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Original Study

Antibiotic Prescribing In Dutch Nursing Homes: How Appropriate Is It?

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A B S T R A C T

Objective: To investigate the appropriateness of decisions to prescribe or withhold antibiotics for nursing home (NH) residents with infections of the urinary tract (UTI), respiratory tract (RTI), and skin (SI).
Design: Prospective study.
Setting: Ten NHs in the central-west region of the Netherlands.
Participants: Physicians providing medical care to NH residents.
Measurements: Physicians completed a registration form for any suspected infection over an 8-month period, including patient characteristics, signs and symptoms, and treatment decisions. An algorithm, developed by an expert panel and based on national and international guidelines, was used to evaluate treatment decisions for appropriateness of initiating or withholding antibiotics.
Results: Appropriateness of 598 treatment decisions was assessed. Overall, 76% were appropriate, with cases that were prescribed antibiotics judged less frequently "appropriate" (74%) compared with cases in which antibiotics were withheld (90%) ($P = .003$). Decisions around UTI were least often appropriate (68%, compared with 87% for RTI and 94% for SI [$P < .001$]). The most common situations in which antibiotic prescribing was considered inappropriate were those indicative of asymptomatic bacteriuria or viral RTI.
Conclusion: Although the rate of appropriate antibiotic prescribing in Dutch NHs is relatively high compared with previous studies in other countries, our results suggest that antibiotic consumption can be reduced by improving appropriateness of treatment decisions, especially for UTI. Given the current antibiotic resistance developments in long-term care facilities, interventions reducing antibiotic use for asymptomatic bacteriuria and viral RTI are warranted.

Antibiotics are one of the most commonly prescribed drug classes in long-term care facilities (LTCFs), with 47% to 79% of the residents receiving at least 1 course of antibiotics annually. The substantial antibiotic use contributes to the development of antibiotic resistance in this setting.[1,2] In addition, there is increasing evidence that LTCFs serve as a reservoir for transmission of resistant organisms to other health care settings.[3–5] Infections with antibiotic-resistant organisms in LTCFs have been associated with increased morbidity, mortality,

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and costs. This has raised awareness of the importance of strategies to reduce antibiotic resistance, including the promotion of appropriate use of antibiotics.[2]

To increase appropriate antibiotic prescribing, we need insight into the degree and nature of inappropriate use. Previous studies in LTCFs reported that, overall, decisions to start antibiotic treatment were appropriate in 49% to 63% of cases.[6–11] For specific infections, 2 American studies reported that criteria to start antibiotic treatment were met in 19% and 27% of urinary tract infections (UTIs),[12,13] and 1 study found that initiation of antibiotics was justified in 81% of respiratory tract infections (RTIs).[14] Some studies used guideline-based criteria to judge appropriateness of antibiotic prescribing.[6,7,11,14] Others used the criteria developed by McGeer et al[15] to assess appropriateness.[8–10,12,13] Although the latter are widely recognized criteria, they have been developed for infection surveillance purposes and are therefore highly specific rather than highly sensitive. Some argue that these criteria should therefore not be used to assess the appropriateness of initiating antibiotic treatment.[5] Further, previous studies relied on patient chart review to assess clinical features, whereas charts may not always reliably reflect the actual clinical situation. For example, Zimmer et al[6] reported that signs and symptoms were registered in patient charts in fewer than half of the cases.

We investigated the appropriateness of decisions to prescribe or withhold antibiotics for nursing home (NH) residents, based on registration forms completed by physicians at the time of diagnosing an infection. The study was conducted in NHs in the Netherlands, where antibiotic consumption in primary care is low compared with other European Union countries,[16] but where antibiotic consumption in NHs is comparable to European means.[17] We quantified appropriateness of decisions to prescribe or withhold antibiotics in Dutch NHs, and investigated if this varied among physicians and if this was associated with patients' characteristics. Further, we identified common clinical situations in which antibiotics are prescribed inappropriately.

Methods

Study Setting

The study was conducted in 10 NHs participating in a research project aimed at rationalizing antibiotic prescribing in LTCFs: the Improving Rational Prescribing of Antibiotics in Long-term Care Facilities (IMPACT) study.[18] The current study comprises a baseline measurement, ahead of any intervening to improve antibiotic prescribing. Table 1 summarizes the recruitment of study facilities. Eight NHs were located in urban areas, and 2 were located in rural areas, all in the central-west region of the Netherlands. In the Netherlands, NHs employ elderly care physicians (formerly called nursing home physicians), which is a distinct medical specialty in the Netherlands. These physicians have the NH as their main, and often only, site of practice. Dutch NHs accommodate residents on 3 types of wards: somatic wards, for physically disabled residents; psychogeriatric wards, predominantly for residents suffering from dementia; and rehabilitation wards.[19] Regarding infection management, hospitalization and the administration of intravenous fluids or drugs are rare in Dutch NHs.[20]

Data Collection

Physicians providing medical care to residents completed a registration form in case they, based on their clinical judgment, suspected a UTI, an RTI, or a skin infection (SI). Infections were registered over an 8-month period, as soon as possible after the consultation, and regardless of whether antibiotic treatment was initiated. In 9 NHs, this 8-month period occurred between January 2012 and October 2012. In 1 NH, due to organizational issues, data collection was delayed and occurred between April 2012 and December 2012. The registration form included documentation of the following: patient characteristics (eg, age, sex, wheelchair dependence), vital signs in the past 48 hours (eg, blood pressure, pulse, temperature), recent/current health status (eg, new or worsening confusion, decreased intake), medical history (eg, diabetes, chronic obstructive pulmonary disease [COPD], dementia), signs and symptoms related to the suspected infection type, and details of the treatment decision (ie, antibiotic prescribing, including details on the prescription, or no antibiotic prescribing including the reason for not prescribing). Recurrent infections were included, as cases were defined as infection consultations rather than patients. Only infections diagnosed in the NH were included. In case an infection was diagnosed by an on-call physician not employed by the NH, the employed physician responsible for the care of the patient completed the registration form based on the descriptions of the on-call physician.

Chart review was conducted to identify missing cases (ie, infection consultations for which physicians did not complete a registration form), and to investigate whether these cases were comparable to those registered. To this end, we selected a random sample of residents and invited these residents or, if not mentally competent, a family member to provide written consent to review their charts. On average, 32% (range 22%–49%) of the residents were selected. Two researchers (LB and SD) screened patient charts of consenting residents for infection consultations, over the same 8-month period during which physicians completed registration forms.

Appropriateness of Treatment Decisions

We developed an algorithm for each infection type to evaluate appropriateness of initiating or withholding antibiotics (Appendix). These algorithms were based on consensus within the research team and a national expert panel, and they were founded on national evidence-based guidelines (of the Dutch College of General Practitioners, and the Dutch Association of Elderly Care Physicians and Social Geriatricians) and an international consensus–driven guideline.[21] The national expert panel comprised 2 infectious disease specialists, 4 general practitioners with extensive expertise in infectious diseases, an infectious diseases researcher, an infectious diseases epidemiologist, an elderly care physician with extensive expertise in infectious diseases, and 2 medical microbiologists. The algorithm classified treatment decisions as (1) appropriate, (2) probably appropriate, (3) probably inappropriate, (4) inappropriate, or (5) insufficient information to evaluate the treatment decision.

Table 1
Recruitment of Study Facilities

Approached	Agreed	Reasons for Refusal
9 individual NHs	6 NHs (2 affiliated with the same health care organization)	Organizational issues (2), unknown (1)
3 health care organizations	1 health care organization (3 of 4 affiliated NHs signed up for participation)	Unknown (2)
1 university-affiliated network of 7 health care organizations	1 affiliated NH signed up for participation	—

A treatment decision was judged "(in)appropriate" if there was strong evidence for this judgment, and "probably (in)appropriate" if the evidence was less strong but still sufficient for this judgment. Two researchers (LB and RV) assessed the first 181 physician-registered infections together, to achieve consistency of evaluations. The remaining cases were assessed by each researcher independently. In case of doubt or disagreement, the researchers discussed their judgments to achieve consensus, in some cases in a project team meeting.

Data Analysis

The data on the infection registration forms were entered into a Microsoft Access 2000 (Microsoft Corporation, Redmond, WA) database by 2 persons independently. The data were subsequently processed in SPSS version 20 (IBM Corporation, New York, NY). We used descriptive statistics to summarize the data. The dichotomous variable "appropriateness" was created based on the conclusions of the algorithm, by combining "appropriate" and "probably appropriate" into "appropriate," and "inappropriate" and "probably inappropriate" into "inappropriate." Chi-square tests, analysis of variance, and Kruskal-Wallis tests were used as appropriate, to analyze differences between facilities in demographic characteristics and appropriateness of treatment decisions, differences between infection types in appropriateness of treatment decisions, and differences between infections treated and not treated with antibiotics in appropriateness of treatment decisions. To investigate our hypothesis that appropriate prescribing may vary among physicians and may be associated with type of unit, dementia, urinary catheter (for UTI), and COPD (for RTI), a second-order penalized quasilikelihood multilevel logistic regression analysis was performed using MLwiN version 2.30 (Centre for Multilevel Modelling, University of Bristol, Bristol, UK). In this model, the data were clustered in 3 levels: NH, patient, and infection consultation. For all analyses, the significance level was a priori set at $P < .05$.

Ethical Approval

All study procedures were reviewed and approved by the Medical Ethics Review Committee of the VU University Medical Center (Amsterdam, The Netherlands) before study commencement.

Results

Demographics

The 10 participating NHs had a mean of 163 beds per facility (range: 67–228) and a mean bed occupancy of 97% (range: 93%–100%). On average, 51% of beds were for psychogeriatric patients (ie, mostly with dementia; range: 0%–78%), 32% for somatic patients (ie, with physical disability; range: 17%–72%), and 17% for rehabilitation patients (range: 0%–35%). In total, 707 consultations for 525 residents were registered by 62 physicians. Of these consultations, 406 (57%) were for UTI, 247 (35%) for RTI, and 54 (8%) for SI.

Table 2 shows demographic characteristics of the residents. Residents had a mean age of 83.5, a median length of stay of 8 months, and were mostly women. Most residents were wheelchair-dependent, incontinent for urine, and diagnosed with dementia. There was substantial variation in case-mix among individual facilities, with significant differences for age, type of unit, proportion of wheelchair-dependent residents, urinary catheter use, proportion of residents with urinary incontinence, and proportion of residents with dementia.

Table 2
Resident Characteristics of Registered Infection Consultations

Characteristic	Infection Consultations, n = 707
Sociodemographic	
Female, n/N (%)	511/707 (72.3)
Age; n, mean (range)	703, 83.5 (43.0–101.0)
Length of stay, mo, n, median (range)	649, 8.0 (0.0–191.0)
Type of unit, n/N (%)	
Somatic	260/705 (36.9)
Psychogeriatric	318/705 (45.1)
Rehabilitation	127/705 (18.0)
Functioning, n/N (%)	
Wheelchair-dependent	374/658 (56.8)
Urinary catheter	106/671 (15.8)
Urinary incontinence*	447/595 (75.1)
Comorbidities, n/N (%)	
Diabetes mellitus	133/682 (19.5)
Chronic obstructive pulmonary disease	108/676 (16.0)
Dementia	340/657 (51.8)

*The physicians sometimes did not know whether a resident was incontinent for urine or not, which explains the relatively high number of missing cases (ie, 112) on this variable.

Appropriateness of Treatment Decisions

Of the 707 registered consultations, sufficient information to evaluate the treatment decision was available for 598 cases (85%; 90% of UTI, 84% of RTI, and 63% of SI). Antibiotics were prescribed in 88% of these cases. Overall, 76% of treatment decisions were judged appropriate, with significantly fewer appropriate treatment decisions for UTI (68%) compared with RTI (87%) and SI (94%) ($P < .001$; Table 3). Weighted for the number of cases per NH, the same overall percentage of 76% appropriate treatment decisions was found (UTI, 70%; RTI, 85%; SI, 94%). Treatment decisions in which antibiotics were prescribed were less frequently judged appropriate (74%) than decisions in which antibiotics were withheld (90%; $P = .003$). Further, facilities differed significantly in proportions of appropriate treatment decisions (range: 59%–91%; $P < .001$).

We found lower proportions of appropriate prescribing decisions in residents of psychogeriatric units (72%, versus 77% on somatic units and 83% on rehabilitation units; $P = .04$). As we found no differences in appropriate treatment decisions between NH units in a subgroup analysis per infection type, the overall difference is probably attributable to different patterns of infection types on different NH units (eg, relatively more UTI on psychogeriatric units). For RTI consultations, we found lower proportions of appropriate prescribing decisions in residents without COPD (83%) compared with those with COPD (94%; $P = .004$). Other variables (ie, the physician, whether a resident was diagnosed with dementia, and whether a resident with UTI had a urinary catheter) were not significantly associated with appropriate prescribing.

Table 4 lists the most common clinical situations in which treatment decisions for UTI and RTI were considered inappropriate (SI was not included because of the low proportion of inappropriate treatment decisions). These all included situations in which antibiotics were prescribed. For UTI, the most common inappropriate prescribing was in cases that may involve asymptomatic bacteriuria. This

Table 3
Proportion of Appropriate Treatment Decisions for Residents With UTI, RTI, and SI

	Appropriate Treatment Decisions, n/N, % (Range Across Facilities)
Overall	453/598, 75.8 (58.6–91.3)
UTI	241/356, 67.7 (53.5–89.3)
RTI	180/208, 86.5 (60.0–96.2)
SI	32/34, 94.1 (66.7–100.0)

Table 4
Clinical Situations that Represent >10% of the Inappropriate Treatment Decisions

% of the Inappropriate Treatment Decisions	Description of Clinical Situation
UTIs (n = 90 inappropriate treatment decisions)	
50.0%	Antibiotic treatment for a patient without a urinary catheter, who does not feel sick, and has no delirium or specific symptoms, but has aspecific symptoms (eg, suprapubic pain, confusion) in combination with a positive nitrite and leukocyte esterase test.
18.9%	Antibiotic treatment for a patient without a urinary catheter, who has no specific symptoms, and a negative nitrite test, but has aspecific symptoms (eg, suprapubic pain, confusion) in combination with a positive leukocyte esterase test.
11.1%	Antibiotic treatment for a patient without a urinary catheter, who does not feel sick, has no delirium, and a negative nitrite test, but has specific symptoms (eg, dysuria, frequency) in combination with a positive leukocyte esterase test.
RTIs (n = 20 inappropriate treatment decisions)	
45.0%	Antibiotic treatment for a patient with acute cough who is moderately ill or has fever (≥38°C), but has no COPD or one-sided abnormalities on lung auscultation.
15.0%	Antibiotic treatment for a moderately ill patient without cough, but with fever (≥38°C), possibly combined with delirium, but without tachypnea, COPD, or one-sided abnormalities on lung auscultation.

occurred more frequently on psychogeriatric units (91% of all inappropriate cases) than on somatic units (78% of all inappropriate cases; $P = .03$). For RTI, the most common inappropriate prescribing involved situations that suggest viral RTI. Inappropriate withholding of antibiotics occurred in only a few cases (n = 7). For UTI, these involved cases with a positive dipstick test (ie, the presence of nitrite and leukocyte esterase) in combination with specific urinary symptoms (n = 2), or nonspecific signs or symptoms in a patient who feels sick (n = 3). For RTI, inappropriate withholding of antibiotics involved moderately ill (n = 1) and severely ill (n = 1) patients with COPD patients and acute cough.

Chart Review

Written informed consent for chart review was obtained for 56% of the invited residents (43% to 73% per NH). Charts of a total of 295 patients were reviewed (12 to 43 per NH) over a mean period of 191 days (134 to 249 per NH). In total, 194 infection consultations (9 to 35 per NH) were identified; in 59% of these cases (37% to 78% per NH), no registration form had been completed by physicians. Because of insufficient detailed information in patient charts, we were not able to assess appropriateness of the treatment decisions that had not been registered by physicians. We therefore compared other characteristics of these consultations with those that were registered, and found that nonregistered infections were less often treated with antibiotics (79% versus 88%), more often involved follow-up consultations (23% versus 11%), and were more often diagnosed and treated outside regular work hours by on-call physicians (18% versus 11%). Further, nonregistered infections were in patients with a longer median length of stay who less commonly resided on rehabilitation units. Other patient characteristics and the distribution of infection types (ie, 60% UTI, 33% RTI, and 7% SI) were comparable between registered and nonregistered infections. There were no indications of overrepresentation of specific physicians among the nonregistered infections.

Discussion

We investigated the appropriateness of decisions to prescribe or withhold antibiotics in Dutch NHs and found that 76% of these decisions were appropriate. Treatment decisions were less often appropriate for UTI compared with decisions for RTI and SI. Decisions were more often appropriate when antibiotics were withheld compared with when antibiotics were prescribed, which indicates that overprescribing occurs more frequently than underprescribing. The most common clinical situations in which antibiotics were inappropriately prescribed were those indicative of asymptomatic bacteriuria and viral RTI.

The proportion of appropriate decisions to prescribe antibiotics (74%) in our study is higher than reported in LTCF studies conducted in other countries (49% to 63%).[6–11] This may be explained by Dutch physicians being more conservative in antibiotic prescribing compared with physicians in other countries.[16,20] This in turn may be related to country-specific characteristics regarding the societal context, physician training, and the organization of NH care (eg, the presence of on-site physicians, which enables them to get to know their patients well).[20,22] Another possible explanation for the high proportion of appropriate treatment decisions is that the physicians' registration of infection consultations increased their awareness on appropriate antibiotic prescribing from the onset of data collection, resulting in higher proportions of appropriate antibiotic prescribing. Alternatively, other studies used chart review and may have underestimated appropriate prescribing if symptoms that justified antibiotic prescribing were not documented in the charts. Further, other algorithms may have been more stringent in evaluating appropriateness. However, some studies used the criteria of McGeer et al[15] in assessing the appropriateness of antibiotic prescribing,[8–10] which have been developed for infection surveillance purposes and are therefore not highly sensitive, resulting in a relatively high risk of missing inappropriate cases.[5] Other studies,[6,7] similar to our study, used guideline-based algorithms developed by an expert panel. The guideline used in these studies, however, dates back to 1971; we considered the minimum criteria developed by Loeb et al[21] more up-to-date and therefore based our algorithm on these criteria, combined with criteria from national treatment guidelines.

Our finding that UTI was the most commonly occurring infection in LTCFs is in line with previous studies, as is our finding that antibiotics were most often inappropriately prescribed for this type of infection.[6,7,9,10,23–25] In addition, our study confirms that most of the inappropriate antibiotic prescribing for UTI is for asymptomatic bacteriuria,[7,9–11,24] a situation for which antibiotic treatment is not beneficial.[26] The prevalence of asymptomatic bacteriuria is high among LTCF residents, and consequently there is a high likelihood of obtaining positive results when performing a dipstick test.[26–28] A dipstick test should therefore be performed only in case symptoms indicative of UTI are present, to rule out the diagnosis when negative.[29] We found that clinical situations indicative of asymptomatic bacteriuria are more common on psychogeriatric units, where most residents have dementia. Diagnosis of infection is challenging in this population because of communication problems and the presentation of atypical symptoms.[1,21] For example, mental status change is a common reason to perform a dipstick test.[12] The high prevalence of

asymptomatic bacteriuria combined with the many other possible causes for mental status change are likely to result in substantial inappropriate antibiotic prescribing. This advocates for requiring the presence of additional signs and symptoms before performing a dipstick test in cognitively impaired residents with a change in mental status, especially as this patient group is more likely to acquire colonization with antibiotic-resistant pathogens compared with other residents.[4]

The finding that the proportion of appropriate prescribing in residents with COPD was higher than in those without COPD can be explained by national and international guidelines reflected in our algorithm, indicating a lower threshold for antibiotic prescribing in this group of patients. Further, in line with other findings, most of the RTI that we judged "inappropriate" were clinical situations that we considered indicative for viral RTI.[9,24] The absence of one-sided abnormalities on lung auscultation often drove evaluation as inappropriate. This clinical sign is not considered in the criteria developed by Loeb et al[21]; however, it was given a central position in our algorithm based on a national guideline of the Dutch College of General Practitioners and consensus within the expert panel that contributed to the development of the algorithm. This is in agreement with 2 studies that reported abnormalities on lung auscultation to be predictors of pneumonia in patients in LTCFs and emergency departments.[30,31] It may be argued that our algorithm should be liberalized due to the subjective nature of findings on lung auscultation, in which case more treatment decisions for RTI would have been classified "appropriate."

A strength of our study is that we assessed both decisions to prescribe and withhold antibiotics, whereas other studies on appropriateness of treatment decisions assessed only infections for which antibiotics were prescribed.[6–11] This enabled us to investigate the occurrence of both overprescribing and underprescribing. Another strength is that data collection was prospective and independent of availability of information in patient charts. The fact that we were not able to assess appropriateness of nonregistered infections due to incomplete information in patient charts, underlines the limitation of using patient charts.

Although registration of infection consultations by physicians thus resulted in more information per case compared with chart review, a limitation of this data collection method was that a substantial part of the infection consultations were not registered. This was at least partly due to physicians forgetting to complete a form in case the infection was diagnosed outside working hours, in case a form was recently completed for the same patient, and in case no antibiotic was prescribed. Another limitation is that we included only the decision to prescribe or withhold antibiotics in our evaluation of appropriateness of treatment decisions. Other elements of appropriate prescribing include, for example, selection of the right antibiotic drug, dose, and treatment duration.[32]

As studies evaluating appropriateness of antibiotic use in LTCFs so far have used different algorithms, the development of a universally applicable instrument would facilitate (international) comparison. Several existing guidelines and articles on appropriate indications for antibiotic treatment[1,21,32–35] could be integrated into an instrument. For the development of such an instrument, it is important that applicability is ensured across LTCFs and nations, and in residents with dementia.[12]

Despite the relatively high proportion of appropriate antibiotic prescribing in the NHs in this study, the study findings indicate room for improvement in terms of reducing inappropriate treatment for asymptomatic bacteriuria and viral RTI. In 2 North American studies, interventions were reported that successfully reduced treatment for asymptomatic bacteriuria.[28,36] In a qualitative study, we demonstrated that a variety of factors may be involved in antibiotic treatment decision-making, including use of diagnostic resources, physicians' perceived risks, influence of others, and influence of the environment (unpublished work by Van Buul LW, MSc, van der Steen JT PhD, Doncker SMMM, MSc, et al; 2014). Such factors may explain part of the observed differences in appropriateness of treatment decisions among facilities, and should therefore be considered in the development of interventions aimed at improving appropriate antibiotic prescribing in local settings.

Conclusion

Our findings suggest that more appropriate treatment decisions can lead to decreased antibiotic consumption in NHs in the Netherlands, as inappropriate treatment decisions were more often related to overuse than underuse of antibiotics. Appropriateness of treatment decisions can be improved by focusing on reduced antibiotic prescribing for asymptomatic bacteriuria, and to a lesser extent for viral RTI. Interventions directed at these conditions, thereby taking into account the many factors involved in antibiotic prescribing decision-making, are warranted to control antibiotic resistance in LTCFs.

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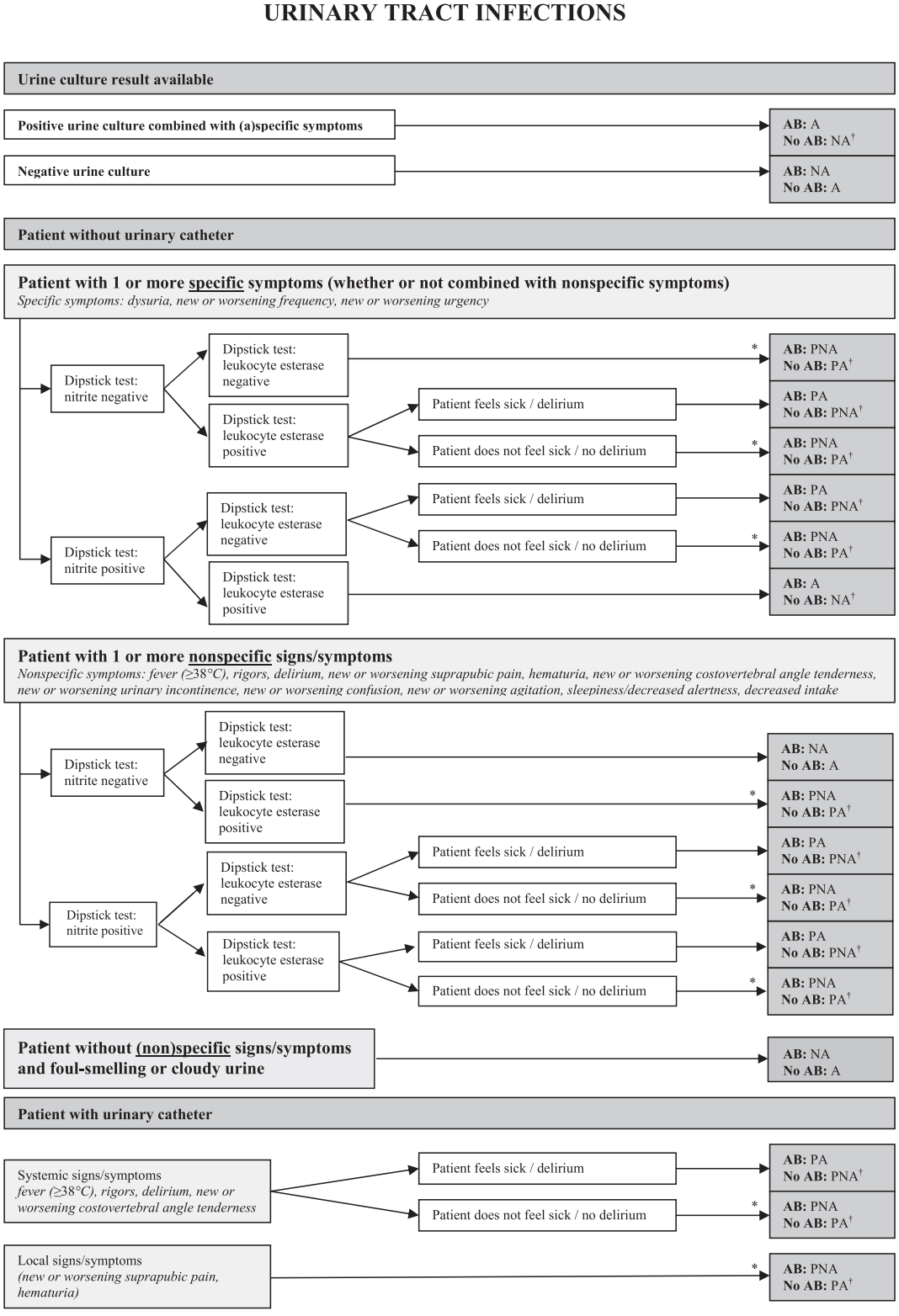
Appendix

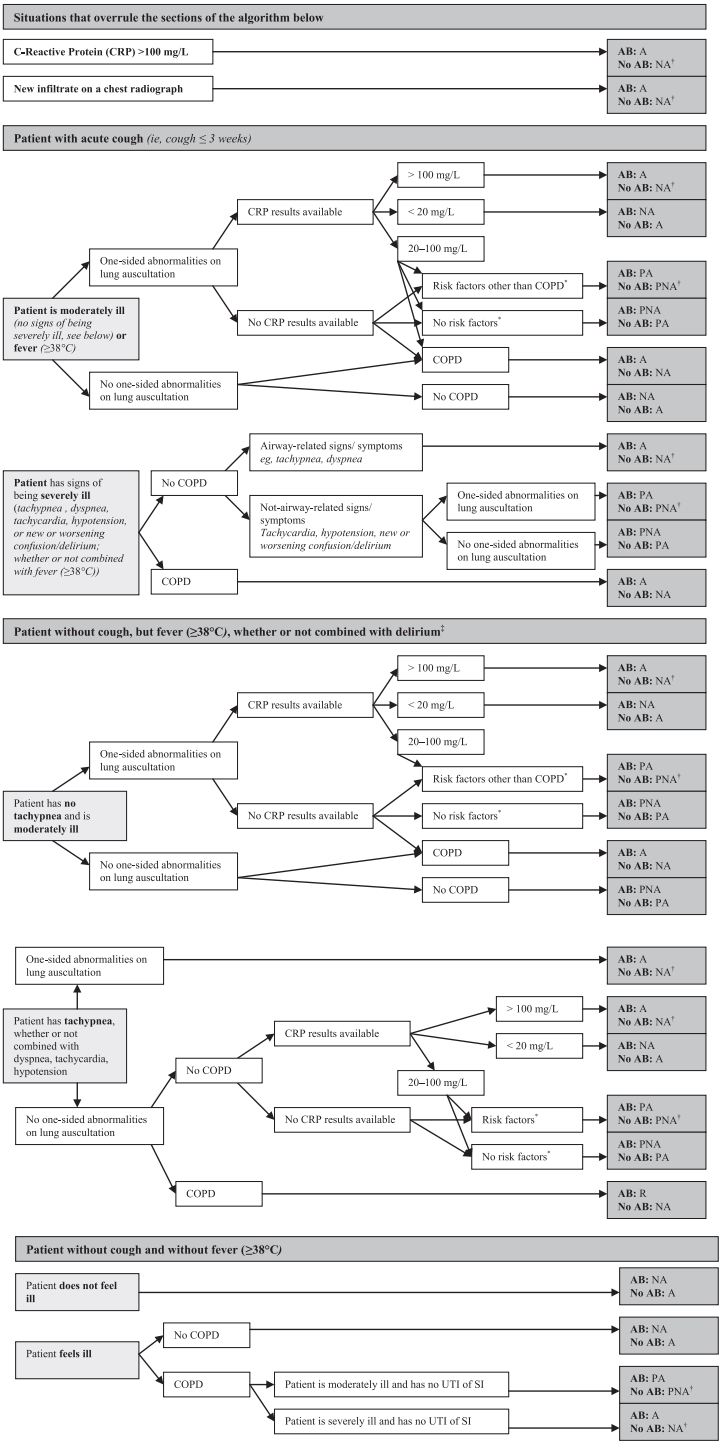
Algorithms for the Evaluation of Appropriateness of Decisions to Prescribe or Withhold Antibiotics for Urinary Tract Infections, Respiratory Tract Infections, and Skin Infections (A, appropriate; AB, antibiotics; NA, not appropriate; PA, probably appropriate; PNA, probably not appropriate).



* Antibiotic treatment not indicated, culture results should be obtained first.

† If a case in which no antibiotic was initiated leads to the judgment probably appropriate, probably not appropriate, or not appropriate, but there are legitimate reasons for not prescribing antibiotics (eg, if a patient does not want to be treated with antibiotics, or if a patient is terminally ill), the case is judged as appropriate.

RESPIRATORY TRACT INFECTIONS



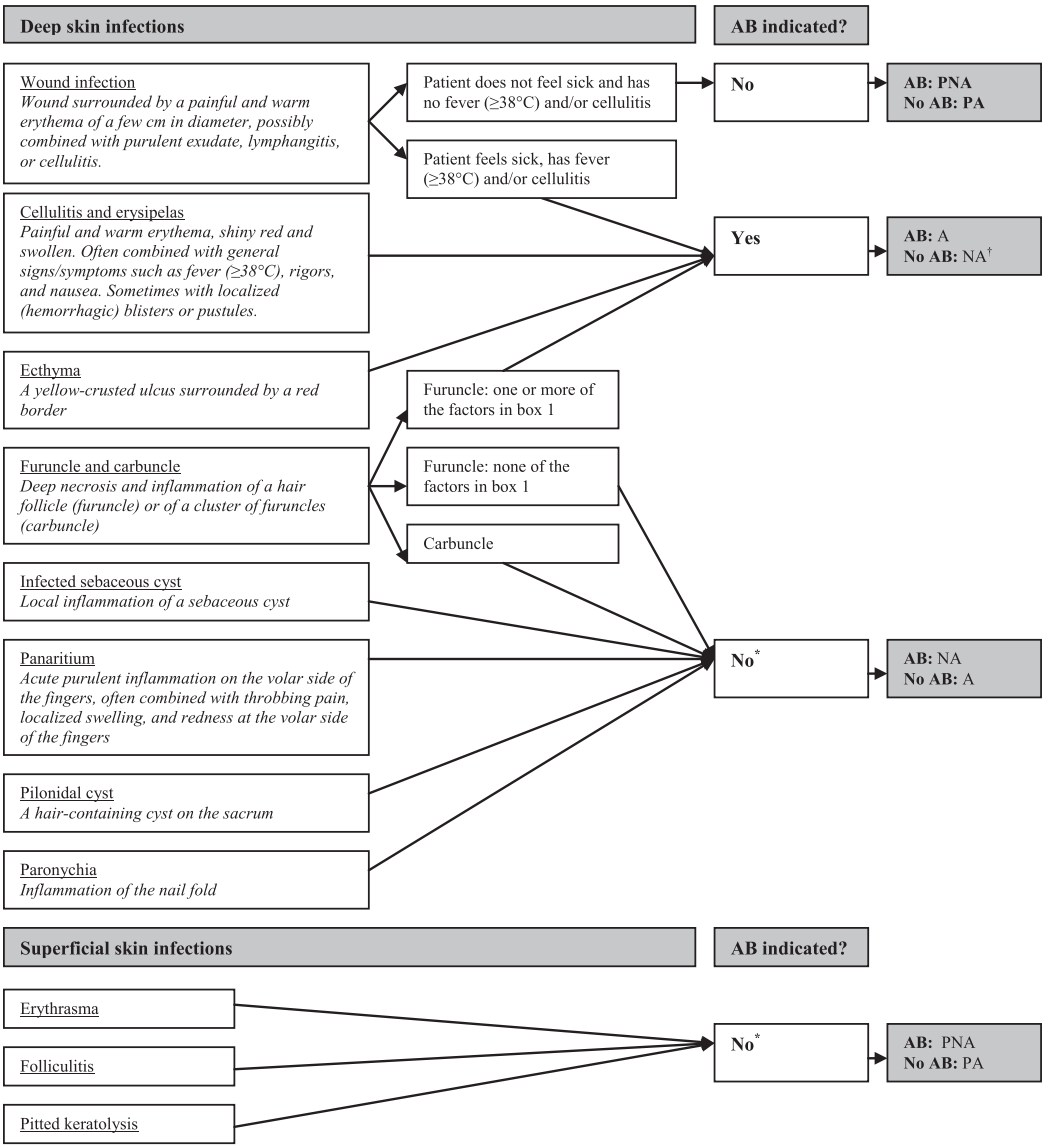
Tachypnea = respiratory rate ≥25/min
Tachycardia = ≥ 100 beats per minute
Hypotension = Systolic blood pressure ≤ 90, diastolic blood pressure ≤ 60 mm Hg

* Risk factors = age >75, hearth failure, COPD, diabetes mellitus, asthma, neurologic disease (eg, amyotrophic lateral sclerosis, multiple sclerosis, Parkinson, Huntington), severe renal insufficiency.

† If a case in which no antibiotic was initiated leads to the judgment probably appropriate, probably not appropriate, or not appropriate, but there are legitimate reasons for not prescribing antibiotics (eg, if a patient does not want to be treated with antibiotics, or if a patient is terminally ill), the case is judged as appropriate.

‡ If a patient who uses fever-supressing drugs has delirium, the algorithm should be followed as if the patient has fever in addition to the delirium.

SKIN INFECTIONS



* Antibiotics are not indicated, unless the infection is increasing (characterized by fever (≥38°C) and/or feeling sick) or if nonmedicamentous treatment (incision and/or drainage) is not effective.

† If a case in which no antibiotic was initiated leads to the judgment probably appropriate, probably not appropriate, or not appropriate, but there are legitimate reasons for not prescribing antibiotics (eg, if a patient does not want to be treated with antibiotics, or if a patient is terminally ill), the case is judged as appropriate.

Box 1
Risk of a complicated course:
- Nonhealing furuncle
- Furuncle in the face
- Increased risk of endocarditis
- Patients with joint prosthesis combined with diabetes mellitus and/or rheumatoid arthritis
- General feeling of being unwell or fever (≥38°C)
- Patients with influenza, decreased immune function, or diabetes mellitus