Implementation of community-acquired pneumonia guidelines at a public hospital in Brazil*

Implementação de uma diretriz para pneumonia adquirida na comunidade em um hospital público no Brasil

Lucieni Oliveira Conterno, Fábio Ynoe de Moraes, Carlos Rodrigues da Silva Filho

Abstract

Objective: To implement community-acquired pneumonia (CAP) guidelines at a public hospital in Brazil and to evaluate the impact of these guidelines on health care quality. **Methods:** A quasi-experimental study, with a before-and-after design, involving adult patients diagnosed with CAP and hospitalized between July of 2007 and October of 2008 in the general ward of the Marília School of Medicine *Hospital das Clínicas*, located in the city of Marília, Brazil. **Results:** During the study period, 68 patients were diagnosed with CAP: 48 before the implementation of the guidelines and 20 after their implementation. After the implementation of the guidelines, 85% of the cases were treated in accordance with the guidelines, and there was a significant increase in the use of antibiotic therapy for atypical bacteria in patients with severe CAP (6.3% vs. 75.0%; $p < 0.001$). Comparing the pre-implementation and post-implementation periods, we observed a trend toward a decrease in the mortality (35.4% vs. 15.0%; $p = 0.09$) and toward an increase in the recording of SpO_2 in the medical charts of the patients (18% vs. 30%; $p = 0.42$). During the study period, the degree of severity was not recorded on the medical charts of most patients. In addition, the initiation of antibiotic therapy followed a pre-established schedule, regardless of the severity of the infection. **Conclusions:** This study showed that, although the development and implementation of CAP guidelines promoted the optimization of the treatment, there were no significant differences regarding the assessment of severity, SpO_2 recording, or the initiation of antibiotic therapy. Therefore, strategies that are more effective are needed in order to modify variables related to the work of physicians and nurses.

Keywords: Guideline adherence; Pneumonia; Health care quality, access, and evaluation; Community-acquired infections.

Resumo

Objetivo: Implementar uma diretriz para pneumonia adquirida na comunidade (PAC) em um hospital público no Brasil e avaliar seu impacto na qualidade da assistência à saúde. **Métodos:** Estudo quasi-experimental com delineamento antes e depois que incluiu os pacientes adultos diagnosticados com PAC e internados na enfermaria geral do Hospital das Clínicas da Faculdade de Medicina de Marília, na cidade de Marília (SP), entre julho de 2007 e outubro de 2008. **Resultados:** Durante o período do estudo, 68 pacientes foram diagnosticados com PAC: 48 antes da implementação da diretriz e 20 após sua implementação. Após a implementação da diretriz, 85% dos casos foram tratados em conformidade com a diretriz, e houve um aumento significativo no uso de antibioticoterapia para germes atípicos nos casos de PAC grave (6,3% vs. 75,0%; $p < 0,001$). Houve uma tendência de diminuição da mortalidade (35,4% vs. 15,0%; $p = 0,09$) e de aumento do registro de SpO_2 nos prontuários dos pacientes (18% vs. 30%; $p = 0,42$) após a implementação da diretriz. Durante o período do estudo, não houve registros da avaliação da gravidade nos prontuários da maioria dos pacientes. Além disso, o início da antibioticoterapia seguiu um esquema de horário pré-estabelecido, independentemente da gravidade do quadro infeccioso. **Conclusões:** Este estudo mostrou que a elaboração e a implementação da diretriz para PAC promoveu a otimização da escolha terapêutica, mas não houve diferenças significativas quanto à avaliação de gravidade, registro de SpO_2 ou no início da antibioticoterapia, evidenciando que as variáveis que se relacionam ao processo de trabalho médico e de enfermagem exigem estratégias mais efetivas para serem modificadas.

Descritores: Fidelidade a diretrizes; Pneumonia; Acesso e avaliação da qualidade da assistência à saúde; Infecções comunitárias adquiridas.

---

* Study carried out at the Marília School of Medicine, Marília, Brazil.

Correspondence to: Lucieni Oliveira Conterno. Rua Zorobabel Silva Leite, 134, Residencial de Recreio Maria Isabel, Bairro Maria Isabel, CEP 17515-500, Marília, SP, Brasil.
Tel 55 14 3402-1831. E-mail: lucieni@famema.br

Financial support: This study received financial support from the *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP, São Paulo Research Foundation) via the research support system of the *Programa de Pesquisa para o Sistema Único de Saúde* (PPSUS, Unified Health Care System Research Program) - Public Policies (Project no. 06/61909-2).
Submitted: 5 November 2010. Accepted, after review: 3 January 2011.

Introduction

Community-acquired pneumonia (CAP) is one of the leading causes of hospitalization, especially among elderly patients, and one of the leading causes of death among hospitalized patients in Brazil.[1-5] However, there is great variability in the care of patients with this disease.

Studies have shown that the percentage of patients diagnosed with CAP and receiving antibiotic therapy in the first four hours after admission is approximately 40%,[6] that the concordance between prescribed antimicrobial agents and those recommended in existing clinical guidelines can range from 5% to 50%, and that blood oxygenation is assessed in few patients. Because some of these variations have been associated with higher mortality, they have come to be considered quality indicators.[7,8]

Since the 1990s, the United States has proposed national projects, such as the National Pneumonia Project and the initiatives of the Joint Commission on Accreditation of Healthcare Organizations, with the aim of assessing the quality of health care delivered to patients with CAP. Chief among the measures used for assessing the quality of health care delivered to patients with CAP are the assessment of oxygenation, the choice of antibiotic therapy—including therapy for atypical pathogens—the door-to-antibiotic time, in-hospital mortality, and costs.[9]

Because many of the abovementioned variables can be translated into actions that can be systematically adopted in Brazil, we decided to develop clinical guidelines aimed at the initial evaluation of patients with clinical suspicion of CAP and to determine the impact that the implementation of those guidelines has on the quality of health care.

Methods

This was a quasi-experimental study, with a before-and-after design, conducted in the adult general ward of the *Faculdade de Medicina de Marília* (FAMEMA, Marília School of Medicine) *Hospital das Clínicas*, located in the city of Marília, Brazil, in order to evaluate the impact of the implementation of clinical guidelines for CAP.[10] We collected data on all adult patients hospitalized in the clinical medicine ward between July of 2007 and October of 2008 (10 months before and 6 months after the implementation of the guidelines, respectively).

The patients were followed from admission to discharge. In addition to general data, we collected information to assess the quality of health care (classification of severity, SpO_2 determination, mean door-to-antibiotic time, degree of compliance between the antibiotic therapy prescribed and the guideline recommendations, and mortality).

Descriptive statistics were computed for all study variables. Quantitative data are expressed as means and standard deviations and were compared by Student's t-test. Qualitative data are expressed as absolute values and percentages (of all cases) and were analyzed by the chi-square test, with Yates' correction or Fisher's exact test, as necessary. Data were entered into a Microsoft Excel database, after which they were processed and analyzed with the Statistical Package for the Social Sciences, version 19.0 (SPSS Inc., Chicago, IL, USA). All statistical tests were two-tailed. The level of statistical significance was set at $p < 0.05$.

The actual intervention was the development, implementation, and dissemination of the CAP guidelines, which included a search of the literature for evidence and for existing clinical guidelines; the identification of key people and opinion leaders who are involved in the direct care of patients or who are responsible for the instruction of residents; the development of the initial proposal; and the discussion of suggestions in person or via e-mail.

For the development of the CAP guidelines, we adopted a mortality prediction score known as CURB-65 (CURP-65 in Portuguese), an acronym based on the key terms of the following parameters: mental Confusion (altered level of consciousness); Urea > 40 mg/dL; Respiratory rate > 30 breaths/min; Blood pressure (systolic < 90 mmHg or diastolic < 60 mmHg); and age > 65 years. Each parameter is given a point score, higher scores corresponding to a higher risk of death. We selected this particular score to assess severity because it is user-friendly and it is currently used in various countries.[11-13] Additional severity criteria were applied: involvement of several lobes or bilateral involvement shown on chest X-ray; $SpO_2 < 90\%$

or PaO_2 < 60 mmHg; and decompensated underlying disease.

The recommendation for antimicrobial treatment considered the susceptibility pattern of *Streptococcus pneumoniae* reported for Brazil, the inclusion of a macrolide in the initial treatment of severe pneumonia; place of admission, and the presence or absence of risk factors for infection with gram-negative organisms.[14-17] We emphasized the need to start antimicrobial treatment as soon as possible after the diagnosis has been established.[3,15,18,19]

It was necessary to include macrolides and fluoroquinolones on the pharmacy requisition form and to make such medications readily available; to purchase digital oximeters, making them available in the wards and the emergency room for the determination of the clinical severity of the cases; and to use digital prescriptions in order to improve clarity and reduce errors, to which end computers and printers were purchased for the prescription rooms of the wards and the emergency room.

For disseminating these guidelines, we used various strategies, including weekly clinical meetings, in which real cases of hospitalized patients were used for evaluating the guideline recommendations; the distribution of educational material (pocket booklets) containing the guidelines to all professors, attending physicians, emergency room physicians, residents, and internists; and the production of posters summarizing and systematizing the initial approaches to the treatment of patients with CAP (Figure 1). These posters were displayed in the prescription rooms of the wards and the emergency room. All of the educational material was made universally available, for viewing or printing, on the FAMEMA website.

This study was approved by the FAMEMA Research Ethics Committee (protocol no. 066/07).

Results

Between July of 2007 and October of 2008, 120 patients diagnosed with respiratory infection were hospitalized in the clinical medicine ward of the FAMEMA *Hospital das Clínicas*. Of those, 68 (66.6%) were diagnosed with CAP, 14 (13.7%) were diagnosed with nosocomial pneumonia, 10 (9.8%) presented with COPD and infection, and 10 (9.8%) were not diagnosed with any infection. Of the 68 patients with CAP, 42 (61.8%) were male. The mean age was 68.5 ± 19.2 years (range: 16-96 years). The mean length of hospital stay was 17.2 ± 19.8 days, and most patients were admitted to the hospital via the emergency room, the mean time to transfer to the ward being 8 ± 5 h (Table 1).

Of the 68 patients diagnosed with CAP, 6 (8.8%) were treated with ampicillin, 9 (13.2%) were treated with ciprofloxacin, 18 (26.5%) were treated with clindamycin, 7 (10.2%) were treated with cephalosporin with antipseudomonal activity, 43 (63.2%) were treated with ceftriaxone and combinations of antimicrobial agents, and 18 (26.5%) were treated with ceftriaxone and azithromycin.

In the initial evaluation, SpO_2 was registered on the medical charts of only 15 patients (22.0%). In terms of severity, we found that 28 patients (42.6%) had a CURB-65 score ≤ 2 points and 39 (57.4%) had a CURB-65 score ≥ 3 points. In 32 patients (47.1%), pulmonary infection had significant systemic repercussions, resulting in severe sepsis. Overall mortality was found to be 29.4% (20/68). Data regarding the precise timing of the administration of the first dose of the antimicrobial agent could not be computed.

The comparison of the data obtained before and after the implementation of the clinical guidelines revealed that the combination of a beta-lactam and a macrolide was prescribed in 3 (6.3%) of the 48 cases treated in the pre-implementation period and in 15 (65.0%) of the 20 cases treated in the post-implementation period, this difference being statistically significant ($p < 0.001$). The use of ciprofloxacin in the treatment of CAP was abolished after the implementation of the guidelines (18% vs. 0% of the cases treated; $p = 0.038$).

There was a statistically significant difference in the proportion of patients diagnosed with sepsis or severe sepsis between the two evaluation periods: sepsis was diagnosed in 19 (39.6%) of the 48 cases treated in the pre-implementation period and in 13 (65.0%) of the 20 cases treated in the post-implementation period ($p = 0.05$).

Overall CAP-related mortality in the pre-implementation and post-implementation periods was, respectively, 35.4% and 15.0%. However, this difference did not reach statistical significance ($p = 0.09$).

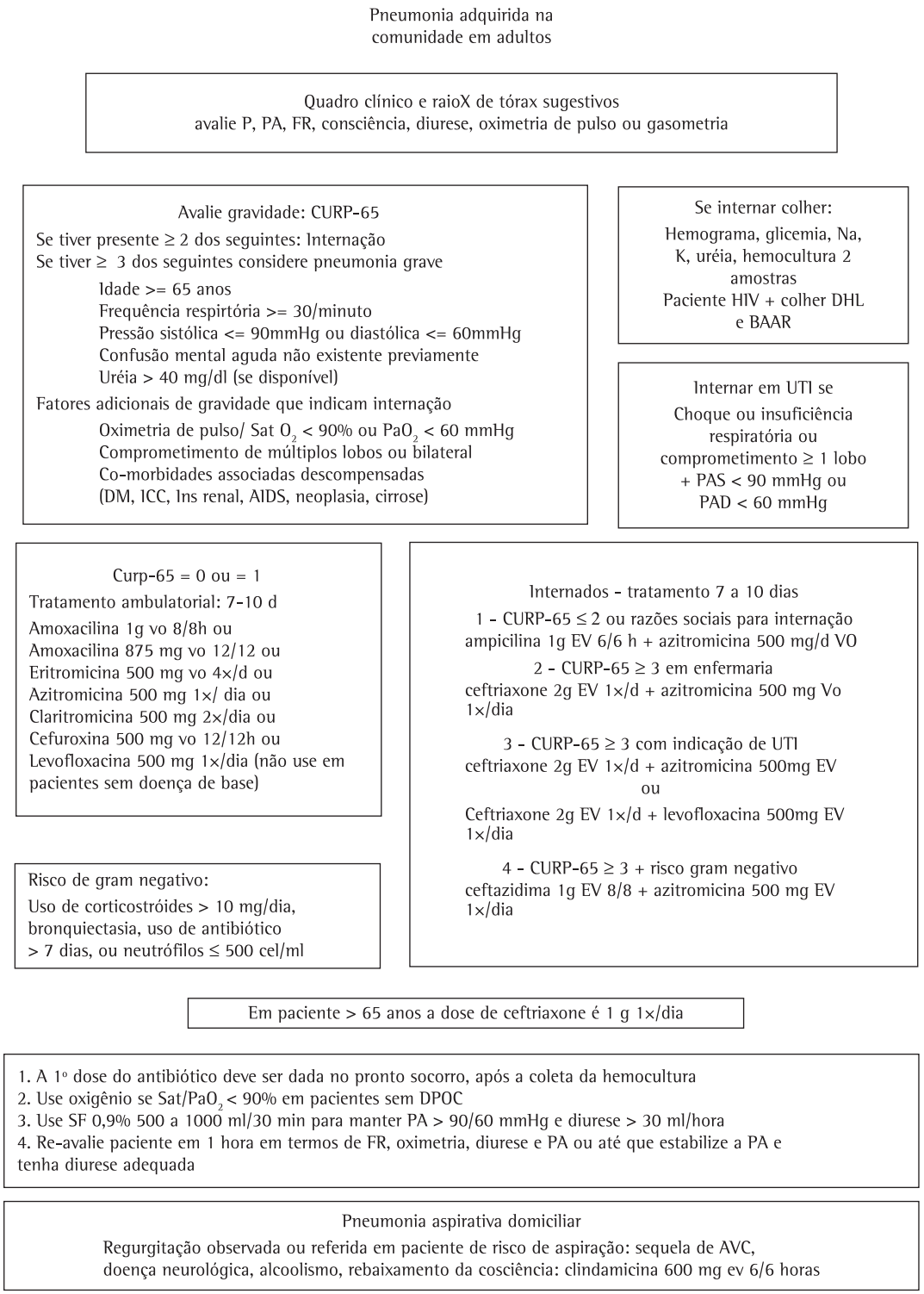

Figure 1 - Poster displayed in the emergency room and in the wards depicting the guidelines for the approach to the hypothesis of community-acquired pneumonia.

Table 1 - Characteristics of the patients hospitalized for community-acquired pneumonia between July of 2007 and October of 2008 at the Marília School of Medicine *Hospital das Clínicas de Marília*, located in the city of Marília. Brazil[a]

Characteristic	Pre-implementation period	Post-implementation period	Total	p
Diagnosed patients, n	48	20	68	
Male	28 (58.3)	14 (70.0)	42 (61.8)	0.36
Female	20 (41.7)	6 (30.0)	26 (38.2)	
Age, in years[b]			68.5 ± 19.2	
Recording of SpO_2 on the medical chart	9 (19)	6 (30)	15 (19)	0.42
CURB-65 score ≥ 3	27 (56.3)	12 (60.0)	39 (57.4)	0.77
Severe sepsis	19 (39.6)	13 (65.0)	32 (47.1)	0.056
Prescribed antimicrobial agents				
Ceftriaxone	26 (54.2)	17 (85.0)	43 (63.2)	0.01
Ciprofloxacin	9 (18.8)	0 (0.0)	9 (13.2)	0.009
Clindamycin	15 (31.3)	3 (15.0)	18 (26.5)	0.16
Azithromycin	4 (8.3)	15 (75.0)	19 (27.9)	0.0001
β-lactam + macrolide	3 (6.3)	15 (75.0)	18 (26.5)	0.0001
Hospital stay, in days[b]	17.8 ± 22	16.1 ± 13.4	17.2 ± 19.8	0.32
Death	17 (35.4)	3 (15.0)	20 (29.4)	0.09

CURB-65: (mortality prediction score) mental Confusion, Urea, Respiratory rate, Blood pressure, and age > 65 years. [a]Values expressed as n (%), except where otherwise indicated. [b]Values expressed as mean ± SD.

Discussion

The primary objective of developing and implementing the clinical guidelines for CAP was to improve the quality of health care provided to patients hospitalized in the clinical medicine ward of the FAMEMA *Hospital das Clínicas*, by means of a proposal that reflected the best scientific knowledge available, adapted to the local situation, and to evaluate the impact that the implementation of those guidelines had on the quality of health care.

The development of the clinical guidelines for CAP was a difficult process, due to the challenge of adapting evidence to the Brazilian situation in terms of structure and culture, as well as to the attempt to legitimize the proposal, involving the professionals directly responsible for providing care to patients with CAP, especially emergency room physicians.

These guidelines were intended to affect the complete process of providing care to patients with CAP, from the beginning of treatment, by proposing the following: the assessment of severity with the CURB-65 score; the routine measurement and recording of SpO_2 on the medical charts; and the use of an antimicrobial regimen recommended in the guidelines and started in the emergency room. The ultimate goal was for the implementation of the guidelines to have a positive impact on mortality.

When evaluating the severity of the hospitalized cases of CAP, we observed that most patients had CURB-65 scores ≥ 3, which would justify hospitalization. However, despite the availability of information allowing this calculation, it was not possible to identify the systematic recording of CURB-65 scores on the medical charts.

The lack of assessment of severity by CURB-65 score shows that the professionals working in the emergency room did not incorporate this score as an instrument to assist the decision-making process. However, in bedside discussions of cases in the wards, the CURB-65 score was routinely used by preceptors and residents, which corroborates the hypothesis that this difficulty was restricted to emergency room physicians.

Similarly, SpO_2, as measured by pulse oximetry, was registered in only 18% and 30% of the patients with CAP in the pre-implementation and post-implementation periods, respectively, with no statistically significant difference between the periods ($p = 0.42$). Our hypothesis is that this parameter was measured but not registered, which reveals another serious problem in Brazil: failure to register data on medical charts.

A culture of producing appropriate and complete medical chart records needs to be fostered and monitored in Brazil. Physicians need to be convinced that correct documentation is essential for them to organize their thinking, explain their approach, support their diagnosis, and share information with other professionals. When using a measure of severity, such as SpO_2, physicians are stratifying patients who require more care and signaling other physicians that they should remain alert due to the increased risk of complications and death in those patients.

Historically, medical chart records have been considered poor and problematic, usually not reflecting what was actually done for patients—correct or incorrect approaches—or the real situation of the cases, and this lack of data has made it impossible to establish cause-and-effect relationships between the prescribed approach and disease progression, as was observed in the present study.

The implementation of the clinical guidelines for CAP resulted in significant advances mainly related to the therapeutic approach. In the post-implementation period, most patients received antimicrobial agents as proposed in the guidelines: 17 (85%) of the 20 patients were treated with a beta-lactam, predominantly a third-generation cephalosporin (ceftriaxone). It is also of note that 75% of the patients received antibiotic therapy for atypical pathogens in the post-implementation period, compared with 6.3% in the pre-implementation period, a difference that was statistically significant ($p < 0.001$). This finding is extremely important, because the use of second-generation or third-generation cephalosporins in combination with a macrolide has been associated with lower mortality when compared with the use of a cephalosporin alone.[20] Physicians stopped prescribing ciprofloxacin for the treatment of CAP, a finding that is quite relevant given that this drug is ineffective against pneumococci. The increase in the number of diagnosed cases of sepsis/severe sepsis observed after the implementation of the guidelines is probably due to the standardization of a sepsis diagnosis protocol, which did not exist previously, rather than to increased prevalence in itself, and this is a positive change.

The time elapsed between the arrival of the patient diagnosed with CAP at the hospital and the administration of the antimicrobial agent has been considered a measure of the quality of health care, given that there are studies showing that the administration of antibiotics within the first hours after admission can reduce mortality by 30%.[6]

The present study failed to change the door-to-antibiotic time, because, as a rule, the patients received the medication according to a pre-established schedule, which reveals the persistence of an archaic process of health provision, focused on a pre-established routine rather than on the needs of individual patients

In a study conducted in 2008,[21] in which possible barriers to the prompt and proper administration of antimicrobial agents to patients with CAP were evaluated, insufficient knowledge about antimicrobial agents, the heavy workload in health care facilities, the lack of appropriate supervision of residents, and the difficulties related to the diagnosis of CAP were identified as such barriers. This was one of the major obstacles that we could not overcome, because here we also found problems in the initial treatment of patients in the emergency room. These problems were related to the work process, drug distribution logistics, the overwhelming numbers of patients with different nosological profiles and different levels of severity, understaffing, the delay in performing X-rays, and the lack of awareness of the importance of the timing of the initiation of antimicrobial therapy in the progression of infections.

In two other studies,[22,23] it was suggested that patients are more likely to receive the antimicrobial agent in a timely manner when the drug is administered in the emergency room, to which end it is necessary that the work process be reviewed and that the emergency room pharmacy have the antimicrobial agents recommended in the guidelines in stock.

Our study did not detect a statistically significant difference in mortality. However, the differences found (35.4% and 15.0% in the pre-implementation and post-implementation periods) could be interpreted as a trend, the confirmation of which requires a longer period of observation and a larger number of cases. It was estimated that, for this difference to be found significant, at least 10 more cases would be necessary in the second period of evaluation.

Another possibility is that the severity of the cases, which was similar in the two periods and is known to be a determinant of mortality, did not allow the implementation of the guidelines to affect disease progression, similarly to what was observed in a study conducted in 2004.[24]

We identified the need for a ongoing monitoring process, to which end it is essential that preceptors be more involved so as to begin to conduct case discussions, considering the approaches recommended by the guidelines, and be committed to checking medical chart records.

In conclusion, our study showed that, at this writing, the implementation of these CAP guidelines was able to modify the antimicrobial prescription pattern but not to change the timing of the administration of the first dose to patients or to ensure the recording of severity or SpO_2 in the initial approach to patients. There was a trend toward lower in-hospital mortality. Changes in the emergency room working conditions are essential so that CAP guidelines can actually have an impact on the quality of health care in all its dimensions.

The difficulties found might be due to factors related to users (they did not know or were not familiarized with what was being proposed, did not agree with or did not feel able to adopt the recommendations, or even acted out of inertia), structure-related factors (lack of time, excessive workload, and nonstandardized work process), or factors related to the guidelines themselves.[25]

The implementation of clinical guidelines is known to be an arduous task that needs to be performed in successive stages and with multiple strategies that are redundant and aligned so that aspects related to knowledge, attitude, and behavior can be changed.[26-28] Time, enthusiasm, and resources are needed for these theoretical recommendations to be fully incorporated into the daily routine.

References

1. Levy ML, Le Jeune I, Woodhead MA, Macfarlaned JT, Lim WS; British Thoracic Society Community Acquired Pneumonia in Adults Guideline Group. Primary care summary of the British Thoracic Society Guidelines for the management of community acquired pneumonia in adults: 2009 update. Endorsed by the Royal College of General Practitioners and the Primary Care Respiratory Society UK. Prim Care Respir J. 2010;19(1):21-7.
2. McCabe C, Kirchner C, Zhang H, Daley J, Fisman DN. Guideline-concordant therapy and reduced mortality and length of stay in adults with community-acquired pneumonia: playing by the rules. Arch Intern Med. 2009;169(16):1525-31.
3. Corrêa Rde A, Lundgren FL, Pereira-Silva JL, Frare e Silva RL, Cardoso AP, Lemos AC, et al. Brazilian guidelines for community-acquired pneumonia in immunocompetent adults - 2009. J Bras Pneumol. 2009;35(6):574-601.
4. DATASUS [homepage on the Internet]. Brasília: Ministério da Saúde [cited 2008 Aug 10]. Available from: www.datasus.gov.br
5. Toyoshima MT, Ito GM, Gouveia N. Trends in morbidity for respiratory diseases among hospitalized patients in the city of São Paulo [Article in Portuguese]. Rev Assoc Med Bras. 2005;51(4):209-13.
6. Barlow G, Nathwani D, Davey P. The CURB65 pneumonia severity score outperforms generic sepsis and early warning scores in predicting mortality in community-acquired pneumonia. Thorax. 2007;62(3):253-9.
7. Reyes Calzada S, Martínez Tomas R, Cremades Romero MJ, Martínez Moragón E, Soler Cataluña JJ, Menéndez Villanueva R. Empiric treatment in hospitalized community-acquired pneumonia. Impact on mortality, length of stay and re-admission. Respir Med. 2007;101(9):1909-15.
8. Müller B, Harbarth S, Stolz D, Bingisser R, Mueller C, Leuppi J, et al. Diagnostic and prognostic accuracy of clinical and laboratory parameters in community-acquired pneumonia. BMC Infect Dis. 2007;7:10.
9. Lindenauer PK, Behal R, Murray CK, Nsa W, Houck PM, Bratzler DW. Volume, quality of care, and outcome in pneumonia. Ann Intern Med. 2006;144(4):262-9.
10. Harris AD, Bradham DD, Baumgarten M, Zuckerman IH, Fink JC, Perencevich EN. The use and interpretation of quasi-experimental studies in infectious diseases. Clin Infect Dis. 2004;38(11):1586-91.
11. Lim WS, van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, et al. Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. Thorax. 2003;58(5):377-82.
12. Man SY, Lee N, Ip M, Antonio GE, Chau SS, Mak P, et al. Prospective comparison of three predictive rules for assessing severity of community-acquired pneumonia in Hong Kong. Thorax. 2007;62(4):348-53.
13. Bauer TT, Ewig S, Marre R, Suttorp N, Welte T; CAPNETZ Study Group. CRB-65 predicts death from community-acquired pneumonia. J Intern Med. 2006;260(1):93-101.
14. Arnold FW, Summersgill JT, Lajoie AS, Peyrani P, Marrie TJ, Rossi P, et al. A worldwide perspective of atypical pathogens in community-acquired pneumonia. Am J Respir Crit Care Med. 2007;175(10):1086-93.
15. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, Campbell GD, Dean NC, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. 2007;44 (Suppl 2):S27-S72.
16. Macfarlane JT, Boldy D. 2004 update of BTS pneumonia guidelines: what's new? Thorax. 2004;59(5):364-6.
17. da Cunha CA, Sader HS, Nicodemo AC; Brazilian Society for Infectious Diseases Practice Guidelines Committee. Antimicrobial therapy for community-acquired pneumonia in adults. Braz J Infect Dis. 2002;6(2):82-7.
18. Houck PM, Bratzler DW, Nsa W, Ma A, Bartlett JG. Timing of antibiotic administration and outcomes for

Medicare patients hospitalized with community-acquired pneumonia. Arch Intern Med. 2004;164(6):637-44.
19. Waterer GW, Kessler LA, Wunderink RG. Delayed administration of antibiotics and atypical presentation in community-acquired pneumonia. Chest. 2006;130(1):11-5.
20. Weiss K, Tillotson GS. The controversy of combination vs monotherapy in the treatment of hospitalized community-acquired pneumonia. Chest. 2005;128(2):940-6.
21. Barlow G, Nathwani D, Myers E, Sullivan F, Stevens N, Duffy R, et al. Identifying barriers to the rapid administration of appropriate antibiotics in community-acquired pneumonia. J Antimicrob Chemother. 2008;61(2):442-51.
22. Schouten JA, Hulscher ME, Kullberg BJ, Cox A, Gyssens IC, van der Meer JW, et al. Understanding variation in quality of antibiotic use for community-acquired pneumonia: effect of patient, professional and hospital factors. J Antimicrob Chemother. 2005;56(3):575-82.
23. Fine JM, Fine MJ, Galusha D, Petrillo M, Meehan TP. Patient and hospital characteristics associated with recommended processes of care for elderly patients hospitalized with pneumonia: results from the Medicare quality indicator system pneumonia module. Arch Intern Med. 2002;162(7):827-33.
24. Almeida, JR, Ferreira Filho OF. Pneumonias adquiridas na comunidade em pacientes idosos: aderência ao Consenso Brasileiro sobre pneumonias. J Pneumol. 2004;30(3):229-36.
25. Compton S, Lang E, Richardson TM, Hess E, Green J, Meurer W, et al. Knowledge translation consensus conference: research methods. Acad Emerg Med. 2007;14(11):991-5.
26. Grimshaw J, Eccles M, Tetroe J. Implementing clinical guidelines: current evidence and future implications. J Contin Educ Health Prof. 2004;24(Suppl 1):S31-7.
27. Grimshaw JM, Eccles MP. Is evidence-based implementation of evidence-based care possible? Med J Aust. 2004;180(6 Suppl):S50-1.
28. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud P, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA. 1999;282(15):1458-65.

About the authors

Lucieni Oliveira Conterno
Coordinator. Department of Infectious Diseases and Center for Clinical Epidemiology, Marília School of Medicine, Marília, Brazil.

Fábio Ynoe de Moraes
Medical Student. Marília School of Medicine, Marília, Brazil.

Carlos Rodrigues da Silva Filho
Coordinator. Department of Clinical Medicine, Marília School of Medicine, Marília, Brazil.