

Implementatie Pakket

**Aanbevelingen IMPACT onderzoek:
Diagnose en behandeling van infectieziekten
in verpleeg- en verzorgingshuizen**

©Universitair Netwerk Ouderengeneeskunde VU medisch centrum (UNO-VUmc)



Inhoudsopgave

Hoofdstuk 1 - Inleiding	3
1.1. Het IMPACT onderzoek	3
1.2. Aanbevelingen uit het IMPACT onderzoek	4
1.3. Implementatie fasen	6
Hoofdstuk 2 – Besluitvorming over het Implementatie Pakket	7
Hoofdstuk 3 - Fase Voorbereiding	8
3.1. Oriëntatie	8
3.2. Kennis en informatie	11
3.3. Acceptatie	11
Hoofdstuk 4 - Fase Uitvoering	13
Hoofdstuk 5 - Fase Borging	14
Bijlage 1	15
Artikel over factoren die antibiotica voorschrijfbeslissingen beïnvloeden in verpleeg- en verzorgingshuizen	
Bijlage 2	26
Artikel over de mate van rationeel voorschrijven van antibiotica in verpleeghuizen	

Colofon

Laura van Buul, Lizette Wattel, Ruth Veenhuizen
Versie augustus 2015

Vragen over dit Implementatie Pakket?

Voor vragen over dit Implementatie Pakket kunt u terecht bij het UNO-VUmc (uno@vumc.nl).

UNO-VUmc
Afdeling huisartsgeneeskunde & ouderengeneeskunde
VUmc, kamer BS7 A-534
Postbus 7057
1007 MB Amsterdam

Hoofdstuk 1 - Inleiding

Implementatie kan worden omschreven als ‘een procesmatige en planmatige invoering van vernieuwingen en/of verbeteringen (van bewezen waarde) met als doel dat deze een structurele plaats krijgen in het handelen’.* Zorginnovaties waarvan bewezen is dat ze effectief zijn, zijn de moeite van het implementeren waard. Maar implementeren gaat niet vanzelf, zelfs niet als mensen enthousiast zijn, als er een voorbeeld beschikbaar is en als je het wiel niet opnieuw hoeft uit te vinden. Een actieve aanpak is nodig.

Dit Implementatie Pakket helpt bij het invoeren van aanbevelingen die voort zijn gekomen uit het IMPACT onderzoek naar de diagnose en behandeling van infectieziekten in verpleeg- en verzorgingshuizen. In paragraaf 1.1 wordt dit onderzoek kort toegelicht, gevolgd door een beschrijving van de op het onderzoek gebaseerde aanbevelingen in paragraaf 1.2. In paragraaf 1.3. worden de verschillende fasen van de implementatie van deze aanbevelingen benoemd.

1.1. Het IMPACT onderzoek

De ontwikkeling van antibioticaresistentie is wereldwijd een toenemend probleem in zorginstellingen. Antibioticaresistentie wil zeggen dat bacteriën niet meer gevoelig zijn voor antibiotica. Als mensen een infectie krijgen met deze bacteriën, helpen antibiotica niet meer (goed) om de bacterie te remmen of te doden, waardoor de patiënt niet of moeilijker geneest. Het gebruik van antibiotica draagt bij aan de ontwikkeling van antibioticaresistentie: hoe vaker antibiotica worden voorgeschreven, hoe groter de kans dat bacteriën resistent worden. Het is daarom belangrijk om terughoudend te zijn met het voorschrijven van antibiotica. Dat wil zeggen dat antibiotica alleen worden voorgeschreven als het écht nodig is. En dat áls ze worden voorgeschreven, dat de middelkeuze, dosering, toedieningswijze en therapieduur optimaal zijn. In dat geval spreken we van ‘rationeel’ antibioticagebruik.

Het IMPACT onderzoek is opgezet omdat er nog weinig bekend was over het voorschrijven van antibiotica in Nederlandse verpleeg- en verzorgingshuizen. Het onderzoek had drie doelstellingen: 1) inzicht krijgen in de mate van (rationeel) antibioticagebruik, 2) interventies-op-maat ontwikkelen en implementeren die gericht zijn op het stimuleren van rationeel antibioticagebruik, en 3) het effect van de interventies-op-maat evalueren. Voor informatie over de aanpak en de resultaten van het onderzoek kunt u het proefschrift van Laura van Buul raadplegen. Dit is online beschikbaar via [deze link](#) of in digitale vorm op te vragen via uno@vumc.nl.

Het huidige document richt zich op de aanbevelingen die uit het proefschrift zijn voortgekomen. Het voorschrijven van antibiotica lijkt misschien een onderwerp dat vooral artsen aangaat, maar uit het proefschrift is gebleken dat óók andere disciplines binnen verpleeg- en verzorgingshuizen een rol kunnen spelen bij het bevorderen van rationeel antibioticagebruik. De aanbevelingen zijn dan ook gericht op verschillende disciplines. Ze worden in de volgende paragraaf beschreven.

* Hulscher M, et al. 2000. *Effectieve implementatie: theorieën en strategieën*. Den Haag, ZonMw.

1.2. Aanbevelingen uit het IMPACT onderzoek

Aanbeveling 1: goede registratie en overdracht van infectiegerelateerde symptomen

Hoe beter en completer de informatie is die artsen tot hun beschikking hebben bij het nemen van een behandelbeslissing, hoe beter zij kunnen inschatten of het bij een bewoner nodig is om antibiotica voor te schrijven. Voor informatie over mogelijk infectiegerelateerde klachten die bewoners hebben, zijn artsen afhankelijk van verpleging en verzorging (V&V). Zij zijn immers de ‘ogen en oren’ van de artsen, omdat zij dag in dag uit contact hebben met de bewoners. Als V&V klachten bij bewoners niet goed registreren, of ze dragen de informatie niet goed over aan de arts, dan heeft de arts minder (goede) informatie bij het nemen van de behandelbeslissing, en is het moeilijker om een beslissing te nemen over antibioticagebruik.

Het is daarom aan te bevelen dat artsen en V&V duidelijke afspraken maken over het registreren en overdragen van infectiegerelateerde symptomen. Het is daarbij van belang dat er bepaald wordt welke informatie artsen nodig hebben voor het stellen van een diagnose, zoals bijvoorbeeld de controles (temperatuur, bloeddruk, pols). Ook is het aan te bevelen dat er afspraken worden gemaakt over wanneer V&V de urine mag stikken bij bewoners: alleen in opdracht van de arts of uitsluitend bij de aanwezigheid van bepaalde symptomen. Soms wordt de urine namelijk gestickt terwijl dit eigenlijk (nog) niet nodig is. Na het maken van de afspraken is het van belang dat deze ook op de werkvloer bekend worden, bijvoorbeeld via klinische lessen en/of de ontwikkeling van protocollen.

Aanbeveling 2: goede communicatie over de behandelbeslissing

Als artsen terughoudend willen zijn met antibiotica, stuiten zij soms op onbegrip bij V&V en/of bij (de familie van) de bewoner. Zij verwachten dan dat de arts ‘iets doet’; in veel gevallen is dat het voorschrijven van een medicijn. Als de arts dit dan niet doet, kan dit frustraties opleveren.

Het is daarom belangrijk dat artsen naar V&V toe onderbouwen waarom zij er in een bepaalde situatie voor kiezen om geen antibiotica voor te schrijven (b.v. vanwege het risico op resistentie en/of bijwerkingen, of omdat het om klachten gaat die nog even aangezien kunnen worden). Dit kan ervoor zorgen dat er bij V&V begrip ontstaat voor de behandelbeslissingen die artsen maken, en kan ook zorgen dat in een volgende situatie de verwachtingen anders zijn. Bovendien kan V&V de uitleg van de arts ook overbrengen naar de (familie van) de bewoner, zodat ook bij hen begrip ontstaat en hun verwachtingspatroon wordt aangepast.

Aanbeveling 3: bewustzijn van het probleem van antibioticaresistentie

Om draagvlak te creëren voor activiteiten gericht op rationeel antibioticagebruik (en infectiepreventie) is bewustzijn van het probleem van antibioticaresistentie in alle lagen van de organisatie belangrijk. Een infectiepreventie commissie / antibiotica commissie zou bijvoorbeeld een faciliterende rol kunnen spelen in het stimuleren van dit bewustzijn bij de verschillende disciplines (b.v. via scholing voor V&V en/of een farmacotherapeutisch overleg (FTO) voor artsen).

Aanbeveling 4: identificatie van beïnvloedende factoren

Er zijn verschillende factoren die invloed kunnen hebben op beslissingen van artsen om wel of geen antibiotica voor te schrijven. Bijvoorbeeld de klachten die de bewoner heeft en of er gegevens beschikbaar zijn uit aanvullend onderzoek (zoals labuitslagen, kweekuitslagen en röntgenfoto's). Daarnaast zijn er risicopercepties bij de arts: wat zijn bijvoorbeeld de gevolgen als er géén antibiotica worden voorgeschreven als dit achteraf toch nodig bleek? Maar ook allerlei externe factoren kunnen een rol spelen. Bijvoorbeeld de wensen of mening van anderen (zoals V&V, de (familie van) de bewoner en/of collega's), hoe goed de arts de bewoner kent (hoe minder goed de arts de bewoner kent, hoe lastiger het soms is om de situatie in te schatten), en of er richtlijnen beschikbaar zijn. Sommige van de factoren kunnen leiden tot irrationeel antibioticagebruik (b.v. antibiotica voorschrijven omdat een collega dat ook altijd doet, of omdat de familie van de bewoner het graag wil, terwijl er op basis van de klachten van de bewoner even aangezien zou kunnen worden).

Het is daarom aan te bevelen dat artsen zich bewust zijn van de factoren die hun voorschrijfgedrag beïnvloeden, en van welke daarvan mogelijk kunnen leiden tot irrationeel antibioticagebruik. Hiertoe kan gebruik worden gemaakt van een model dat ontwikkeld is in het IMPACT onderzoek (zie het artikel in *Bijlage 1*). Tijdens een artsenoverleg kan worden besproken welke factoren uit het model de behandelbeslissingen van de artsen beïnvloeden, en vervolgens kunnen er afspraken gemaakt worden over het omgaan met factoren die als belemmerend worden ervaren.

Aanbeveling 5: een terugkerend FTO infectieziekten

Voorschrijfpatronen en resistentiepatronen zijn onderhevig aan veranderingen in de tijd. Het is daarom van belang om met regelmaat een FTO te plannen gericht op de behandeling van infectieziekten, met als doel het evalueren en eventueel bijstellen van het formularium. Het is aan te bevelen om hierbij de apotheker te betrekken, en deze te vragen om een overzicht te maken van de voorgeschreven middelen in het verpleeg- of verzorgingshuis, idealiter uitgesplitst naar afdeling en naar arts. Dit laatste opent een dialoog over verschillen in voorschrijfgedrag. Ook aan te bevelen is het betrekken van een arts microbioloog, en deze te vragen om een overzicht aan te leveren van resistentie in de instelling, organisatie en/of regio. Het antibioticabeleid kan vervolgens worden afgestemd op basis van beide overzichten.

Aanbeveling 6: bespreken van het antibioticabeleid bij artsenwisselingen

Uit het IMPACT onderzoek bleek dat artsenwisselingen veel invloed kunnen hebben op het gebruik van antibiotica in een instelling, omdat er verschillen zijn tussen artsen in de mate waarin zij (rationeel) voorschrijven. Het is daarom aan te bevelen dat afspraken rondom antibioticagebruik besproken worden bij wisselingen in het artsteam. Dit opent een dialoog over voorschrijfgedrag, geef mogelijk input voor afspraken of veranderingen in het antibioticabeleid (nieuwe artsen kunnen bijvoorbeeld nieuwe inzichten brengen met betrekking tot antibioticagebruik), en zorgt er zo voor dat de 'neuzen in dezelfde richting' staan als het gaat om het voorschrijven van antibiotica.

1.3. Implementatie fasen

De implementatie van de bovenstaande aanbevelingen voor de praktijk kan beginnen op het moment dat er door je organisatie besloten wordt om het Implementatie Pakket te gaan gebruiken (zie hoofdstuk 2). Het Implementatie Pakket beschrijft drie fasen van implementatie: Voorbereiding (hoofdstuk 3), Uitvoering (hoofdstuk 4) en Borging (hoofdstuk 5). De fase 'Vorbereiding' is het meest uitgebreid, een goede implementatie van een zorginnovatie begint tenslotte met een goede voorbereiding. De fase 'Uitvoering' is de verandering zelf, in deze fase wordt voor het eerst volgens de nieuwe werkwijze gewerkt. In de fase 'Borging' gaat het om de borging van de interventie in de bestaande werkwijzen, zodat de verandering na de projectfase behouden blijft.

Hoofdstuk 2 – Besluitvorming over het Implementatie Pakket

Je hebt als UNO commissie dit Implementatie Pakket ontvangen. De eerste stap is nu dat er besloten wordt of dit binnen je organisatie gebruikt zal gaan worden. Dit kan als volgt aangepakt worden:

- Bespreek het Implementatie Pakket tijdens een bijeenkomst van de UNO commissie. Hoe denken de commissieleden over het Implementatie Pakket? Bijvoorbeeld: gaat het om een onderwerp dat binnen de organisatie als belangrijk gezien wordt? En is het huidige moment geschikt voor het implementeren van de aanbevelingen?
- Breng als UNO commissie een advies uit aan de directie over het Implementatie Pakket. Eventueel kan er voor het opstellen van dit advies ook contact gezocht worden met relevante personen buiten de UNO commissie (b.v. met het artsenteam).
- De directie neemt een besluit over het wel of niet implementeren van de aanbevelingen uit het Implementatie Pakket binnen de organisatie, op basis van het advies van de UNO commissie en eventueel van personen buiten de UNO commissie die door de directie geraadpleegd zijn.
- Is het besluit **positief**? Begin dan met de voorbereiding voor het implementeren van de aanbevelingen (zie hoofdstuk 3).

Is het besluit **negatief**? Stuur dan een bericht naar het UNO-VUmc (uno@vumc.nl) om door te geven dat het Implementatie Pakket niet ingevoerd zal worden, met een toelichting.

Hoofdstuk 3 – Fase: Voorbereiding

De fase ‘Voorbereiding’ bestaat uit drie stappen: 3.1. Oriëntatie, 3.2. Kennis en informatie, 3.3. Acceptatie. Voor het uitwerken van deze stappen kan indien gewenst gebruik worden gemaakt van het ‘Werkdocument Implementatie Pakket’ (*dit is meegestuurd met dit Implementatie Pakket en is anders te downloaden op de website (www.vumc.nl/uno) of op te vragen via uno@vumc.nl*).

3.1. Oriëntatie

De eerste stap in de voorbereiding is de oriëntatie. Voor het succesvol implementeren van de aanbevelingen, wordt in deze stap de huidige situatie rondom de diagnose en behandeling van infectieziekten in kaart gebracht. Zo wordt er geïnventariseerd of er aanbevelingen zijn waaraan al wordt voldaan. En wat de knelpunten zijn bij de aanbevelingen waaraan nog niet wordt voldaan. Hieronder een overzicht van de acties voor de oriëntatiefase:

Acties oriëntatiefase

- Benoem een ‘trekker’ binnen de organisatie die de implementatie gaat begeleiden en ondersteunen, en zorg dat deze persoon daar ook ruimte (uren) voor krijgt. Heeft de organisatie een infectie(preventie) commissie? Dan zou het implementeren van de aanbevelingen uit het IMPACT onderzoek als taak van deze commissie benoemd kunnen worden.
- De ‘trekker’ formeert een werkgroep: hij/zij denkt na over voor welke doelgroepen de aanbevelingen van belang zijn, en nodigt op basis daarvan betrokkenen uit de verschillende relevante disciplines uit voor de werkgroep (zoals een specialist ouderengeneeskunde, een verpleegkundige/verzorgende, de apotheker, een manager). Deze werkgroep zou ook kunnen bestaan uit (een gedeelte van) de reeds bestaande infectie(preventie) commissie. Zorg dat er ten minste één lid van de UNO commissie in de werkgroep zit, zodat deze de link vormt tussen de werkgroep en de UNO commissie / het UNO-VUmc.
- De werkgroep brengt de uitgangssituatie in kaart:
 - Welke aanbevelingen worden in de praktijk al toegepast? Als er al aanbevelingen worden toegepast: hebben deze het gewenst effect of is er behoefte om de toepassing ervan te optimaliseren?
 - In hoeverre is er behoefte om de aanbevelingen die nog niet worden toegepast, te implementeren? Bij welke disciplines bestaan deze behoeften? Wat zijn de knelpunten?
- De werkgroep maakt een plan van aanpak met tijdsplanning voor het implementeren van (een deel van) de aanbevelingen. *Voor advies kan er altijd contact opgenomen worden met de coördinatoren van het UNO-VUmc via uno@vumc.nl*. Hieronder volgen per aanbeveling voorbeelden van vragen die bij het maken van het plan van aanpak aan de orde kunnen komen:

- ❑ **Aanbeveling 1: goede registratie en overdracht van infectiegerelateerde symptomen**

Wie worden er betrokken bij het maken van afspraken over het registreren en overdragen van infectiegerelateerde symptomen (b.v. V&V, artsen, teamleiders)? Waar en wanneer worden de afspraken gemaakt (b.v. tijdens één of meer multidisciplinaire bijeenkomsten)? Hoe worden de afspraken gecommuniceerd naar de werkvloer (b.v. door middel van scholing en/of de introductie van protocollen in klinische lessen / door teamleiders)? Hoe wordt erop toegezien dat de afspraken nageleefd worden (b.v. door te stimuleren dat medewerkers elkaar aanspreken op het naleven van de afspraken, of door het doen van audits)?
- ❑ **Aanbeveling 2: goede communicatie over de behandelbeslissing**

Hoe wordt er nagegaan in welke situaties er bij V&V sprake is van onbegrip bij voorschrijfbeslissingen, en aan welke informatie er dan precies behoefte is (b.v. door een multidisciplinair overleg aan dit onderwerp te wijden)? Op welke manier wordt ervoor gezorgd dat V&V de informatie krijgt die nodig is om voorschrijfbeslissingen te begrijpen en over te dragen naar (familie van) bewoners (b.v. via mondelinge/schriftelijke toelichting door de arts in bepaalde situaties, of door situaties die op onbegrip stuiten te bespreken in klinische lessen)? Hoe wordt er nagegaan dat er inderdaad meer begrip ontstaat bij V&V voor voorschrijfbeslissingen in bepaalde situaties, en dat zij dit ook uitdragen naar (familie van) bewoners (b.v. door na een tijd nog een multidisciplinair overleg te wijden aan dit thema)? En hoe wordt ervoor gezorgd dat het begrip na verloop van tijd niet afneemt?
- ❑ **Aanbeveling 3: bewustzijn van het probleem van antibioticaresistentie**

Wie neemt/nemen de verantwoordelijkheid voor het stimuleren van het bewustzijn van het probleem van antibioticaresistentie (b.v. de infectie(preventie) commissie / antibiotica commissie, een specialist ouderengeneeskunde, een hygiëne kwaliteitsmedewerker of een deskundige infectiepreventie)? Welke disciplines vormen de doelgroep (b.v. artsen, V&V, medewerkers van de facilitaire dienst)? Welke activiteit(en) wordt/worden ondernomen om het bewustzijn bij deze doelgroep(en) te stimuleren (b.v. scholing, een FTO)? Hoe wordt er nagegaan dat het bewustzijn toeneemt bij de doelgroepen? Hoe wordt ervoor gezorgd dat het bewustzijn na verloop van tijd niet afneemt (b.v. het periodiek herhalen van de scholing, het FTO)?
- ❑ **Aanbeveling 4: identificatie van beïnvloedende factoren**

Wanneer hebben de artsen het artikel uit *Bijlage 1* gelezen? En wanneer wordt in een artsenoverleg op basis van dit artikel een discussie gevoerd over de factoren die zij herkennen als bevorderend en belemmerend bij het nemen van voorschrijfbeslissingen? Wat is het doel van dit artsenoverleg (b.v. kennisvergaring, bewustwording, het maken van afspraken en/of het ondernemen van activiteiten om bepaalde afspraken te realiseren)?

Aanbeveling 5: een terugkerend FTO infectieziekten

Hoe vaak zal er een FTO worden georganiseerd rondom het thema infectieziekten? Wanneer is het eerstvolgende FTO? Welke thema's zullen er tijdens dit FTO aan bod komen? Wie zorgt ervoor dat de apotheker bij het FTO aanwezig is, en vraagt deze om als voorbereiding voorschrijfgegevens uit te draaien (idealiter is dit in ieder geval een overzicht van de hoeveelheid voorschriften en de typen antibiotica die zijn voorgeschreven per infectietype, uitgesplitst naar afdeling en/of behandelaar)? Wie vraagt de arts microbioloog om als voorbereiding van het FTO resistentiegegevens van de instelling, organisatie en/of regio te verzorgen, en nodigt eventueel de arts microbioloog ook uit voor het FTO?

Tip 1: het Instituut voor Verantwoord Medicijngebruik (IVM) heeft voor het IMPACT onderzoek modules ontwikkeld met werkmateriaal voor FTO over urineweginfecties en luchtweginfecties in verpleeg- en verzorgingshuizen (waaronder kennistoetsen en casuïstiek). Deze modules zijn op te vragen via uno@vumc.nl.

Tip 2: lees ter voorbereiding van het FTO het artikel in Bijlage 2. Dit artikel beschrijft bevindingen van het IMPACT onderzoek met betrekking tot de mate van rationeel voorschrijven in verpleeghuizen. Het bevat ook per infectietype een algoritme dat gebruikt kan worden om te beoordelen of voorschrijfbeslissingen rationeel zijn.

Aanbeveling 6: bespreken van het antibioticabeleid bij artsenwisselingen

Wie zorgt ervoor dat het antibioticabeleid een agendapunt wordt bij het artsenoverleg, nadat er een wisseling in het artsenteam heeft plaatsgevonden?

De werkgroep benoemt voorwaarden voor het implementeren van de aanbevelingen uit het IMPACT onderzoek. Bijvoorbeeld:

Het bestuur staat erachter om de aanbevelingen volgens het plan van aanpak te implementeren en draagt dit ook uit, bijvoorbeeld door de implementatie van de aanbevelingen op te nemen in het beleidsplan en door het informeren van betrokken groepen (b.v. de manager zorg, het hoofd van de behandeldienst) over de implementatie plannen.

Het bestuur en management ondersteunen en faciliteren de implementatie van de aanbevelingen, bijvoorbeeld door tijd beschikbaar te stellen voor degenen die bij de implementatie betrokken zijn (b.v. de trekker en de werkgroep) en door financiële middelen beschikbaar te stellen (b.v. voor scholing).

Er zijn geen zaken die de implementatie kunnen belemmeren of vertragen, zoals verbouw- of reorganisatie plannen of veel andere lopende (onderzoeks)projecten. Als er wel zaken zijn die mogelijk kunnen conflicteren

met de implementatie plannen, zijn er van tevoren afspraken gemaakt over hoe hiermee omgegaan zal worden.

- Er is voldoende expertise aanwezig binnen de organisatie om de aanbevelingen te implementeren, en als dit niet het geval is, kan deze extern worden geraadpleegd.
- De (leidinggevenden van) betrokken doelgroepen (zoals de manager zorg, het hoofd van de behandeldienst) zijn geïnformeerd over de implementatie plannen en ondersteunen en faciliteren deze.

3.2. Kennis en informatie

De tweede stap in de voorbereiding is informeren van de organisatie over de inhoud van de aanbevelingen en over het implementatieplan. Hieronder een overzicht van de acties voor deze fase:

Acties kennis en informatie

- De trekker/werkgroep bespreekt met de directie het bovengenoemde plan van aanpak en de voorwaarden om de aanbevelingen uit het IMPACT onderzoek te kunnen implementeren, met als doel om hier van de organisatie steun/financiën voor te krijgen.
- De trekker/werkgroep bespreekt, eventueel samen met de directie, het plan van aanpak met sleutelfiguren binnen de organisatie. Afhankelijk van de te implementeren aanbevelingen, kunnen dit bijvoorbeeld zijn: de manager zorg, teamleiders zorg, EVV'ers, de behandeldienst, de infectie(preventie) commissie en de manager facilitaire dienst. Pas het plan van aanpak eventueel aan op basis van wensen en/of knelpunten die benoemd worden door deze sleutelfiguren.
- Indien aanbeveling 4 ('identificatie van beïnvloedende factoren') wordt geïmplementeerd: voorzie het artsenteam alvast van het artikel uit bijlage 1, zodat zij zich kunnen voorbereiden op het artsenuitvoeringsoverleg. Indien aanbeveling 5 ('een terugkerend FTO infectieziekten') wordt geïmplementeerd: voorzie het artsenteam alvast van het artikel uit bijlage 2 en desgewenst van de FTO modules van het IVM (te verkrijgen via een mail aan uno@vumc.nl), zodat zij al voorbereidingen kunnen treffen voor het eerstvolgende FTO (b.v. een programma samenstellen).
- Indien scholing een onderdeel uitmaakt van het implementatie plan, spreek dan alvast data af met betrokkenen (b.v. teamleiders zorg, manager zorg, medewerkers scholingsprogramma) waarop deze scholing plaats kan vinden en door wie de scholing zal worden verzorgd.

3.3. Acceptatie

De derde stap in de voorbereiding is de acceptatie van de implementatie van de aanbevelingen. Met name in deze stap is het van belang om bij de benadering van verschillende groepen de strategie aan te passen. In iedere organisatie en bij iedere discipline zullen er voorlopers, volgers en achterblijvers herkenbaar zijn (zie *Figuur 1*). Om draagvlak te creëren voor de implementatie van de aanbevelingen, is het belangrijk dat er

van alle betrokken disciplines 'voorlopers' worden geïdentificeerd. Zij kunnen hun rol als 'voorloper' gebruiken voor het creëren van draagvlak binnen de andere groepen. Het is vaak nodig om de andere groepen, de 'volgers' en de 'achterblijvers', op een andere manier te benaderen dan de 'voorlopers', omdat deze groepen minder gemotiveerd zijn om te veranderen (zie 'methoden van implementatie' in *Figuur 1*).

	Voorlopers	Volgers/Middengroep	Achterblijvers
Motivatie om te veranderen	Intrinsiek: zien voordelen	Erbij horen, relatie met anderen	Extrinsiek: het moet
Effectieve beïnvloeding	Gericht op cognitie	Gericht op attitude	Gericht op gedrag
Methoden van implementatie	Goede informatie Schriftelijk	Inzet sleutelfiguren Intercollegiale activiteiten Feedback collega's	Regels en afspraken Beloning Hulp bij praktische problemen Duidelijk leiderschap

Figuur 1. Implementatie en motivatie om te veranderen.[†]

Acties acceptatie

- ❑ Indien aanbevelingen 1 ('goede registratie en overdracht van infectiegerelateerde symptomen') en/of 2 ('goede communicatie over de behandelbeslissing') worden geïmplementeerd, is het van belang om binnen bij de V&V 'koplopers' te identificeren die de afspraken rondom het registreren van overdragen van symptomen kunnen uitdragen (aanbeveling 1) en/of begrip voor behandelbeslissingen van de arts kunnen overbrengen (aanbeveling 2). Deze 'koplopers' kunnen vervolgens een rol spelen bij het motiveren van de 'volgers'. Voor de 'achterblijvers' kunnen andere activiteiten overwogen worden, zoals het controleren van het naleven van de afspraken.
- ❑ Indien aanbevelingen 4 ('identificatie van beïnvloedende factoren'), 5 ('een terugkerend FTO infectieziekten') en/of 6 ('bespreken van het antibioticabeleid bij artsenwisselingen') worden geïmplementeerd, kan het van belang zijn om één of meerdere leden van het artsenteam te identificeren als 'koploper(s)'. Dit zijn dan artsen die enthousiast zijn over het implementeren van de aanbeveling(en), en die andere leden van het artsenteam (de 'volgers') kunnen enthousiasmeren. Als er artsen binnen het artsenteam zijn die niet enthousiast zijn over de aanbevelingen (de 'achterblijvers'), kunnen er eventueel andere activiteiten overwogen worden om ook deze personen te betrekken bij de implementatie (b.v. controle op voorschrijfgedrag door apotheker).

[†] Grol R en Wensing M. *Implementatie. Effectieve verbetering van de patiëntenzorg. 3e en herziene druk, Maarssen, 2006.*

Hoofdstuk 4 – Fase: Uitvoering

In de fase ‘Uitvoering’ worden de aanbevelingen geïmplementeerd volgens het plan van aanpak. Deze fase gaat pas van start op het moment dat alle acties van de fase ‘Voorbereiding’ (zie vorige hoofdstuk) zijn afgerond. De voortgang van de uitvoering kan indien gewenst worden bijgehouden in het ‘Werkdocument Implementatie Pakket’ (*dit is meegestuurd met dit Implementatie Pakket en is anders te downloaden op de website (www.vumc.nl/uno) of op te vragen via uno@vumc.nl*).

Tijdens de uitvoering is het van belang dat er op de werkvloer personen zijn die toezicht houden op de implementatie van de aanbevelingen, en die collega’s motiveren om de aanbevelingen te implementeren. Dit kan – afhankelijk van het type aanbeveling – bijvoorbeeld een algemeen agendapunt zijn van de infectie(preventie) commissie of van het artsenteam. Het kan ook één bepaalde persoon per aanbeveling zijn (b.v. iemand van de V&V ziet toe op de naleving van een protocol voor het registreren en overdragen van tekenen van infectie, een arts ziet toe op de terugkeer van een FTO infectieziekten op de agenda). In het laatste geval is het van belang dat deze verantwoordelijkheid wordt overgedragen bij eventueel vertrek van de persoon. Naast het houden van toezicht op de naleving van de gemaakte afspraken, maatregelen of activiteiten is het ook van belang om na te gaan of het gewenste effect er (nog) mee wordt bereikt. Als dit niet het geval is, moet er worden nagedacht over herhaling van bepaalde activiteiten, of over het aanpassen van de afspraken, maatregelen en/of activiteiten.

Hoofdstuk 5 – Fase: Borging

In de fase ‘Borging’ gaat het erom dat de geïmplementeerde aanbevelingen ook na de projectfase in werking blijven. Oftewel, dat de aanbevelingen onderdeel zijn geworden van de dagelijkse praktijk.

Voordat de projectfase afgerond kan worden, is het van belang dat er een eindevaluatie plaatsvindt door de trekker en de werkgroep. Daarbij wordt gekeken in hoeverre de onderdelen van het plan van aanpak geïmplementeerd zijn. Hierbij kan gebruik gemaakt worden van onderstaande matrix voor de borging van de aanbevelingen. Indien de vragen die van toepassing zijn met ‘ja’ worden beantwoord, is de implementatie geslaagd. In dat geval kan de werkgroep inactief worden. Het is aan te bevelen dat de leden van de voormalige werkgroep nog wel jaarlijks bijeen komen om de stand van zaken te bespreken (kunnen de vragen uit de matrix nog steeds met ‘ja’ beantwoord worden?). Als daarbij blijkt dat de borging van de aanbevelingen te wensen overlaat, kan besloten worden de werkgroep weer opnieuw te activeren.

	ja	nee	n.v.t.*
Aanbeveling 1: goede registratie en overdracht van infectiegerelateerde symptomen			
Er zijn vastgelegde afspraken / er is een protocol voor de registratie en overdracht van infectie gerelateerde symptomen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deze afspraken / dit protocol zijn/is gecommuniceerd naar de werkvloer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De afspraken / het protocol voor de registratie en overdracht van infectie gerelateerde symptomen wordt / worden in de praktijk nageleefd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aanbeveling 2: goede communicatie over de behandelbeslissing			
Er is geïnventariseerd in welke situaties er bij V&V onbegrip is over voorschrijfbeslissingen door de arts, en aan welke informatie er in die situaties behoefte is	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Artsen communiceren in deze situaties de argumenten voor beslissingen om (geen) antibiotica voor te schrijven naar V&V	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
V&V communiceren deze argumenten van de arts naar (familie van) bewoners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aanbeveling 3: bewustzijn van het probleem van antibioticaresistentie			
Er worden periodiek activiteiten ondernomen om bij artsen het bewustzijn van het probleem van antibioticaresistentie te bevorderen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Er worden periodiek activiteiten ondernomen om bij V&V het bewustzijn van het probleem van antibioticaresistentie te bevorderen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Er worden periodiek activiteiten ondernomen om bij andere dan bovengenoemde twee disciplines het bewustzijn van het probleem van antibioticaresistentie te bevorderen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aanbeveling 4: identificatie van beïnvloedende factoren			
Binnen het artsteam is overleg geweest over de factoren die behandelbeslissingen rondom antibiotica beïnvloeden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Binnen het artsteam zijn afspraken gemaakt over hoe er wordt omgegaan met factoren die rationeel antibioticagebruik belemmeren	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
De afspraken uit het bovengenoemde punt worden in de praktijk nageleefd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aanbeveling 5: een terugkerend FTO infectieziekten			
Er is een terugkerend FTO infectieziekten	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bij het FTO infectieziekten is een apotheker betrokken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ten behoeve van het FTO levert de apotheker voorschrijfgegevens aan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bij het FTO infectieziekten is een arts microbioloog betrokken	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ten behoeve van het FTO levert de arts microbioloog gegevens over antibioticaresistentie aan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Op basis van de voorschrijfgegevens en gegevens over antibioticaresistentie wordt het formulairium geëvalueerd en zo nodig aangepast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aanbeveling 6: bespreken van het antibioticabeleid bij artsenwisselingen			
Het antibioticabeleid is een vast agendapunt voor het artsenoverleg dat plaatsvindt na een wisseling in het artsenteam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Vink 'n.v.t.' aan als er bij voorbaat geen plannen waren om de aanbeveling te implementeren.

Figuur 2. Matrix voor borging aanbevelingen

Bijlage 1

Artikel IMPACT onderzoek: over factoren die antibiotica voorschrijfbeslissingen beïnvloeden in verpleeg- en verzorgingshuizen

RESEARCH ARTICLE

Open Access

Factors influencing antibiotic prescribing in long-term care facilities: a qualitative in-depth study

Laura W van Buul^{1,2*}, Jenny T van der Steen^{1,2*}, Sarah MMM Doncker^{1,2}, Wilco P Achterberg³, François G Schellevis^{1,2,4}, Ruth B Veenhuizen^{1,2} and Cees MPM Hertogh^{1,2}

Abstract

Background: Insight into factors that influence antibiotic prescribing is crucial when developing interventions aimed at a more rational use of antibiotics. We examined factors that influence antibiotic prescribing in long-term care facilities, and present a conceptual model that integrates these factors.

Methods: Semi-structured qualitative interviews were conducted with physicians (n = 13) and nursing staff (n = 13) in five nursing homes and two residential care homes in the central-west region of the Netherlands. An iterative analysis was applied to interviews with physicians to identify and categorize factors that influence antibiotic prescribing, and to integrate these into a conceptual model. This conceptual model was triangulated with the perspectives of nursing staff.

Results: The analysis resulted in the identification of six categories of factors that can influence the antibiotic prescribing decision: the clinical situation, advance care plans, utilization of diagnostic resources, physicians' perceived risks, influence of others, and influence of the environment. Each category comprises several factors that may influence the decision to prescribe or not prescribe antibiotics directly (e.g. pressure of patients' family leading to antibiotic prescribing) or indirectly via influence on other factors (e.g. unfamiliarity with patients resulting in a higher physician perceived risk of non-treatment, in turn resulting in a higher tendency to prescribe antibiotics).

Conclusions: Our interview study shows that several non-rational factors may affect antibiotic prescribing decision making in long-term care facilities, suggesting opportunities to reduce inappropriate antibiotic use. We developed a conceptual model that integrates the identified categories of influencing factors and shows the relationships between those categories. This model may be used as a practical tool in long-term care facilities to identify local factors potentially leading to inappropriate prescribing, and to subsequently intervene at the level of those factors to promote appropriate antibiotic prescribing.

Keywords: Antimicrobials, Drug prescribing, Nursing homes, Residential care homes

* Correspondence: l.vanbuul@vumc.nl; j.vandersteen@vumc.nl

¹EMGO Institute for Health and Care Research, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, the Netherlands

²Department of General Practice & Elderly Care Medicine, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, the Netherlands

Full list of author information is available at the end of the article

Background

Antibiotics are commonly prescribed in nursing homes and residential care homes. As much as 47% to 79% of the people residing in these facilities receives at least one course of antibiotics per year, of which a substantial part in situations where antibiotic treatment is not indicated [1]. This inappropriate antibiotic use contributes to the development of antibiotic resistance, which is also common in long-term care settings. These insights have led to awareness regarding appropriate use of antibiotics, and to several initiatives to promote rational antibiotic prescribing.

To be effective, interventions aimed at a more rational use of antibiotics should take into account the factors that impede and facilitate appropriate prescribing. Such factors may apply to the patient, the physician, the care setting, and the larger cultural and socio-economic context [2]. Factors that influence antibiotic prescribing in general practice and hospitals have been studied extensively. Examples of such factors include patients' symptoms and results of physical examination, availability of resources, availability and awareness of evidence with regard to antibiotic treatment, diagnostic uncertainty, peer practice, patient expectations, financial interests, and physicians' perceptions regarding antibiotic prescribing and resistance [2-14]. The diversity of these factors indicates that the antibiotic prescribing decision can be complex in these settings.

Less research has been conducted on factors that influence antibiotic prescribing in nursing homes and residential care homes. Whereas several factors identified for the general practice and hospital setting are likely to be valid – at least partly – in long-term care settings, other factors may be involved that relate to the specific characteristics of these facilities, the physicians delivering care, and the patient population. A few studies quantitatively investigated associations between antibiotic prescribing and possible determinants in long-term care facilities [15-20]. These found that prescribing decisions can be affected by, for example, the severity of illness and the ability to communicate with residents. Other studies qualitatively investigated factors that influence antibiotic prescribing for specific conditions (i.e. urinary tract infection and pneumonia), and reported that antibiotic prescribing decisions may be influenced by nursing staff, family wishes, and familiarity with the patient [21-23]. To date, factors that influence antibiotic prescribing in general have not been qualitatively explored in-depth in long-term care facilities.

Based on qualitative interviews with physicians and nursing staff, this study therefore examines factors that influence antibiotic prescribing in general in long-term care facilities in the Netherlands, where prevalence of antibiotic prescribing is high compared to ambulatory care settings and average in comparison with long-term care facilities in other European countries [24,25]. We present a conceptual

model that integrates these factors, which may guide the development and implementation of interventions aimed at rationalizing antibiotic use in long-term care facilities.

Methods

Study setting

The current interview study is part of a research project aimed at rationalizing antibiotic prescribing in long-term care facilities: the IMPACT study [26]. The IMPACT study was conducted in 14 long-term care facilities, of which seven were allocated to an intervention group and seven to a control group. In the interview study, which preceded implementation of interventions to improve prescribing practices, we included only facilities from the intervention group (5 nursing homes and 2 residential care homes), to avoid undue influence of participation in qualitative research activities on prescribing behavior in control group facilities.

In the Netherlands, organization of medical care differs between nursing homes and residential care homes. Nursing homes employ elderly care physicians (formerly called nursing home physicians), which is a distinct medical specialty in the Netherlands. Medical care in residential care homes is provided by general practitioners, who operate from their own practice. Interviewees were from both care settings.

All participating facilities were located in the central-west region of the Netherlands. A sample of 13 out of approximately 30 physicians was purposefully selected by the researchers to reflect variation in sex, age, years of professional experience, and professional specialism. One of the 13 initially selected physicians was not able to participate in an interview due to time constraints, and another physician was selected instead. The physicians in this final sample all provided written consent to participate in the interviews. A sample of 13 nursing staff members was additionally selected by researchers with the help of a location manager, a physician, or a medical secretary, similarly pursuing variation. These participants provided consent in person prior to the start of the interviews.

Data collection

A team of researchers (LB, JS, SD, FS, CH) developed two topic lists (Additional file 1), one for physicians and one for nursing staff, based on field experience of the project team, relevant literature on factors associated with drug prescribing, and a literature-based conceptual model developed by Zimmerman et al [27]. Both topic lists aimed at exploring perceptions and motivations with regard to three themes: infectious diseases, antibiotic prescribing, and antibiotic resistance. For the theme 'antibiotic prescribing', respondents were asked to describe two recent cases: one in which antibiotics were prescribed and one in

which antibiotics were not prescribed. The topic list was used to raise follow up questions to determine factors influencing prescribing decisions.

One semi-structured interview per respondent was conducted by trained interviewers (LB and SD). To achieve concordance, the interviewers conducted the first two interviews together. All interviews were tape-recorded and transcribed in full, and we removed any information from which the particular respondent or long-term care facility could be identified.

Data analysis

We started the analysis with the recent cases that were described by physicians, as these constituted the basis of the interviews. These case descriptions were studied by two researchers (LB and SD) to identify and categorize factors that influence antibiotic prescribing decisions. The resulting categories were regarded as basic considerations for treatment decisions (i.e. they are generally considered in treatment decisions), and were therefore considered the core of a conceptual model. An iterative analysis was applied to further elaborate this conceptual model. Hereby, the remaining material of the physician interviews – which contained descriptions of other practice situations with regard to antibiotic prescribing decisions – was studied in a stepwise fashion: 1) fragments of the material were labelled according to their content (open coding), 2) relationships were sought between the coded fragments (axial coding), and 3) the related coded fragments were categorized (selective coding) and added to the conceptual model.

Open coding was conducted by two researchers (LB and SD), who independently coded transcripts of 3 physician interviews, and developed a separate code list. These code lists were compared, discussed, and combined into a collective code list. The 3 previously coded transcripts and the remaining 10 transcripts were (re)coded by each researcher according to the collective code list. After each third coded transcript, the researchers compared and discussed the transcripts and – where necessary – codes were added or adjusted according to reached consensus. Coding of the last few transcripts yielded no new codes, which indicates data saturation. Axial and selective coding was conducted by one of the researchers (LB), and discussed with the other researcher (SD). The qualitative data analysis software program Atlas.ti, version 6 (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) was used to process the coded transcripts.

Since physicians are responsible for the prescribing decision, the physician interviews were used for the initial development of the conceptual model. Subsequently, this model was triangulated with perspectives derived from the 13 coded interviews with nursing staff. The coding procedure of these interviews was identical to and independent of

the procedure of the physician interviews. The information retrieved from the interviews with nursing staff was used to support and enhance the understanding of antibiotic prescribing decisions made by physicians. In addition, the conceptual model was studied by all members of the study team and adjustments to the model were made upon critical discussion of the analytic steps and interpretation of the results.

Ethical approval

The IMPACT study was approved by the Medical Ethics Review Committee of the VU University Medical Center (Amsterdam, the Netherlands).

Results

Table 1 shows the demographic characteristics of the interviewed physicians and nursing staff; there was substantial variation in age (range: 24 – 61) and years of professional experience (range: 0 – 36). The duration of the interviews varied from 19 minutes to 53 minutes, with a mean of 34 minutes overall (physicians: 39 minutes, nursing staff: 30 minutes).

The analysis of recent cases that were described by physicians led to the identification of two core categories of factors that influence the antibiotic prescribing decision: the clinical situation, and advance care plans. These categories were also derived from the analysis of other practice situations that physicians described with regard to antibiotic prescribing. The latter analysis additionally resulted in the identification of the following categories: utilization of diagnostic resources, physicians' perceived risks, influence of others, and influence of the environment. Figure 1 shows our conceptual model that integrates these categories and demonstrates how they are interrelated. Interviews with nursing staff supported the identified categories and added no new information to the model. The categories of factors that were identified as influencing the antibiotic prescribing decision are described in more detail below.

Clinical situation

Both the current clinical situation and the patients' medical history appeared to play a crucial role in the decision to prescribe or not prescribe antibiotics. Table 2 shows considerations with regard to the clinical situation that affect the prescribing decision for urinary tract infection, respiratory tract infection, and skin infection. Two situations were described in which the clinical situation can be unclear: 1) when communication with patients is impaired, which is common in residents with dementia, and 2) when (typical) clinical signs and symptoms are absent. Such situations result in diagnostic uncertainty, which can either promote antibiotic use if uncertainty leads to prescribing, or impede antibiotic use if uncertainty leads to further

Table 1 Demographics of the interviewed physicians and nursing staff

Demographic		Physicians (n = 13)	Nursing staff (n = 13)	Overall (n = 26)
Sex	Male	4	1	5
	Female	9	12	21
Age (yr)	Mean (range)	45 (25–60)	45 (24–61)	45 (24–61)
Years of professional experience	Mean (range)	15 (0–36)	17 (0–32)	16 (0–36)
Type of facility	Nursing home	10	9	19
	Residential care home	3	4	7
Facility location	Urban area	8	7	15
	Rural area	5	6	11
Professional specialism	Nursing home	Elderly care physician (7)	Nurse* (4)	-
		Elderly care physician in training (1)		
	Residential care home	Junior doctor (1)	Nurse assistant* (5)	
		Physician assistant (1)		

* United States equivalents: nurse = registered nurse, nurse assistant (levels 2, 3 and 4) = licensed practical nurse (level 4) or nurse aid (levels 2 and 3).

observing the course of infection. According to the interviewed physicians, a reason for not prescribing antibiotics for urinary tract infection is the absence of clinical signs and symptoms despite a positive dipstick test (i.e. the presence of leukocyte esterase, nitrite, or both). Some physicians expressed dissatisfaction with nursing staff performing a dipstick test in such situations, especially when the rationale for the test was a change in urine odor or appearance. Nursing staff, on the other hand, may not always be aware of this dissatisfaction, as some respondents indicated a change in urine odor or appearance as a reason to perform a dipstick test. This is illustrated in the following quotations:

Elderly care physician, female, 53: “The nurses call out ‘yes, the urine stinks’. And so they started dipstick

testing [the urine]. And I say ‘well I am not treating urine, I am treating the patient.’”
Nurse, female, 53: “Sometimes the urine is checked because it is just very nasty. Very concentrated, or it smells really bad.”

Advance care plans

The interviews showed that advance care plans can play a central role in the decision making process in nursing homes (they were not mentioned for residential care homes). These include the documentation of considerations to guide future (non-)treatment decisions, as formulated by the physician and the patient or the patients’ family. Antibiotic treatment may be included in the advance care plan, thereby anticipating situations in which antibiotic treatment potentially prolongs life. The interviewed

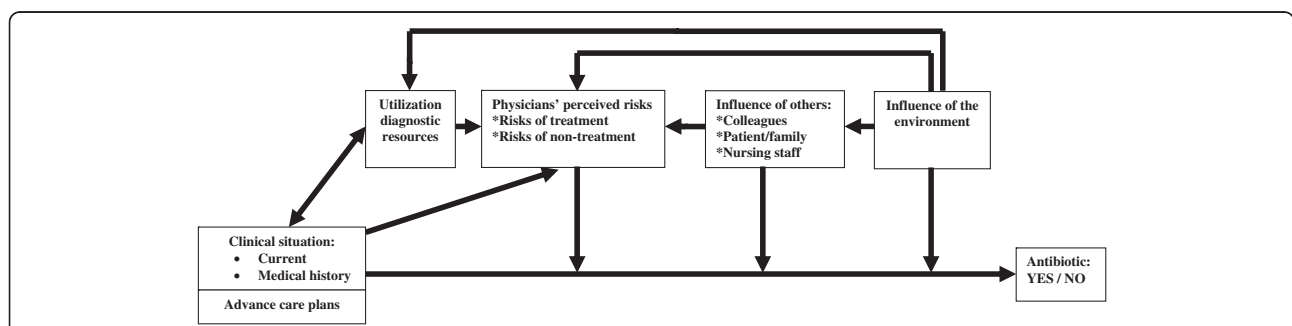


Figure 1 Conceptual model of factors that influence antibiotic prescribing in nursing homes and residential care homes in the Netherlands. The model shows that the clinical situation and advance care plans constitute the basis of the antibiotic prescribing decision. The other four categories can exert a direct influence on this prescribing decision, or an indirect influence via other categories. The *clinical situation* can influence the *use of diagnostic resources* (e.g. no X-ray when a patient is severely ill) and vice versa (e.g. less information about the clinical situation when no diagnostic resources are used). The use of diagnostic resources can also be influenced by environmental factors (e.g. availability of on-site diagnostic resources). *Physicians' perceived risks* can be influenced by the clinical situation (e.g. higher perceived risk of non-treatment if a patient is severely ill), the use of diagnostic resources (e.g. more uncertainty if no diagnostic resources are used), others (e.g. pressure from patients), and the environment (e.g. different risk perceptions when on call). *The influence of others* can be affected by the environment (e.g. the influence of nursing staff may differ when a consultation is by telephone compared to a physical consultation).

Table 2 Elements of the clinical situation that result in the decision to prescribe or not prescribe antibiotics for urinary tract infections, respiratory tract infections, and skin infections

Clinical situation	Antibiotic	Urinary tract infection	Respiratory tract infection	Skin infection
Current	YES	Signs and symptoms (or a high risk of signs and symptoms), positive dipstick test (for leukocyte esterase, nitrite, or both)/dipslide/culture, patient experiences burden, patient feels ill, hematuria, vulnerability of the patient, comorbidity, no prior antibiotic resistance	Signs and symptoms, patient feels ill, vulnerability of the patient, risk of death, comorbidity	Signs and symptoms, vulnerability of the patient
	NO	Absence of (relevant) signs and symptoms whether or not in combination with a positive dipstick test (for leukocyte esterase, nitrite, or both), negative dipstick test, awaiting culture results in case of no/minimal signs and symptoms, patient does not feel ill, poor prognosis, acceptance of resistant bacteria in urine	Poor prognosis, suspected viral infection, no/minimal signs and symptoms, patient does not feel (severely) ill, physical inability to take oral medication, allowing immune system of the patient to clear infection	Absence of (relevant) signs and symptoms
Medical history	YES	Positive effect of treatment for previous infection, no/limited history of infection, ineffective previous treatment	Severe course of previous infection	-
	NO	-	No history of infection	-

physicians consulted the advance care plan when a patient develops a potentially life-threatening infection such as pneumonia. They stated to not prescribe antibiotics when the overall care goal in the advance care plan was defined as comfort rather than life prolongation.

Utilization of diagnostic resources

The interviews demonstrated that the extent to which physicians resort to diagnostic resources is limited in long-term care facilities. Consequently, physicians have less information to judge a clinical situation compared to situations in which additional diagnostic information would be available, which in turn contributes to diagnostic uncertainty. We abstracted from the interviews four explanations for not using diagnostic resources to facilitate treatment decisions. First, certain diagnostics can be too burdensome for the vulnerable long-term care population (e.g. referring a patient to the hospital for further investigation). A second explanation includes the inability to obtain a good sputum or urine sample for culture from elderly patients. In addition, logistic considerations can be involved in the decision not to use diagnostic resources. In this regard, physicians pointed to a lack of on-site diagnostic resources (e.g. C-reactive protein point-of-care test, X-ray, urine culture), difficulties to consult the laboratory outside regular visit days for collection of specimen of residents, higher workload for the physician when taking cultures, and the length of time needed to obtain laboratory culture results (i.e. approximately one week). Finally, financial considerations can also be involved, in particular related to laboratory costs of cultures.

Physicians' perceived risks

The interviews showed that risks perceived by physicians can influence the antibiotic prescribing decision.

These can be divided into perceived risks of treatment and perceived risks of non-treatment. With regard to perceived risks of treatment, some physicians described situations in which the risk of side effects was mentioned as one of the reasons to not prescribe antibiotics. Further, some physicians raised the risk of antibiotic resistance development, which was considered from two points of view. The first point of view was that antibiotics should not be prescribed because of the risk of antibiotic resistance, if the clinical situation does not necessarily require antibiotic treatment. The second perception was that antibiotic resistance is not an important consideration in antibiotic prescribing, as the vulnerable long-term care population has a short life-expectancy. For example:

General practitioner, female, 38: "...if the gentleman is going to die anyway then any antibiotic resistance is not relevant. So in my mind that is something of a mitigating thing."

Perceived risks of non-treatment appeared to influence the antibiotic prescribing decision especially when physicians experience uncertainty, for example due to diagnostic uncertainty or unfamiliarity with the patient. We identified three situations in which perceived risks of non-treatment resulted in treating more readily with antibiotics. The first situation involves a perceived risk of adverse outcomes. For example:

General practitioner, female, 47: "So even if I initially think well it's only viral, but I feel there is a very substantial risk of a superimposed infection in case they have a respiratory infection, then I am just very quick [to prescribe antibiotics]."

The second situation involves a perceived sense of alarm (i.e. a “gut feeling”). For example:

Elderly care physician, female, 36: “... if I am not completely sure and I simply don't trust the situation, then I will [prescribe antibiotics]. In that case I think well, better safe than sorry.”

The third situation involves a perceived risk of not fulfilling the patients' expectations. The quotation below shows that the physician perceives that the patient expects her to “do something,” which she interpreted as the prescription of an antibiotic:

Elderly care physician in training, female, 25: “If I don't take action it looks like I don't want to help the patient, but perhaps I already know, well is it going to work at all?”

Influence of others

Physicians described several situations that showed influence of others on the prescribing decision. These can be colleagues, the patient, the patients' family, and nursing staff. Some situations showed that physicians may be more susceptible to the opinion or wish of others in uncertain situations. Vice versa, the opinion or wish of others may also affect the degree of uncertainty experienced by physicians.

Three situations in which colleagues influenced the prescribing decision were described: 1) following the advice of a colleague when in doubt about whether to treat with antibiotics or not, 2) an agreement to treat patients according to the habits of a colleague when covering for this colleague, 3) adaptation to prescribing habits of peers. The latter is illustrated by the following quote:

Physician assistant, male, 51: “That is during the weekend [...] and then almost everybody prescribes Augmentin [i.e. amoxicillin-clavulanate]. That's why. That was my motivation too.”

Physicians and nursing staff described several situations in which patients or the patients' family expressed their wish with regard to the treatment of an infection. Based on these descriptions, we identified three scenarios of how physicians handle these situations: 1) physician complies with a wish not to treat, 2) physician complies with a wish to treat, and 3) physician does not comply with a wish to treat. These are described and illustrated with relevant quotations in Table 3.

The interviews showed indirect and direct influence of nurses and nurse assistants on treatment decisions of physicians. Indirect influence includes the dependence of physicians on nursing staff for information about the

clinical situation of a patient: the poorer the quality of the information or the conveyance of information, the more difficult it can be for a physician to assess the clinical situation and make a treatment decision. Physicians' opinions differed about the quality of information obtained and conveyed by nursing staff. Some mentioned that nursing staff is well-capable of recognizing signs of infection and judging when the physician should see a patient, others indicated that the quality of information and conveyance of information depends on the experience and level of education of the nursing staff member. The quality of information conveyance can also be influenced by the work schedule of nursing staff; staff that had the previous days off may not be as informed about the clinical situation of a patient as staff that personally witnessed the course of illness. Furthermore, some physicians mentioned that their treatment decision is often complicated by the omission of nursing staff to register the patients' temperature, blood pressure, and pulse.

With regard to direct influence of nursing staff, several situations were described in which nursing staff expressed a request for antibiotic treatment. For example:

Nurse, female, 53: “Then I sometimes call directly to say ‘there are unmistakable signs of an infection, come and prescribe antibiotics.’”

Whereas some physicians reported not to comply with such requests in situations where they considered antibiotic treatment medically futile, others indicated that they value and comply with the opinion of nursing staff in certain situations, for example:

Elderly care physician, female, 36: “When a nurse has serious concerns I think I would be more tempted to prescribe an antibiotic, [...] Nurses are often good judges of patients because they know them much longer than I do.”

Influence of the environment

The interviews demonstrated that the antibiotic prescribing decision can be influenced by several environmental factors. These include the availability of evidence with regard to treatment of infections. Some physicians reported that treatment decisions are complicated by a lack of prescribing guidelines for the older population, and a lack of insight into local resistance patterns. Another environmental factor is the lack of on-site diagnostic resources, which contributes to the limited extent to which diagnostic resources are utilized. In addition, limited accessibility of information in medical files can complicate antibiotic prescribing decision making. Two other environmental factors, which are often related, are the organization of cross-covering, and familiarity with patients. Some physicians indicated that they

Table 3 Scenarios of how physicians handle situations in which patients or the patients' family express their opinion or wish regarding the treatment of an infection

Scenario	Description of situation	Relevant quotations
Physician COMPLIES with patients'/family's WISH NOT TO TREAT	Physicians indicate to not prescribe antibiotics when the patient or his/her family does not want life-prolonging antibiotic treatment (often recorded in advance care plans).	<i>Junior doctor, female, 30: "...if the family really decides not to do it [treat with antibiotics], then they accept the risk that he [the patient] will die as a result of it. And who am I to say well I am going to give antibiotics anyway. At that point that is not my role. Then I just have to accept what they want."</i>
Physician COMPLIES with patients'/family's WISH TO TREAT	<p>Antibiotic treatment is considered necessary by physician.</p> <p>Antibiotic treatment is considered (partly) medically futile by physician, but:</p> <ul style="list-style-type: none"> • family wants to have time to deliberate with a family member that cannot be reached, in case of a poor prognosis of the patient. • physician is willing to concede to the wish of family due to unfamiliarity with the patient and inability to predict the outcome. • physician considers it unethical to ignore the religion-based wish of the patient/family, in case of a poor prognosis of the patient. • a perception that scientific research showed that the outcome of a pneumonia is not much influenced by treatment with antibiotics [in case of respiratory tract infections at the end-of-life]. • family should be allowed time to get used to the idea that the condition of a patient deteriorates. • patients on rehabilitation units are used to get antibiotics from their general practitioner and will consult this general practitioner if no antibiotic is provided. 	<p><i>Elderly care physician in training, female, 25: "... then I decided in consultation with his son to start the antibiotics [...] because another son was on holiday [...]. And we couldn't get a hold of him on the phone."</i></p> <p><i>Junior doctor, female, 30: "... if they [the family] insist, then we should do it [prescribe antibiotics] because I don't know the man. So it's difficult to predict. I think it won't make much of a difference, but still, if the family really insists, then I am quite willing to prescribe [antibiotics]."</i></p> <p><i>General practitioner, female, 38: "...I think it is very unethical to say at a moment like that I'm sorry, but you are not getting them [antibiotics]. Even if everything in me says you're not going to make it, this is literally the last mile, but the gentleman feels like 'I've done everything, if I die now then it must be God's will!'"</i></p> <p><i>Elderly care physician, male, 51: "...now we also know from scientific research that if you talk about pneumonia that the outcome [...] is not really determined by whether you use an antibiotic or not. And that makes it a little easier for us to give it even when you think 'well, if it was my mother I wouldn't have done this.'"</i></p> <p><i>Elderly care physician, male, 48: "... I just happened to have had some patients recently of whom I thought in retrospect I just shouldn't have done it [prescribed antibiotics]. But sometimes you do it for the family. [...] In the past I used to be more principled about this, I would say look, you shouldn't do this, and now I think well, it's a process for them too and I do tell them [that there is not much point], but if they can't go along with that yet then I don't push harder."</i></p> <p><i>Nurse assistant, female, 35: "[That is because] people are a bit more articulate of course [on the rehabilitation unit]: [...] I just have a urinary tract infection'. And this is treated in the home situation. So sometimes that is the reason that the physician does treat it here, sometimes [...]"</i></p>
Physician DOES NOT COMPLY with patients'/family's WISH TO TREAT	<p>Antibiotic treatment is considered medically futile by physician.</p> <p>Family of a mentally competent patient wants treatment whereas the patient does not want treatment.</p>	<p><i>Elderly care physician, female, 53: "...and some patients [...] then demand treatment. [...] When I am convinced that 'this is pointless, this is medically completely pointless'. Then I don't do it [prescribe antibiotics]."</i></p> <p><i>Elderly care physician, female, 53: "Well it depends [...], if someone is competent. And this person says 'no' [no antibiotics] but the family says 'yes' [give antibiotics], then I also say I won't do that. Because your mother is quite clear about it."</i></p>

tend to treat more readily with antibiotics when on call, due to unfamiliarity with patients:

Elderly care physician, female, 57: "We have discussed this with the partners in our call group. That you are much quicker to give antibiotics in the weekends. Just

because these patients, these families are strangers. You don't know them very well."

Further, the conduction of telephone-consultations can affect the degree to which others influence treatment decisions. For example, some physicians indicated

that they are more dependent on nursing staff in case of a telephone consultation. A final environmental factor that can influence antibiotic prescribing decisions is the day of the week a consultation takes place. For example:

Elderly care physician, male, 48: "Fridays it's always more difficult than on Mondays [to use antibiotics prudently]. [...] on Fridays I think [...] well, someone else is going to come in and have a look [during the weekend], he won't be able to compare and will prescribe the antibiotics anyway, so I might as well prescribe it today. Otherwise this colleague will have to come in especially tomorrow."

Discussion

Qualitative interviews with physicians and nursing staff in seven long-term care facilities in the Netherlands showed the following categories of factors that can influence antibiotic prescribing decisions: the clinical situation, advance care plans, utilization of diagnostic resources, physicians' perceived risks, influence of others, and influence of the environment. In-depth analysis of these categories showed several factors that may result in inappropriate antibiotic prescribing decisions, such as risk avoidance ('better safe than sorry'), adaptation to peer practice, and pressure exerted by patients, family members or nursing staff. We developed a conceptual model that integrates the categories of factors and demonstrates how they may interrelate. This model may be used as a practical tool, whereby facilities explore which local non-rational factors influence their prescribing patterns, and subsequently intervene at the level of those factors to promote appropriate prescribing.

We identified the clinical situation and advance care plans as the two core categories of factors that influence antibiotic prescribing, and these therefore constitute the basis of the conceptual model. In line with our findings, these categories were among the most important factors in a Dutch study that quantitatively investigated treatment decisions with regard to pneumonia in nursing home residents with dementia [18]. We are not aware of any other studies that investigated the role of advance care plans in the antibiotic prescribing decision making process in long-term care. Future research may further elucidate this role.

A lack of on-site diagnostic resources was previously described to result in limited utilization of diagnostic resources in long-term care facilities [22,28-30]. Other factors that reportedly contributed to this limited utilization include the length of time needed to obtain laboratory results, and difficulties in obtaining appropriate specimens for culture, which corresponds with our findings [22,30]. In addition, another Dutch study described limited use of procedures such as x-ray examination in the vulnerable nursing home population, which indicates that the burden of

diagnostic measures for residents can be a reason not to use these [19]. Limited utilization of diagnostic resources contributes to diagnostic uncertainty. We found that other contributors to diagnostic uncertainty include impaired communication, and absence of clinical signs and symptoms, which is supported by other long-term care studies [21,29,30].

Our finding that nursing staff, patients, and family can influence the antibiotic prescribing decision corresponds with previous long-term care studies [16,18,20-23]. We found that most of the situations in which physicians complied with family wishes to prescribe antibiotics involved end-of-life situations. Other situations in which physicians took the opinion of others into account include uncertain situations, which is supported by a Dutch study on treatment decisions for nursing home residents with dementia who develop pneumonia [18]. The influence of patients and family members on antibiotic prescribing decisions can differ between countries. For example, it was found that prescribing decisions of physicians in the United States were more strongly guided by family wishes than were those of their Dutch counterparts [18,23].

Other previously-reported factors that can influence prescribing decisions in long-term care include physicians being more inclined to prescribe antibiotics just before the weekend [22], and physician familiarity with the patient or the patients' family [20]. In our study, a lack of familiarity with the patient or the patients' family appeared to play a role particularly when a physician was cross-covering, and less so during regular work hours. This is likely due to the organization of nursing home care in the Netherlands; elderly care physicians are employed by the nursing home, and as their main site of practice, this facilitates the development of a relationship between the physician and their patients and patient's family, and ensures that the physician is well-aware of their treatment preferences [31]. In countries where physician practice in nursing homes is often organized differently, such as in the United States, unfamiliarity with nursing homes residents is common [20,23]. In line with our findings, unfamiliarity with patients can promote antibiotic prescribing due to fears of adverse outcomes [21].

Some of the factors we identified in the present study have, to our knowledge, not been described before for the long-term care population, but have been reported in the general practice or hospital setting. These include a lack of insight into local resistance patterns and a lack of awareness of prescribing guidelines [3,4,9,12]. In addition, prescribing habits of peers, also referred to as "prescribing etiquette", was reported as an important factor in the antibiotic prescribing decision in hospitals and general practice [7,10,13]. Other factors previously-reported in these settings are related to physicians' perceived risks. In line with our findings, the risk of antibiotic resistance

development influenced the prescribing of a minority of physicians in two qualitative general practice studies [7,12]. Furthermore, the risk of adverse outcomes in case of non-treatment, and a perceived duty towards the patient were previously reported to influence prescribing decisions [2-4,7-10].

Two factors that were reported to influence antibiotic prescribing in other settings were not found in the present study. We did not identify disagreement or distrust with regard to existing evidence, [7,10,11] which may be explained by the opinion of interviewed physicians that there is not enough evidence regarding treatment of infections in long-term care. Second, the interviews did not show evidence of a direct influence of financial considerations on antibiotic prescribing [3,10]. However, regarding utilization of diagnostic resources, financial considerations were mentioned in the present study, and so may affect antibiotic prescribing indirectly.

A strength of the current study is that the antibiotic prescribing process was investigated from the perspective of both physicians and nursing staff. As these parties collaborate and depend on each other in daily practice, we believe that our findings provide a good insight into factors that influence antibiotic prescribing in long-term care facilities. An additional strength is that we focused on recent case descriptions in the interviews, and subsequently explored other practice situations. This approach facilitates a realistic representation of daily practice with regard to antibiotic prescribing decisions.

A limitation of the study, inherent to qualitative research, is that no assumptions can be made regarding the weight that each identified factor adds to the prescribing decision. Future quantitative research is needed to elucidate the contribution of each factor to the antibiotic prescribing decision. Another limitation is that our study design did not allow for checking data saturation at the time of data collection. However, no new codes appeared when coding the last few interviews, which supports that a sufficient amount of data was collected for drawing conclusions on this topic.

A proper analysis of relevant factors that influence antibiotic prescribing is crucial for the development of an antibiotic prescribing improvement program [3]. Several studies show that interventions that target factors that impede appropriate antibiotic prescribing are likely to be more effective [32-34]. The conceptual model presented in this study may be used as a practical tool, whereby facilities explore, for each category in the model, which factors influence local antibiotic prescribing, and identify which of these are inappropriate. Subsequently, they can intervene at the level of inappropriate factors to promote rational antibiotic prescribing. For example, if pressure exerted by patients is identified as a factor leading to inappropriate prescribing, interventions

such as patient education could be implemented to address this factor. Factors resulting in inappropriate prescribing may differ between facilities and nations. For instance, influence of nursing staff on the prescribing decision may be more important in facilities where – unlike in the Netherlands – no on-site physicians are present, and where many consultations are conducted by telephone. In addition, the extent to which diagnostic resources are used may differ between facilities, with some facilities having better access to such resources than others. Whereas the importance of each factor in decision making may differ between facilities and nations, we believe that our model in general is likely to be widely applicable as many of the factors that we incorporated in the model have been reported in a variety of settings and countries. In addition, it shows overlap with a literature-based prescribing decision model developed in a long-term care study conducted in the United States, [27] as well as with elements of a more general model for physician adherence to clinical practice guidelines [35].

Conclusions

Our qualitative study shows a variety of factors that influence antibiotic prescribing in long-term care facilities, of which several may lead to inappropriate antibiotic use. Some of these factors have not been previously reported for the long-term care setting, but have been described in studies in the general practice and hospital setting, indicating that several factors involved in these settings also apply to the long-term care setting. We developed a conceptual model that shows the relationships between the identified factors. This model may be used as a practical tool to identify local factors potentially leading to inappropriate prescribing, to guide the development of antibiotic prescribing improvement programs that target these factors.

Additional file

Additional file 1: Topic lists for physician (A) and nursing staff (B) interviews. Description of data = Topic lists used for qualitative interviews with physicians (A) and nursing staff (B), on infectious diseases, antibiotic prescribing, and antibiotic resistance.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JS, WA, FS, and CH contributed to conception and design of the IMPACT project; LB, JS, WA, FS, RV, and CH contributed to conception and design of the present study; LB and SD collected the data; LB, JS, SD, RV, and CH contributed to the data analysis; all authors contributed to the interpretation of the data; LB drafted the article; all authors revised the article critically for important intellectual content and approved the final draft.

Acknowledgments

The authors thank the physicians and nursing staff who participated in the interviews and shared their experiences and perceptions.

The authors acknowledge prof Philip D Sloane and prof Sheryl Zimmerman, of the University of North Carolina at Chapel Hill, for their contribution to the conception and design of the IMPACT study.

This work was supported by a grant from The Netherlands Organisation for Health Research and Development (ZonMw, The Hague; grant number 205 100011). The funding organization had no influence on study design, data collection, data analysis, and data interpretation, and did not play a role in writing the manuscript and in the decision to submit the manuscript for publication.

Author details

¹EMGO Institute for Health and Care Research, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, the Netherlands.

²Department of General Practice & Elderly Care Medicine, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, the Netherlands. ³Department of Public Health and Primary Care, Leiden University Medical Center, Hippocratespad 21, 2300 RC Leiden, the Netherlands. ⁴NIVEL (Netherlands Institute for Health Services Research), Otterstraat 118 – 124, 3513 CR Utrecht, the Netherlands.

Received: 16 July 2014 Accepted: 11 December 2014

Published: 16 December 2014

References

1. Van Buul LW, van der Steen JT, Veenhuizen RB, Achterberg WP, Schellevis FG, Essink RTGM, van Benthem BHB, Natsch S, Hertogh CPM: **Antibiotic use and resistance in long term care facilities.** *J Am Med Dir Assoc* 2012, **13**(6):568.e1–13.
2. Hulscher MEJL, van der Meer JWM, Grol RPTM: **Antibiotic use: how to improve it?** *Int J Med Microbiol* 2010, **300**(6):351–356.
3. Hulscher MEJL, Grol RPTM, van der Meer JWM: **Antibiotic prescribing in hospitals: a social and behavioural scientific approach.** *Lancet Infect Dis* 2010, **10**(3):167–175.
4. Grossman Z, del Torso S, Hadjipanayis A, van Esso D, Drabik A, Sharland M: **Antibiotic prescribing for upper respiratory infections: European primary paediatricians' knowledge, attitudes and practice.** *Acta Paediatr* 2012, **101**(9):935–940.
5. Brookes-Howell L, Hood K, Cooper L, Coenen S, Little P, Verheij T, Godycki-Cwirko M, Melbye H, Krawczyk J, Borrás-Santos A, Jakobsen K, Worby P, Goossens H, Butler CC: **Clinical influences on antibiotic prescribing decisions for lower respiratory tract infection: a nine country qualitative study of variation in care.** *BMJ Open* 2012, **2**(3):e000795.
6. Moro ML, Marchi M, Gagliotti C, Di Mario S, Resi D, the "Progetto Bambini Antibiotici" Regional Group: **Why do paediatricians prescribe antibiotics? Results of an Italian regional project.** *BMC Pediatr* 2009, **9**:69.
7. Björnsdóttir I, Kristinsson KG, Hansen EH: **Diagnosing infections: a qualitative view on prescription decisions in general practice over time.** *Pharm World Sci* 2010, **32**(6):805–814.
8. McNulty CA, Francis NA: **Optimizing antibiotic prescribing in primary care settings in the UK: findings of a BSAC multi-disciplinary workshop 2009.** *J Antimicrob Chemother* 2010, **65**(11):2278–2284.
9. Brookes-Howell L, Hood K, Cooper L, Little P, Verheij T, Coenen S, Godycki-Cwirko M, Melbye H, Borrás-Santos A, Worby P, Jakobsen K, Goossens H, Butler CC: **Understanding variation in primary medical care: a nine-country qualitative study of clinicians' accounts of the non-clinical factors that shape antibiotic prescribing decisions for lower respiratory tract infection.** *BMJ Open* 2012, **2**(4):e000796.
10. Tonkin-Crine S, Yardley L, Little P: **Antibiotic prescribing for acute respiratory tract infections in primary care: a systematic review and meta-ethnography.** *J Antimicrob Chemother* 2011, **66**(10):2215–2223.
11. Schouten JA, Hulscher ME, Natsch S, Kullberg BJ, van der Meer JW, Grol RP: **Barriers to optimal antibiotic use for community-acquired pneumonia at hospitals: a qualitative study.** *Qual Saf Health Care* 2007, **16**(2):143–149.
12. Simpson SA, Wood F, Butler CC: **General practitioners' perceptions of antimicrobial resistance: a qualitative study.** *J Antimicrob Chemother* 2007, **59**(2):292–296.
13. Charani E, Castro-Sanchez E, Sevdalis N, Kyrtasis Y, Drumright L, Shah N, Holmes A: **Understanding the determinants of antimicrobial prescribing within hospitals: the role of "prescribing etiquette".** *Clin Infect Dis* 2013, **57**(2):188–196.
14. Björnsdóttir I, Hansen EH: **Ethical dilemmas in antibiotic prescribing: analysis of everyday practice.** *J Clin Pharm Ther* 2002, **27**(6):431–440.
15. Benoit SR, Nsa W, Richards CL, Bratzler DW, Shefer AM, Steele LM, Jernigan JA: **Factors associated with antimicrobial use in nursing homes: a multilevel model.** *J Am Geriatr Soc* 2008, **56**(11):2039–2044.
16. Gahr P, Harper J, Kieke B, Como-Sabetti K, Craig Christianson R, Williams D, Pederson J, Lynfield R: **Healthcare professional surveys: judicious antibiotic use in Minnesota long-term care facilities.** *J Am Geriatr Soc* 2007, **55**(3):473–474.
17. Van der Steen JT, Helton MR, Ribbe MW: **Prognosis is important in decisionmaking in Dutch nursing home patients with dementia and pneumonia.** *Int J Geriatr Psychiatry* 2009, **24**(9):933–936.
18. Van der Steen JT, Muller MT, Ooms ME, van der Wal G, Ribbe MW: **Decisions to treat or not to treat pneumonia in demented psychogeriatric nursing home patients: development of a guideline.** *J Med Ethics* 2000, **26**(2):114–120.
19. Van der Steen JT, Ooms ME, Adèr HJ, Ribbe MW, van der Wal G: **Withholding antibiotic treatment in pneumonia patients with dementia: a quantitative observational study.** *Arch Intern Med* 2002, **162**(15):1753–1760.
20. Kistler CE, Sloane PD, Platts-Mills TF, Beeber AS, Khandelwal C, Weber DJ, Mitchell CM, Reed D, Chisholm L, Zimmerman S: **Challenges of antibiotic prescribing for assisted living residents: perspectives of providers, staff, residents, and family members.** *J Am Geriatr Soc* 2013, **61**(4):565–570.
21. Walker S, McGeer A, Simor AE, Armstrong-Evans M, Loeb M: **Why are antibiotics prescribed for asymptomatic bacteriuria in institutionalized elderly people? A qualitative study of physicians' and nurses' perceptions.** *CMAJ* 2000, **163**(3):273–277.
22. Schweizer AK, Hughes CM, Macauley DC, O'Neill C: **Managing urinary tract infections in nursing homes: a qualitative assessment.** *Pharm World Sci* 2005, **27**(3):159–165.
23. Helton MR, van der Steen JT, Daaleman TP, Gamble GR, Ribbe MW: **A cross-cultural study of physician treatment decisions for demented nursing home patients who develop pneumonia.** *Ann Fam Med* 2006, **4**(3):221–227.
24. Stichting Werkgroep Antibiotica Beleid (SWAB): **Nethmap 2014, consumption of antimicrobial agents and antimicrobial resistance among medically important bacteria in the Netherlands.** Nijmegen; 2014. [http://www.swab.nl/swab/cms3.nsf/uploads/05ABE3EF93A82F4BC1257D0071DE8BC/\$FILE/Boek%20Nethmap-MARAN%202014%20TG.pdf]
25. European Surveillance of Antimicrobial Consumption (ESAC): **Report on point prevalence survey of antimicrobial prescription in European nursing homes, 2009.** Antwerp; 2010. [https://www.google.nl/url?url=https://www.rki.de/DE/Content/Infekt/Krankenhaushygiene/Heime/esac_report2009.pdf%3F__blob%3DpublicationFile&rct=j&frm=1&q=&esrc=s&sa=U&ei=nNueVLv4AsvaOIXGgZgH&ved=0CBkQFjAA&usq=AFQjCNEe9CGLSs-n2LoQUea2t4YOcruq1A]
26. Van Buul LW, Sikkens JJ, van Agtmael MA, Kramer MHH, van der Steen JT, Hertogh CPM: **Participatory action research in antimicrobial stewardship: a novel approach to improve antimicrobial prescribing in hospitals and long term care facilities.** *J Antimicrob Chemother* 2014, **69**(7):1734–1741.
27. Zimmerman S, Mitchell CM, Beeber AS, Kistler C, Reed D, Chisholm L, Bertrand R, Sloane PD: **Strategies to reduce potentially inappropriate antibiotic prescribing in assisted living and nursing homes.** In *Advances in the Prevention and Control of Healthcare-Associated Infections*. Edited by Battles JB, Cleeman JI, Kahn KK, Weinberg DA. Rockville (MD): Agency for Healthcare Research and Quality (US); 2014.
28. Lohfeld L, Loeb M, Brazil K: **Evidence-based clinical pathways to manage urinary tract infections in long-term care facilities: a qualitative case study describing administrator and nursing staff views.** *J Am Med Dir Assoc* 2007, **8**(7):477–484.
29. Loeb M, Bentley DW, Bradley S, Crossley K, Garibaldi R, Gantz N, McGeer A, Muder RR, Mylotte J, Nicolle LE, Nurse B, Paton S, Simor AE, Smith P, Strausbaugh L: **Development of minimum criteria for the initiation of antibiotics in residents of long-term-care facilities: results of a consensus conference.** *Infect Control Hosp Epidemiol* 2001, **22**(2):120–124.
30. Nicolle LE, Bentley DW, Garibaldi R, Neuhaus EG, Smith PW: **Antimicrobial use in long-term-care facilities SHEA Long-Term-Care Committee.** *Infect Control Hosp Epidemiol* 2000, **21**(8):537–545.
31. Helton MR, Cohen LW, Zimmerman S, van der Steen JT: **The importance of physician presence in nursing homes for residents with dementia and pneumonia.** *J Am Med Dir Assoc* 2011, **12**(1):68–73.
32. Grimshaw JM, Shirran L, Thomas R, Mowatt G, Fraser C, Bero L, Grilli R, Harvey E, Oxman A, O'Brien MA: **Changing provider behavior: an**

overview of systematic reviews of interventions. *Med Care* 2001, **39**(8 Suppl 2):II2-II45.

33. Arnold SR, Straus SE: Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Database Syst Rev* 2005, **4**:CD003539.
34. Lim CJ, Kong DC, Stuart RL: Reducing inappropriate antibiotic prescribing in the residential care setting: current perspectives. *Clin Interv Aging* 2014, **13**(9):165-177.
35. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, Rubin HR: Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999, **282**(15):1458-1465.

doi:10.1186/1471-2318-14-136

Cite this article as: van Buul et al.: Factors influencing antibiotic prescribing in long-term care facilities: a qualitative in-depth study. *BMC Geriatrics* 2014 **14**:136.

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit



Bijlage 2

Artikel IMPACT onderzoek: over de mate van rationeel voorschrijven van antibiotica in verpleeghuizen



JAMDA

journal homepage: www.jamda.com

Original Study

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



Laura W. van Buul MSc^{a,b}, Ruth B. Veenhuizen MD, PhD^{a,b}, Wilco P. Achterberg MD, PhD^c,
François G. Schellevis MD, PhD^{a,b,d}, Rob T.G.M. Essink MPH, PharmD^e,
Sabine C. de Greeff PhD^f, Stephanie Natsch PharmD, PhD^g,
Jenny T. van der Steen PhD^{a,b,*}, Cees M.P.M. Hertogh MD, PhD^{a,b}

^aEMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands

^bDepartment of General Practice and Elderly Care Medicine, VU University Medical Center, Amsterdam, The Netherlands

^cDepartment of Public Health and Primary Care, Leiden University Medical Center, Leiden, The Netherlands

^dNIVEL (Netherlands Institute for Health Services Research), Utrecht, The Netherlands

^eDutch Institute for Rational Use of Medicine (IVM), Utrecht, The Netherlands

^fCentre for Infectious Disease Control (CIb), National Institute for Public Health and the Environment (RIVM), Bilthoven, The Netherlands

^gDepartment of Pharmacy, Radboud University Medical Center, Nijmegen, The Netherlands

A B S T R A C T

Keywords:

Nursing homes
antibiotic prescribing
urinary tract infection
respiratory tract infection

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.

© 2015 AMDA – The Society for Post-Acute and Long-Term Care Medicine.

The authors declare no conflicts of interest.

This study was funded by a grant from The Netherlands Organisation for Health Research and Development (ZonMw, The Hague; grant number 205 100011).

* Address correspondence to Jenny T. van der Steen, PhD, EMGO Institute for Health and Care Research, and Department of General Practice and Elderly Care Medicine, VU University Medical Center, Van der Boechorststraat 7, 1081 BT Amsterdam, The Netherlands.

E-mail address: J.vandersteen@vumc.nl (J.T. van der Steen).

<http://dx.doi.org/10.1016/j.jamda.2014.10.003>

1525-8610/© 2015 AMDA – The Society for Post-Acute and Long-Term Care Medicine.

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,

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 al¹⁵ 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 al⁶ 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 quasilielihood 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 ($\geq 38^\circ\text{C}$), 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 ($\geq 38^\circ\text{C}$), 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 al¹⁵ 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 al²¹ 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 al²¹; 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.

Acknowledgments

We acknowledge the following persons: Philip D. Sloane and Sheryl Zimmerman (University of North Carolina at Chapel Hill), for their contribution to the conception and design of the IMPACT study; Sarah M.M.M. Doncker, for her contribution to data collection; Giselka Gutschow, for her contribution to data processing; and Jochen W. Cals, Susanne E. Geerlings, Marlies E.J.L. Hulscher, Marianne A.B. van der Sande, Paul B.M. Went, Ellen E. Stobberingh, John E. Degener, Inge C. Gyssens, Theo J.M. Verheij, L.W. (Willem) Draijer, and Rogier M. Hopstaken for their contribution to the development of the algorithm for the evaluation of appropriateness of initiating or withholding antibiotics.

We thank the LTCFs for their participation in the study, in particular the physicians for their registration of infection consultations, and the residents and their family members for giving permission for chart review.

References

- Nicolle LE, Bentley DW, Garibaldi R, et al. Antimicrobial use in long-term-care facilities. SHEA Long-Term-Care Committee. *Infect Control Hosp Epidemiol* 2000;21:537–545.
- Van Buul LW, van der Steen JT, Veenhuizen RB, et al. Antibiotic use and resistance in long term care facilities. *J Am Med Dir Assoc* 2012;13:568.e1–568.e13.
- Nicolle E, Sellers HE. Resistant bacteria in nursing homes: A rational approach. *Hosp Pract* (1995) 1996;31:15.
- Pop-Vicas A, Mitchell SL, Kandel R, et al. Multidrug-resistant gram-negative bacteria in a long-term care facility: Prevalence and risk factors. *J Am Geriatr Soc* 2008;56:1276–1280.
- Nace DA, Drinka PJ, Crnich CJ. Clinical uncertainties in the approach to long-term care residents with possible urinary tract infection. *J Am Med Dir Assoc* 2014;15:133–139.
- Zimmer JG, Bentley DW, Valenti WM, Watson NM. Systemic antibiotic use in nursing homes. A quality assessment. *J Am Geriatr Soc* 1986;34:703–710.
- Montgomery P, Semenchuk M, Nicolle L. Antimicrobial use in nursing homes in Manitoba. *J Geriatr Drug Ther* 1995;9:55–74.
- Stuart RL, Wilson J, Bellaard-Smith E, et al. Antibiotic use and misuse in residential aged care facilities. *Intern Med J* 2012;42:1145–1149.
- Lim CJ, McLellan SC, Cheng AC, et al. Surveillance of infection burden in residential aged care facilities. *Med J Aust* 2012;196:327–331.
- Loeb M, Simor AE, Landry L, et al. Antibiotic use in Ontario facilities that provide chronic care. *J Gen Intern Med* 2001;16:376–383.
- Peron EP, Hirsch AA, Jury LA, et al. Another setting for stewardship: High rate of unnecessary antimicrobial use in a Veterans Affairs long-term care facility. *J Am Geriatr Soc* 2013;61:289–290.
- D’Agata E, Loeb MB, Mitchell SL. Challenges in assessing nursing home residents with advanced dementia for suspected urinary tract infections. *J Am Geriatr Soc* 2013;61:62–66.

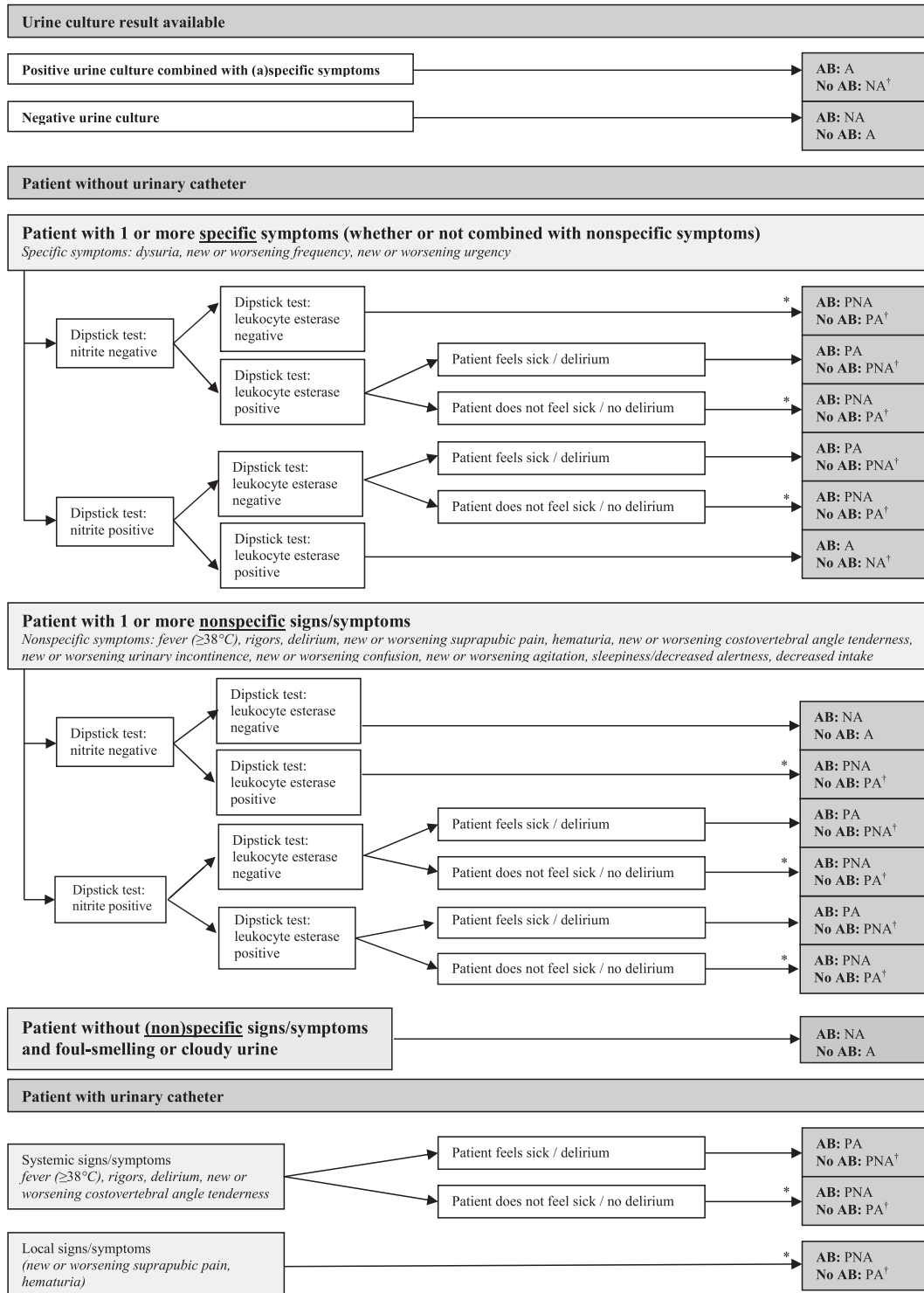
13. Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. *Arch Intern Med* 2011;171:438–443.
14. Vergidis P, Hamer DH, Meydani SN, et al. Patterns of antimicrobial use for respiratory tract infections in older residents of long-term care facilities. *J Am Geriatr Soc* 2011;59:1093–1098.
15. McGeer A, Campbell B, Emori TG, et al. Definitions of infection for surveillance in long-term care facilities. *Am J Infect Control* 1991;19:1–7.
16. Cars O, Mölstad S, Melander A. Variation in antibiotic use in the European Union. *Lancet* 2001;357:1851–1853.
17. ESAC Nursing Home Collaborators. Report on point prevalence survey of antimicrobial prescription in European nursing homes, 2009. 2010. [report].
18. Van Buul LW, Sikkens JJ, van Agtmael MA, et al. Participatory action research in antimicrobial stewardship: A novel approach to improving antimicrobial prescribing in hospitals and long-term care facilities. *J Antimicrob Chemother* 2014;69:1734–1741.
19. Ribbe MW, Ljunggren G, Steel K, et al. Nursing homes in 10 nations: A comparison between countries and settings. *Age Ageing* 1997;26:3–12.
20. Van der Steen JT, Kruse RL, Ooms ME, et al. Treatment of nursing home residents with dementia and lower respiratory tract infection in the United States and The Netherlands: An ocean apart. *J Am Geriatr Soc* 2004;52:691–699.
21. Loeb M, Bentley DW, Bradley S, et al. Development of minimum criteria for the initiation of antibiotics in residents of long-term-care facilities: Results of a consensus conference. *Infect Control Hosp Epidemiol* 2001;22:120–124.
22. Helton MR, van der Steen JT, Daaleman TP, et al. A cross-cultural study of physician treatment decisions for demented nursing home patients who develop pneumonia. *Ann Fam Med* 2006;4:221–227.
23. Jones SR, Parker DF, Liebow ES, et al. Appropriateness of antibiotic therapy in long-term care facilities. *Am J Med* 1987;83:499–502.
24. Warren JW, Palumbo FB, Fitterman L, Speedie SM. Incidence and characteristics of antibiotic use in aged nursing home patients. *J Am Geriatr Soc* 1991;39:963–972.
25. Katz PR, Beam TR Jr, Brand F, Boyce K. Antibiotic use in the nursing home. *Arch Intern Med* 1990;150:1485–1488.
26. Nicolle LE. Urinary tract infection in long-term-care facility residents. *Clin Infect Dis* 2000;31:757–761.
27. Walker S, McGeer A, Simor AE, et al. Why are antibiotics prescribed for asymptomatic bacteriuria in institutionalized elderly people? A qualitative study of physicians' and nurses' perceptions. *CMAJ* 2000;163:273–277.
28. Zabarsky TF, Sethi AK, Donskey CJ. Sustained reduction in inappropriate treatment of asymptomatic bacteriuria in a long-term care facility through an educational intervention. *Am J Infect Control* 2008;36:476–480.
29. Juthani-Mehta M, Tinetti M, Perrelli E, et al. Role of dipstick testing in the evaluation of urinary tract infection in nursing home residents. *Infect Control Hosp Epidemiol* 2007;28:889–891.
30. Mehr DR, Binder EF, Kruse RL, et al. Clinical findings associated with radiographic pneumonia in nursing home residents. *J Fam Pract* 2001;50:931–937.
31. Heckerling PS, Tape TG, Wigton RS, et al. Clinical prediction rule for pulmonary infiltrates. *Ann Intern Med* 1990;113:664–670.
32. Gyssens IC, van den Broek PJ, Kullberg BJ, et al. Optimizing antimicrobial therapy. A method for antimicrobial drug use evaluation. *J Antimicrob Chemother* 1992;30:724–727.
33. Lim CJ, Kong DCM, Stuart RL. Reducing inappropriate antibiotic prescribing in the residential care setting: Current perspectives. *Clin Interv Aging* 2014;9:165–177.
34. Zimmerman S, Sloane PD, Bertrand R, et al. Successfully reducing antibiotic prescribing in nursing homes. *J Am Geriatr Soc* 2014;62:907–912.
35. High KP, Bradley SF, Gravenstein S, et al. Clinical practice guideline for the evaluation of fever and infection in older adult residents of long-term care facilities: 2008 update by the Infectious Diseases Society of America. *J Am Geriatr Soc* 2009;57:375–394.
36. Loeb M, Brazil K, Lohfeld L, et al. Effect of a multifaceted intervention on number of antimicrobial prescriptions for suspected urinary tract infections in residents of nursing homes: Cluster randomised controlled trial. *BMJ* 2005;331:669.

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).

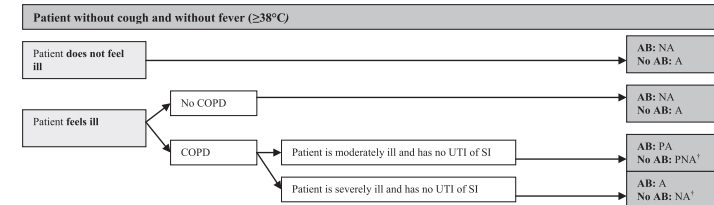
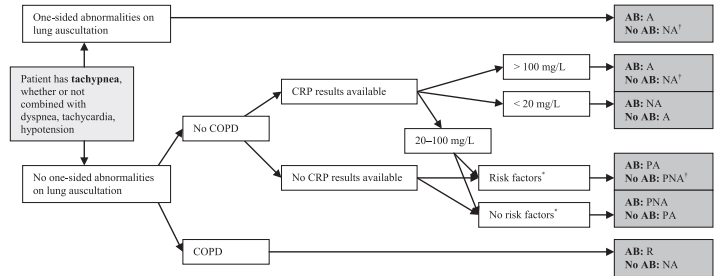
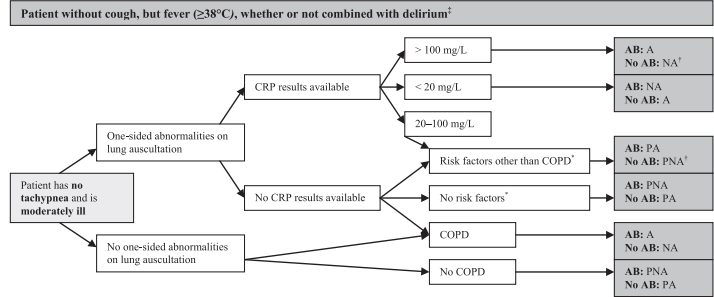
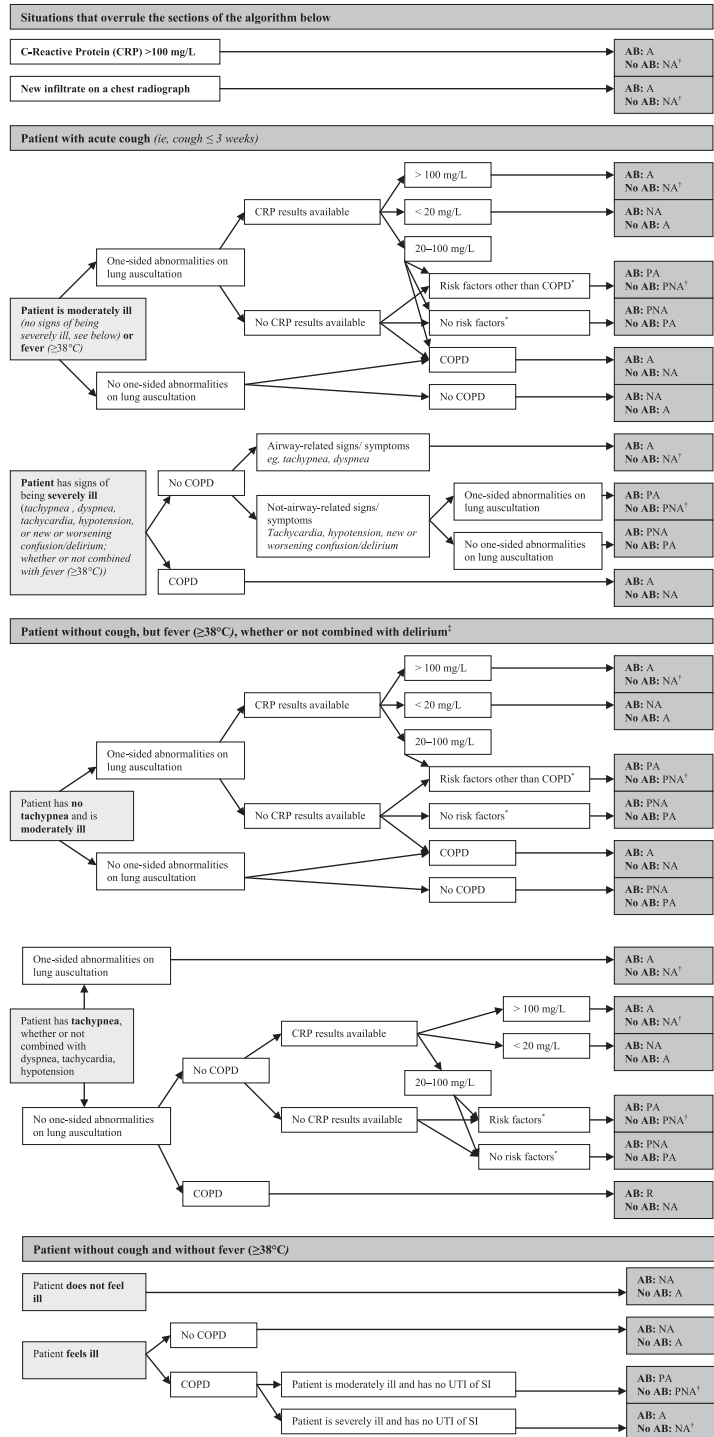
URINARY TRACT INFECTIONS



* 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



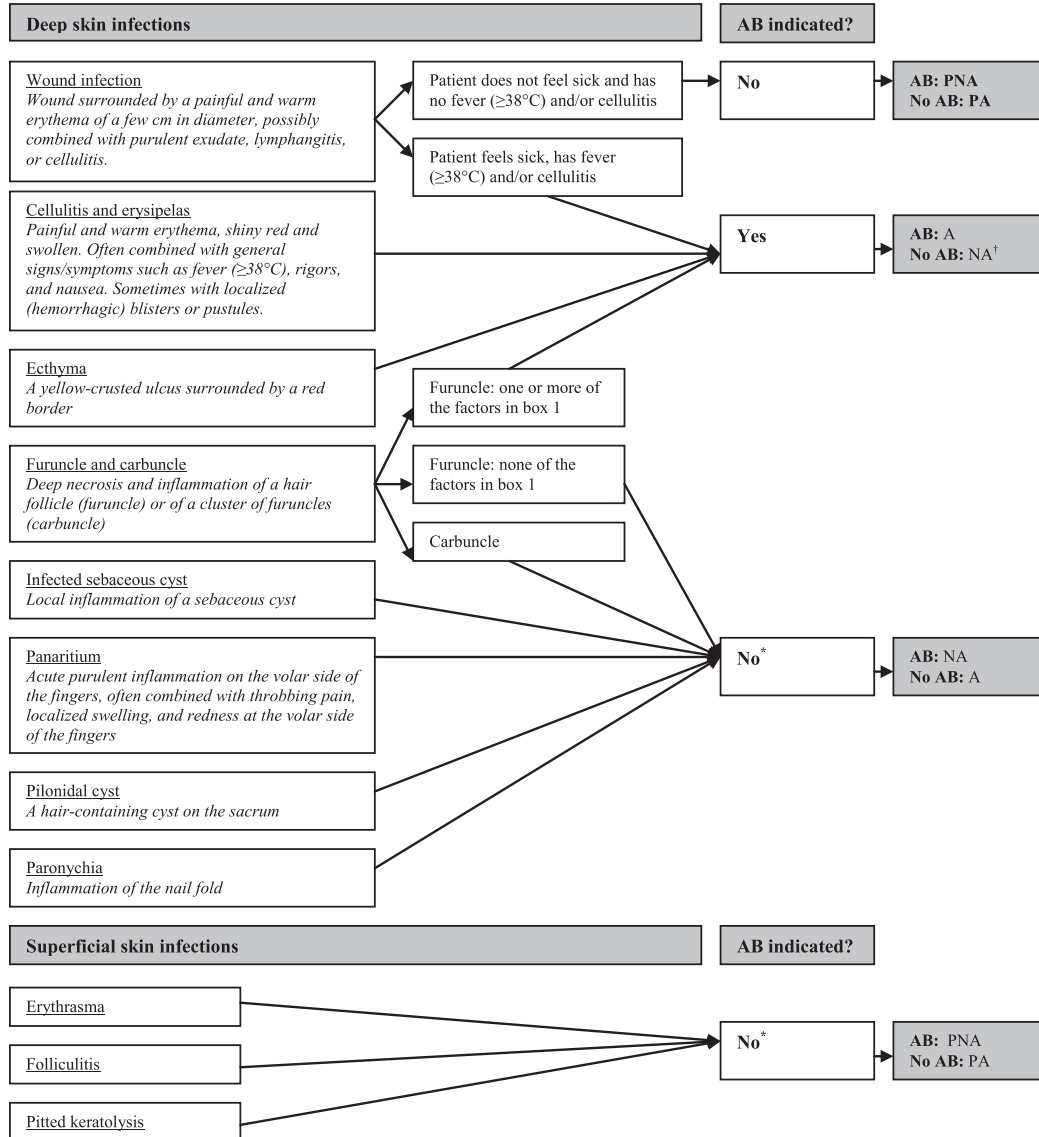
Tachypnea = respiratory rate ≥25/min
 Tachycardia = ≥ 100 beats per minute
 Hypotension = Systolic blood pressure ≤ 90, diastolic blood pressure ≤ 60 mm Hg

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

¹ 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.

² If a patient who uses fever-suppressing 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 ($\geq 38^{\circ}\text{C}$) 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 ($\geq 38^{\circ}\text{C}$)
- Patients with influenza, decreased immune function, or diabetes mellitus