data points are clustered closely around the mean.

Principal Component Analyses and Reliability

Several exploratory principal component analyses were conducted resulting in 10, 8, 7 and 5 factor solutions. It was determined that the optimum solution was five factors as they accounted for more than 50% of the variance, were cohesive, and made theoretical sense (see Table 2). The five factors identified as leadership competencies were Social Responsibility, Innovation, Self Management, Task Management, and Justice Orientation.

Of the initial 63 items, eleven were removed since they had small loadings (< 0.40) on all factors. The removed questions were from the following competency domains: one from Task Management; one from Social Responsibility; one from Self Management Competencies; six from Leading Others; and one from Innovation.

As can be seen from Table 2, the eigenvalue for Factor 1 (Social Responsibility) is large (35.55) compared to the others. This shows that the Social Responsibility factor across countries, languages, sex, professions and experiences in medical education was the most cohesive, accounting for the most variance (16.63%). Innovation was identified as the second factor, accounting for 15.35% of the total variance. Self Management, Task Management, and Justice Orientation were also identified as shown in Table 2.

Insert Table 1 Here

The results summarized in Table 2 also show very high reliability of items within each factor. Cronbach`s alpha was 0.93 for Social Responsibility and Innovation,

respectively, 0.84 for Self Management, 0.72 for Task Management, and 0.93 for Factor 5 Justice Orientation. All five factors where intercorrelated (mean r = 0.55; range: 0.44 – 0.79; $p < .01$)

Together with the high internal consistency each factor's items, the overall pattern of factor loadings supports the coherence of the factors. Among the items that had the highest loadings on Social Responsibility, for example, are honesty and integrity (.81) and accountability (.81). All the other loadings on this factor were moderate (e.g., >.40) to large (>.80). A similar pattern of loadings is evident for the other four factors.

A close inspection of Table 2 also shows that there is agreement between the items that form the scales of the original instrument[16] and the obtained factor structure. Many of the items do load on the expected factors (or scales) even though our results produced a slightly different set of scales (i.e., Justice Orientation) compared to the original Wagner et al. instrument[16]. The sum of scores was calculated for items with the highest loadings under each factor. These new scores were used as dependent variables in the subsequent analyses.

Insert Table 2 Here

Differences between Countries and Sex Differences

Given the disproportionate number of women (60.9%) in the sample, we compared the number of men and women who spoke each language. Accordingly, a contingency table with sex by language with Fisher`s Exact Test was done. There was a significant difference between the proportion of English speaking women (90; 66.7%) and German (45; 33.3%) speaking ones ($p < .01$), while for men there were approximately equal proportions (English = 51.1%; German 48.9%). Two, one-way ANOVAs (independent variable = sex) with the dependent variables (age and leadership experience) were run. There were no significant differences for age ($F = 0.48$, $p < 0.49$) or for leadership experience ($F = 1.80$, $p < 0.18$) between men and women.

Insert Table 3 Here

Sex and Language Differences by Sub-scales

A two-way MANOVA (independent variables = sex and language) with 5 dependent variables (factors = Social Responsibility, Innovation, Self Management, Task Management and Justice Orientation) was run. There was no main effect for sex (Wilk`s lambda = 0.96, $p < 0.10$). There was a main effect for language (Wilk`s lambda = 0.93, $p < 0.007$), but on only two factors (Innovation, Justice Orientation) with English speakers providing higher ratings than German speakers on both factors (Table 3). There were no significant interaction effects (Wilk`s lambda = 0.98, $p < 0.50$). The means and standard deviations of the factors by sex and language are shown in Table 3.

Differences between Physicians and Other Health Professionals

A one-way MANOVA (independent variable = physicians and other health professionals) with 5 dependent variables (factors = Social Responsibility, Innovation, Self Management, Task Management and Justice Orientation) was conducted. There were significant differences between physicians and other health professionals (Wilk`s lambda = 0.93, $p < 0.01$). As shown in Table 4, Social Responsibility, Innovation, and Justice Orientation were rated higher by other health professionals than by physicians.

To identify which groups of health professionals (nurse, general practitioner, internist, surgeon, and educator)[±] endorse higher ratings on the three leadership competences, a one-way MANOVA was used. There were significant differences across specialties (Wilk`s lambda = 0.82, $p < 0.003$). Post hoc tests (Tukey's HSD) revealed that Social Responsibility was rated the highest by nurses (M = 71.79), followed by internists (M = 70.83). General practitioners rated this leadership competency the lowest (M = 66.53). Innovation was rated

[±] A total of 53 specialities in medical and health professions were identified. To permit analyses across specialities they were coded into five groups: (1) nursing, which included nursing, midwifery, physiotherapy, and occupational therapy; (2) general practitioner comprising general practitioners, dentists, family medicine etc. (3) internal medicine comprising internists, gynaecologists, palliative specialists, oncologists, cardiologists, endocrinologists etc. (4) surgery comprising sub-specialities in surgery and anaesthesiologists, and (5) educators comprising psychologists, sociologists, biologists, chemistry educators, administrators etc.

the highest by nurses (M = 82.23) and the lowest by general practitioners (M = 74.26). Justice Orientation was rated the highest by nurses (M = 21.64) and the lowest by general practitioners (M = 20.20). There were no significant differences for Self Management and Task Management.

Insert Table 4 Here

Group Differences between Junior, Midlevel, Senior and Administrator Scholars

A one-way MANOVA determined whether there were any significant differences in the five leadership competencies across junior, midlevel, senior and administrator level positions. No significant differences were found (Wilk`s lambda = 0.90, $p > 0.05$).

Discussion

The purpose of the present study was to identify and empirically investigate the perceived competencies of leadership in medical education. First, a group of medical education leaders selected 63 of the most important leadership characteristics from a list of 107 identified in previous research. Second, questionnaire data were used in principal component analyses to obtain five competencies of leadership that include Social Responsibility, Innovation, Self Management, Task Management, and Justice Orientation. Cronbach's alpha reliabilities of the factors were high, indicating good coherence and internal consistency. Third, differences between men and women, areas of specialization, and language were found for Social Responsibility, Innovation and Justice Orientation. Fourth, all five factors were strongly intercorrelated indicating that they all assessing the construct of leadership. These combined results suggest that the five leadership competences represent a coherent, reliable, and parsimonious model of leadership in medical education. Moreover, these fit well with the definition provided by Vroom and Jago[5] of leadership as a process of motivating people to "accomplish great things" in medical education by demonstrating social

responsibility, innovation and justice, as well as more prosaic activities of self and task management.

Medical education leaders identified Social Responsibility as the most dominant competency. It was found to be the least important, in contrast, by Wagner et al.[17]. This difference is likely due to the emphasis on collaboration and inter-disciplinary practice within the medical and health professions, in comparison to competition and independence within business[1]. Another major difference between the two models is that we identified a Justice Orientation competency, which was not part of the Wagner et al. [17] model. It is not surprising that maintaining safety, following laws and regulations, and monitoring progress, as indicated by Justice Orientation, are critical to teaching in medicine. Innovation was also deemed to be a major leadership competency in the present study, according to ratings of knowing learning principles and building relationships. With limited resources and high expectations, leadership requires creative approaches that are based on sound principles and human resources. Self Management involves setting and achieving goals despite barriers; and Task Management entails planning and efficiency. All of these qualities are important for managing threats to human health and providing leadership to health professionals.

The expert input from the focus group together with the principal component analyses confirmed that medical educators do have a shared vision of the competencies that comprise effective leadership in medical education. These competencies, in addition, are cohesive, theoretically meaningful and reliable. There were no sex differences on any of the factors. Moreover, while there was generally agreement in the two language groups on three factors, as indicated by the similarity in scores between languages, there were differences for Innovation and Justice Orientation. It was the English language respondents who rated these two factors higher than did the German language respondents. This probably reflects the emphasis put on innovation and justice in educational and health systems in the Anglo world.

Additionally, there were significant differences between physicians and other health professionals on some of the dimensions (Social Responsibility, Innovation, and Justice Orientation). The physicians gave lower ratings to the importance of these competencies compared to the other health professionals. The majority of responders from other health professions were nurses, followed by physiotherapists, midwives, and educators. This group is likely to spend considerable time with patients developing rapport and perhaps a sense of responsibility for creative solutions to ensure that their personal needs are met. Nurses, thus, may be likely to endorse the need for social responsibility and innovation in medical education. The Justice Orientation competency was also rated higher by other health professionals than by physicians. Knowing and applying principles of fairness to ensure that subordinates are treated fairly, may resonate more with nurses and other health care professionals than with physicians, who tend to be in a position of power over other health care professionals.

Limitations

The survey response rate was high (67.8%) but the completers were slightly older and had slightly more years of teaching and clinical experience than did the non-completers. In several other ways the two groups were the same so it is unlikely that these minor differences produced biased results. All of the six countries represent Western cultures, and, therefore, are not fundamentally different regarding social, economic and demographic characteristics.

Conclusions

The present study indicates that core competencies in medical education leadership can be empirically identified and categorized into five factors: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation that are theoretical meaningful, coherent, internal consistent and parsimonious in explaining the variance of the data. Although there are some between-group differences in the factors (physicians versus other health care professionals), there are no substantive differences by

country or language. Accordingly, the competencies appear to be stable and coherent. Notwithstanding the limitations of the present study, it is one of the few that has explicitly defined and provided empirical evidence for leadership competencies considered to be the most important in medical education.

Future research should be designed to replicate, extend and confirm the present findings. Our 5-factor leadership competency model needs to be replicated and extended with larger representative samples from other cultures. Future research could be theoretically strengthened by employing confirmatory factor analyses on a new dataset. Meanwhile, we have provided an empirical model of leadership competencies that can be employed to further investigate leadership in medical and health professions education.

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Table 1: Minimum, Maximum, Mean and Standard Deviation of the 63 Questionnaire Items

Items	Min	Max	Mean	SD
1. Maintain Quality	1	5	4.16	0.77
2. Succession Planning/Recruiting	1	5	4.31	0.82
3. Personnel Decision Quality	1	5	4.54	0.69
4. Maintaining Safety	1	5	4.13	0.87
5. Enhancing Task Knowledge	2	5	4.24	0.70
6. Eliminating Barriers to Performa.	1	5	4.26	0.72
7. Strategic Task Management	1	5	4.43	0.70
8. Communication with Community	1	5	3.85	0.90
9. Providing a Good Example	2	5	4.58	0.67
10. Knowledge of Organization Justice	2	5	4.44	0.72
11. Legal Regulations	1	5	4.29	0.75
12. Open-Door Policy	2	5	4.41	0.78
13. Explaining Decisions respect.	1	5	4.55	0.66
14. Servant Leadership	1	5	4.30	0.77
15. Distributing Rewards Fairly	1	5	4.28	0.85
16. Responsibility for Others	1	5	4.24	0.81
17. Financial Ethics	1	5	4.17	0.93
18. Honesty and Integrity	1	5	4.76	0.59
19. Being Accountable	1	5	4.71	0.61
20. Time Management	1	5	4.24	0.71
21. Goal Orientation	2	5	4.21	0.66
22. Taking Initiatives	1	5	4.13	0.74
23. Effort: achieve goals	1	5	4.26	0.73
24. Persistence: despite challenges	2	5	4.32	0.71
25. Self Control	1	5	4.17	0.80
26. Stress Tolerance	2	5	4.36	0.67
27. Adaptability	1	5	4.45	0.73
28. Self Reliance	1	5	4.21	0.79
29. Continuous Learning	1	5	4.36	0.71
30. Seeking Feedback	1	5	4.35	0.72
31. Communicating with Co-workers	2	5	4.51	0.67
32. Active Listening	1	5	4.50	0.71
33. Facilitating Discussion	1	5	4.37	0.71
34. Developing External Contacts	1	5	4.11	0.80
35. Psychological Knowledge	2	5	4.02	0.79
36. Social Perceptiveness	2	5	4.10	0.75
37. Nurturing Relationships	2	5	4.32	0.69
38. Taking Charge	2	5	4.20	0.73
39. Orienting Others	1	5	4.10	0.80
40. Setting Goals for Others	2	5	4.00	0.77
41. Reinforcing Success	3	5	4.18	0.68
42. Developing and Building Teams	2	5	4.32	0.69
43. Knowing Principles of Learning	2	5	3.94	0.83
44. Assessing Others	2	5	4.07	0.71

45. Coaching, Develop, Instructing	1	5	4.23	0.76
46. Cooperating	1	5	4.36	0.66
47. Resolving Conflicts/Negotiating	2	5	4.44	0.62
48. Empowerment	2	5	4.38	0.71
49. Political Savvy	1	5	4.10	0.88
50. Critical Thinking	2	5	4.41	0.68
51. Creative Problem Solving	1	5	4.44	0.72
52. Identifying Problems	3	5	4.44	0.64
53. Seeking Improvement	2	5	4.17	0.76
54. Openness to Ideas	1	5	4.46	0.70
55. Collaborating	1	5	4.36	0.74
56. Perceiving Systems	2	5	4.15	0.76
57. Evaluating Consequences	2	5	4.21	0.76
58. Visioning	2	5	4.02	0.88
59. Managing the Future	2	5	4.20	0.75
60. Sensitivity to Situations	2	5	4.16	0.75
61. Challenging the Status Quo	1	5	4.24	0.82
62. Intelligent Risk-Taking	2	5	4.21	0.75
63. Reinforcing Change	2	5	4.29	0.69

Table 2: Principal Components Orthogonally Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion*

	Factors				
Items	1 Social Responsibility	2 Innovation	3 Self Management	4 Task Management	5 Justice Orientation
Succession Planning /Recruiting				.636 TM	
Personnel Decision Quality				.578 TM	
Maintaining Safety					.480 TM
Enhancing Task Knowledge				.401 TM	
Eliminating Barriers				.457 TM	
Strategic Task Management				.540 TM	
Communication with Community					
Providing a Good Example	.511 SR				
Knowledge of Organization Justice					.546 SR
Legal Regulations					.674 SR
Open-Door Policy	.677SR				
Explaining Decisions respect	.698SR				
Servant Leadership	.563 SR				
Distributing Rewards Fairly	.434 SR				
Responsibility for Others				.486 SR	
Honesty and Integrity	.810 SR				
Being Accountable	.806 SR				
Goal Orientation			.544 SM		
Taking Initiatives			.515 SM		
Effort: achieve			.576 SM		

goals					
Persistence: despite challenges			.516 SM		
Self Control			.484 SM		
Stress Tolerance			.530 SM		
Adaptability	.651 SM				
Self Reliance			.623 SM		
Continuous Learning			.431 SM		
Seeking Feedback	.506 SM				
Communicating with Co-workers	.511 LO				
Active Listening	.658 LO				
Facilitating Discussion	.494 LO				
Developing and Building Teams		.498LO			
Psychological Knowledge		.593LO			
Social Perceptiveness		.649LO			
Setting Goals for Others			.568 LO		
Knowing Principles of Learning		.565LO			
Assessing Others		.495 LO			.567 LO
Coaching, Development, Instruction		.546 LO			.405 LO
Cooperating	.603 LO				
Empowerment	.425 LO				
Political Savvy		.596LO			
Critical Thinking		.521IN			
Creative Problem Solving	.473 LO	.529IN			
Identifying Problems		.509IN			

Openness to Ideas	.654IN				
Collaborating	.542IN	.418IN			
Perceiving Systems		.643IN			
Evaluating Consequences		.616IN			
Visioning		.657IN			
Managing the Future		.720IN			
Sensitivity to Situations		.664IN			
Challenging the Status Quo	.437IN	.499IN			
Intelligent Risk-Taking		.642IN			
Reinforcing Change		.537IN			
Eigenvalue	35.55	5.68	3.66	3.48	3.12
% of Variance	16.63	15.35	7.09	6.92	5.19
M	69.52	79.00	37.71	25.82	20.95
SD	8.22	10.15	4.56	3.06	2.73
Cronbach`s alpha	0.93	0.93	0.84	0.72	0.93

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 12 iterations; SR = Social Responsibility; LO = Leading Others; SM = Self Management; I = Innovation; TM = Task Management.

Table 3: Means and Standard Deviations for the Five Subscales for Sex and Language

	Sex	Language	M	SD	n
Social Responsibility	Male	English	67.40	11.05	47
		German	68.60	7.72	45
		Total	67.99	9.54	92
	Female	English	71.31	7.35	90
		German	68.63	6.32	43
		Total	70.44	7.12	133
	Total	English	69.97	8.95	137
		German	68.61	7.03	88
		Total	69.44	8.26	225
Innovation*	Male	English	77.68	11.94	47
		German	77.38	10.95	45
		Total	77.53	11.41	92
	Female	English	80.99	9.00	90
		German	77.33	8.54	43
		Total	79.80	8.99	133
	Total	English	79.85	10.18	137
		German	77.35	9.79	88
		Total	78.88	10.09	225
Self Management	Male	English	37.57	5.06	47
		German	37.56	4.93	45
		Total	37.57	4.97	92
	Female	English	38.32	4.23	90
		German	36.60	4.28	43
		Total	37.77	4.31	133
	Total	English	38.07	4.53	137
		German	37.09	4.62	88
		Total	37.68	4.58	225
Task Management	Male	English	25.68	3.25	47
		German	25.69	2.75	45
		Total	25.68	3.00	92
	Female	English	25.84	3.31	90
		German	25.77	2.67	43
		Total	25.82	3.11	133
	Total	English	25.79	3.28	137
		German	25.73	2.69	88
		Total	25.76	3.06	225
Justice Orientation*	Male	English	20.74	3.17	47
		German	19.98	2.84	45
		Total	20.37	3.02	92
	Female	English	21.96	2.30	90
		German	20.19	2.35	43
		Total	21.38	2.45	133
	Total	English	21.54	2.68	137
		German	20.08	2.60	88
		Total	20.97	2.74	225

*$p < .05$

Table 4: Means and Standard Deviations between Physicians and Other Health Professionals

	Physicians versus Health Professions	M	SD	n
Social Responsibility**	Physicians	67.12	9.58	91
	Health Professionals	71.09	6.76	138
	Total	69.51	8.22	229
Innovation**	Physicians	76.20	10.53	91
	Health Professionals	80.83	9.32	138
	Total	78.99	10.05	229
Self Management	Physicians	37.12	5.00	91
	Health Professionals	38.09	4.22	138
	Total	37.70	4.56	229
Task Management	Physicians	25.51	3.06	91
	Health Professionals	26.00	3.05	138
	Total	25.81	3.05	229
Justice Orientation*	Physicians	20.46	2.85	91
	Health Professionals	21.27	2.61	138
	Total	20.95	2.73	229

*p < .05; **p < .01

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 5
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-8
Objectives	3	State specific objectives, including any pre-specified hypotheses	8
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-10
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-10
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 11
		(b) Indicate number of participants with missing data for each variable of interest	12
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	12-14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Leadership competencies for medical education and healthcare professions: population based study

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Leadership competencies for medical education and healthcare professions: population based study

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Article Focus

- The major focus was to identify and empirically investigate the dimensions of leadership in medical education and healthcare professions
- A 63 item survey was developed and administered via electronic mail to 229 health care professional educators and leaders in six countries (Austria, Canada, Germany, Switzerland, the United Kingdom, and the United States of America)

Key Messages

- Exploratory principal component analyses yielded 5 dimensions of leadership: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation
- Social Responsibility was rated higher by other health professionals compared to physicians, as was Innovation, and Justice Orientation

Strengths and Limitations

- The results of the principal component analyses support the theoretical meaningfulness of these factors, their coherence, internal consistency and parsimony in explaining the variance of the data
- Our 5-factor leadership competency model needs to be replicated and extended with larger representative samples from other cultures
- Notwithstanding the limitations of the present study, it is one of the few that has explicitly defined and provided empirical evidence for leadership competencies considered to be the most important in medical education.

ABSTRACT

Objective: To identify and empirically investigate the dimensions of leadership in medical education and healthcare professions.

Design: A population based design with a focus group and a survey were used to identify the perceived competencies for effective leadership in medical education.

Setting: The focus group, consisting of 5 experts from three countries (Austria n=1; Germany n=2; Switzerland n=2), was conducted (all masters of medical education) and the survey was sent to health professionals from medical schools and teaching hospitals in six countries (Austria, Canada, Germany, Switzerland, the United Kingdom, and the United States of America).

Participants: The participants were educators, physicians, nurses, and other health professionals who held academic positions in medical education. A total of 229 completed the survey; 135 (59.0%) women (age M = 50.3 years) and 94 (41.0%) men (mean age = 51.0 years).

Measures: A 63 item survey measuring leadership competencies was developed and administered via electronic mail to participants.

Results: Exploratory principal component analyses yielded 5 factors accounting for 51.2% of the variance: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation. There were significant differences between physicians and other health professionals on some factors (Wilk`s lambda = 0.93, $p < 0.01$). Social Responsibility was rated higher by other health professionals (M=71.09) than by physicians (M=67.12), as was Innovation (health professionals M=80.83; physicians M=76.20), and Justice Orientation (health professionals M=21.27; physicians M=20.46).

Conclusions: The results of the principal component analyses support the theoretical meaningfulness of these factors, their coherence, internal consistency and parsimony in

explaining the variance of the data. Although there are some between-group differences, the competencies appear to be stable and coherent.

Leadership competencies for medical education and healthcare professions: population based study

According to Bennis[1] – an expert in the study of leadership – an important threat facing the world today is the lack of effective leadership of our human institutions. Indeed, Lipman-Blumen[2] has called attention to the failure of leadership in government, universities, healthcare and financial institutions. Health organizations and medical schools – like other human institutions – need competent and effective leaders now more than ever to face the threats and challenges of the modern world[3,4].

Long time scholars in the field of leadership, Vroom and Jago[5] defined leadership as a "process of motivating people to work together collaboratively to accomplish great things" (p. 18). Accordingly, leadership is a process, not a property of a person. It involves a particular form of influence called *motivating,* resulting in collaboration in pursuit of a common goal to achieve the great things that are in the minds of both leader and followers[5]. Identifying and defining the central competencies of leadership, however, remains elusive. The major purpose of the present study was to empirically investigate the core competencies for medical education leaders – an area that has not been systematically studied.

Leaders face many challenges in healthcare and medical education institutions[6,7,8]. Educational leaders are under scrutiny to achieve heightened expectations for improvement to teaching and learning. They are called to be educational visionaries, instructional and curriculum leaders, assessment experts, community builders, public relations experts, budget analysts, facility managers, special programs administrators, and expert overseers of legal, contractual, and policy mandates and initiatives. Yet, they encounter major challenges such as commercialization of the university's and medical school's central purpose, perceived lack of accountability of higher education, and heightened sensitivity of taxpayers toward ineffective and inefficient leadership in academia[9]. Medical school leaders, in addition, are confronted with many concerns such as financial stability, curriculum development, research

support, and accreditation standards. The ability to meet these demands may be compromised as a result of inadequate and inefficient leadership.

Leadership Theories

In a recent (2011) meta-analysis of trait and behavioral theories of leadership, Derue Nahrgang, Wellman and Humphrey[10] concluded that much of the research evidence fails to provide an integrated framework for understanding what constitutes leadership effectiveness. They did empirically identify some leader traits and behaviors that represent effective leadership, however. The concept of leadership overlaps with two similar terms, management and administration. The former is used widely in Europe and Africa, while the latter is preferred in the United States, Canada and Australia. Leadership is often of great contemporary interest in most countries in the developed world[11].

Some leadership researchers distinguish between leadership, administration and management. They suggest that leadership is synonymous with change while management and administration is considered as maintenance. All three dimensions are identified as critical functions of organizational activity. Taken together, leadership can be construed as a means of shaping the goals, motivations, and actions of others to initiate change or maintain stability[12]. Some researchers have adopted a social perspective to conceptualize leadership. Spillane, Halverson and Diamond[13], for example, argued that leadership activity is defined or constructed through the interaction of leaders and followers during the execution of leadership tasks.

The Importance of Effective Leadership

Many authors[14,15] have argued that high-quality leadership is imperative to the success of educational institutions. Many researchers have emphasized idealized personal characteristics such as educational visionaries, instructional and curriculum leaders, assessment experts, community builders, public relations experts, budget analysts, facility managers, special programs administrators, and expert overseers of legal, contractual, and

policy mandates and initiatives are thought to characterize effective leaders. The preponderance of empirical evidence, however, does not support this trait model of leadership effectiveness[10]. Although effective leaders can have a positive influence on achievement, poor leaders can have a marginal or even negative impact on success[14].

Waters and Grubb[14] in their study reported three major findings that support the notion that school-level leadership matters in student achievement. First, they found that principal leadership was correlated with student achievement; one standard deviation improvement in principal leadership was associated with a 10 percentile increase in student achievement. Second, they identified several leadership practices or processes required to fulfill a number of responsibilities that were significantly and directly related to student achievement. Third, they found a differential impact of leadership – just as leaders can have a positive impact on student's achievement, they also can have marginal or, worse, a negative impact on student's achievement.

Wagner and colleagues operationalized leadership competencies based on a systematic review of research in business practices, resulting in an inventory of over 107 specific competencies [16]. These were categorized to obtain five major competencies including self management that refers to personal insight and self-control; leading others involves motivating others to set and meet goals; task management includes effective and efficient completion of prioritized duties; innovation describes developing a vision and responding to opportunities; and social responsibility entails promoting integrity. It is not yet known whether these types of competencies are relevant to medical education. Indeed, only one study has examined leadership in this context. Violato and Cawthorpe[17] in a systematic review identified key competencies for scholars, teachers, researchers, and leaders in medical education. These include (1) medical education expert, (2) educational leadership, (3) curriculum designer, (4) teacher, (5) educational researcher and scholar, and (6) learner

assessor. They concluded that acquisition of these competencies requires systematic formal education such as graduate studies.

Leadership is a complex, multifaceted phenomena that is widely observed but poorly understood. In consonance with the conclusions of others[1,10] the foregoing review indicates that further empirical work in leadership – particularly in medical education – is required. Given that leadership is associated with student achievement, successful team functioning, and efficient institutional operations, it is critical that an empirically supported, comprehensive definition be developed in medical education. The major purpose of the present study, therefore, was to identify the core competencies for medical education leaders. Accordingly, we adapted a survey questionnaire based on the instrument from Wagner et al.[16] to present to medical education leaders to identify the primary competencies of medical education leadership. Specifically, we wished to address the following research questions: 1) what are the perceived competencies that characterize successful leadership in medical education? 2) Do these perceived leadership competencies in medical education vary by country or language groups or for men and women? 3) Do these desired leadership competencies in medical education differ between physicians and other health professions?

Methods

Participants

Experts

A focus group consisting of 5 medical education experts from three countries (Austria n=1; Germany n=2; Switzerland n=2) was conducted (Master of medical education graduates who earned their Masters degree at University of Bern in collaboration with University of Illinois at Chicago). Their specialization background was medicine (n=2) or health professions (n=3). The mean age of the focus group participants was 43.2 years. They had several years of clinical (M = 10.7 years) and teaching experience (M = 10.3 years), with a few years of medical education leadership (M = 2.4 years).

Survey Respondents

A final sample of 229 participants from six countries completed an electronic survey (338 had been contacted for a 67.8% response rate). Most participants were from Canada (n = 75; 32.8 %), followed by the USA (n = 59; 25.8%), Switzerland (n = 41; 17.9%), Germany (n = 25; 10.9%), Austria (n = 14; 6.6%), and the UK (n=14; 6.1%). The participants all held academic positions in medical education with different backgrounds including physicians (n = 91; 39.7%), nurses (n = 84; 36.7%), educators (n = 25; 10.9%), and other health professionals (n = 29; 12.7%).

There were 135 (59.0%) women and 94 (41.0%) men. The mean age for women was 50.3 years and for men was 51.0 years. There were 137 (59.8%; women = 90; men = 47) from countries with English as the predominant language, 88 (38.4%; women = 45; men = 43) from countries with German as the predominant language, and 4 from countries with various other identified predominant languages (2.2%; Netherlands = 2; Denmark = 1; South Africa = 1). Respondents indicated the following academic titles: Professor = 123 (53.7%); Associate Professor = 37 (16.2%); Assistant Professor = 28 (12.2%); Master degree teacher = 36 (15.7%); and Bachelor degree teacher = 5 (2.2%).

Compared to the 109 participants (32.2%) that did not complete the survey, those that had completed the survey had slightly more years of experience in leadership (M = 11.97(.58) versus M = 8.54 (8.39), $p < .05$), years of teaching experience (M = 17.34(10.81) versus M = 14.26 (10.43), $p < .05$) as they did years of clinical experience (M = 17.75 (12.22) versus M = 15.23(12.26), $p < .05$). There were no differences between the two groups, however, for sex composition, language group, and level of scholar.

Focus Group Procedures

Five experts in a focus group were asked to select the most appropriate competencies relevant for medical education from the Leadership Competency Model questionnaire developed by Wagner et al.[16]. To determine which competencies to retain from the 107 items

dealing with leadership in general, a consensus approach was used. At least four expert raters (80%) were required to independently agree that the competency was applicable to leadership in medical education for the competency to be retained. Based on this procedure the questionnaire was reduced to 63 items applicable to leadership in medical education. In the present study we used the same long definitions as did Wagner et al. but because of space considerations, we used brief descriptions in the tables. Appendix A contains all of the Wagner et al items and an indication of which we retained in the present study and which we did not use.

Survey Procedures

Survey participants were from four medical schools in each country, which was randomly selected using the cluster sampling method (Austria, Canada, Germany, Switzerland, United Kingdom, and the USA). In cluster sampling, according to Gay et al.[18] intact groups rather than individuals are randomly selected. Cluster sampling was the only feasible method of selecting a sample because it was not possible to obtain a list of all members from the theoretical population. Gay et al.[18] suggest using this method when the population is very large and spread over a wide geographical area such as the present sample[±]. The 63-item survey was sent by email to professors, associate professors and assistant professors.

Data Analyses

Reliability of the survey scores was assessed using Cronbach's alpha. In addition to content validity, evidence of factorial validity was assessed using exploratory factor analysis. Specifically, principal components analysis with varimax rotation was utilized. Between group differences were analyzed using contingency tables (Fisher's Exact Test) and

[±] Switzerland has only five medical schools and Austria has four. Switzerland has only four universities that offer academic nursing or health professions education. Austria has also only four such institutions.

multivariate analyses of variance (MANOVAs). The study was approved by the Ethics Review Committee of the University Ambrosiana.

Results

Descriptive Statistics of the Survey Items

Descriptive statistics of the items are summarized in Table 1. Most of the participants rated each item as important (4) or very important (5), but for many items the entire scale (1 – 5) was utilized (Table 1). The means of the items ranged from 3.85 (#18: Honesty and Integrity) to 4.76 (#3: Personnel Decision Quality). The standard deviations are typical (< 1.0) for 5-point items, indicating that data points are clustered closely around the mean.

Principal Component Analyses and Reliability

Several exploratory principal component analyses were conducted resulting in 10, 8, 7 and 5 factor solutions. It was determined that the optimum solution was five factors as they accounted for more than 50% of the variance, were cohesive, and made theoretical sense (see Table 2). The five factors identified as leadership competencies were Social Responsibility, Innovation, Self Management, Task Management, and Justice Orientation.

Of the initial 63 items, eleven were removed since they had small loadings (< 0.40) on all factors. The removed questions were from the following competency domains: one from Task Management; one from Social Responsibility; one from Self Management Competencies; six from Leading Others; and one from Innovation.

As can be seen from Table 2, the eigenvalue for Factor 1 (Social Responsibility) is large (35.55) compared to the others. This shows that the Social Responsibility factor across countries, languages, sex, professions and experiences in medical education was the most cohesive, accounting for the most variance (16.63%). Innovation was identified as the second factor, accounting for 15.35% of the total variance. Self Management, Task Management, and Justice Orientation were also identified as shown in Table 2.

Insert Table 1 Here

The results summarized in Table 2 also show very high reliability of items within each factor. Cronbach`s alpha was 0.93 for Social Responsibility and Innovation, respectively, 0.84 for Self Management, 0.72 for Task Management, and 0.93 for Factor 5 Justice Orientation. All five factors where intercorrelated (mean r = 0.55; range: 0.44 – 0.79; $p < .01$)

Together with the high internal consistency each factor's items, the overall pattern of factor loadings supports the coherence of the factors. Among the items that had the highest loadings on Social Responsibility, for example, are honesty and integrity (.81) and accountability (.81). All the other loadings on this factor were moderate (e.g., >.40) to large (>.80). A similar pattern of loadings is evident for the other four factors.

A close inspection of Table 2 also shows that there is agreement between the items that form the scales of the original instrument[16] and the obtained factor structure. Many of the items do load on the expected factors (or scales) even though our results produced a slightly different set of scales (i.e., Justice Orientation) compared to the original Wagner et al. instrument[16]. The sum of scores was calculated for items with the highest loadings under each factor. These new scores were used as dependent variables in the subsequent analyses.

Insert Table 2 Here

Differences between Countries and Sex Differences

Given the disproportionate number of women (60.9%) in the sample, we compared the number of men and women who spoke each language. Accordingly, a contingency table with sex by language with Fisher`s Exact Test was done. There was a significant difference between the proportion of English speaking women (90; 66.7%) and German (45; 33.3%) speaking ones ($p < .01$), while for men there were approximately equal proportions (English = 51.1%; German 48.9%). Two, one-way ANOVAs (independent variable = sex) with the dependent variables (age and leadership experience) were run. There were no significant

differences for age (F = 0.48, p < 0.49) or for leadership experience (F= 1.80, p < 0.18) between men and women.

Insert Table 3 Here

Sex and Language Differences by Sub-scales

A two-way MANOVA (independent variables = sex and language) with 5 dependent variables (factors = Social Responsibility, Innovation, Self Management, Task Management and Justice Orientation) was run. There was no main effect for sex (Wilk`s lambda = 0.96, p < 0.10). There was a main effect for language (Wilk`s lambda = 0.93, p < 0.007), but on only two factors (Innovation, Justice Orientation) with English speakers providing higher ratings than German speakers on both factors (Table 3). There were no significant interaction effects (Wilk`s lambda = 0.98, p < 0.50). The means and standard deviations of the factors by sex and language are shown in Table 3.

Differences between Physicians and Other Health Professionals

A one-way MANOVA (independent variable = physicians and other health professionals) with 5 dependent variables (factors = Social Responsibility, Innovation, Self Management, Task Management and Justice Orientation) was conducted. There were significant differences between physicians and other health professionals (Wilk`s lambda = 0.93, p < 0.01). As shown in Table 4, Social Responsibility, Innovation, and Justice Orientation were rated higher by other health professionals than by physicians.

To identify which groups of health professionals (nurse, general practitioner, internist, surgeon, and educator)[±] endorse higher ratings on the three leadership competences, a one-way MANOVA was used. There were significant differences across specialties (Wilk`s

[±] A total of 53 specialities in medical and health professions were identified. To permit analyses across specialities they were coded into five groups: (1) nursing, which included nursing, midwifery, physiotherapy, and occupational therapy; (2) general practitioner comprising general practitioners, dentists, family medicine etc. (3) internal medicine comprising internists, gynaecologists, palliative specialists, oncologists, cardiologists, endocrinologists etc. (4) surgery comprising sub-specialities in surgery and anaesthesiologists, and (5) educators comprising psychologists, sociologists, biologists, chemistry educators, administrators etc.

lambda = 0.82, $p < 0.003$). Post hoc tests (Tukey's HSD) revealed that Social Responsibility was rated the highest by nurses (M = 71.79), followed by internists (M = 70.83). General practitioners rated this leadership competency the lowest (M = 66.53). Innovation was rated the highest by nurses (M = 82.23) and the lowest by general practitioners (M = 74.26). Justice Orientation was rated the highest by nurses (M = 21.64) and the lowest by general practitioners (M = 20.20). There were no significant differences for Self Management and Task Management.

Insert Table 4 Here

Group Differences between Junior, Midlevel, Senior and Administrator Scholars

A one-way MANOVA determined whether there were any significant differences in the five leadership competencies across junior, midlevel, senior and administrator level positions. No significant differences were found (Wilk`s lambda = 0.90, $p > 0.05$).

Discussion

The purpose of the present study was to identify and empirically investigate the perceived competencies of leadership in medical education. First, a group of medical education leaders selected 63 of the most important leadership characteristics from a list of 107 identified in previous research. Second, questionnaire data were used in principal component analyses to obtain five competencies of leadership that include Social Responsibility, Innovation, Self Management, Task Management, and Justice Orientation. Cronbach's alpha reliabilities of the factors were high, indicating good coherence and internal consistency. Third, differences between men and women, areas of specialization, and language were found for Social Responsibility, Innovation and Justice Orientation. Fourth, all five factors were strongly intercorrelated indicating that they all assessing the construct of leadership. These combined results suggest that the five leadership competences represent a coherent, reliable, and parsimonious model of leadership in medical education. Moreover,

these fit well with the definition provided by Vroom and Jago[5] of leadership as a process of motivating people to "accomplish great things" in medical education by demonstrating social responsibility, innovation and justice, as well as more prosaic activities of self and task management.

Medical education leaders identified Social Responsibility as the most dominant competency. It was found to be the least important, in contrast, by Wagner et al.[16]. This difference is likely due to the emphasis on collaboration and inter-disciplinary practice within the medical and health professions, in comparison to competition and independence within business[1]. Another major difference between the two models is that we identified a Justice Orientation competency, which was not part of the Wagner et al. [16] model. It is not surprising that maintaining safety, following laws and regulations, and monitoring progress, as indicated by Justice Orientation, are critical to teaching in medicine. Innovation was also deemed to be a major leadership competency in the present study, according to ratings of knowing learning principles and building relationships. With limited resources and high expectations, leadership requires creative approaches that are based on sound principles and human resources. Self Management involves setting and achieving goals despite barriers; and Task Management entails planning and efficiency. All of these qualities are important for managing threats to human health and providing leadership to health professionals.

The expert input from the focus group together with the principal component analyses confirmed that medical educators do have a shared vision of the competencies that comprise effective leadership in medical education. The items of Leading Others in Wagner et al. [17] model are found in our results as well, but are spread across several factors. If a leader demonstrates high social responsibility, innovation, self-management, task-management and justice orientation, these competencies will support him or her to efficiently lead others.

These competencies, in addition, are cohesive, theoretically meaningful and reliable. There were no sex differences on any of the factors. Moreover, while there was generally

agreement in the two language groups on three factors, as indicated by the similarity in scores between languages, there were differences for Innovation and Justice Orientation. It was the English language respondents who rated these two factors higher than did the German language respondents. This probably reflects the emphasis put on innovation and justice in educational and health systems in the Anglo world.

Additionally, there were significant differences between physicians and other health professionals on some of the dimensions (Social Responsibility, Innovation, and Justice Orientation). The physicians gave lower ratings to the importance of these competencies compared to the other health professionals. The majority of responders from other health professions were nurses, followed by physiotherapists, midwives, and educators. This group is likely to spend considerable time with patients developing rapport and perhaps a sense of responsibility for creative solutions to ensure that their personal needs are met. Nurses, thus, may be likely to endorse the need for social responsibility and innovation in medical education. The Justice Orientation competency was also rated higher by other health professionals than by physicians. Knowing and applying principles of fairness to ensure that subordinates are treated fairly, may resonate more with nurses and other health care professionals than with physicians, who tend to be in a position of power over other health care professionals.

Limitations

The survey response rate was high (67.8%) but the completers were slightly older and had slightly more years of teaching and clinical experience than did the non-completers. In several other ways the two groups were the same so it is unlikely that these minor differences produced biased results. All of the six countries represent Western cultures, and, therefore, are not fundamentally different regarding social, economic and demographic characteristics.

Conclusions

The present study indicates that core competencies in medical education leadership can be empirically identified and categorized into five factors: (1) Social Responsibility, (2) Innovation, (3) Self Management, (4) Task Management, and (5) Justice Orientation that are theoretical meaningful, coherent, internal consistent and parsimonious in explaining the variance of the data. Although there are some between-group differences in the factors (physicians versus other health care professionals), there are no substantive differences by country or language. Accordingly, the competencies appear to be stable and coherent. Work in the UK has also resulted in a classification of "clinical leadership" competencies that are in concordance with the present findings[19]. Notwithstanding the limitations of the present study, it is one of the few that has explicitly defined and provided empirical evidence for leadership competencies considered to be the most important in medical education.

Future research should be designed to replicate, extend and confirm the present findings. Our 5-factor leadership competency model needs to be replicated and extended with larger representative samples from other cultures. Future research could be theoretically strengthened by employing confirmatory factor analyses on a new dataset. Meanwhile, we have provided an empirical model of leadership competencies that can be employed to further investigate leadership in medical and health professions education.

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Table 1: Minimum, Maximum, Mean and Standard Deviation of the 63 Questionnaire Items

Items	Min	Max	Mean	SD
1. Maintain Quality	1	5	4.16	0.77
2. Succession Planning/Recruiting	1	5	4.31	0.82
3. Personnel Decision Quality	1	5	4.54	0.69
4. Maintaining Safety	1	5	4.13	0.87
5. Enhancing Task Knowledge	2	5	4.24	0.70
6. Eliminating Barriers to Performa.	1	5	4.26	0.72
7. Strategic Task Management	1	5	4.43	0.70
8. Communication with Community	1	5	3.85	0.90
9. Providing a Good Example	2	5	4.58	0.67
10. Knowledge of Organization Justice	2	5	4.44	0.72
11. Legal Regulations	1	5	4.29	0.75
12. Open-Door Policy	2	5	4.41	0.78
13. Explaining Decisions respect.	1	5	4.55	0.66
14. Servant Leadership	1	5	4.30	0.77
15. Distributing Rewards Fairly	1	5	4.28	0.85
16. Responsibility for Others	1	5	4.24	0.81
17. Financial Ethics	1	5	4.17	0.93
18. Honesty and Integrity	1	5	4.76	0.59
19. Being Accountable	1	5	4.71	0.61
20. Time Management	1	5	4.24	0.71
21. Goal Orientation	2	5	4.21	0.66
22. Taking Initiatives	1	5	4.13	0.74
23. Effort: achieve goals	1	5	4.26	0.73
24. Persistence: despite challenges	2	5	4.32	0.71
25. Self Control	1	5	4.17	0.80
26. Stress Tolerance	2	5	4.36	0.67
27. Adaptability	1	5	4.45	0.73
28. Self Reliance	1	5	4.21	0.79
29. Continuous Learning	1	5	4.36	0.71
30. Seeking Feedback	1	5	4.35	0.72
31. Communicating with Co-workers	2	5	4.51	0.67
32. Active Listening	1	5	4.50	0.71
33. Facilitating Discussion	1	5	4.37	0.71
34. Developing External Contacts	1	5	4.11	0.80
35. Psychological Knowledge	2	5	4.02	0.79
36. Social Perceptiveness	2	5	4.10	0.75
37. Nurturing Relationships	2	5	4.32	0.69
38. Taking Charge	2	5	4.20	0.73
39. Orienting Others	1	5	4.10	0.80
40. Setting Goals for Others	2	5	4.00	0.77
41. Reinforcing Success	3	5	4.18	0.68
42. Developing and Building Teams	2	5	4.32	0.69
43. Knowing Principles of Learning	2	5	3.94	0.83
44. Assessing Others	2	5	4.07	0.71

45. Coaching, Develop, Instructing	1	5	4.23	0.76
46. Cooperating	1	5	4.36	0.66
47. Resolving Conflicts/Negotiating	2	5	4.44	0.62
48. Empowerment	2	5	4.38	0.71
49. Political Savvy	1	5	4.10	0.88
50. Critical Thinking	2	5	4.41	0.68
51. Creative Problem Solving	1	5	4.44	0.72
52. Identifying Problems	3	5	4.44	0.64
53. Seeking Improvement	2	5	4.17	0.76
54. Openness to Ideas	1	5	4.46	0.70
55. Collaborating	1	5	4.36	0.74
56. Perceiving Systems	2	5	4.15	0.76
57. Evaluating Consequences	2	5	4.21	0.76
58. Visioning	2	5	4.02	0.88
59. Managing the Future	2	5	4.20	0.75
60. Sensitivity to Situations	2	5	4.16	0.75
61. Challenging the Status Quo	1	5	4.24	0.82
62. Intelligent Risk-Taking	2	5	4.21	0.75
63. Reinforcing Change	2	5	4.29	0.69

Table 2: Principal Components Orthogonally Rotated Varimax Factor Matrix to the Normalized Kaiser Criterion*

	Factors				
Items	1 Social Responsibility	2 Innovation	3 Self Management	4 Task Management	5 Justice Orientation
Succession Planning /Recruiting				.636 TM	
Personnel Decision Quality				.578 TM	
Maintaining Safety					.480 TM
Enhancing Task Knowledge				.401 TM	
Eliminating Barriers				.457 TM	
Strategic Task Management				.540 TM	
Communication with Community					
Providing a Good Example	.511 SR				
Knowledge of Organization Justice					.546 SR
Legal Regulations					.674 SR
Open-Door Policy	.677SR				
Explaining Decisions respect	.698SR				
Servant Leadership	.563 SR				
Distributing Rewards Fairly	.434 SR				
Responsibility for Others				.486 SR	
Honesty and Integrity	.810 SR				
Being Accountable	.806 SR				
Goal Orientation			.544 SM		
Taking Initiatives			.515 SM		
Effort: achieve			.576 SM		

goals					
Persistence: despite challenges			.516 SM		
Self Control			.484 SM		
Stress Tolerance			.530 SM		
Adaptability	.651 SM				
Self Reliance			.623 SM		
Continuous Learning			.431 SM		
Seeking Feedback	.506 SM				
Communicating with Co-workers	.511 LO				
Active Listening	.658 LO				
Facilitating Discussion	.494 LO				
Developing and Building Teams		.498LO			
Psychological Knowledge		.593LO			
Social Perceptiveness		.649LO			
Setting Goals for Others			.568 LO		
Knowing Principles of Learning		.565LO			
Assessing Others		.495 LO			.567 LO
Coaching, Development, Instruction		.546 LO			.405 LO
Cooperating	.603 LO				
Empowerment	.425 LO				
Political Savvy		.596LO			
Critical Thinking		.521IN			
Creative Problem Solving	.473 LO	.529IN			
Identifying Problems		.509IN			

Openness to Ideas	.654IN				
Collaborating	.542IN	.418IN			
Perceiving Systems		.643IN			
Evaluating Consequences		.616IN			
Visioning		.657IN			
Managing the Future		.720IN			
Sensitivity to Situations		.664IN			
Challenging the Status Quo	.437IN	.499IN			
Intelligent Risk-Taking		.642IN			
Reinforcing Change		.537IN			
Eigenvalue	35.55	5.68	3.66	3.48	3.12
% of Variance	16.63	15.35	7.09	6.92	5.19
M	69.52	79.00	37.71	25.82	20.95
SD	8.22	10.15	4.56	3.06	2.73
Cronbach`s alpha	0.93	0.93	0.84	0.72	0.93

*Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; Rotation converged in 12 iterations; SR = Social Responsibility; LO = Leading Others; SM = Self Management; I = Innovation; TM = Task Management.

Table 3: Means and Standard Deviations for the Five Subscales for Sex and Language

	Sex	Language	M	SD	n
Social Responsibility	Male	English	67.40	11.05	47
		German	68.60	7.72	45
		Total	67.99	9.54	92
	Female	English	71.31	7.35	90
		German	68.63	6.32	43
		Total	70.44	7.12	133
	Total	English	69.97	8.95	137
		German	68.61	7.03	88
		Total	69.44	8.26	225
Innovation*	Male	English	77.68	11.94	47
		German	77.38	10.95	45
		Total	77.53	11.41	92
	Female	English	80.99	9.00	90
		German	77.33	8.54	43
		Total	79.80	8.99	133
	Total	English	79.85	10.18	137
		German	77.35	9.79	88
		Total	78.88	10.09	225
Self Management	Male	English	37.57	5.06	47
		German	37.56	4.93	45
		Total	37.57	4.97	92
	Female	English	38.32	4.23	90
		German	36.60	4.28	43
		Total	37.77	4.31	133
	Total	English	38.07	4.53	137
		German	37.09	4.62	88
		Total	37.68	4.58	225
Task Management	Male	English	25.68	3.25	47
		German	25.69	2.75	45
		Total	25.68	3.00	92
	Female	English	25.84	3.31	90
		German	25.77	2.67	43
		Total	25.82	3.11	133
	Total	English	25.79	3.28	137
		German	25.73	2.69	88
		Total	25.76	3.06	225
Justice Orientation*	Male	English	20.74	3.17	47
		German	19.98	2.84	45
		Total	20.37	3.02	92
	Female	English	21.96	2.30	90
		German	20.19	2.35	43
		Total	21.38	2.45	133
	Total	English	21.54	2.68	137
		German	20.08	2.60	88
		Total	20.97	2.74	225

*$p < .05$

Table 4: Means and Standard Deviations between Physicians and Other Health Professionals

	Physicians versus Health Professions	M	SD	n
Social Responsibility**	Physicians	67.12	9.58	91
	Health Professionals	71.09	6.76	138
	Total	69.51	8.22	229
Innovation**	Physicians	76.20	10.53	91
	Health Professionals	80.83	9.32	138
	Total	78.99	10.05	229
Self Management	Physicians	37.12	5.00	91
	Health Professionals	38.09	4.22	138
	Total	37.70	4.56	229
Task Management	Physicians	25.51	3.06	91
	Health Professionals	26.00	3.05	138
	Total	25.81	3.05	229
Justice Orientation*	Physicians	20.46	2.85	91
	Health Professionals	21.27	2.61	138
	Total	20.95	2.73	229

*p < .05; **p < .01

APPENDIX A

Table (Appendix D): shows the questioner of Wagner et al. (2004), consisting 107 questions.

* = excluded questions in the present study

** = included questions in the present study

Part 1 of 5: Task Management Competencies
*1. * Performing Administrative Activities: Approving requests, handling paperwork, and performing other daily administrative tasks. Entering, transcribing, recording, or storing either written or electronic information.*
*2. **Maintaining Quality: Evaluating materials and information produced against a set of standards through the use of measures of quality in order to track system and/or group progress.*
*3. **Succession Planning/Recruiting: Examining organizational structure to identify staffing issues needed to achieve strategic objectives. Attracting many qualified applicants for open positions within the organization.*
*4. **Personnel Decision Quality: Making good personnel decisions by identifying and assessing the knowledge, skills, and experiences needed to successfully perform a role in the organization.*
*5. * Managing Personnel Policies: Developing and monitoring policies, programs, and procedures related to work practices and compensation.*
*6. **Maintaining Safety: Minimizing potential safety hazards and maintaining compliance with company policies, safety laws, and regulations.*
*7. **Enhancing Task Knowledge: Involving the group in discovering methods to enhance task performance and redirecting the group to achieve better task completion.*
*8. **Eliminating Barriers to Performance: Identifying roadblocks and redundancies in work processes. Promoting improvements in task performance.*
*9. * Benchmarking: Looking outside of the leaders' organization to identify the best practices in task design and performance and integrate these into the leaders' organization.*
*10. **Strategic Task Management: Matching the appropriate people and resources in the organization to maximize task performance.*
Part 2 of 5: Social Responsibility Competencies
*11. **Communicating with the Community: Communicating the organization's intentions and activities to the public (e.g., local press, radio, television) and representing the organization in community affairs and public activities to promote awareness and foster goodwill.*
*12. * Helping the Community: Meeting community needs by promoting opportunities for corporate giving of financial and human resources.*
*13. * Civic Action: Supporting participation in civic duties by encouraging others to vote and engaging in other duties of the political system.*
*14. * Adopting Beneficial Values for Society: Embracing and endorsing values that benefit society at large (not just the leader's organization).*
*15. **Providing a Good Example: Acting in accordance with society's and the organization's laws, rules, and guidelines, and behaving in fair and ethical manner.*
*16. * Social Action: Affecting needed changes in one's community or country by advocating for under-represented or needy groups.*
*17. * Sociology and Anthropology Knowledge: Knowledge of the political systems, values, beliefs, economic practices, and leadership styles of countries other than one's home country, as well as knowledge of universal group dynamics, behavior, and socio-cultural history.*
*18. * History and Geography Knowledge: Knowledge of the physical location and relationships between different land and sea regions and the historical events that have shaped the culture of inhabitants of these regions.*
*19. * Foreign Language Knowledge: Understanding a non-native language in order to communicate in oral and written form with people who speak that language.*
*20. * Philosophy and Theology Knowledge: Knowledge of ethics and the philosophical viewpoints behind various ethical models and understanding how different philosophical and religious systems affect behavior of groups and individuals within a cultural context.*
*21. **Knowledge of Organizational Justice Principles: Knowing and understanding fairness principles and being able to apply them to ensure subordinates are treated fairly. May include knowledge and*

application of equity theory/distributive justice, procedural, interpersonal and informational justice concepts.
*22. **Legal Regulations: Awareness of local, state, and federal laws and regulations and abiding by these regulations at all times.*
*23. **Open-Door Policy: Promoting a climate of openness and trust. Allowing individuals who are upset about an aspect of the organization to voice displeasures without retribution or repercussions.*
*24. * Instituting and Following Fair Procedures: Instituting and applying rules and procedures in a consistent, unbiased, accurate, and correctable fashion to ensure that subordinates know that fair rules are being used.*
*25. **Explaining Decisions in a Respectful Manner: Explaining decisions that affect subordinates thoroughly and in a manner that demonstrates dignity and respect for the subordinates.*
*26. * Ensuring Ethical Behavior of Subordinates: Implementing policies that ensure subordinates treat each other and the organization fairly and with dignity. Disseminating information about laws and regulations to subordinates and make sure that they follow laws and regulations by overseeing, monitoring, and auditing behavior.*
*27. **Servant Leadership: Being attentive to the needs of followers, empathizing with their concerns, and serving their best interests.*
*28. * Valuing Diversity: Encouraging a wide range of viewpoints among team members to promote healthy group process and arrive at culturally sensitive solutions.*
*29. **Distributing Rewards Fairly: Ensuring that pay, recognition, and other rewards are distributed in a fair manner, with clear guidelines and enforcement of those guidelines.*
*30. **Responsibility for Others: Willingness to be responsible for the behavior of subordinates in one's organization and correct their unethical behaviors.*
*31. * Avoiding Exploitative Mentality: Concern for others not sacrificed in the pursuit of organizational goals.*
*32. **Financial Ethics: Understanding and following ethical financial management and accounting principles.*
*33. * Work-Place Ethics: Understanding and following ethical guidelines at one's work place.*
*34. **Honesty and Integrity: Behaving in an honest and ethical manner.*
*35. **Being Accountable: Accepting responsibility for the effects of one's own actions.*
*36. * Courage of Convictions: Avoiding behavior that is unethical even if the unethical behavior is encouraged by the public or by public opinion. Upholding decisions that are ethical but perhaps unpopular.*
Part 3 of 5: Self Management Competencies
*37. **Time Management: Organizing, prioritizing and scheduling tasks in order to maximize the efficiency of how time is used.*
*38. **Goal Orientation: Setting and attaining specific and challenging goals for oneself.*
*39. * Organization Skills: Organizing responsibilities so they can be performed with a maximum level of efficiency.*
40. Work Ethic: Being disciplined and diligent in the course of completing job tasks to ensure their successful completion.
*41. * Follow Through: Ensuring that one's promises are realized in behaviour; or "doing what one said one would do."*
*42. **Initiative: Taking on new challenges.*
*43. **Effort: Exerting oneself to complete tasks successfully and achieve goals.*
*44. **Persistence: Enduring in one's tasks despite challenges or difficulties.*
*45. * Energy: Maintaining enthusiasm as progress is made toward the completion of a task.*
*46. * Optimism: Having a positive outlook about oneself and others.*
*47. **Self Control: Controlling one's emotions even in difficult or challenging situations.*
*48. **Stress Tolerance: Remaining effective even when situations become stressful.*
*49. * Personal Resiliency: Withstanding and overcoming stressful situations.*
*50. * Work/Life Balance: Controlling the reciprocal influence of stresses of one's non-work and work lives.*
*51. **Adaptability: Adapting to changing or dynamic situations.*
*52. * Self Confidence: Believing in one's self and in one's ability to perform a successful job as a leader and acting accordingly.*
*53. * Self Awareness: Ability to honestly assess levels of success in learning or working activities. Knowledge of one's strengths and weaknesses.*
*54. **Self Reliance: Being able to perform at a high level without the guidance or supervision of others.*

55. * Humility: Being able to have a realistic perspective of one's worth and ability and admit mistakes.
56. * Suspending Judgment: Keeping one's personal beliefs and biases from overly influencing one's decisions.
57. * Learning Strategies: Devising plans to develop oneself through the use of multiple approaches.
58. * Intellectual Curiosity: Valuing learning and seeking situations that increase one's knowledge.
59. **Continuous Learning: Keeping informed on updated information within the leader's profession, and keeping up to date on information about leadership in general.
60. **Seeking Feedback: Willingness to seek feedback on one's performance as a leader and to use that feedback to learn and grow as a leader.
Part 4 of 5: Leading Others Competencies
61. **Communicating with Co-workers: Communicating information coherently using either face-to-face, written, or via telephone or computer.
62. **Active Listening: Listening intently to what others are saying and asking for further details when appropriate.
63. **Facilitating Discussion: Promoting openness and courtesy during group work in order to encourage involvement of all group members in completing tasks.
64. * Public Speaking: Vocalizing clearly, maintaining a comfortable pace, and using appropriate non-verbal behaviours during formal presentations. Utilizing visual aids during presentations. Engaging the audience and responding to questions from the audience.
65. **Developing External Contacts: Developing and maintaining contacts with the professional community outside of the organization the leader is working in.
66. * Communicating Outside the Organization: Exchanging information with others outside the organization (e.g., customers, other organizations) using face-to-face or written communications, the telephone, or electronic means.
67. **Psychological Knowledge: Knowledge of human behavior, mental processes, and individual and group performance.
68. * Social Orientation: Being comfortable interacting and working with others.
69. **Social Perceptiveness: Awareness and understanding of how and why others are reacting the way they are.
70. * Service Orientation: Actively seeking out ways to assist others with their duties.
71. **Nurturing Relationships: Building positive and cooperative working relationships with others and maintaining those relationships over time.
72. **Taking Charge: Initiating the activities of a group and leading them toward common goals.
73. **Orienting Others: Providing new employees an overview of the organization and its policies, work rules, and job responsibilities.
74. **Setting Goals for Others: Setting challenging but attainable goals for individuals and groups. Specifying actions, strategies and timelines necessary for goal attainment.
75. **Reinforcing Success: Measuring and tracking progress toward goals to evaluate individual and group performance and provide feedback. Rewarding others' positive work behavior to reinforce activities that are aligned with the goals of the work group and the organization.
76. **Developing and Building Teams: Effectively managing groups during the early stages of group functioning. Promoting cooperation, trust, and confidence to enhancing the performance of a group and the satisfaction of group members.
77. **Knowledge of Principles of Learning: Knowledge of learning theories and how to design individual and group teaching activities.
78. * Interpreting the Meaning of Information for Others: Translating or explaining information in a way that it can be understood by others.
79. **Assessing Others: Evaluating the strengths and weaknesses of others' efforts at learning or performing tasks.
80. **Coaching, Developing, Instructing: Coaching, teaching, and advising others to help them develop their knowledge and skills. Creating individual development plans. Selecting appropriate training courses to address developmental needs.
81. **Cooperating: Working well with others to jointly achieve goals.
82. * Persuading: Convincing others to perform a task or to approach a problem in a different manner.
83. **Resolving Conflicts/Negotiating: Dealing with complaints, resolving conflicts, and addressing the grievances of others. Encouraging others to reconcile differences together.
84. **Empowering: Delegating authority and investing power in others.
85. * Inspiring: Convincing others to believe in the organization's values and to act in accordance with those values.

*86. **Political Savvy: Knowledge of the political climate of their organization and how decisions/outcomes will be affected by that climate.*
Part 5 of 5: Innovation Competencies
*87. * Generating Ideas: Devising a variety of approaches to solving a problem.*
*88. **Critical Thinking: Understanding the strengths and weaknesses of different approaches to solving a problem, and making decisions based on this evaluation.*
*89. * Synthesis/Reorganization: Combining known information about a problem and reevaluating it to find better solutions.*
*90. **Creative Problem Solving: Using novel ideas to solve problems. Thinking "outside of the box."*
*91. **Identifying Problems: Pinpointing the actual nature and cause of problems and the dynamics that underlie them.*
*92. **Seeking Improvement: Constantly seeking ways to improve the leader's organization.*
*93. * Gathering Information: Identifying useful sources of information. Isolating, gathering and utilizing only that information which is essential to solving a problem.*
*94. * Independent Thinking: Autonomously engaging in problem solving processes. Ability to resist popular but irrational approaches toward solving a problem.*
*95. * Technological Savvy: Understanding and utilizing technology to improve work processes.*
*96. **Openness to Ideas: A willingness to listen to suggestions from others and to try new ideas.*
*97. * Research Orientation: Observing the behavior of others, reading extensively, and keeping an open mind toward ideas and solutions from others. Reading and talking to people in related fields to discover innovations or current trends in the field.*
*98. **Collaborating: Working with and seeking the opinions of others.*
*99. * Engaging in Non-Work Related Interests: Being "well-rounded." Seeking out information from other fields and areas of life to find information applicable to one's own situation.*
*100. **Perceiving Systems: Understanding important changes that occur in an organizational system and/or predicting accurately when change might occur.*
*101. **Evaluating Long-Term Consequences: Understanding how a change in an organizational system will effect the system in the long-term.*
*102. **Visioning: Developing, disseminating, and "selling" an image of an ideal working state of the leader's organization.*
*103. **Managing the Future: Evaluating future directions and risks based on current and prospective strengths, weaknesses, opportunities and threats.*
*104. **Sensitivity to Situations: Assessing situational forces and variables that are promoting or inhibiting changes in an organization.*
*105. **Challenging the Status Quo: Willingness to act against the way things have traditionally been done when these traditions are found to actually hinder performance or prevent improvements.*
*106. **Intelligent Risk-Taking: Willingness and ability to evaluate risk and reward information. Using that information to determine the appropriateness of making a potentially risky decision.*
*107. **Reinforcing Change: Encouraging subordinates to come up with innovative solutions. Recognizing and rewarding those who take initiative and act in a creative manner. Facilitating the institutionalization of change initiatives.*

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 5
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-8
Objectives	3	State specific objectives, including any pre-specified hypotheses	8
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-10
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	8-9
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9-10
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10
		(*b*) Describe any methods used to examine subgroups and interactions	10
		(*c*) Explain how missing data were addressed	10
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	

		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 11
		(b) Indicate number of participants with missing data for each variable of interest	12
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	12-14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13-14
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.