9-28-2011

Nield v. Pocatello Health Services Clerk's Record v. 3 Dckt. 38823

Vol 3 of 8

SUPREME COURT OF THE STATE OF IDAHO

JUDY NIELD,

Plaintiff-Appellant

vs.

POCATELLO HEALTH SERVICES, INC. A Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as Agents and employees of Pocatello, etal

Defendants-Respondents

LAW CLERK

Hon. Robert C. Naftz **District Judge**

Appealed from the District Court of the Sixth **Judicial District of the State of Idaho, in and for** Bannock **County.**

Reed W. Larsen

Cooper & Larsen, Chartered

Attorney X **For Appellant** X

Keely E. Duke

Hall, Farley, Oberrecht & Blanton, P.A.

Attorney X **For Respondent** X

Filed this ____ **day of** ____ 2008

FILED - COPY

SEP 26 2011

Clerk

Deputy

38823

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE

STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff-Appellant, vs. POCATELLO HEALTH SERVICES, INC., A Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as Agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants-Respondents,	)	Supreme Court No. 38823-2011 Volume III

CLERK'S RECORD

Appeal from the District Court of the Sixth Judicial District of the State of Idaho, in and for the County of Bannock.

Before **HONORABLE Robert C. Naftz** District Judge.

For Appellant:

Reed W. Larsen
Cooper & Larsen, Chartered
P.O. Box 4229
Pocatello, Idaho 83205-4229

For Respondent:

Keely E. Duke
Hall, Farley, Oberrecht & Blanton, P.A.
P.O. Box 1271
Boise, Idaho 83701

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Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
10/1/2009	LOCT	DCANO	CR	Peter D. McDermott
	NCPI	DCANO	New Case Filed-Personal Injury	Peter D. McDermott
	SMIS	DCANO	Summons Issued	Peter D. McDermott
	COMP	DCANO	Verified Complaint and Demand for Jury Trial Filed	Peter D. McDermott
		DCANO	Filing: A - All initial civil case filings of any type not listed in categories B-H, or the other A listings below Paid by: cooper and larsen Receipt number: 0036486 Dated: 10/1/2009 Amount: $88.00 (Check) For:	Robert C. Naftz (Magistrate)
	ATTR	JANA	Plaintiff: Nield, Judy Attorney Retained Reed W Larsen	Peter D. McDermott
10/26/2009		CAMILLE	Affidavit of return; srvd on Pocatello Health services inc. thru Gard Skinner on 10-16-09	Robert C Naftz
11/12/2009		MEGAN	Filing: I1 - Initial Appearance by persons other than the plaintiff or petitioner Paid by: Hall Farley Oberrecht & Blanton P.A. Receipt number: 0041727 Dated: 11/12/2009 Amount: $58.00 (Check) For: Pocatello Health Services, Inc. (defendant)	Robert C Naftz
		CAMILLE	Def Pocatello Health services, inc Pocatello care and Rehabilitation centers Answer to Plntfs Verified complaint and demand for Jury Trial; aty Keely Duke for def Pocatello Health	Robert C Naftz
	ATTR	CAMILLE	Defendant: Pocatello Health Services, Inc. Attorney Retained Keely E Duke	Robert C Naftz
		CAMILLE	Notice of service - Def Pocatello Health services, Inc. dba Pocatello care and rehabilitation centers first set of Interrog. and requests for production of documents to plntf: aty Keely Duke for def	Robert C Naftz
1/16/2009		CAMILLE	Notice of Depo of Judy Nield on 1-12-2010 @ 9am: aty Chris Comstock for def	Robert C Naftz
1/19/2009		CAMILLE	Order for submission of information for scheduling Order; Plntf shall submit to the court, within 14 days of the date of this Order, a Stipulated statement: J Naftz 11-19-09	Robert C Naftz
/20/2009		CAMILLE	Notice of sevice - Plntfs First set of Discovery to Def Pocatello Health Services, Inc. aty Reed larsen for plntf	Robert C Naftz
/4/2009		CAMILLE	Stipulated Statement; aty Reed Larsen for plntf	Robert C Naftz
/8/2009	HRSC	NICOLE	Hearing Scheduled (Jury Trial 11/16/2010 09:00 AM) 10-12 days requested	Robert C Naftz
	HRSC	NICOLE	Hearing Scheduled (Jury Trial 02/15/2011 09:00 AM) 10 - 12 days requested	Robert C Naftz
		DCANO	Scheduling Order, Notice of Trial Setting and Initial Pretrial Order	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
12/14/2009		CAMILLE	Notice of service - Plntfs Discovery Responses to Def Pocatello Health Care: aty Reed larsen for plntf	Robert C Naftz
12/21/2009		CAMILLE	Notice Vacating Depo of Judy Neild; aty Keely Duke for defs	Robert C Naftz
12/29/2009		CAMILLE	Amended Notice of Depo of Judy Nield on 2-18-2010: aty Chris Comstock	Robert C Naftz
12/30/2009		CAMILLE	Notice of service - Answers to Plntfs First set of Interrog and REq for Production of Documents w/ this notice of service : aty Keely Duke for defs	Robert C Naftz
1/4/2010		CAMILLE	Notice of Service - Plntfs Supplemental Discovery Responses to Def Pocatello Health Services, Inc; aty Reed Larsen for plnt	Robert C Naftz
1/8/2010		CAMILLE	Second Amended Notice of Depositoin; set for 2-24-2010 @ 9am: aty Chris Comstock	Robert C Naftz
4/21/2010		CAMILLE	Plaintiffs witness Disclosures; aty Reed Larsen for Plaintiff	Robert C Naftz
6/2/2010		CAMILLE	Notice of service - Plntfs Second Supplemental Discovery Responses to def Pocatello Care & Rehabilitation Centers First set of Interrog and req for production of Documents to plntf: aty Reed Larsen for plntf	Robert C Naftz
6/10/2010		CAMILLE	Stipulation to Amend Scheduling Order; aty Keely Duke for Def Pocatello Health Service	Robert C Naftz
6/11/2010		CAMILLE	Notice of Service - Plntfs Third Supplemental Discovery Responses to Defendant Pocatello Health Services, Inc. and this Notice: aty Reed Larsen for p lntf	Robert C Naftz
6/16/2010		CAMILLE	Order granting Stipulation to Amend Scheduling Order; s/ Judge Naftz 6-16-2010	Robert C Naftz
6/29/2010		CAMILLE	Notice of Deposition of Mary Akina on 7-12-2010 @ 8:30 am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition of Melody Lee on 7-12-2010 @ 10:30 am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition of Wendy Sneddon on 7-12-2010 @ 1:30 pm: aty Reed Larsen	Robert C Naftz
		CAMILLE	Notice of Deposition of DAna Camphouse on 7-12-2010 @ 3:30 pm: aty Reed Larsen fo rplntf	Robert C Naftz
		CAMILLE	Notice of Deposition of Lachelle Pratt on 7-13-2010 @ 8:30 am: aty Reed Laren for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition fo Jill Schuette on 7-13-2010 @ 10:30 am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition of TAra Tanner on 7-13-2010 @ 1:30 pm: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition of Connie Funk on 7-13-2010 @ 3:30 pm: aty Reed Larsen for plntf	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
6/29/2010		CAMILLE	Notice of Depositon of Debra Cheatum on 7-14-2010 @ 8:30 am: aty Reed Larsen	Robert C Naftz
7/2/2010		CAMILLE	Notice of service - First Supplemental Answers to Pltfs First set of Interrog and requests for Production of Documents and this Notice: aty Keely Duke	Robert C Naftz
7/8/2010		CAMILLE	Amended Notice of Deposition of connie Funk on 7-13-2010 @ 1pm: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Debra Cheatum; set for 7-13-2010 @ 2pm: aty Reed larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Melody Lee on 7-13-2010 @ 3pm: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Lachelle Pratt on 7-14-2010 @ 8am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Dana Camphouse on 7-14-2010 @ 9am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Mary Akina on 7-14-2010 @ 10am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Wendy Sneddon on 7-14-2010 @ 11am: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Jill Schuette on 7-14-2010 @ 1:30 pm: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Tara Tanner on 7-14-2010 @ 2:30 pm: aty Reed Larsen for plntf	Robert C Naftz
7/22/2010		CAMILLE	Defendants Pocatello care and Rehabilitation Centers expert witness disclosure; aty Keely Duke	Robert C Naftz
7/26/2010		CAMILLE	Motion for stay of Proceedings; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Affidavit of Reed Larsen in Support of Motion to Stay Proceedings; aty Reed Larsen for pltnf	Robert C Naftz
		CAMILLE	Notice of service - Def Pocatello Health services Inc. Pocatello Care and Rehabilitation Centers Answers to Pltfs First set of Interog. aty Keely Duke for def	Robert C Naftz
8/4/2010	HRSC	NICOLE	Hearing Scheduled (Motion for Summary Judgment 09/13/2010 01:30 PM)	Robert C Naftz
8/6/2010		CAMILLE	Notice of Hearing; set for Pltfs Motion for Stay of Proceedings: on 8-23-2010 @ 1:30 pm: aty Reed Larsen for plntf	Robert C Naftz
8/20/2010	HRVC	NICOLE	Hearing result for Motion for Summary Judgment held on 09/13/2010 01:30 PM: Hearing Vacated upon request of Defendant	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
8/20/2010	HRVC	NICOLE	Hearing result for Motion held on 08/23/2010 01:30 PM: Hearing Vacated Motion for Stay of Proceedings upon request of Plaintiff	Robert C Naftz
		CAMILLE	Stipulation to Vacate; aty Reed Larsen for plntf	Robert C Naftz
8/23/2010	HRVC	NICOLE	Hearing result for Jury Trial held on 11/16/2010 09:00 AM: Hearing Vacated 10-12 days requested	Robert C Naftz
		CAMILLE	Order granting Stipulation to Vacate Trial; s/ Judge Naftz 8-20-2010 (this matter shall be reset to 2-15-28, 2011)	Robert C Naftz
8/24/2010	HRSC	NICOLE	Hearing Scheduled (Motion for Summary Judgment 11/08/2010 01:30 PM)	Robert C Naftz
10/8/2010		CAMILLE	Defendant Pocatello Health services, Inc DBA Pocatello care and rehabiltation centers Motin for Summary Judgment; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Memorandum in Support of Def Pocatello Health Services, Inc DBA Pocatello Care and Rehabilitation Centers Motion for summary Judgment; aty Keely Duke	Robert C Naftz
		CAMILLE	Affidavit of Keely Duke in Support of Defendant Pocatello care and Rehabilitation centers Motion for Summary Judgment; aty Keely Duke for def	Robert C Naftz
		DCANO	Affidavit of Thomas J. Coffman, MD, in Support of Defendant Pocatello Health Services, Inc. D/B/A Pocatello Care and Rehabilitation Center's Motion for Summary Judgment; Keely E. Duke, Attys for Dfdts.	Robert C Naftz
10/21/2010	CONT	NICOLE	Continued (Motion for Summary Judgment 12/13/2010 01:30 PM) Defendant's Motion upon request of defense	Robert C Naftz
10/28/2010		CAMILLE	Notice of Deposition of Laree Dun on 11-9-2010 @ 9am: aty Javier Gabiola	Robert C Naftz
		CAMILLE	Notice of Deposition of Joyce Maxfield on 11-9-2010 @ 1pm: aty Javier Gabiola for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition of Thomas Coffman MD: on 11-11-2010 @ 9:30am: aty Javier Gabiola for plntf	Robert C Naftz
		CAMILLE	Notice of Deposition Derick Glum on 11-16-2010 @ 9:30 am: aty Javier Gabiola for plntf	Robert C Naftz
		CAMILLE	Notice of Depositon of Marji Brim on 11-19-2010 @ 1:30pm: aty Javier Gaboiola for plntf	Robert C Naftz
11/15/2010		CAMILLE	Stipulation to vacate trial and amend scheduling order; aty Keely Duke	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Thomas J Coffman, MD: (11-19-2010 9am) aty Javier Gabiola for plntf	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
11/15/2010		CAMILLE	Amended Notice of Deposition of Joyce Maxfield; set for Joyce Maxfield on 11-17-2010 1pm): aty Javier Gabolia for plntf	Robert C Naftz
		CAMILLE	Amended Notice of Deposiiton of Derrick Glum; on 11-16-2010 @ 8:30 am: aty Javier Gabolia for plntf	Robert C Naftz
		CAMILLE	Amended Notice of hearing; set for 12-13-2010 @ 1:30 pm: aty Keely Duke for Def.	Robert C Naftz
11/18/2010		CAMILLE	Defendant Pocatello care and rehabilitation centers first supplemental expert witness disclosure; aty Keely Duke	Robert C Naftz
		CAMILLE	Amended Notice of Deposition of Laree Dunn on 11-17-2010 @ 9am: aty Javier Gabiola for p lntf	Robert C Naftz
11/29/2010		CAMILLE	Memorandum in support of Plaintiffs Motion to Strike the Affidavit of Dr. Coffman: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Motion to continue hearing on Summary Judgment or in the Alternative Additional time to suppplement the record: aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Memorandum in support of plnts motion to continue hearing on summary judgment or in the alternative additional time to supplement the record; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Memorandum in opposition to defendants motion for summary judgment; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Affidavit of Reed Larsen in support of plntfs opposition to defs motion for summary judgment; aty Reed Larsen for plntf	Robert C Naftz
11/30/2010	HRSC	NICOLE	Hearing Scheduled (Motion 12/13/2010 01:30 PM) Motion to Strike Affidavit of Dr. Coffman	Robert C Naftz
		CAMILLE	Affidavit of Suzanne Frederick; aty Suzann Frederick for plntf	Robert C Naftz
		CAMILLE	Motion to strike the Affidavit of Dr. Coffman; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Affidavit of Javier Gabiola in support of plntfs motion to continue hearing on summary judgment or in the alternative additional time to supplemental the record: aty Reed Larsen for plntf	Robert C Naftz
12/1/2010		CAMILLE	Affidavit of Hughes Selznick, MD; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Affidavit of Sidney Gerber;	Robert C Naftz
12/2/2010		CAMILLE	Notice of hearing; set for 12-13-2010 @ 1:30 pm: aty Reed Larsen for plntf	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
12/6/2010		CAMILLE	Motion to strike portions of the affidavit s of Hugh Selznick, MD Suzanne Frederick and Sidney Gerber; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Memorandum in Opposition to plntfs Motion to continue hearing on summary Judgment or in the Alternative Additional time to supplement the record: aty Keely Duke for def	Robert C Naftz
		CAMILLE	Motion to Shorten Time Regarding Motin to Strike Portions of the Affidavits of Hugh Selznick, MD Suzanne Frederick and Sidney Gerber; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Notice of Hearing regarding motion to strike portions of the affidavit s of Hug Selznick, MD Suzann Frederick and Sidney Gerber: aty KeelyDuke for def	Robert C Naftz
		CAMILLE	Memorandum in Opposition t oplntf to plntfs motion to strike the affidavit of Dr. Coffman; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Reply Memorandum in support of def pocatello Health services, Inc DBA Pocatello care and rehabiliation centers motion for summary judgment. aty Keely Duke for Def	Robert C Naftz
		CAMILLE	Memorandum in support of motion to strike portions of the affidavit of Hugh Selznick, MD Suzanne Frederrick and Sidney Gerber; aty Keely Duke	Robert C Naftz
2/8/2010	CONT	NICOLE	Continued (Jury Trial 10/25/2011 09:00 AM) 10-12 days requested; 9 scheduled	Robert C Naftz
		CAMILLE	Order granting stipulation to amend scheduling order; s/ Judge Naftz 11-22-2010	Robert C Naftz
2/9/2010		CINDYBF	Reply Memorandum in Support of Plaintiff's Motion to Continue Hearing on Summary Judgment or in the Alternative Additional Time to Supplement the Record- by PA Larsen.	Robert C Naftz
		CINDYBF	Reply Memorandum in Support of Plaintiff's Motion to Strike the Affidavit of Dr. Coffman- by PA Larsen.	Robert C Naftz
		CINDYBF	Memorandum in Opposition to Defendant's Motion to Strike Portions of the Affidavits of Hugh Selznick, MD, Suzanne Frederick and Sidney Gerber- by PA Larsen.	Robert C Naftz
2/17/2010		CAMILLE	Notice of service - Plaintiffs Second set of Discovery to Defendant : aty Javier Gabiola for plntf	Robert C Naftz
21/2011	HRVC	NICOLE	Hearing result for Motion held on 12/13/2010 01:30 PM: Hearing Vacated Motion to Continue Hearing on Summary Judgment; withdrawn by Plaintiff	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
1/21/2011	DCHH	NICOLE	Hearing result for Motion held on 12/13/2010 01:30 PM: District Court Hearing Held Court Reporter: Stephanie Davis Number of Transcript Pages for this hearing estimated: less than 100 pages Motion to Strike Affidavit of Dr. Coffman	Robert C Naftz
	DCHH	NICOLE	Hearing result for Motion for Summary Judgment held on 12/13/2010 01:30 PM: District Court Hearing Held Court Reporter: Stephanie Davis Number of Transcript Pages for this hearing estimated: less than 100 pages Defendant's Motion	Robert C Naftz
		CAMILLE	Memorandum Decision and Order; Defendants Motion for Summary Judgment is hereby GRANTED: s/ Judge Naftz 1-21-2011	Robert C Naftz
2/4/2011		CAMILLE	Plaintiffs motion for reconsideration; aty Reed Larsen for plntf	Robert C Naftz
		CAMILLE	Memorandum in support of Plaintiffs Motion for Recosnsideration; aty Reed Larsen for plntf	Robert C Naftz
2/8/2011	HRSC	NICOLE	Hearing Scheduled (Motion 02/28/2011 01:30 PM) Motion for Reconsideration (Plaintiff)	Robert C Naftz
2/9/2011		CAMILLE	Notice of hearing; set for plntf motion for reconsideration on 2-28-2011 @ 1:30 pm: aty Javier Gabiola for plntf	Robert C Naftz
2/18/2011		CAMILLE	Pocatello Health services, inc dba Pocatello care and rehabilitation centers Memorandum in opposition to plntfs motion for reconsideration; aty Keely Duke for def	Robert C Naftz
2/24/2011	STIP	DCANO	Stipulation to Vacate Hearing on Motion for Reconsideration; Keely E. Duke, Atty for Dfdts.	Robert C Naftz
2/25/2011	CONT	NICOLE	Continued (Motion 03/28/2011 01:45 PM) Motion for Reconsideration (Plaintiff) per stipulatin	Robert C Naftz
		CAMILLE	Reply Memorandum in support of plaintiffs motion for reconsideration; aty Reed Larsen	Robert C Naftz
3/3/2011	ORDR	DCANO	Order Granting Stipulation to Vacate Hearing on Plaintiff's Motion for Reconsideration; Javier L. Gabiola, Atty for Plntfs.	Robert C Naftz
/28/2011	INHD	BRANDY	Hearing result for Motion held on 03/28/2011 01:45 PM: Interim Hearing Held Motion for Reconsideration (Plaintiff)	Robert C Naftz
/3/2011	HRVC	BRANDY	Hearing result for Jury Trial held on 10/25/2011 09:00 AM: Hearing Vacated 10-12 days requested; 9 scheduled	Robert C Naftz
		CAMILLE	Memorandum Decision and Order; Plaintiffs Motion for rexonsideration is hereby DENIED; court will prepare judgment: s/ Judge Naftz	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
5/3/2011	JDMT	CAMILLE	Judgment; court DENIED the plntf Motion for reconsideration, court is hereby ordered and adjudged that all of the plntfs claims against the def in this matter are dismissed withprej: s/ Judge Naftz 5-3-2011	Robert C Naftz
	CSTS	CAMILLE	Case Status Changed: Closed	Robert C Naftz
5/12/2011		NOELIA	Filing: L4 - Appeal, Civil appeal or cross-appeal to Supreme Court Paid by: Larsen, Reed W (attorney for Nield, Judy) Receipt number: 0016659 Dated: 5/12/2011 Amount: $101.00 (Check) For: Nield, Judy (plaintiff)	Robert C Naftz
	APSC	DCANO	Appealed To The Supreme Court	Robert C Naftz
	NOTC	DCANO	Notice of Appeal: Javier L. Gabiola, Atty for Plaintiff	Robert C Naftz
	MISC	DCANO	Received Check #27668 for $101.00 filing fee on Appeal and Check # 27669 for $100.00 for Deposit of Clerk's Record.	Robert C Naftz
5/17/2011		CAMILLE	Pocatello Health Services, Inc. dba Pocatello care and rehabilitation centers motion for costs; aty Keely Duke for Def.	Robert C Naftz
		CAMILLE	Pocatello Health services, Inc dba Pocatello care and rehailitation centers verified Memorandum of costs; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Affidavit of ocunsel in support of Memorandum for fees and costs; aty Keely Duke for def	Robert C Naftz
5/18/2011		CAMILLE	Pocatello Health services, Inc's Memorandum in support of Motion to amend Judgment; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Pocatello Health services, Inc's Motion to Amend Judgment; aty Keely Duke	Robert C Naftz
5/19/2011	HRSC	NICOLE	Hearing Scheduled (Motion 06/13/2011 02:00 PM) Motion for Costs Motion to Amend Judgment	Robert C Naftz
	CSTS	NICOLE	Case Status Changed: Closed pending clerk action	Robert C Naftz
5/24/2011	MISC	DCANO	CLERK'S CERTIFICATE OF APPEAL: Signed and Mailed to Counsel and SC on 5-24-11.	Robert C Naftz
5/25/2011		CAMILLE	Notice of hearing; aty Keely Duke for def	Robert C Naftz
		CAMILLE	Defendant Pocatello Health services, Inc's requests for additions to the clerks record; aty Keely Duke	Robert C Naftz
5/26/2011		CAMILLE	Plaintiff's Memorandum i n Opposition to Def Pocatello Health services, Inc. dba Pocatello care and rehabilitation centers motion to amend judgment and motion for costs; aty Reed larsen	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
5/27/2011		CAMILLE	Affidavit of Javier Gabiola in support of plaintiffs Memorandum in opposition to defs pocatello health services, Inc dba pocatello care and rehabilitation centers motion to amend judgment and motion for costs; aty Reed larsen	Robert C Naftz
6/2/2011	MISC	DCANO	IDAHO SUPREME COURT; Notice of Appeal received in SC on 5-26-11. Docket Number # 38823-2011. Clerk's Record and Reporter's Transcripts must be filed in SC on 8-3-11. (6-30-11 5 weeks prior). The following Transcritps to be lodged: Motion for Summary Judgment 12-13-10 and Reconsideration 3-28-11.	Robert C Naftz
		DCANO	IDAHO SUPREME COURT; Clerk's Certificate filed with SC. Examine Title of Cert. if any corrections contact Dist. Clerk. Title in the Cert. must appear on all documents filed with SC.	Robert C Naftz
6/9/2011		DCANO	Pocatello Health Services, Inc. dba Pocatello Care and Rehabilitation Center's Reply Memorandum in Support of Motion for Costs; Keely E. Duke, Atty for Defendants.	Robert C Naftz
		DCANO	Defendant Pocatello Health Services, Inc.'s Second Request for Additions to the Clerk's Record./ Keely E. Duke, Atty for Defendants.	Robert C Naftz
		DCANO	Pocatello Health Services, Inc.'s Reply Memorandum in Support of Motion to Amend Judgment; Keely E. Duke, Atty for Defendants.	Robert C Naftz
		DCANO	Pocatello Health Services, Inc. dba Pocatello Care and Rehabilitation Center's Amended Verified Memorandum of Costs; Keely E. Duke, Atty. for Defendants.	Robert C Naftz
6/10/2011		CAMILLE	Affidavit of counsel in support of Pocatello health services, inc. dba Pocatello care and rehabilitation centers reply memorandum in support of motion for costs: aty Keely Duke for def	Robert C Naftz
6/16/2011		CAMILLE	Plaintiffs request for additions to clerks record; aty Reed Larsen	Robert C Naftz
6/17/2011	DCHH	NICOLE	Hearing result for Motion held on 06/13/2011 02:00 PM: District Court Hearing Held Court Reporter: Stephanie Davis Number of Transcript Pages for this hearing estimated: less than 100 pages Motion for Costs Motion to Amend Judgment	Robert C Naftz
6/20/2011		CAMILLE	Minute Entry and Order; Plntfs Motion to Amend Judgment and Motion for costs are DENIED: s/ Judge Naftz 6-20-2011	Robert C Naftz

Judy Nield vs. Pocatello Health Services, Inc.

Date	Code	User		Judge
7/7/2011	MISC	DCANO	IDAHO SUPREME COURT; Documents filed in SC. Defendant Pocatello Helath Serivces, Inc.'s Request for Additions to the Clerk's Record and Defendant Poctello Haelth Service, Inc.'s Second Request for Additions to the Clerk's Record.	Robert C Naftz
7/26/2011		DCANO	REPORTER'S TRANSCRIPTS received in Court Records on 7-26-ll from Stephanie Davis for the following hearings: Dfdts. Motn Summary Judge, Motion to Strike, Plntfs Motion to Strike and Motn to Continue held 12-13-10. Pltnfs. Motion to Reconsider held 3-28-11.	Robert C Naftz
8/12/2011	MISC	DCANO	CLERK'S RECORD RECEIVED IN Court Records on 8-12-11.	Robert C Naftz

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Attorneys for Defendant Pocatello Health Services, Inc. d/b/a Pocatello Care and Rehab

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD,

Plaintiff,

vs.

POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHAB, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a Pocatello Care and Rehab,

Defendants.

Case No. CV 09 3869 PI

NOTICE OF HEARING

ORIGINAL

PLEASE TAKE NOTICE, defendant Pocatello Health Services, Inc., d/b/a Pocatello Care and Rehab ("Pocatello Care and Rehab"), by and through its counsel of record, has set before this Court to be heard a Motion for Summary Judgment. Said motion shall be heard on the 8th day of November, 2010 at the hour of 1:30 p.m. before the Honorable Robert c. Naftz.

DATED this 7th day of October, 2010.

HALL, FARLEY, OBERRECHT &
BLANTON, P.A.

By: Keely E. Duke
Keely E. Duke – Of the Firm
Chris D. Comstock – Of the Firm
Attorneys for Defendant Pocatello Health Services, Inc. d/b/a Pocatello Care and Rehab

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on the 7th day of October, 2010, I caused to be served a true copy of the foregoing **NOTICE OF HEARING**, by the method indicated below, and addressed to each of the following:

Reed W. Larsen
COOPER & LARSEN, CHARTERED
151 North 3rd Avenue, 2nd Floor
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W:\4\4-568.1\Discovery\Defendant's Expert Disclosure.First Supplemental.doc
Attorneys for Defendant Pocatello Health Services, Inc. d/b/a Pocatello Care and Rehabilitation Center

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE

STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD,

Plaintiff,

vs.

POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER,

Defendants.

Case No. CV 09 3869 PI

DEFENDANT POCATELLO CARE AND REHABILITATION CENTER'S FIRST SUPPLEMENTAL EXPERT WITNESS DISCLOSURE

COMES NOW defendant Pocatello Health Services, Inc., d/b/a Pocatello Care and Rehabilitation Center ("the Center") by and through its counsel of record Hall, Farley, Oberrecht

& Blanton, P.A., and hereby makes the following disclosures pursuant to Rule 26(b)(4) of the Idaho Rules of Civil Procedure related to experts who may be called to testify at trial:

SUPPLEMENTAL DISCLOSURES

Without waiving such objections, and subject to such reservations, the Center makes the following supplement to its Expert Disclosure provided on July 21, 2010:

Thomas J. Coffman, M.D.
125 E. Idaho Suite 203
Boise, Idaho 83712

- Dr. Coffman may testify regarding causation of Ms. Nield's left below knee amputation. Specifically, Dr. Coffman may testify that Ms. Nield's comorbidities including but not limited to: poorly controlled diabetes; chronic non healing ulcers caused by leukocytoclastic vasculitis and severe neuropathy of the left lower extremity may have eventually required a below left knee amputation regardless of whether or not she was MRSA colonized.
- Dr. Coffman may testify that Ms. Nield's left leg below knee amputation was more likely required as a result of her leukocytoclastic vasculitis as opposed to her MRSA colonization. Dr. Coffman will testify regarding the characteristics, causes, symptoms and effects of leukocytoclastic vasculitis and the effect Ms. Nield's leukocytoclastic vasculitis had on her. Dr. Coffman will explain how Ms. Nield's leukocytoclastic vasculitis interacted with her MRSA colonization.
- Dr. Coffman will testify that if Ms. Nield had contracted MRSA in the Center, it would be expected that she would have contracted a hospital acquired strain of MRSA, as opposed to a community acquired strain. Dr. Coffman will testify that the strain of MRSA Ms. Nield was identified with is a mixture of hospital

acquired and community acquired MRSA, that is more closely associated with community rather than hospital acquired MRSA based upon an antibiotic susceptibility profile.

ARTICLES

Literature upon which Dr. Coffman may rely or testify concerning:

- *Methicillin-Resistant* Staphylococcus aureus *Disease in Three Communities,* NEW ENG. J. MED. 2005; 352:1436-1444
- *The Role of Nasal Carriage in Staphylococcus aureus Infections*, THE LANCET INFECTIOUS DIS. 2005, 5: 751–62
- *Methicillin-Resistant Staphylococcus aureus: An Evolutionary, Epidemiologic, and Therapeutic Odyssey*, CLINICAL INFECTIOUS DISEASES 2005; 40:562–73
- *Throat Swabs Are Necessary to Reliably Detect Carriers of Staphylococcus aureus,* CLINICAL INFECTIOUS DISEASES 2007; 45:475–7
- *Methicillin-Resistant Staphylococcus aureus (MRSA) Nares Colonization at Hospital Admission and Its Effect on Subsequent MRSA Infection*, CLINICAL INFECTIOUS DISEASES 2004; 39:776–82
- *Predicting the Staphylococcus aureus Nasal Carrier State: Derivation and Validation of a "Culture Rule"*, CLINICAL INFECTIOUS DISEASES 2004; 39:806–11
- *Community-Associated Methicillin-Resistant Staphylococcus aureus: The Way to the Wound Is through the Nose*, THE JOURNAL OF INFECTIOUS DISEASES 2006; 193:169–71
- *Predicting the Staphylococcus aureus Nasal Carrier State: Derivation and Validation of a "Culture Rule"*, CLINICAL INFECTIOUS DISEASES 2004; 39:806–11.

Discovery in this matter is still underway, and the Center reserves the right to supplement these opinions based upon its experts' review of depositions in this case that have not yet been taken and any other additional discovery, including additional documents that are provided to them.

DATED this 16th day of November, 2010.

HALL, FARLEY, OBERRECHT & BLANTON, P.A.

By _____
Keely E. Duke – Of the Firm
Chris D. Comstock – Of the Firm
Attorneys for Defendant Pocatello Health Services, Inc. d/b/a Pocatello Care and Rehabilitation Center

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on the 16th day of November, 2010, I caused to be served a true copy of the foregoing **POCATELLO CARE AND REHABILITATION CENTER'S FIRST SUPPLEMENTAL EXPERT WITNESS DISCLOSURE**, by the method indicated below, and addressed to each of the following:

Reed W. Larsen
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Fax: (208) 235-1182
Attorneys for Plaintiff

- ☐ U.S. Mail, Postage Prepaid
- ☐ Hand Delivered
- ☐ Overnight Mail
- ☑ Telecopy

and by email w/ literature attached

for Keely E. Duke

ORIGINAL ARTICLE

Methicillin-Resistant *Staphylococcus aureus* Disease in Three Communities

Scott K. Fridkin, M.D., Jeffrey C. Hageman, M.H.S., Melissa Morrison, M.P.H., Laurie Thomson Sanza, R.N., Kathryn Como-Sabetti, M.P.H., John A. Jernigan, M.D., Kathleen Harriman, Ph.D., Lee H. Harrison, M.D., Ruth Lynfield, M.D., and Monica M. Farley, M.D., for the Active Bacterial Core Surveillance Program of the Emerging Infections Program Network

ABSTRACT

BACKGROUND

Methicillin-resistant *Staphylococcus aureus* (MRSA) infection has emerged in patients who do not have the established risk factors. The national burden and clinical effect of this novel presentation of MRSA disease are unclear.

METHODS

We evaluated MRSA infections in patients identified from population-based surveillance in Baltimore and Atlanta and from hospital-laboratory–based sentinel surveillance of 12 hospitals in Minnesota. Information was obtained by interviewing patients and by reviewing their medical records. Infections were classified as community-acquired MRSA disease if no established risk factors were identified.

RESULTS

From 2001 through 2002, 1647 cases of community-acquired MRSA infection were reported, representing between 8 and 20 percent of all MRSA isolates. The annual disease incidence varied according to site (25.7 cases per 100,000 population in Atlanta vs. 18.0 per 100,000 in Baltimore) and was significantly higher among persons less than two years old than among those who were two years of age or older (relative risk, 1.51; 95 percent confidence interval, 1.19 to 1.92) and among blacks than among whites in Atlanta (age-adjusted relative risk, 2.74; 95 percent confidence interval, 2.44 to 3.07). Six percent of cases were invasive, and 77 percent involved skin and soft tissue. The infecting strain of MRSA was often (73 percent) resistant to prescribed antimicrobial agents. Among patients with skin or soft-tissue infections, therapy to which the infecting strain was resistant did not appear to be associated with adverse patient-reported outcomes. Overall, 23 percent of patients were hospitalized for the MRSA infection.

CONCLUSIONS

Community-associated MRSA infections are now a common and serious problem. These infections usually involve the skin, especially among children, and hospitalization is common.

From the Division of Bacterial and Mycotic Diseases (S.K.F.) and Division of Healthcare Quality Promotion (J.C.H., M.M., J.A.J.), National Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta; Emory University School of Medicine and the Veterans Affairs Medical Center, Atlanta (M.M., J.A.J., M.M.F.); Johns Hopkins University Bloomberg School of Public Health, Baltimore (L.T.S., L.H.H.); and the Minnesota Department of Health, Minneapolis (K.C.-S., K.H., R.L.). Address reprint requests to Dr. Fridkin at the CDC, NCID, DBMD, MDB, MS C-09, 1600 Clifton Rd., NE, Atlanta, GA 30333, or at skf0@cdc.gov.

N Engl J Med 2005;352:1436-44.

IN THE UNITED STATES, *STAPHYLOCOCCUS aureus* is the most common cause of skin and soft-tissue infections, as well as of invasive infections acquired in hospitals.[1,2] Treatment of serious *S. aureus* infections can be challenging, and the associated mortality rate remains 20 to 25 percent despite the availability of highly active antimicrobial agents.[3,4] However, most antistaphylococcal agents are ineffective against methicillin-resistant *S. aureus* (MRSA), which was first identified as a hospital-acquired pathogen in the 1960s.[2,3,5,6]

Over the past 40 years, MRSA infections have become endemic in most U.S. hospitals[1,2] and hospitals worldwide,[7] striking, with rare exception, only patients with established risk factors.[8,9] More recently, however, MRSA infections have been described in patients without established risk factors who are living in the community.[10-19] The current approach to suspected cases of community-associated (also referred to as community-acquired) *S. aureus* infections (suggested by findings of furuncles, abscesses, or cellulitis) commonly includes empirical treatment with β-lactam antibiotics. This approach may need to be reconsidered if community-associated MRSA becomes a clinically significant pathogen.

The Centers for Disease Control and Prevention (CDC) and three sites participating in the Emerging Infections Program began a specialized MRSA surveillance project in 2001 using the Active Bacterial Core Surveillance program, a population-based surveillance component of the Emerging Infections Program Network designed to study the epidemiologic features of invasive bacterial disease and to track drug resistance in the United States. We used these data to evaluate the incidence of endemic community-associated MRSA infection, racial disparities in the incidence, patterns of antimicrobial susceptibility, and clinical outcomes in several areas in the United States.

METHODS

SURVEILLANCE POPULATION

The MRSA Active Bacterial Core Surveillance project monitored all MRSA isolates from all body sites from patients in 11 Baltimore hospitals serving a population of 700,000; Health District 3 in greater Atlanta, comprising eight counties with a total population of 3.3 million; and 12 sentinel hospital–based laboratories representative of the state in Minnesota (6 rural and 6 urban, representing 16 percent of the licensed hospital beds in the state). Laboratories served both outpatient clinic networks and hospital inpatients; sites in Atlanta included several referral laboratories serving predominantly ambulatory care settings. Surveillance was performed consecutively for 12 months in Baltimore (beginning February 2002), 18 months in Atlanta (beginning July 2001), and 24 months in Minnesota (beginning January 2001). In Baltimore, 1 of 12 eligible hospitals declined to participate in the MRSA study; however, this omission would be unlikely to have a substantial effect. The laboratory in that hospital historically reports only about 5 percent of the cases of infections with other pathogens under surveillance as part of the Active Bacterial Core Surveillance system in Baltimore.

CASE DEFINITIONS AND ASCERTAINMENT

A community-associated MRSA isolate was defined as an MRSA isolate recovered from a clinical culture from a patient residing in the surveillance area who had no established risk factors for MRSA infection. Established risk factors included the isolation of MRSA two or more days after hospitalization; a history of hospitalization, surgery, dialysis, or residence in a long-term care facility within one year before the MRSA-culture date; the presence of a permanent indwelling catheter or percutaneous medical device (e.g., tracheostomy tube, gastrostomy tube, or Foley catheter) at the time of culture; or previous isolation of MRSA. We reviewed the medical records of patients with suspected community-associated MRSA isolates to identify risk factors for infection. We attempted to interview by telephone all patients for whom no risk factors were identified to confirm the absence of established risk factors and to obtain a brief history of the clinical outcome. At least 15 attempts were made, after which suspected community-associated MRSA isolates were classified as confirmed in the case of patients who were successfully interviewed and confirmed to have no established risk factors or as probable in the case of patients who were not interviewed but who had no established risk factors on a review of medical records. The remaining isolates were classified as either health care–associated when established risk factors were identified or indeterminate if no information on the patient could be obtained.

A case of community-associated MRSA disease was defined as illness compatible with staphylococcal disease in a patient residing in the surveillance

areas and isolation of community-associated MRSA from a clinically relevant site. Only a subgroup of patients with community-associated MRSA isolates had actual disease and achieved case status.

To identify cases, surveillance personnel routinely contacted all clinical microbiology laboratories serving residents of each catchment area regarding MRSA isolated from clinical cultures (infection-control surveillance cultures were excluded). Periodic audits of laboratory records were conducted by surveillance personnel to identify any unreported cases and ensure the completeness of reporting. Surveillance personnel collected information on patients using a standardized questionnaire that included demographic and isolate data on all MRSA isolates; information on antimicrobial-susceptibility testing (with results characterized as susceptible, intermediate, or resistant) and clinical characteristics were obtained from available medical records (e.g., emergency room, primary care, or hospital) only for patients with confirmed or probable community-associated MRSA isolates. The collection of additional data on disease outcome, employment status, household structure, socioeconomic status, and level of education was limited to patients with confirmed cases of community-associated MRSA disease.

The study was approved by the appropriate institutional review boards at the participating sites, including all participating Baltimore hospitals, the Maryland Department of Health and Mental Hygiene, Johns Hopkins University Bloomberg School of Public Health, the Georgia Department of Human Resources, Emory University School of Medicine, the Minnesota Department of Health, and the CDC. Oral informed consent was obtained from all those who were interviewed.

STATISTICAL ANALYSIS

Statistical analysis was conducted with SAS software (SAS Institute). Annual cumulative incidence rates were calculated, after adjustment for the study period at each site, with the use of projections of the 2001 and 2002 population from the Census Bureau. Initial therapy was categorized as active if the patient received an antimicrobial agent with activity against *S. aureus* and to which the MRSA was susceptible in vitro. Therapy was categorized as inactive if initial therapy consisted of antimicrobial agents to which the isolate had intermediate resistance on testing or was resistant in vitro. If the results of susceptibility testing were not available for a prescribed agent or the patient received no antimicrobial agents, the patient was excluded from analyses correlating inactive therapy and outcomes. The Mantel–Haenszel chi-square test was used to compare the incidence according to race and other categorical data, and the t-test was used for continuous data. All comparisons were initially stratified according to the reporting area, and rate ratios were pooled if there were no significant differences between areas according to the Breslow–Day test for homogeneity of the rate ratios.

RESULTS

SURVEILLANCE

During the study period, 12,553 patients with MRSA isolates were reported. Of these patients, 9972 (79 percent) were immediately classified as having health care–associated MRSA infection and did not require interviews. Interviews were attempted with 2581 patients with suspected cases of community-associated MRSA infection; 1063 of these patients (41 percent) were interviewed, allowing 280 (11 percent) to be reclassified as having health care–associated MRSA. Among the remaining patients with suspected cases of community-associated MRSA infection, 2107 (17 percent) were classified as having confirmed or probable community-associated MRSA isolates (Atlanta, 1590 of 7819 [20 percent]; Minnesota, 370 of 3714 [12 percent]; and Baltimore, 147 of 1720 [8 percent]; $P<0.001$). MRSA isolates in 196 patients were classified as indeterminate (2 percent).

The overall incidence of invasive MRSA infection (i.e., MRSA recovered from a normally sterile site), regardless of whether the infection was acquired in the community or at a health care facility, was 19.3 infections per 100,000 population in Atlanta and 40.4 infections per 100,000 in Baltimore.

Of the 2107 confirmed or probable isolates of community-associated MRSA, 1647 (78 percent) were associated with clinical illness and were classified as cases of community-associated MRSA disease. Among these cases, the confirmed and the probable community-associated MRSA isolates were obtained from similar body sites and demonstrated similar susceptibilities to antimicrobial agents with one exception, i.e., there was variable sensitivity to erythromycin (details are provided in the Supplementary Appendix, available with the full text of this article at www.nejm.org). The annual incidence of community-associated MRSA disease

in the two areas that performed population-based surveillance was 25.7 cases per 100,000 in Atlanta and 18.0 per 100,000 in Baltimore (rate ratio, 0.70; 95 percent confidence interval, 0.58 to 0.85) (Fig. 1). In both surveillance areas, the incidence was significantly higher among persons who were less than two years old than among those who were two years of age or older (unadjusted relative risk, 1.51; 95 percent confidence interval, 1.19 to 1.92) (Fig. 1). Incidence rates were significantly higher among blacks than whites in Atlanta among all age groups (age-adjusted relative risk, 2.74; 95 percent confidence interval, 2.44 to 3.07); racial differences in incidence were not significant in the Baltimore population, even in the youngest age group (relative risk, 2.58; 95 percent confidence interval, 0.31 to 21.5).

CLINICAL CHARACTERISTICS

The type of infection varied slightly among the surveillance areas (Table 1); of the 1647 patients with community-associated MRSA disease, most (1266 [77 percent]) were categorized as having skin or soft-tissue infections. Specific types included abscess in 751 patients (59 percent), cellulitis in 528 patients (42 percent), folliculitis in 88 patients (7 percent), and impetigo in 33 patients (3 percent). Among the other types of infection reported, 103 (6 percent) were invasive, including bacteremia, septic arthritis, and osteomyelitis; 157 were in wounds (10 percent); and 31 were pneumonia (2 percent) (Table 1).

Most patients (1333 [81 percent]) were treated with antimicrobial agents; specific antimicrobial agents were documented for 1297 patients (97 percent). Among these 1297 patients, 757 (58 percent) received β-lactam antibiotics alone, 199 (15 percent) received a β-lactam with a non–β-lactam agent, and 341 (26 percent) received only non–β-lactam therapy. Among the patients whose antibiotic regimens were documented, significantly more of the 1099 patients with skin infections than of the 198 patients with other types of infection received β-lactam agents alone (64 percent vs. 28 percent, $P<0.001$).

Antimicrobial susceptibilities were obtained from the medical records of 1345 of the 1647 patients with community-associated MRSA disease (82 percent). With few exceptions, the patterns of susceptibility were similar among the study areas. However, isolates from patients in Atlanta and Baltimore were significantly less likely than those from Minnesota to be susceptible to erythromycin and ciprofloxacin (Table 2). Susceptibility data and documented information on empirical therapy were available for most patients who received empirical therapy (1215 of 1297 [94 percent]); 884 (73 percent) received inactive therapy.

Limited information on the effect of the disease was available from the medical records; 506 patients (31 percent) were hospitalized, including 371 (23 percent) who were hospitalized specifically for MRSA disease (Table 1). For these 371 patients, hospitalization was unlikely to be the result of the clinician's receiving the MRSA-culture report. The interval between specimen collection and admis-

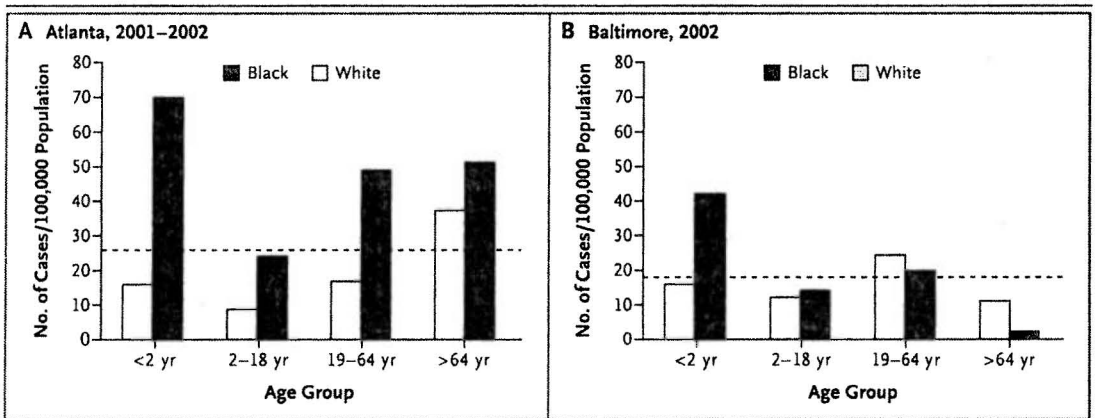

Figure 1. Incidence of Community-Associated MRSA Disease in Atlanta and Baltimore, According to Race and Age Group.
The horizontal line in each graph is the overall site-specific annual incidence. Race was determined in most cases by study personnel.

Table 1. Infections and Outcomes Associated with Community-Associated MRSA Disease, 2001–2002.

Variable	Atlanta (N=1267)	Baltimore (N=115)	Minnesota (N=265)	Total (N=1647)	P Value*
Invasive infections — no. (%)†					
Bacteremia	30 (2)	7 (6)	6 (2)	43 (3)	0.66
Meningitis	1 (<1)	1 (1)	0	2 (<1)	0.84
Osteomyelitis	11 (1)	6 (5)	7 (3)	24 (1)	<0.01
Bursitis	12 (1)	0	7 (3)	19 (1)	0.04
Arthritis	13 (1)	0	2 (1)	15 (1)	0.52
Other infections — no. (%)†					
Skin and soft tissue	973 (77)	95 (83)	198 (75)	1266 (77)	0.71
Wound	136 (11)	8 (7)	13 (5)	157 (10)	<0.01
Pneumonia	23 (2)	4 (3)	4 (2)	31 (2)	0.97
Urinary tract	57 (4)	4 (3)	3 (1)	64 (4)	0.01
Sinus	60 (5)	0	1 (<1)	61 (4)	<0.01
Underlying illness — no. (%)	594 (47)	70 (61)	80 (30)	744 (45)	0.08
Hospitalization — no. (%)	339 (27)	72 (63)	95 (36)	506 (31)	0.68
MRSA disease primary reason — no./total no. (%)	251/339 (74)	41/72 (57)	79/95 (83)	371/506 (73)	0.62
Intensive care unit stay — no./total no. (%)	26/339 (8)	7/72 (10)	4/95 (4)	37/506 (7)	0.14
Discharged from hospital — no./total no. (%)	323/339 (95)	71/72 (99)	86/95 (91)	480/506 (95)	0.07
Median stay — days	5	5	3	4	0.20

* P values were determined by means of the Cochran–Mantel–Haenszel summary statistic and indicate significant differences in infection rates among sites.
† Patients could have more than one infection.

Table 2. Number of Community-Associated MRSA Isolates That Were Susceptible to Selected Antimicrobial Agents, 2001–2002.*

Agent Tested	Atlanta	Baltimore	Minnesota	Total	P Value†
	no. of susceptible isolates/total no. (percent)				
Ciprofloxacin	408/648 (63)	6/31 (19)	146/182 (80)	560/861 (65)	<0.001
Clindamycin	840/970 (87)	78/92 (85)	211/239 (88)	1129/1301 (87)	0.58
Erythromycin	98/907 (11)	11/94 (12)	110/235 (47)	219/1236 (18)	<0.001
Gentamicin	429/444 (97)	66/71 (93)	184/188 (98)	679/703 (97)	0.59
Rifampin	682/694 (98)	6/9 (67)	179/184 (97)	867/887 (98)	0.21
Tetracycline	726/814 (89)	43/70 (61)	163/179 (91)	932/1063 (88)	0.44
Vancomycin‡	1016/1017 (100)	95/96 (99)	232/232 (100)	1343/1345 (100)	0.88
Linezolid	13/13 (100)	11/12 (92)	0	24/25 (96)	0.30
Trimethoprim–sulfamethoxazole	912/943 (97)	30/36 (83)	236/239 (99)	1178/1218 (97)	0.32

* Results were obtained at local facilities.
† P values were determined by means of the Cochran–Mantel–Haenszel summary statistic.
‡ Two isolates were nonsusceptible with the use of automated testing methods, but these results were not confirmed with the use of recommended methods.[20,21]

sion was less than one day for 226 of the 371 patients (61 percent), one to two days for 115 (31 percent), and more than two days for 22 (6 percent) (2 percent had missing data). A total of 37 patients (10 percent) required hospitalization in the intensive care unit. Hospitalization lasted a median of four days, and only 1 of the 37 patients who died during hospitalization had documentation that the community-associated MRSA was causal or contributory to the death.

Information on other outcomes associated with community-associated MRSA infection was available for 575 patients with confirmed cases (i.e., interviewed patients). Among these patients, 560 (97 percent) received some antimicrobial agents, 136 (24 percent) were hospitalized, 226 (39 percent) underwent incision and drainage, and 176 (31 percent) required a follow-up visit with their physician.

To assess the relationship between inactive antimicrobial therapy and outcome more closely, we attempted to identify a homogeneous group of patients in which to compare clinical outcomes on the basis of empirical antimicrobial treatment. We limited further analysis to 453 patients with confirmed cases of community-associated MRSA disease involving skin or soft-tissue infections who received antimicrobial therapy at the time of the isolation of community-associated MRSA and for whom information on initial treatment and clinical outcome was available from the interview. Neither initial incision and drainage nor initial antimicrobial therapy that was inactive was significantly associated with an increased frequency of the following patient-reported outcomes after the initial evaluation for illness: follow-up visits to a health care provider, subsequent incision and drainage, or subsequent change in antimicrobial therapy (Table 3). Also, among the subgroup of patients who did not initially undergo incision and drainage, there were no significant differences in outcomes ac-

Table 3. Effect of Initial Therapy on Selected Outcomes among 453 Patients with Confirmed Skin or Soft-Tissue Infections Due to Community-Associated MRSA, 2001–2002.*

Initial Therapy	No. of Patients	Follow-up Visit to Health Care Provider		Incision and Drainage on Follow-up Visit	New Antimicrobial Agent Prescribed on Follow-up Visit
		≥1 Times	≥2 Times		
Incision and drainage					
Yes — no. (%)	196	54 (28)	30 (15)	19 (10)	45 (23)
No — no. (%)	257	69 (27)	43 (17)	14 (5)	66 (26)
Rate ratio (95% CI)	—	1.01 (0.80–1.29)	0.94 (0.70–1.27)	1.37 (1.00–1.87)	0.92 (0.71–1.18)
Inactive therapy					
Yes — no. (%)	254	59 (23)	35 (14)	15 (6)	55 (22)
No — no. (%)	199	64 (32)	38 (19)	18 (9)	56 (28)
Rate ratio (95% CI)	—	0.81 (0.66–1.00)	0.83 (0.65–1.07)	0.80 (0.54–1.17)	0.85 (0.69–1.05)
Incision and drainage					
Inactive therapy — no. (%)	108	20 (19)	11 (10)	8 (7)	16 (15)
Active therapy — no. (%)	88	34 (39)	19 (22)	11 (12)	29 (33)
Rate ratio (95% CI)	—	0.60 (0.41–0.87)	0.63 (0.39–1.02)	0.75 (0.43–1.28)	0.58 (0.39–0.88)
No incision and drainage					
Inactive therapy — no. (%)	146	39 (27)	24 (16)	7 (5)	39 (27)
Active therapy — no. (%)	111	30 (27)	19 (17)	7 (6)	27 (24)
Rate ratio (95% CI)	—	0.99 (0.78–1.26)	0.98 (0.73–1.31)	0.87 (0.51–1.49)	1.05 (0.83–1.34)

* The outcomes were reported during the interview with each patient. Only patients who were interviewed were included in the analysis. Initial therapy was categorized as active if the patient received an antimicrobial agent with activity against *S. aureus* and to which the MRSA was susceptible in vitro. Therapy was categorized as inactive if initial therapy included only antimicrobial agents to which the isolate had intermediate susceptibility on testing or was resistant in vivo. The rate ratio is the ratio of the rate of the outcome among the exposed group to the rate of the outcome among the group that was not exposed. CI denotes confidence interval.

cording to whether the initial therapy was inactive (Table 3).

POTENTIAL EXPOSURES TO MRSA

Although none of the established risk factors for MRSA infection were documented in any patient, 744 patients (45 percent) had underlying conditions or factors that were associated with skin infections or suggested some contact with the health care system. Among the 1250 patients whose age was known to be at least 18 years, 653 (52 percent) reported 1249 underlying conditions, including smoking (35 percent), previous skin infections (21 percent), diabetes (19 percent), asthma (12 percent), infection with the human immunodeficiency virus (HIV) (9 percent), intravenous drug use (7 percent), alcohol abuse (6 percent), and coronary vascular disease (5 percent). Among 345 patients who were younger than 18 years old, 76 (22 percent) reported 90 preexisting conditions, including skin disease (42 percent), asthma (35 percent), and smoking (7 percent). Among the 575 patients with confirmed community-associated MRSA disease, detailed information on household characteristics and employment status was obtained from the interview, and several points of contact with the health care system exclusive of established risk factors for MRSA infection were identified (Table 4).

DISCUSSION

In this study, 8 to 20 percent of all MRSA isolates collected as part of prospective population-based surveillance were not associated with traditional risk factors and were classified as community-associated MRSA. Most of these isolates were associated with clinically relevant infections that required treatment. The most common infections involved skin and soft tissues; however, 6 percent were considered invasive. Attributable mortality was low, but 23 percent of patients were hospitalized for these infections.

The incidence of clinically relevant community-associated MRSA disease varied between the Atlanta surveillance area (25.7 per 100,000) and the Baltimore surveillance area (18.0 per 100,000), and we found marked disparity in the incidence of community-associated MRSA disease between blacks and whites in Atlanta but not in Baltimore, even among the youngest age group. Several reports have highlighted the increased incidence of staphylococcal disease among Pacific Islanders, American Indians, and Alaskan Natives.[16,18,22,23] Black race was associated with increased rates of invasive *S. aureus* disease in 1998 in one population-based study in Connecticut[24] and in other studies evaluating invasive pneumococcal disease.[25-28] The increased prevalence of certain underlying diseases (e.g., diabetes and HIV infection), differences in immune response, or differences in other socioeconomic factors (e.g., crowding in the household or decreased access to medical care), which are correlated with black race, may contribute to these findings.[29]

The differences observed in incidence rates between Baltimore and Atlanta can probably be explained on the basis of the different populations under surveillance. The lower overall incidence of community-associated MRSA disease in Baltimore suggests that this surveillance population may be more likely to have established risk factors for MRSA infection. The incidence may also be falsely low, since 1 of 12 eligible laboratories declined to participate in the study. However, it is unlikely that the Baltimore surveillance underreported cases from the remaining laboratories, since the rates of invasive MRSA disease (regardless of whether the infection was acquired in the community or at a health care facility) were higher in Baltimore (40 per 100,000) than Atlanta (19 per 100,000). The Atlanta surveillance area encompassed an eight-county urban and suburban area and included a large referral laboratory; the Baltimore surveillance area was limited to urban hospital-based laboratories likely to serve persons with more frequent contact with the hospitals.

Our large, prospective series of community-associated MRSA infections identified with the use of standardized methods to measure rates of endemic disease allows for an accurate description of the clinical course and effect of these infections. In a manner consistent with previous reports from outbreaks and smaller surveillance studies, we found that most patients who were treated empirically received β-lactam antimicrobial agents. Measuring the effect of inactive therapy on these infections has been difficult owing to the small numbers of cases and imprecise outcome measurements.[30-35] Although we relied on self-reported measures, our data suggest that patients with community-associated MRSA skin or soft-tissue disease who initially receive inactive antimicrobial therapy have out-

comes similar to those among patients who are treated with antimicrobial agents to which the organism is susceptible in vitro. Prospective evaluations with more objective measurements are needed to clarify whether the addition of active systemic therapy to topical agents or surgical drainage increases the beneficial effect in patients with community-associated MRSA infections involving the skin and soft tissues.

Our report reflects the results of one to two years of active surveillance in three large and diverse geographic areas. However, certain limitations should be borne in mind. First, we were unable to perform population-based estimates in Minnesota, where sentinel surveillance was conducted. However, the descriptive data probably reflect the patient mix in that state. Second, our surveillance required isolation of MRSA from a clinically relevant culture; since *S. aureus* skin disease is often treated empirically without a diagnostic test, our results probably underestimate the true burden of disease. Some caution must be taken in generalizing our findings to the U.S. population. First, we were able to interview only 41 percent of eligible patients, eliminating a majority of patients from the outcome analysis. Second, although there were rarely significant differences among the reporting areas, the majority of cases were reported in the Atlanta area. Also, patients who could not be interviewed may have been misclassified as having community-associated MRSA infection, since no interview data were available. However, we believe pooling the patients with probable and confirmed cases of community-associated MRSA disease was justified on the basis of the similarities between both patients' and isolates' characteristics, reflecting a pattern typically seen in previously reported outbreaks of community-associated MRSA infection.[10,11,15,36-38]

To avoid clinical complications from community-acquired MRSA infections, clinicians should now consider MRSA as a potential pathogen in patients with suspected *S. aureus* infections in the community setting. Clinicians should obtain appropriate material for bacterial culture; should follow up on the results of susceptibility testing of all *S. aureus* isolates, since by definition MRSA organisms are not susceptible to β-lactam antibiotics; and should recommend surgical drainage of infections when feasible. The choice of appropriate antimicrobial agents for suspected *S. aureus* infections of skin and soft tissue in patients in the community must now take into account the emergence of community-associated MRSA; providers should be aware that several available antimicrobial agents should be effective in treating these infections.

Table 4. Frequency of Characteristics Potentially Related to Infection among 575 Patients with Confirmed Community-Associated MRSA Disease, 2001–2002.*

Potential Risk Factor	No. of Patients (%)
Any visit to a physician's office in past yr	357 (62)
Receipt of any antimicrobial agents in past yr	224 (39)
Chronic noninfectious skin disease	190 (33)
Stayed >2 wk in non–health care high-risk setting in past 5 yr†	10 (2)
Health care–related employment in past 5 yr	69 (12)
Health care provider or direct care	23 (4)
Health care–delivery support services	26 (5)
Other type of health care	46 (8)
Acute care or skilled-nursing facility	30 (5)
Clinic or ambulatory care facility	12 (2)
Crowded household (>1 person/bedroom)‡	121 (51)
≥1 Household member ≤2 yr old	132 (23)
≥1 Household member >60 yr old	109 (19)
≥1 Household member with established risk factor for MRSA infection	92 (16)
Job in the health care setting	69 (12)
Attendance at day care§	52 (9)
History of MRSA infection	35 (6)
Receipt of home care services	17 (3)
Self-reported annual income¶	
<$20,000	144 (29)
$20,000–$50,000	178 (36)
>$50,000	173 (35)
Receipt of public assistance	92 (16)

* The categories are not mutually exclusive.
† A high-risk setting was defined as a department-of-corrections facility or military barracks.
‡ Data on crowding were available for 236 of the 575 interviewed patients.
§ Day-care attendance among household members was for a median of 20 hours per week (range, 20 to 60).
¶ Data on income were available for 495 interviewed patients.

Supported by the CDC Emerging Infections Program. (The use of product names in this article does not imply their endorsement by the Public Health Service or the Department of Health and Human Services.)

We are indebted to Virginia Rego, Wendy Baughman, Christina Payne, Matthew Johns, Margaret Pass, Elizabeth Hopewell, Chris Van Beneden, Tami Hilger, Anne Schuchat, and personnel in hospitals and laboratories participating in the Community-Associated MRSA Special Project of the Active Bacterial Core Surveillance program for their contributions to this project.

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CORRECTION

Methicillin-Resistant *Staphylococcus aureus* Disease in Three Communities

Methicillin-Resistant *Staphylococcus aureus* Disease in Three Communities . In the Abstract on page 1436, the Methods and Results sections should have referred to "community-associated" infection, rather than "community-acquired" infection, as printed. We regret the error.

The role of nasal carriage in *Staphylococcus aureus* infections

Heiman F L Wertheim, Damian C Melles, Margreet C Vos, Willem van Leeuwen, Alex van Belkum, Henri A Verbrugh, Jan L Nouwen

Staphylococcus aureus **is a frequent cause of infections in both the community and hospital. Worldwide, the increasing resistance of this pathogen to various antibiotics complicates treatment of *S aureus* infections. Effective measures to prevent *S aureus* infections are therefore urgently needed. It has been shown that nasal carriers of *S aureus* have an increased risk of acquiring an infection with this pathogen. The nose is the main ecological niche where *S aureus* resides in human beings, but the determinants of the carrier state are incompletely understood. Eradication of *S aureus* from nasal carriers prevents infection in specific patient categories—eg, haemodialysis and general surgery patients. However, recent randomised clinical trials in orthopaedic and non-surgical patients failed to show the efficacy of eliminating *S aureus* from the nose to prevent subsequent infection. Thus we must elucidate the mechanisms behind *S aureus* nasal carriage and infection to be able to develop new preventive strategies. We present an overview of the current knowledge of the determinants (both human and bacterial) and risks of *S aureus* nasal carriage. Studies on the population dynamics of *S aureus* are also summarised.**

Lancet Infect Dis 2005; 5: 751–62

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Introduction

Staphylococcus aureus is both a human commensal and a frequent cause of clinically important infections (figure 1).[1] Although the prevalence of meticillin-resistant *S aureus* (MRSA) is still very low in northern European countries,[2] there is a worldwide increase in the number of infections caused by MRSA. Vancomycin is one of the last therapeutic options available for MRSA infections. The recent isolation of vancomycin-resistant MRSA strains in the USA is a major cause for concern.[3] Therefore, the prevention of staphylococcal infections and reduction of the spread and emergence of MRSA are essential.

The association between *S aureus* nasal carriage and staphylococcal disease was first reported by Danbolt in 1931, who studied furunculosis.[4] The increasing incidence of penicillin-resistant *S aureus* hospital infections since 1947 emphasised the need for a better understanding of the pathogenesis of staphylococcal disease. Subsequently, numerous studies confirmed Danbolt's finding.[5–9] A causal relation between *S aureus* nasal carriage and infection is supported by the fact that the nasal *S aureus* strain and the infecting strain share the same phage type or genotype.[8,10] Furthermore, nasal application of an antistaphylococcal drug temporarily decolonises the nose and other body sites, which prevents infection.[11]

Our knowledge of the mechanisms, risks, and treatment of *S aureus* nasal carriage has greatly expanded over the past decade. Table 1 presents an overview of major events in *S aureus* research. Here, we focus on the latest insights into the determinants of *S aureus* nasal carriage and the risks of infection associated with *S aureus* nasal carriage. Most studies were done in western countries, so conclusions drawn can not always be generalised.

Determinants of nasal carriage of *S aureus*

S aureus nasal carriage patterns

S aureus colonises the skin and mucosae of human beings and several animal species.[5] Although multiple body sites can be colonised in human beings, the anterior nares of the nose is the most frequent carriage site for *S aureus*.[5] Extra-nasal sites that typically harbour the organism include the skin, perineum, and pharynx.[5,23–25] Other carriage sites including the gastrointestinal tract,[5,26] vagina,[27] and axillae[5,25,28] harbour *S aureus* less frequently (figure 2).

Most studies on *S aureus* nasal carriage have used a cross-sectional design with a single nasal culture to

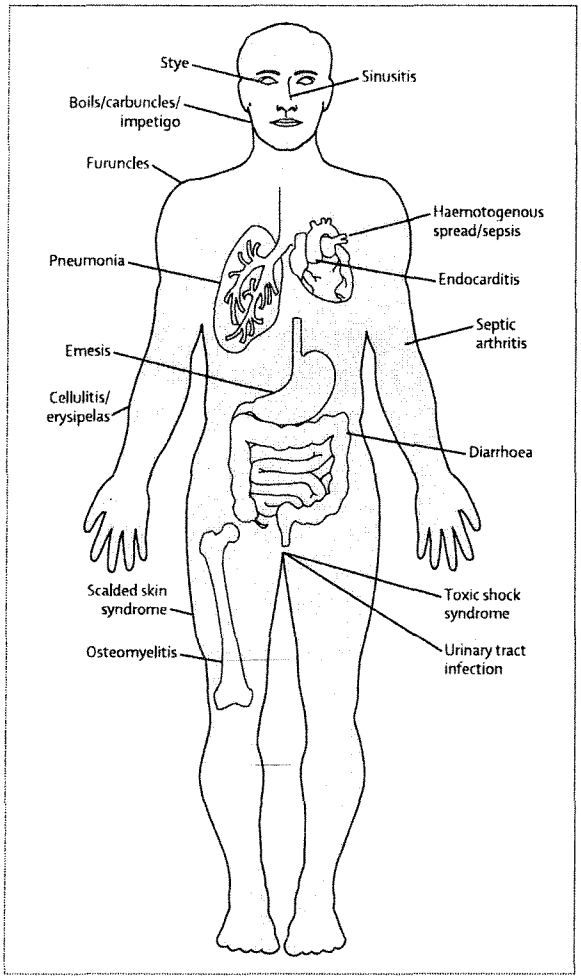

Figure 1: **Large diversity in *S aureus* infections**

Year	Event
1880	Alexander Ogston identifies micrococci in purulent infections[12]
1931	Association between nasal colonisation and furunculosis discovered[4]
1934	Popularisation of the coagulase test for the identification of *S aureus*[5]
1944	Introduction of phage typing[13]
1947	Penicillin-resistant *S aureus* reported[14]
1952	Association between nasal colonisation of *S aureus* and infection with the same strain determined by phage typing[15,16]
1961	Meticillin-resistant *S aureus* (MRSA) reported[17]
1991	Pulsed field gel electrophoresis used for genotyping *S aureus*[32]
1994	Identification of microbial surface components recognising adhesive matrix molecules (MSCRAMMs)[18]
2000	Multilocus sequence typing developed for studying clonality of *S aureus*[19]
2001	Whole genome of *S aureus* sequenced[20]
2001	80% of bacteraemic *S aureus* isolates are endogenous[8]
2001	Increase in community-onset MRSA infections[21]
2002	Vancomycin-resistant *S aureus* reported[22]

Table 1: **Major events in *S aureus* research**

classify an individual as a carrier or not. However, longitudinal studies distinguish at least three *S aureus* nasal carriage patterns in healthy individuals: persistent carriage, intermittent carriage, and non-carriage.[5,6,23,29,30] Some studies make a further distinction between occasional and intermittent carriers.[29,31] Therefore, a patient classified as a carrier in cross-sectional studies could either be a persistent or an intermittent carrier. This distinction is important because persistent carriers have higher *S aureus* loads and a higher risk of acquiring *S aureus* infection.[32,33] Likewise, non-carriers in a cross-sectional study may actually be intermittent carriers.

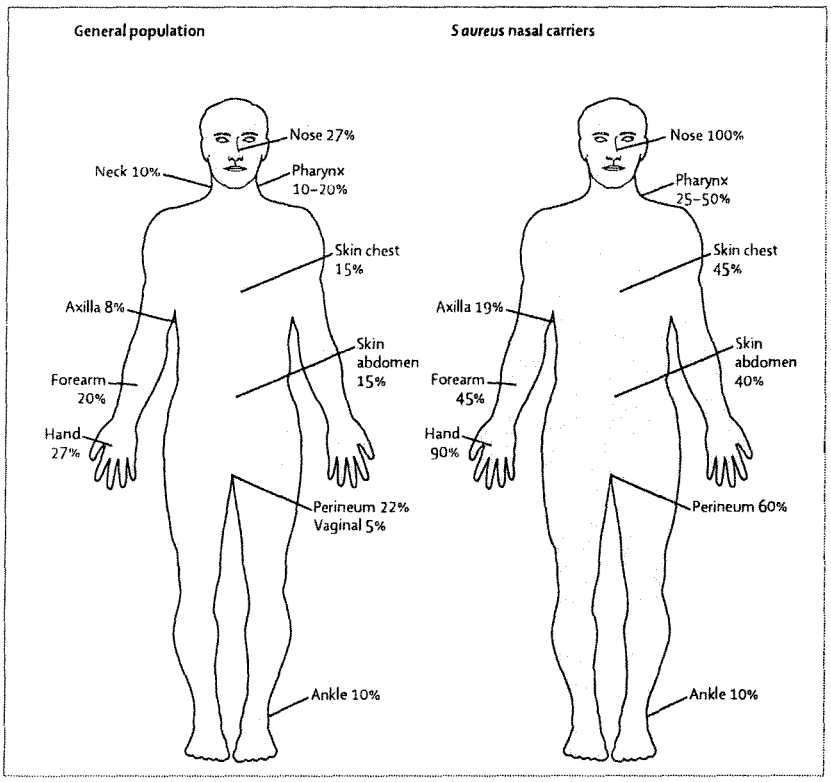

Figure 2: ***S aureus*** **carriage rates per body site in adults**
There is an increase in carriage rates at extra-nasal sites within nasal *S aureus* carriers. The mentioned rates are approximations using data from the literature cited in the text.

The definition of persistent carriage varies from study to study. There is no general consensus on how many cultures should be taken and how many cultures should be positive to define persistence. One study concludes that a "culture rule" that combines qualitative and quantitative results of two nasal swabs taken with a week interval can accurately classify *S aureus* nasal carriage.[34] Since adequate, internationally accepted definitions are needed, the so-called culture rule is an improvement for those studying determinants and risks of *S aureus* nasal carriage.

Longitudinal studies show that about 20% (range 12–30%) of individuals are persistent *S aureus* nasal carriers, approximately 30% are intermittent carriers (range 16–70%), and about 50% (range 16–69%) non-carriers.[6,29,34,35] The very wide ranges found in the proportions of intermittent and non-carriers are the result of the use of different culture techniques, different populations being studied, and the use of different interpretation guidelines.[10] Although at least seven nasal swab cultures are necessary to segregate non-carriers from intermittent carriers, the more nasal cultures are analysed, the higher the chance of identifying an intermittent carrier.[34]

Children have higher persistent carriage rates than adults.[23,36,37] Rates vary substantially with age, falling from approximately 45% during the first 8 weeks to 21% by 6 months.[38] More than 70% of newborn babies have at least one positive nasal culture with *S aureus*.[18] There is a transition from persistent carriage to intermittent or non-carriage states during adolescence (figure 3).[5,23] Cross-sectional surveys of healthy adult populations have reported *S aureus* nasal carriage rates of approximately 27% since 2000.[7,9,39–46] This rate is much lower than the earlier reported prevalence of 35%, which included studies since 1934.[6] Plotting the carriage rates of either healthy populations or a general hospital population clearly illustrates a substantial decline in the *S aureus* nasal carriage rate in time (figure 4, patient categories with known higher *S aureus* nasal carriage rates, like dialysis patients, were excluded). Explanations for this decline include improved personal hygiene, changes in socioeconomic class,[47] and smaller families.[48]

Determinants of *S aureus* nasal carriage

Although the reasons remain unknown, the basic determinants of persistent and intermittent carriage are thought to be different. Persistent carriers are often colonised by a single strain of *S aureus* over long time periods, whereas intermittent carriers may carry different strains over time.[29,30,35] Furthermore, the load of *S aureus* is higher in persistent carriers, resulting in increased dispersal and a higher risk of infection.[33,34] Nasal carriers who are also perineal carriers have higher *S aureus* loads and disperse more *S aureus*.[4,25,49]

The mechanisms leading to *S aureus* nasal carriage are multifactorial. A recent study in which volunteers (non-carriers and persistent carriers) were artificially inoculated with a mixture of *S aureus* strains showed that non-carriers quickly eliminated the inoculated *S aureus* strains, whereas most persistent carriers selected their original resident *S aureus* strain from the inoculation mixture.[50] The investigators concluded that host characteristics substantially co-determine the *S aureus* carrier state and that an optimal fit between host and bacteria seems to be essential.[50]

This view is further supported by the fact that *S aureus* carriage rates vary between different ethnic groups, with higher rates in white people[5,40] and in men,[5,29,51] and depend on age.[23,38,52] Patients with diabetes mellitus (both insulin dependent and non-insulin dependent),[53] patients undergoing haemodialysis[54,55] or continuous peritoneal dialysis for end stage renal disease,[56] patients with end stage liver disease,[57,58] patients with HIV,[59,60] patients with *S aureus* skin infections and skin disease (eg, eczema or psoriasis),[61–63] and obesity and a history of cerebrovascular accident[51] have been shown to have higher *S aureus* nasal carriage rates. Most studies are hospital or outpatient-clinic based and need confirmation from community-based surveys. In one community-based study, Boyko and co-workers[64] found similar *S aureus* carriage rates in diabetics and non-diabetics, by contrast with an earlier clinic-based study.[53]

Nasal colonisation of *S aureus* can be seen as the net result of repellent and attracting forces. There are four prerequisites to becoming a nasal carrier of *S aureus*. First, the nose has to come in contact with *S aureus*. Second, *S aureus* needs to adhere to certain receptors in the nasal niche. Third, *S aureus* needs to overcome the host defences. Finally, *S aureus* should be able to propagate in the nose. We will discuss these issues separately (table 2).

How does *S aureus* reach the nose?

S aureus cells can survive for months on any type of surface.[65] Hands are the main vector for transmitting *S aureus* from surfaces to the nasal niche—eg, nose picking.[66] *S aureus* cells are principally found in the anterior nares (vestibulum nasi or "nose picking area"), and *S aureus* nasal carriage and hand carriage are strongly correlated.[4] Some studies find higher carriage rates more proximal in the nose, but these studies are rare and probably reflect a chance finding.[67] *S aureus* may also reach the nose directly through the air, but this probably occurs less frequently.[68] However, airborne transmission is important for the dispersal of staphylococci to many different reservoirs, from where, via the hands, they can reach the nose. *S aureus* nasal carriers with rhinitis can disperse high loads of *S aureus* into the environment and may be the source of an outbreak of *S aureus* infections—the so called "cloud" individual.[69]

Environmental factors can also influence the *S aureus* nasal carriage state. Hospitalisation, for example, has been

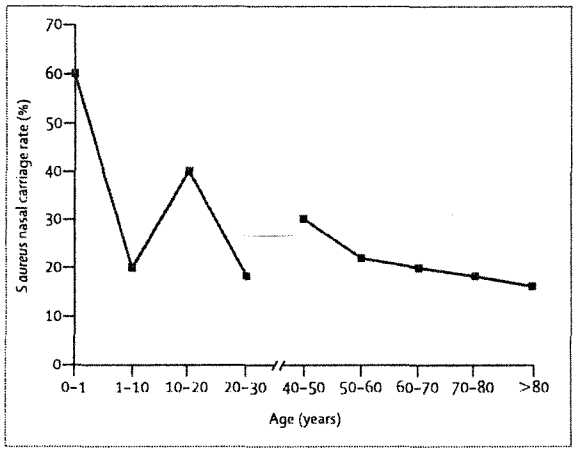

Figure 3: Rates of *S aureus* nasal carriage according to age

shown to be an important risk factor.[70] Furthermore, it seems that *S aureus* carriers can "impose" their carrier state upon other household members. Recently, Peacock and colleagues[38] found concordant carrier states between mothers and their children. Also, Bogaert and co-workers[48] found large households (≥five members) to be positively associated with *S aureus* nasal carriage. Most mothers carry the same strain as their children, indicating that carriage strains are transmitted to close contacts.[38] A study among an elderly population demonstrated that not only persistent but also non-carriage or intermittent *S aureus* nasal carrier states are shared among household members.[71] Up to 65% of people with positive cultures living within one household shared genotypically identical strains.[71] Intrafamilial spread of MRSA from and to health-care workers has also been shown to be an

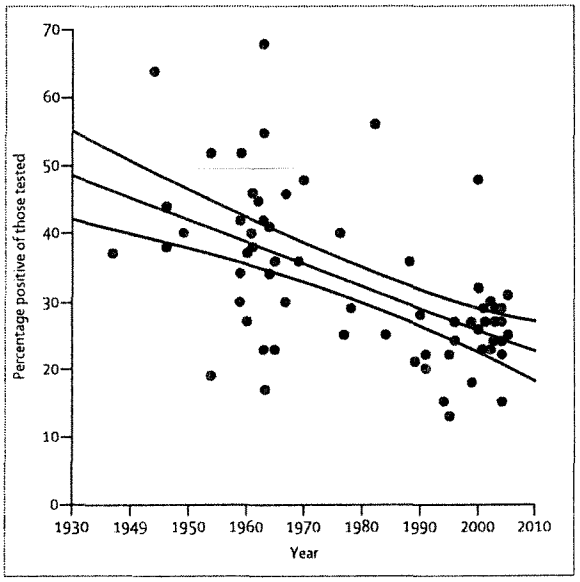

Figure 4: Reported *S aureus* nasal carriage rates through the years
There is a significant negative correlation between the year of reporting and the reported carriage rate (correlation coefficient −0·55; $p<0·001$).

Mechanism	Host	*S aureus*
General	Age, sex, ethnicity	Virulence
	Socioeconomic class	
	Antibiotic use	Antibiotic resistance
	Underlying disease (insulin-dependent diabetes mellitus, HIV, liver disease, eczema, nasal abnormalities, and others)	
	HLA type	
	Immune status	
Exposure	(Heavily) colonised partner	
	Hospital environment	
	Nose picking	
Adherence	Receptors	Adhesins
	(Extracellular) matrix proteins	MSCRAMMs
	Cytokeratin type 10	Clumping factor B
	Epithelial membrane	(Lipo)teichoic acid
		Capsule
	Mucins	Capsular polysaccharides
	Surface charge	Surface charge
	Hydrophobicity	Hydrophobicity
(Evading) immune response	Mucosal/skin barrier	Proteases, lipases
	Clearance in mucus by microvilli	Host cell internalisation
	Immunoglobulins	Protein A (binds Fc of IgG)
	Lysozyme, lactoferrin, antimicrobial peptides	Resistance to antimicrobial peptides
	Opsonisation	Capsule

MSCRAMMs=microbial surface components recognising adhesive matrix molecules

Table 2: **Overview of mechanisms associated with *S aureus* nasal carriage**

important risk factor for the re-introduction of MRSA into hospitals.[72] Furthermore, Herwaldt and colleagues[73] demonstrated that in 21% of patients receiving continuous peritoneal dialysis, the source of newly acquired nasal *S aureus* strains were their respective family members.

Activities leading to skin lesions are also correlated with higher *S aureus* nasal carriage rates. These include river rafting,[74] football,[75] and (pig-)farming.[76] Repeated skin punctures in drug users and diabetics were thought to explain higher *S aureus* nasal carriage rates.[6] However, recent studies do not support this theory: intravenous drug users have a lower prevalence of *S aureus* nasal carriage compared with drug users on an oral methadone programme,[77] and *S aureus* nasal carriage rates are not different between diabetic patients injecting insulin and those using oral glucose-lowering medication.[53,64]

There is no relation between carriage rate and seasonality, temperature, or relative humidity.[5,78,79] A population-based cohort of children and adolescents showed that active cigarette smoking is associated with a lower *S aureus* nasal carriage rate, whereas passive smoking is associated with a higher *S aureus* nasal carriage rate.[48] The aetiological basis of this observation is unknown.

How does *S aureus* withstand and evade the host immune response?

Nasal secretions have a prominent role in the innate host defence. Components of nasal secretions that contribute to the innate immune response include immunoglobulin A and G, lysozyme, lactoferrin, and antimicrobial peptides.[80] *S aureus* nasal carriers may have a dysregulation of these innate humoral factors in their nasal secretions.[81] Such people have raised concentrations of the alpha-defensins (eg, human neutrophil peptide [HNP] 1, 2, and 3) and human beta-defensin 2 (HBD2), indicative of the presence of both neutrophil-mediated and epithelial-mediated inflammation.[81] Lipoteichoic acid, present in the *S aureus* cell wall, is a strong stimulus for neutrophil recruitment.[82] Therefore, this inflammatory response could be induced by *S aureus* colonisation. However, studies have shown that HNP1, 2, and 3, and HBD2 are not microbicidal against *S aureus* in vitro, suggesting that the host response is ineffective and insufficient to prevent *S aureus* nasal carriage.[40] The role of the cellular response is unclear. The previously established relation between glycaemic control and *S aureus* carriage rate in diabetics[53] could be seen as the result of hyperglycaemia-related reduced phagocytic activation.[83]

Several studies have found that certain antimicrobial peptides have no or little activity against *S aureus* or that other peptides are needed to enhance their activity.[84,85] The inability of nasal antimicrobial peptides to clear *S aureus* from the nose may be explained by (1) the anatomy of the nose in relation to *S aureus* nasal carriage and (2) resistance of *S aureus* to many antimicrobial peptides.[40,86] *S aureus* predominantly colonises an area in the vestibulum nasi that is devoid of cilia and relatively free from nasal mucous secretions that contain antimicrobial peptides and immunoglobulins.[40] It is nevertheless possible that the innate immune response prevents *S aureus* from invading the mucosa and causing more extensive forms of colonisation or even infection.

In-vitro studies have shown that *S aureus* is able to resist certain cationic antimicrobial peptides by reducing the net negative charge of its cell wall and cell membrane, or perhaps by using efflux pumps or by releasing proteases.[86] *S aureus* has several mechanisms—including staphylokinase[87] and membrane lipid modification[88]—through which it can withstand an attack by cationic antimicrobial peptides, including defensins and cathelicidins, which are present in nasal secretions.[86,89] Whether the resistance of *S aureus* to defensins and other cationic antimicrobial peptides is a determinant of *S aureus* nasal carriage is currently not known. Cathelicidin can synergistically work with defensins to exert a bactericidal effect on *S aureus*.[84] Furthermore, all *S aureus* strains are lysozyme resistant since they possess the peptidoglycan-specific O-acetyltransferase.[90]

The presence of *S aureus* in the nose elicits a subclinical immune response, as shown in a study where seroconversion occurred after carriage was established.[91] *S aureus* produces protein A that binds the Fc region of immunoglobulins, thereby inactivating them.[65] It is clear that *S aureus* has a wide arsenal of strategies to evade the host immune response. Further studies are needed to

identify all the components of the immune response towards *S aureus* in the nose.

How does *S aureus* adhere to, and propagate in, the anterior nares?

The vestibulum nasi is limited laterally by the interior of the wing of a nostril and medially by a mucous fold (limen nasi), behind which the nasal cavity with mucosal lining begins (figure 5).[92] The epithelial inner wall of a nostril is fully keratinised and includes apocrine sweat glands, sebaceous glands, and hair follicles of the vibrissae.[92] Most studies on determinants of *S aureus* nasal carriage focus on mucosal and mucin binding.[93–95] Considering the anatomy of the vestibulum nasi, this focus should be changed.

Bibel and colleagues[96] demonstrated the importance of keratinised epithelial cells in binding *S aureus*. In addition to the nose, *S aureus* can also multiply independently in the area of the perineum.[97] Both the vestibulum nasi and the perineum contain large apocrine sweat glands, which is an important clue in studying determinants of *S aureus* nasal carriage, but has not been studied thoroughly.[25] Since *S aureus* binding to mucosa or mucin probably has a transient nature, we propose that: (1) intermittent carriers are actually "mucosal carriers" and (2) persistent carriers use a special niche, such as an apocrine gland, where *S aureus* cells can multiply to high numbers.

S aureus adherence may also be non-specifically mediated via physicochemical forces, including hydrophobic interactions.[6] Alternatively, adherence may be more specifically accomplished through binding of certain bacterial cell surface moieties (adhesins) to defined structural receptors in the membranes of the host cells.[6] *S aureus* has a greater affinity for nasal epithelial cells sampled from carriers than from non-carriers,[94] and the bacterium adheres better to nasal epithelial cells from patients with eczema than to cells from patients without eczema.[6]

Recent experiments have shown that clumping factor B (ClfB) and the *S aureus* surface protein G (SasG) bind to nasal epithelial cells.[98,99] ClfB specifically binds human cytokeratin type 10 and SasG to an unknown ligand of desquamated nasal epithelial cells.[98] Also, cell wall teichoic acid is essential for *S aureus* nasal carriage.[95,100] Microbial surface components recognising adhesive matrix molecules (MSCRAMMs) can bind to fibronectin, fibrinogen, and collagen related polysaccharides.[18] MSCRAMMs probably have a role in the binding of staphylococci to sites where the mucosal lining is breached, exposing these matrix molecules.[66] Differences in the expression of genes coding for these factors, depending on the ecological niche, and other putative adhesins and receptors may provide clues to the true determinants of *S aureus* nasal carriage or non-carriage.

Bacterial interference has been postulated to be a major determinant of the *S aureus* carrier state, or rather, non-carrier state. When an ecological niche is already occupied by certain bacteria, other bacteria do not seem to have the means to replace this resident bacterial population.[101] The resident flora must be reduced or eliminated before other bacteria can successfully "interfere" with the resident bacterial population.[102] Cross-inhibition of the expression of various virulence factors by the accessory gene regulator (*agr*) and staphylococcal accessory regulator (*sar*) may be one mechanism by which one strain excludes others from colonising sites including the anterior nares,[103] although a large *S aureus* population genetic analysis failed to confirm this suggestion.[104] Still, bacterial interference can be seen as a determinant of *S aureus* nasal carriage, although it does not appear to be the ultimate determinant.[38]

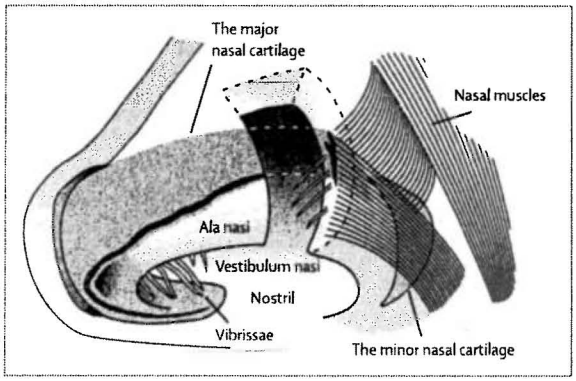

Figure 5: **Anatomy of the nostril**
Adapted from reference 92.

Bacterial interference by active colonisation using a non-pathogenic *S aureus* strain (502A) was successful in nurseries during outbreaks of *S aureus* infections in the 1960s and for treatment of patients with recurrent furunculosis.[102,105] The early practice of artificial inoculation with *S aureus* 502A was abandoned after alleged complications[106] and the advent of newer antistaphylococcal antibiotics in the early 1970s.

Bacterial population dynamics

To understand *S aureus* nasal carriage and the relation with subsequent disease, we need to define the population structure of *S aureus*. Several techniques have been used to describe the natural population structure of *S aureus*, including multilocus enzyme electrophoresis,[107] pulsed-field gel electrophoresis,[108] multilocus sequence typing (MLST),[19,109] and amplified fragment length polymorphism (AFLP).[110] These studies have revealed that *S aureus* is highly clonal, by contrast with other pathogenic species such as *Streptococcus pneumoniae*.[111] Most recent studies have assessed the population structure of *S aureus* using MLST.[19,109] This molecular typing method characterises bacterial isolates on the basis of the sequence of internal fragments of seven housekeeping genes that represent the stable "core" of the bacterial genome. These MLST studies have placed most *S aureus* isolates (colonising as well as invasive isolates of meticillin-sensitive *S aureus* [MSSA]

and MRSA) in five major clusters—clonal complex (CC) 8, CC30, CC5, CC22, and CC45.[109,112,113] MRSA isolates were found in several major clonal complexes, indicating that meticillin resistance has developed in most distinct phylogenetic sub-populations of *S aureus*.[110,114,115] The pandemic penicillin-resistant *S aureus* clone in the 1950s, now known as CC30, is currently re-emerging as a pandemic MRSA clone.[116,117]

Most population structure studies of *S aureus* were biased by the use of mostly clinical isolates and collections of nosocomial MRSA.[108,114] Recently, the population structure of *S aureus* isolated from the nose of people living in the community was analysed by AFLP.[110] AFLP is a whole genome typing method, documenting the contribution of "accessory genetic elements" as well as genome-core polymorphisms. This study revealed the existence of three major (I, II, III) and two minor (IVa and IVb) genetic clusters of *S aureus* (figure 6). AFLP clusters II and III—identical to MLST CC30 and CC45, respectively—account for almost half (47%) of all carriage isolates, suggesting that these two clonal complexes have evolved to be very successful in colonising human beings.[110] Melles and co-workers[110] identified the same major clusters as the MLST studies (Oxford database, UK; http://www.mlst.net). Apparently, these clonal clusters have spread successfully worldwide.[110]

There is controversy as to whether all *S aureus* strains have equal disease invoking potential or whether invasive disease is associated with particularly virulent genotypes. Feil and co-workers[109] found no significant differences in the distribution of genotypes between strains isolated from carriers and those from patients with invasive disease. There was, therefore, no evidence for the existence of hyper-virulent *S aureus* clones. By contrast, subclusters of strains with differential degrees of pathogenicity were observed in the study by Melles and colleagues,[110] who identified subclusters with an over-representation of bacteraemia isolates. Furthermore, expansion of multidrug-resistant clones or clones associated with skin disease (impetigo) were observed. Some clones have been shown to be more virulent than others; however, given the appropriate clinical conditions each and every strain of *S aureus* can become a life-threatening pathogen. Another study found that invasive *S aureus* strains belonging to a clonal complex are associated with a higher in-hospital mortality rate, indicating co-evolution of *S aureus* virulence and spread among human beings.[119] This study also concluded that (major) CC45 was significantly under-represented among invasive strains (odds ratio [OR] 0·2, 0·04–0·6), which corroborated earlier findings.[110,119] Furthermore, Peacock and colleagues[120] provided evidence of considerable horizontal transfer of virulence-associated genes in a clonal background. In summary, *S aureus* will remain an important clinical challenge and, apparently, some strains will present challenges that are more vigorous than others. It remains to be seen whether the possibility of identifying the more pathogenic clones of *S aureus* in the laboratory can be translated into a reliable diagnostic tool with clinical relevance in the future.

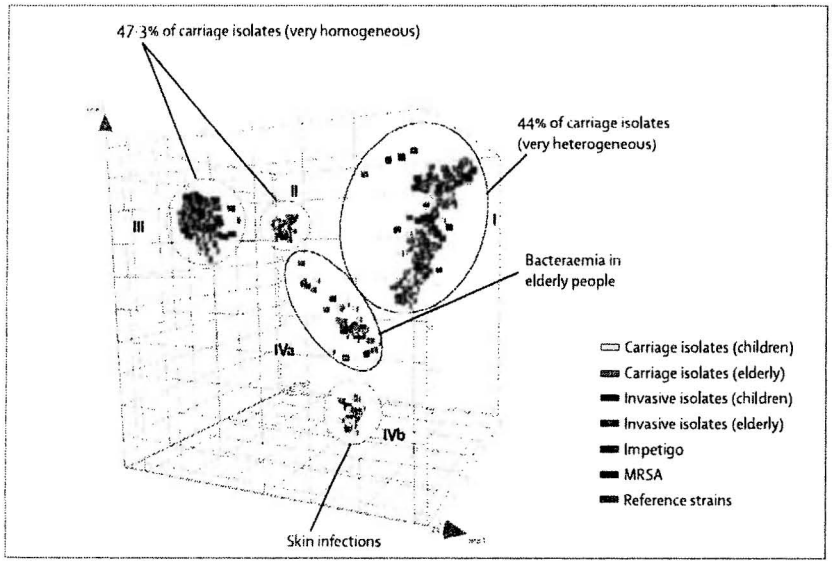

Figure 6: **Principal component analysis of 1056 *S aureus* strains reveals genetic clusters of hypervirulent clones[110,118]**

The different boxes, plotted here in a three-dimensional space and coloured according to their source, represent each *S aureus* strain analysed in the study. The five circles indicate the three major (I, II, and III) and two minor (IVa and IVb) different phylogenetic clusters identified by AFLP. Although strains from each of the genetic clusters are essentially able to cause invasive disease, some clusters contain proportionally more invasive isolates.

Risks of *S aureus* nasal carriage

Community-acquired infections

Most studies regarding the risks of acquiring *S aureus* infections in the community concern skin and soft tissue infections. Several, mostly older, studies investigated the relation between *S aureus* nasal carriage and skin infections,[121] including furunculosis,[122,123] impetigo,[124] sycosis barbae,[10,122,125] and stye.[126] On average, 80% (range 42–100%) of those with skin lesions were *S aureus* nasal carriers, and 65% (range 29–88%) had the same phage type in the nose and lesion.

In one large prospective population-based study among elderly people there was no relation between persistent *S aureus* nasal carriage and all-cause mortality, a surrogate end-point for serious staphylococcal disease.[71] Earlier retrospective cohort or case-control studies have demonstrated increasing age, male sex, alcoholism, lung disease, cancer, diabetes mellitus, end stage renal failure, and dialysis to be risk factors for community-acquired *S aureus* infections necessitating hospital admission.[127–129] These factors have also been identified earlier as determinants of *S aureus* nasal carriage in case-control or cross-sectional studies.[6]

The spectrum of community *S aureus* disease is rapidly changing with the advent and spread of community-onset MRSA strains.[75,116,130,131] Overall MRSA carriage rates in the community are still low,[2,42,132] but seem to be rising rapidly in certain parts of the world.[130,133] In the only prospective

study done so far on nasal carriage of community-onset MRSA and risk of infections in soldiers, Ellis and co-workers[134] found a relative risk of 3·1 (95% CI 1·5–6·5) for nasal MRSA carriers to acquire a MRSA infection (eg, cellulitis, abscesses) in the community. In a retrospective study concerning community-onset MRSA skin infections among professional football players, Kazakova and colleagues[75] did not find any MRSA in nasal swabs or environmental cultures, although 42% were nasal carriers of MSSA strains. Apart from these highly selected populations, it remains questionable whether the results from these studies can be extrapolated to the general population.[134] We need more community-based studies to better understand the ecology, pathophysiology, and epidemiology of *S aureus* nasal carriage and infections in the community and to develop and target preventive measures.

Nosocomial infections

S aureus (MSSA as well as MRSA) ranks as the second most common cause of hospital-acquired (nosocomial) bloodstream infections. About 20% of patients undergoing surgery acquire at least one nosocomial infection, leading to increased morbidity, mortality, hospital stay, and costs.[135–139] Hospital treatment usually requires that first line barriers for pathogens—of which the skin is an important one—are intentionally breached, resulting in an increased risk of infection. Most of these nosocomial *S aureus* infections are caused by the patient's own *S aureus* cells, which were already present on the skin or mucosal membranes before hospital admission in at least 80% of the cases.[7,8] It could well be that more infections are of endogenous origin, since 10% of the nasal *S aureus* carriers have more than one genotype or phage type in their nose.[5,140]

S aureus nasal carriage has been identified as a risk factor for the development of nosocomial infections in general hospital populations,[141] surgical patients (general,[5,6,9] orthopaedic,[142] thoracic surgery,[143] and children[144]), patients on haemodialysis or continuous peritoneal dialysis,[6,33,54,145,146] patients with liver cirrhosis and after liver transplantation,[58,147–149] HIV-infected patients,[59,60] and patients admitted to intensive care units.[150–152] In a recent study there was a threefold increased risk for non-surgical patients who were *S aureus* nasal carriers to acquire a nosocomial *S aureus* bacteraemia versus non-carriers.[7] Also nasal carriers among surgical patients have a higher risk (OR 4·0) for nosocomial *S aureus* bacteraemia compared with controls.[153]

Second to coagulase-negative staphylococci, *S aureus* is the most prevalent organism causing intravascular device-associated bacteraemia.[6,137,154] Pujol and colleagues[150] looked at bacteraemia in an intensive care unit. Most of the *S aureus* bacteraemias had an intravascular device as a source. In this study, carriers of *S aureus* had a relative risk of 12·4 for the development of *S aureus* bacteraemia.[150] In a study by Wertheim and co-workers,[7] the source of bacteraemia was device related in more than 50% of the cases. Interestingly, the mortality rate from *S aureus* bacteraemia is higher in non-carriers compared with carriers.[7] Since bacteraemia is usually endogenous in carriers, partial immunity may have an important role here. This finding needs confirmation and the underlying mechanism resolved.

In HIV-positive patients, increased rates of *S aureus* bacteraemia and deep soft tissue infections have been observed, which frequently recur. Even higher infection rates are found in patients with AIDS compared with HIV-positive asymptomatic patients. Nguyen and colleagues[59] found that nasal carriage is an important risk factor in this patient population (OR 5·1). Other risk factors for infection in this study were presence of a vascular catheter (OR 4·9), low CD4 cell count (<100 cells/μL; OR 3·5), and neutropenia. The risk for developing an *S aureus* infection was approximately 10% for every 6 months in patients who were nasal carriers of *S aureus* and had CD4 cell counts of less than 100 cells/μL. It should be noted that *S aureus* nasal carriage was more common in patients who were not receiving co-trimoxazole prophylaxis for prevention of *Pneumocystis jiroveci* pneumonia.

In haemodialysis patients, *S aureus* is the most frequently found pathogen in infections at the vascular access site and in bacteraemia. The infection rate is higher in carriers on haemodialysis, with relative risks varying from 1·8 to 4·7.[6,54,145,146,155] *S aureus* isolates are usually identical to the one previously isolated from the patient's nose.[156] In a study by Nielsen and colleagues,[155] the relative risk for *S aureus* bacteraemia was 26·2 (6·1–113) when *S aureus* was colonising the insertion site, and 3·3 (0·74–15·1), in the case of only *S aureus* nasal carriage. However, multiple studies have demonstrated that long-term eradication of *S aureus* nasal carriage by (repeated) application of mupirocin effectively prevents *S aureus* infections among patients who are receiving dialysis, thereby decreasing complications and costs.[157–160] Additional application of a local antibiotic ointment to exit sites is also important in preventing infections.[161]

In patients on continuous peritoneal dialysis, *S aureus* is the leading cause of continuous peritoneal dialysis-related infections, often leading to catheter loss. *S aureus* nasal carriage has been found to be a major risk factor for infections in patients on continuous peritoneal dialysis, mainly associated with exit site and tunnel infections.[33,56,162–166] Intervention studies consistently demonstrated a substantial reduction in the incidence of exit site infections, but not a consistent reduction in the incidence of continuous peritoneal dialysis-related peritonitis.[54,166–170] Two studies did not find a correlation between *S aureus* nasal carriage and the development of *S aureus* exit site infections.[171,172] In a recent study it was demonstrated that only continuous peritoneal dialysis patients who are persistent *S aureus* nasal carriers are at increased risk of acquiring continuous peritoneal dialysis-

Search strategy and selection criteria

We searched Pubmed with the following search terms: "*Staphylococcus aureus*", "colonisation", "carriage", "nose", "nasal", "vestibulum nasi", "mucosa", "nasal", "nosocomial", "epidemiology", "determinants", "risk factor", "treatment", and "infection". The following limits were used: English language, abstract, and human studies. We identified additional articles by searching the reference lists of existing articles.

related *S aureus* infections.[33] Intermittent nasal carriers of *S aureus* have the same risk of *S aureus* infection as non-carriers.[33] Targeting interventions to prevent continuous peritoneal dialysis-related infections is thus possible, thereby eliminating unnecessary prophylactic and therapeutic antibiotic use and resistance development.[173] The nasal strain and the infectious strain are clonally related in most patients on continuous peritoneal dialysis with *S aureus* infection.[6,33,56]

Studies in the 1950s and 1960s show that with increasing numbers of staphylococcal bacteria in the nose, as in persistent carriers, *S aureus* skin carriage rates increase proportionally, in parallel with a rise in risk of *S aureus* surgical site infections.[4,32,174,175] The more recent observation that patients carrying *S aureus* in their nose as well as perineal (or rectal) skin are at a higher risk for subsequent *S aureus* infections when compared with only perineal or nasal carriers can probably also be explained by a higher *S aureus* load.[49] Presumably people who carry *S aureus* in their nose contaminate their hands, then transferring the organism to other sites on their bodies.[66] The number of staphylococcal cells needed to cause infection decreases dramatically at the site of a suture, compared with healthy skin.[176]

Although *S aureus* nasal carriage is unanimously accepted as one of the most important risk factors for nosocomial and surgical site infections today and studies using historical controls have reported substantial reductions of surgical site infections among patients receiving mupirocin,[136,177–179] randomised controlled trials uniformly failed to confirm these results.[9,180,181] Perl and colleagues[9] could only demonstrate a significant effect (48% risk reduction, p=0·02) on the rate of nosocomial *S aureus* infections after surgery among *S aureus* nasal carriers before surgery. The 37% reduction in *S aureus* surgical site infections was not statistically significant (p=0·15).[9] Wertheim and colleagues[180] and Kalmeijer and co-workers[181] did not find a significant effect of eradication of *S aureus* nasal carriage in a general hospital and orthopaedic patient population, respectively. In the study of Perl and co-workers,[9] 53% of *S aureus* surgical site infections occurred in the non-carrier group, and 15% of the *S aureus* surgical infections in carriers was caused by a strain other than their resident strain. These infections probably result from exogenous transmissions from the hospital environment or undetected extra-nasal *S aureus* carriage sites. Health-care workers can be important sources of transmission of *S aureus* and cross-infection.[182]

Conclusions

Many studies have been published on *S aureus* nasal carriage—a Pubmed search with the terms "*Staphylococcus aureus*" and "nasal" gives 1383 hits. Based on these studies and the results of contradicting twin studies[183,184] a simple Mendelian trait probably does not explain the different *S aureus* nasal carrier states.[38,48] The repeated exposure to *S aureus* in the (household) environment is considered to be an important determinant of *S aureus* nasal carriage, probably more important than the genetic background of individuals. In general, a multifactorial genesis underlies *S aureus* nasal carriage.

We now need to identify which factors of *S aureus* and the nasal niche are of importance in adherence. Recent in-vitro and in-vivo studies in rats have begun to elucidate these factors, which is an important step forward.[98–100] Furthermore, we may need to change the focus from mucosal adherence to adherence to more prevalent epitopes present in the anterior nares. The real importance of these factors needs to be confirmed in a human colonisation model. Only then may we find new, effective ways of decolonising the nares and other body sites. So far there is limited evidence that decolonisation of the anterior nares to prevent staphylococcal disease is only effective in dialysis and surgical patients. Recent clinical trials in non-surgical and orthopaedic patients did not show any positive effect.[180,181] Focusing only on at-risk patients—eg, persistent carriers—may improve the outcome of an intervention. Also the decolonisation of extra-nasal sites needs to be improved.[74]

So far, there has been concern only for the increased risk of *S aureus* nasal carriers for acquiring *S aureus* infections. However, studies have shown that non-carriers who acquire exogenous *S aureus* bacteraemia have a fourfold increased mortality rate compared with *S aureus* nasal carriers.[7] Thus, the immunological mechanisms of *S aureus* nasal carriage need to be resolved. In non-carriers, preventing the acquisition of *S aureus* strains deserves more attention.

Conflicts of interest

We declare that we have no conflicts of interest.

Acknowledgments

This work was made possible by grants from the Netherlands Organisation for Scientific Research, the Netherlands Organisation for Health Research and Development, Dutch Kidney Foundation, Dutch Ministry of Economic Affairs, and Trustfonds of the Erasmus University.

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REVIEW ARTICLE

Methicillin-Resistant *Staphylococcus aureus*: An Evolutionary, Epidemiologic, and Therapeutic Odyssey

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Methicillin-resistant *Staphylococcus aureus*, first identified just over 4 decades ago, has undergone rapid evolutionary changes and epidemiologic expansion. It has spread beyond the confines of health care facilities, emerging anew in the community, where it is rapidly becoming a dominant pathogen. This has led to an important change in the choice of antibiotics in the management of community-acquired infections and has also led to the development of novel antimicrobials.

HISTORICAL BACKGROUND AND EPIDEMIOLOGY

It was only 1 year after an Oxfordshire constable, Albert Alexander, became the first recipient of penicillin, that Rammelkamp reported the identification of isolates of *Staphylococcus aureus* resistant to this miracle drug [1]. Infections caused by penicillin-resistant *S. aureus* were initially limited to hospitalized patients and were only later detected in the community, where they eventually became common [2]. In an historical reprise, the identification of methicillin-resistant *S. aureus* (MRSA) was reported within 1 year after the 1960 introduction of this semisynthetic penicillin, and once again, an organism that was initially present only in hospitals later became prevalent in the community [2, 3]. The spread of MRSA from the hospital to the community was a predictable event. The emergence in the past decade of novel strains of MRSA in the community that are genetically distinct from MRSA strains originating in the hospital was perhaps less anticipated.

MRSA is currently the most commonly identified antibiotic-resistant pathogen in US hospitals [4, 5]. Although 25.9% of *S. aureus* strains isolated from outpatients were methicillin resistant [5], most of these strains were recovered from individuals who were likely to have acquired them in the health care environment [6, 7]. Their association with health care may, however, have been indirect; household contacts of individuals with hospital-acquired MRSA (HA-MRSA) are at significantly increased risk for MRSA colonization [8]. In a recent and dramatic evolutionary development, however, infection with novel community-acquired strains of MRSA (CA-MRSA) in previously healthy individuals without either direct or indirect association with health care facilities has emerged as a new and important public health problem [9–11].

In some community settings, CA-MRSA have become the prevalent form of *S. aureus* isolated from cutaneous infections, especially among children. At a Houston pediatric hospital, 74% of community-acquired *S. aureus* strains isolated since 2001 have been resistant to methicillin [12]. Clusters and outbreaks in adolescents and adults have been reported to occur in Native Americans [13], homeless youth [14], men who have sex with men [9], jail inmates [10], military recruits [15], children in child care centers [16], and competitive athletes [17]. Although most infections have involved skin and skin structures, potentially lethal invasive infections have also occurred. The report in 1999 of the deaths of 4 previously healthy children in Minnesota and North Dakota who did not have pre-

Received 23 August 2004; accepted 10 November 2004; electronically published 24 January 2005.

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Clinical Infectious Diseases 2005; 40:562–73

1058-4838/2005/4004-0011$15.00

vious contact with health care facilities unequivocally illustrated the potential dangers presented by CA-MRSA [18].

Reversing and completing an epidemiologic cycle, CA-MRSA are now being introduced from their site of origin in the community into the hospital [19, 20]. At some hospitals, CA-MRSA are displacing classic hospital-associated strains of *S. aureus*, which is consisitent with the hypothesis that the former may be more fit [21].

MOLECULAR EPIDEMIOLOGY OF METHICILLIN RESISTANCE

The mechanism of resistance to methicillin was uncovered in 1981 with the the identification of reduced-affinity penicillin-binding proteins in MRSA [22]. The altered protein, PBP2a (PBP2′ in the United Kingdom), retains effective transpeptidase activity while having reduced affinity for penicillin and other available β-lactam antibiotics. PBP2a exhibit both a reduced rate-constant for acylation by β-lactams and elevated dissociation constants [23]. These 2 factors, acting together, prevent acylation of PBP2a and thus result in β-lactam resistance [23].

PBP2a is encoded by the *mecA* gene (for a glossary of genetic terms, see Appendix) [24]. The mobile *mecA* gene complex is comprised of *mecA* together with its regulator genes, *mecI* and *mecR*, and resides within a genomic island, the staphylococcal cassette chromosome *mec* (SCC*mec*) that constitutes 1%–2% of the ~2.9 million–bp *S. aureus* chromosome [24–26] (figure 1). SCC*mec* also contains the insertion sequence, IS431*mec*, as well as recombinases necessary for site-specific integration and excision. Some SCC*mec* types also contain various additional genetic elements, such as *Tn554* (which encodes resistance to macrolides, clindamycin, and streptogramin B) and *pT181* (which encodes resistance to tetracyclines) [2].

The expression of PBP2a is induced by the binding of β-lactam antibiotics to a cytoplasmic membrane sensor-transducer receptor encoded by the *mecR1* gene, triggering a signal leading to the proteolytic release of the *mecI* repressor from the operator region of the *mecA* gene [27, 28]. Phenotypic resistance to methicillin is variably expressed, and population analysis demonstrates that each MRSA strain has a characteristic growth profile at each concentration of methicillin examined [29]. In contrast to this heterogeneously expressed resistance to methicillin, homogeneous resistance requires the interaction of additional factors, such as the *femA–F* genes that are involved in peptidoglycan synthesis [30].

MOLECULAR EVOLUTIONARY HISTORY

Although PFGE is commonly used in hospitals to determine the relatedness of isolates for epidemiologic purposes, this method is insufficiently discriminatory for evolutionary studies [31]. The overall genetic background of *S. aureus* isolates is unambiguously determined through multilocus sequence typing by determination of the sequence of portions of 7 housekeeping genes [25]. The mobile SCC*mec* elements, on the other hand, are classified by analysis of their cassette chromosome recombinase (*ccr*) and *mecA* gene complexes [32]. SCC*mec* types also differ with regard to their acquisition of resistance determinants acquired as the result of integration of plasmids and transposons [32]. At least 5 SCC*mec* types (types I–V), varying in size from ~20 kb to 68 kb, have been identified [33] (table 1). The smallest of these—SCC*mec* types I, IV, and V—contain only recombinase genes and the structural and regulatory genes for resistance to methicillin and lack the transposable elements and genes encoding resistance to non–β-lactam antibiotics carried by types II and III [33, 35]. SCC*mec* types I-IV contain alleles of *ccrA* and *ccrB*, whereas type V, which has to date been identified in a small number of Australian CA-MRSA isolates, contains a novel *ccr* designated *ccrC* [33]. Two possible additional SCC*mec* types have recently been identified among Australian CA-MRSA strains [36].

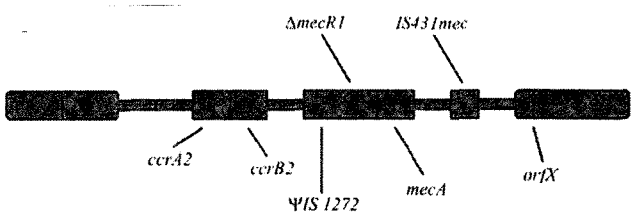

Figure 1. Diagram showing the staphylococcal cassette chromosome *mec* type IV (SCC*mec* type IV) (adapted from [24]). SCC*mec* type IV lacks antibiotic resistance elements directed at non–β-lactam antibiotics that are present in SCC*mec* types characteristic of hospital-acquired methicillin-resistant *Staphylococcus aureus*. *ccrA2* and *ccrB2* designate cassette chromosome recombinases. Ψ*IS 1272* designates IS*431mec* insertion sequences. *mecA* encodes PBP2a. *orfX* indicates an open reading frame. Δ*mecR1* is a signal transducer gene whose activation by β-lactam antibiotics inactivates the *mecI* repressor gene product, allowing expression of *mecA*.

Genetic evolutionary analyses have demonstrated that the *mecA* gene has been transferred into methicillin-susceptible *S. aureus* (MSSA) on ≥20 occasions, having emerged in ≥5 phylogenetically distinct lineages (as well as reemerging within individual lineages) [25, 31, 37]. It has been suggested that the emergence of PBP2a initially resulted from a recombination event involving the genes encoding an existing PBP and an inducible β-lactamase [38]. The donor strains that became the source of PBP2a are likely to have been coagulase-negative staphylococci, with *Staphylococcus sciuri* identified as a prime candidate [39]. A recent study of 44 methicillin-resistant *Staphylococcus epidermidis* isolates from the blood of patients with prosthetic valve endocarditis from 1973 to 1983 found that 2% carried SCC*mec* type I, 34% carried type II, 28% carried type III, and 36% carried type IV [40]. The introduction of *mecA* from the putative donor species into MSSA strains that are

Table 1. Characteristics of staphylococcal cassette chromosome *mec* (SCC*mec*) types I–V.

SCC*mec* type	SCC*mec* size, kb	Other antibiotic-resistant elements (gene) on SCC*mec*	Origin of *S. aureus* isolatates carrying the specified SCC*mec* type	Presence of Panton-Valentine leukocidin in *S. aureus* isolates carrying the specified SCC*mec* type[a]
I	34	...	Hospital	Infrequent
II	53	PUB110 *(aadD)*[b], Tn554 *(ermA)*[c]	Hospital	Infrequent
III	67	PUB110 *(aadD)*[b], PT181 *(tetK)*[d]	Hospital	Infrequent
IV	21–24	...	Community	Frequent
V	28	...	Community	Unknown

NOTE. Data is adapted from [40] and [155]. PVL, Panton-Valentine leukocidin; *S. aureus, Staphylococcus aureus.*

[a] In general, <5% of *S. aureus* strains that carry SCC*mec* types I–III also carry the PVL gene; with some exceptions, 40%–90% of *S. aureus* strains that carry SCC*mec* type IV carry the PVL gene.

[b] Encodes resistance to tobramycin and kanamycin.

[c] Encodes resistance to macrolide-lincosamide-streptogramin antibiotics.

[d] Encodes resistance to tetracycline.

already successfully adapted to hospital environments and to the community have, in turn, created successful epidemic HA-MRSA and CA-MRSA clones [31, 35, 41, 42].

Evidence indicates that the ancestral MRSA genotype, ST250-MRSA, is a strain originating in Denmark and possessing SCC*mec* type I, most extant isolates of which were obtained in the 1960s [37]. (By convention, strains are named by their sequence type [ST] and the presence or absence of methicillin resistance. Thus, this strain is a methicillin-resistant S. aureus of a sequence type designated as 250). ST250-MRSA arose as the consequence of the acquisition of the mec gene by the methicillin-susceptible strain ST250-MSSA, which had itself arisen from ST8-MSSA by a chromosomal point mutation [37]. ST250-MRSA is no longer a major cause of epidemic MRSA infections, but ST247-MRSA (the "Iberian clone"), which evolved from ST250-MRSA by a single point mutation, remains an important hospital pathogen in Europe and has been reported to have caused an outbreak in a New York City hospital [43]. As indicated above, there have since been multiple introductions of *mec* into *S. aureus* [31]. The emergence of CA-MRSA strains, in particular, has repeatedly occurred as a result of the introduction of SCC*mec* type IV into a variety of genetic MSSA backgrounds [41]. In the United States, one of the resultant clones, ST8-MSSA (USA 300) has proven increasingly successful [44].

EPIDEMIOLOGIC SUCCESS AND VIRULENCE OF CA-MRSA

CA-MRSA strains differ in a number of important ways from the 6 major pandemic clones of MRSA that account for nearly 70% of epidemic HA-MRSA strains [45]. These differences are found in the composition of the gene cassette coding for methicillin resistance, in the carriage of plasmids encoding resistance to antibiotics of other classes (as well as resistance to heavy metals), and in their associated virulence factors.

The earliest strain of MRSA in which SCC*mec* type IV has been identified was isolated in 1981 [32]. Despite this apparently recent emergence, an analysis of a large number of MRSA isolates detected SCC*mec* type IV in twice as many clones as any of the other types, suggesting its greater promiscuity and successful persistence [26]. This may be the result of greater efficiency of transfer and/or a lesser fitness cost to the recipient clone, possibly because of its smaller size and lack of the "excess baggage" included in other SCC*mec* types [26, 35, 41]. Although HA-MRSA has been reported to replicate more slowly than MSSA [46], a CA-MRSA clinical isolate harboring SCC*mec* type IV has been demonstrated to replicate more rapidly than HA-MRSA isolates with other SCC*mec* types [41, 42]. In contrast, transformation of an SCC*mec* type I element into *S. aureus* strains yielded highly oxacillin-resistant transformants with a reduced growth rate [47]. This relatively greater fitness of CA-MRSA strains carrying SCC*mec* type IV may account for its remarkable success in displacing other MRSA strains in some hospitals after its introduction from the community [21].

MOLECULAR BASIS OF VIRULENCE OF CA-MRSA

Sequencing of the genome of CA-MRSA strain MW2, which caused fatal sepsis in a 16-month-old girl from North Dakota [18], identified 19 putative virulence genes not found in 5 simultaneously examined HA-MRSA strains [42]. These included genes for several superantigens, such as enterotoxins B and C, as well as the amphipathic leukotoxin, the Panton-Valentine leukocidin (PVL). PVL, first described in 1932 [48], is a bicomponent synergohymenotropic (synergistic membrane-tropic) toxin that was present in <5% of unselected *S.*

aureus isolates but is present in the majority of CA-MRSA isolates studied [49, 50]. CA-MRSA isolates from Australia, on the other hand, infrequently carry the genes encoding PVL [36].

PVL is encoded by contiguously located cotranscribed genes, *lukS-PV* and *lukF-PV,* inserted near the *att* site [50]. These genes are transmitted by a temperate phage designated øPVL [51, 52]. Their gene products, 33 kDa and 34 kDa in size, respectively, assemble as hetero-oligomers and synergistically exert cytolytic pore-forming activity specifically directed at the cell membranes of polymorphonucelar neutrophils and monocytes and/or macrophages [49, 50]. Injection of PVL into the skin of rabbits causes dermal necrosis [53], suggesting that it may play a role in the severity of skin and skin-structure infections in humans. In addition, an association between PVL-containing strains of MRSA and virulent necrotizing pneumonia has been reported [54].

RESISTANCE TO ANTIBIOTICS OTHER THAN β-LACTAMS

In contrast to the multidrug resistance usually seen in HA-MRSA strains, antibiotic resistance in CA-MRSA strains is often limited to β-lactams. The small size of SCC*mec* type IV may preclude its carriage of additional genetic material, in contrast to the characteristic presence of additional genetic material in SCC*mec* type II and SCC*mec* type III [25, 26]. This does not, however, preclude chromosomally encoded resistance or the presence of resistance plasmids in strains carrying any of the *mec* types. For instance, some CA-MRSA strains isolated in western Australia contain a 41.4-kb plasmid encoding resistance to tetracycline and trimethoprim, as well as resistance to mupirocin and cadmium [55, 56]. Fluoroquinolone resistance is frequent in CA-MRSA carrying SCC*mec* type IV isolated from homeless youth in San Francisco [57]. Nonetheless, in contrast to HA-MRSA strains, most CA-MRSA isolates remain susceptible to tetracyclines, clindamycin, and trimethoprim-sulfamethoxazole (TMP-SMZ) [11].

AVAILABLE ANTIBIOTICS FOR THE TREATMENT OF MRSA INFECTION

Vancomycin. Compared with β-lactam therapy, vancomycin therapy has been associated with slower clinical response and longer duration of MSSA bacteremia, and it has been associated with more frequent complications in patients with endocarditis [58, 59]. Failure of vancomycin therapy may be observed in the treatment of patients with bacteremia due to strains of MRSA that have MICs of vancomycin well within the range considered susceptible [60]. Heterogeneous vancomycin resistance, which is not readily detected by routine clinical laboratory methodology, is also associated with failure of vancomycin therapy [61, 62]. The appearance of vancomycin-intermediate *S. aureus* and, more recently, vancomycin-resistant *S. aureus* is of further concern [63].

Quinupristin/dalfopristin. This combination is active in vitro against MSSA and MRSA [64]. It is bactericidal against *S. aureus,* although in the presence of constitutive expression of macrolide-lincosamide-streptogramin resistance, it is only bacteriostatic [65]. In a randomized trial, patients with nosocomial MRSA pneumonia who received quinupristin/dalfopristin had a clinical response rate of 19.4%, compared with 40% in vancomycin recipients [66].

Linezolid. Linezolid and vancomycin yielded comparable results in hospitalized patients with MRSA infections at a variety of anatomic sites in a randomized, open-label trial [67], as well as in the treatment of skin and skin-structure infections caused by gram-positive organisms [68]. A retrospective subset analysis of 2 prospective randomized clinical trials found evidence suggesting that linezolid was superior to vancomycin in the treatment of hospital-acquired pneumonia due to MRSA [69, 70].

Daptomycin. Daptomycin is a novel lipopeptide antibiotic with bactericidal activity against *S. aureus* that binds, in a calcium-dependent manner, to the bacterial cell membrane, disrupting membrane potential [71]. Daptomycin has received approval from the US Food and Drug Administration for the treatment of complicated skin and skin-structure infections due to susceptible gram-positive pathogens [72]. Daptomycin therapy failed in a trial involving patients with community-acquired pneumonia; daptomycin not only has limited penetration into pulmonary epithelial lining fluid, but its activity is inhibited by pulmonary surfactant [72, 73].

Tetracyclines. In vitro susceptibility results involving tetracycline derivatives must be interpreted with caution, because *S. aureus* isolates that are tetracycline-resistant but that have relatively low MICs of doxycycline and/or minocycline may, in fact, harbor inducible efflux genes [74, 75]. Minocycline has been shown to have bactericidal activity similar to that of vancomycin against a single strain of MRSA in an animal model of endocarditis [76]. Of 14 patients with MRSA infection who were treated with doxycycline or minocycline, either alone or in combination with rifampin, 3 (21%) experienced treatment failure [77].

TMP-SMZ. TMP-SMZ was less active than vancomycin in a rabbit model of MRSA endocarditis and less rapidly bactericidal than nafcillin in a rabbit model of MSSA meningitis [78, 79]. A randomized trial of treatment of *S. aureus* infections, 47% of which were due to MRSA, concluded that treatment with TMP-SMZ was inferior to treatment with vancomycin [80]. An extensive literature review, however, concluded that TMP-SMZ "may be effective for the treatment of infections due to low bacterial burdens of susceptible strains of *S. aureus*" [81, pg. 340].

Fluoroquinolones. Although most CA-MRSA strains are

reported to be fluoroquinolone susceptible, this is not true in some locales [36, 57]. Fluoroquinolone resistance emerged very rapidly in HA-MRSA in the years after widespread utilization of agents of this class; at one institution, fluoroquinolone resistance increased from 7% before 1988 to 83% in 1990 [82]. In vitro passage of both fluoroquinolone-susceptible MSSA and MRSA in the presence of either ciprofloxacin or levofloxacin is associated with the frequent selection of clones resistant to these antibiotics [83]. Furthermore, fluoroquinolones select MRSA from among heterogeneously methicillin-resistant populations in vitro [84], and fluoroquinolone use is associated with an increased risk of nosocomial acquisition of MRSA (but not of MSSA) [85]. The fluoroquinolones with C8 substitutions, such as gatifloxacin and moxifloxacin, appear to be more potent against *S. aureus* than are older drugs of this class, and they may be less likely to select resistant mutants, an effect that may be strengthened by the addition of rifampin [86–88].

Clindamycin. Clindamycin has been used successfully in the treatment of invasive CA-MRSA infections in children [89, 90]. Inducible resistance to clindamycin, however, is not detected by routine susceptibility testing, but requires the use of other methods (e.g., a double-disk diffusion test) [90–93]. Flattening of the zone in the area between the disks to resemble the letter "D" indicates the presence of inducible resistance (figure 2 and table 2).

Rifampin. Rifampin selects resistant mutants from among both MSSA and MRSA strains at a frequency of 10^{-6} to 10^{-8}, but this may be prevented by using rifampin in combination with a second active drug [94].

Topical agents. MRSA strains that are resistant to mupirocin, mutants of which can be selected in vitro at frequencies of 10^{-7} to 10^{-8}, are reported with increasing frequency [95]. MRSA isolates with elevated MICs of triclosan have been identified [96, 97].

OVERVIEW OF CHOICE OF SYSTEMIC ANTIBIOTIC THERAPY

For some infections that require parenteral therapy and are due to MRSA strains that are multidrug resistant, the treatment choices may be restricted to vancomycin, daptomycin, linezolid, and quinupristin/dalfopristin therapy. The potential superiority of linezolid therapy over vancomycin therapy in treating nosocomial pneumonia due to MRSA has been noted [69, 70]. Daptomycin is ineffective in the treatment of pneumonia (Cubist Pharmaceuticals, data on file). The bacteriostatic activity of linezolid may prove to limit its effectiveness in circumstances in which bactericidal activity is required [67].

Choices for treatment of infections due to CA-MRSA may include, in addition to the drugs mentioned above, TMP-SMZ, tetracyclines, clindamycin, and fluoroquinolones. The widespread use of fluoroquinolones for treating these infections may, if history repeats itself, lead to the rapid emergence of resistance to this class of antibiotics. Tetracycline therapy, contraindicated in children and in those who are pregnant, may prove to be effective, but further clinical data are required. TMP-SMZ appears to be effective in treating infections of limited extent and severity. Linezolid is an effective agent for which

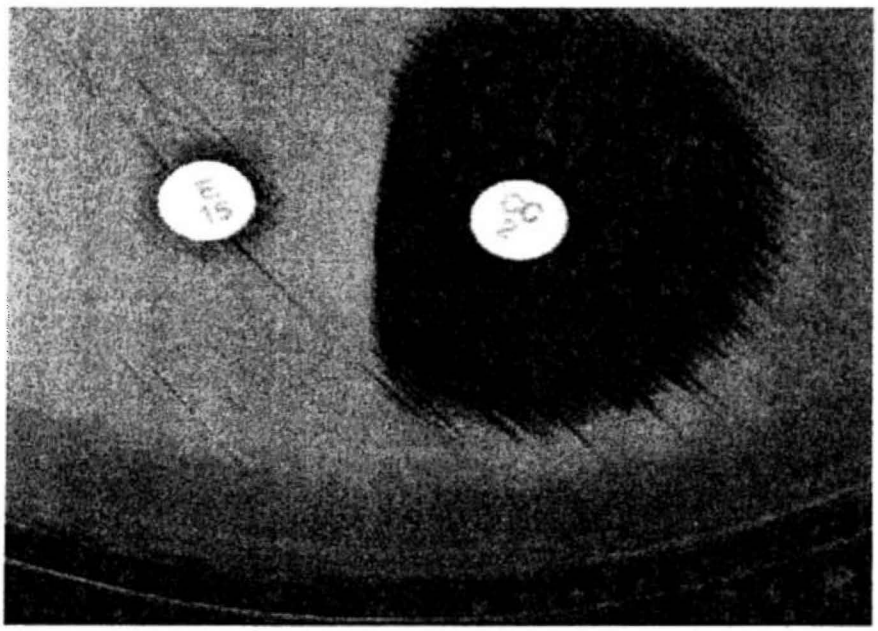

Figure 2. Image shows the results of a double-disk diffusion test for inducible, *erm*-mediated resistance to clindamycin. The demonstration of flattening of the clindamycin zone between the disks is indicative of inducible resistance to clindamycin [34].

use has been limited by its cost. Antibiotic therapy is not always required: a retrospective analysis has found resolution of CA-MRSA infection in children with subcutaneous abscesses <5 cm in diameter who underwent incision and drainage in the absence of administration of an antibiotic to which the pathogen was susceptible [98].

INVESTIGATIONAL AGENTS WITH ACTIVITY AGAINST MRSA

Semisynthetic glycopeptides. Oritavancin is a semisynthetic glycopeptide derivative that is active against some vancomycin-resistant, gram-positive bacteria [99, 100]. A randomized trial of oritavancin in the treatment of skin and skin-structure infections demonstrated results comparable to those observed with a vancomycin-based regimen [101]. Its mean terminal plasma half-life ($\pm$ SD) of 151 $\pm$ 39 h allowed it to be given in a total of 3 daily doses [101, 102].

Dalbavancin has a terminal plasma half-life of 9–12 days [103]. A total of 2 doses given 1 week apart in the treatment of skin and skin-structure infections resulted in a 94% cure rate, compared with a 76.2% cure rate in those patients randomized to receive standard-of-care [103]. A third drug of this class, telavancin, with a terminal plasma half-life of 7 h in young volunteers and 11 h in elderly subjects, was effective in a neutropenic mouse thigh model and is also in clinical trials [104–107].

Glycylcyclines. The minocycline derivative tigecycline has bacteriostatic activity against both MSSA and MSRA, including tetracycline-resistant strains [99, 108, 109]. In a randomized dose-comparison study, clinical cure rates were 67% and 74% in patients with skin and skin-structure infections who received 25 mg and 50 mg daily, respectively [110].

Novel β-lactams. A series of β-lactamase–stable cephalosporins with high affinity for PBP2a are in clinical development [111]. The PBP2a affinity of BMS-247243 is 100-fold greater than that of methicillin or cefotaxime, and the drug is bactericidal against MRSA at twice the rate of vancomycin [112]. Other drugs of this class in development include the zwitterionic cephem RWJ-54428 [113], CB-181963 [114], BAL5788 [115], a prodrug of BAL9141 [116, 117], and S-3578 [118]. ME1036 (formerly CP5609) is a C2-modified carbapenem with high affinity for PBP2a and with an MIC_{90} of 2.0 μg/mL against MRSA [119]. SM-197436, SM-232721, and SM-232724 are novel methylcarbapenems that are also active in vitro against MRSA [120].

Fluoroquinolones. DW286, a naphthyridone, is among several fluoroquinolones in development that have in vitro activity against MRSA [121]. Active against MRSA strains that are resistant to other fluoroquinolones, it selects fluoroquinolone-resistant mutants at a lower frequency than do older agents (as may another fluoroquinolone, ABT-492) [122, 123].

Oligosaccharides. Evernimicin is a complex sugar derivative with a novel mode of action [124, 125]. A related compound, avilamycin, has been used in animal feed, raising the specter of rapid emergence of resistance to this class of drugs [126].

Miscellaneous antimicrobials. The rifamycin rifalazil retains activity against some isolates that are resistant to rifampin [127]. Epiroprim is a dihydrofolate reductase inhibitor with activity against some trimethoprim-resistant strains of *S. aureus*; its combination with dapsone results in in vitro activity against *S. aureus* that is greater than that of TMP-SMZ [128]. Iclaprim is another dihydrofolate reductase inhibitor with activity against MRSA [129].

Other examples of modifications of existing molecules with antistaphylococcal activity include the oxazolidinones ranbezolid [130, 131] and eperezolid [129, 132], as well as N-acylated ornithine analogues of daptomycin [133]. Among drugs with novel targets are the peptide deformylase–inhibitors NVP-PDF 713 [134, 135] and BB-83698 [136].

A number of naturally occurring cationic proteins have in vitro activity against *S. aureus* [137], and some have been demonstrated to have activity in animal models of infection [138]. Lysostaphin is active in vitro against *S. aureus* [139] and was effective in a rabbit model of MRSA endocarditis [140]. Its use in a patient with *S. aureus* infection and neutropenia was first reported in 1974 [141]. Specific bacteriophage has been demonstrated to be effective in protecting mice against lethal *S. aureus* infection [142, 143].

Targeting virulence factors. RNAIII-inhibiting peptide inhibits *S. aureus* pathogenesis by disrupting quorum-sensing mechanisms [144]. The accessory gene regulator *(agr)* is an important regulator of virulence that is, at least in part, related to quorum sensing [145]; a truncated thiolactone peptide has been found to be a potent inhibitor for all 4 *agr*-specificity groups of *S. aureus* [146].

S. aureus immune globulin intravenous (human) (Altastaph; NABI Biopharmaceuticals) is a hyperimmune, polyclonal, intravenous immunoglobulin product derived from the plasma of human donors who have previously been vaccinated with S. aureus polysaccharide conjugate vaccine (StaphVAX; NABI Biopharmaceuticals), a bivalent conjugate capsular polysaccharide covalently bound to recombinant exoprotein A, which has been demonstrated to provide temporary protection against the occurrence of *S. aureus* bacteremia in patients receiving hemodialysis [147, 148]. Patients with *S. aureus* bacteremia and persisting fever are currently being enrolled in a phase I/II trial [149]. Also in progress is a phase II prevention trial involving infants with low birth weights [150].

Tefibazumab (Aurexis; Inhibitex) is a humanized monoclonal antibody directed at the microbial surface components recognizing adhesive matrix molecule (MSCRAMM) clumping

Table 2. Macrolide-lincosamide-streptogramin resistance in methicillin-resistant *Staphylococcus aureus*.

Mechanism of resistance	Gene determinant	Drug resistance	
		Erythromycin	Clindamycin
Efflux	*msrA*	Resistant	Susceptible
Ribosomal methylation	*erm*	Resistant	Susceptible or resistant (inducible);[a] resistant (constitutive)

NOTE. Data are adapted from [34].

[a] Resistant strains have inducible resistance. Determination of resistance requires specific testing (e.g., use of a double-disk diffusion test).

factor A [151] that is currently being evaluated in a phase II trial in patients with *S. aureus* bacteremia [152]. INH-A21 (Veronate; Inhibitex) is a donor-selected human polyclonal immunoglobulin preparation that is also enriched in antibody to staphylococcal MSCRAMM proteins and that is undergoing clinical trial evaluation for the prevention of infection in infants with very low birth weights [153]. Another cell surface component, teichoic acid, is the target of BYSX-A110, an IgG1 chimeric monoclonal antibody that is in clinical trials for the prevention of staphylococcal infections in infants with low birth weights [154].

Aurograb (NeuTec Pharma) is a single-chain antibody fragment lacking the immunoglobulin Fc domain targeted at EMRSA-15, a 61-kDa ABC transporter expressed by epidemic strains of MRSA that is in clinical therapeutic trials in the United Kingdom [155, 156].

Pooled intravenous immune globulin preparations neutralize a number of staphylococcal superantigen toxins and, as a consequence, are commonly used in the therapy of toxic shock syndrome [157]. The identification of a conserved epitope on staphylococcal enterotoxins that appears to be critical to their activity raises the possibility of another approach to superantigen neutralization [158]. PVL can also be neutralized in vitro by commercial intravenous immunoglobulin preparations [159].

The story of antibiotic resistance and virulence in *S. aureus* is, as has been stated by others, one of "depressing evolutionary progression" [37, pg. 92]. The emergence of CA-MRSA, the rapid introduction of SCC*mec* type IV into multiple genetic backgrounds, and the epidemiological success of the resultant strains indicate that this problem will continue its inexorable march [37, 160, 161]. Mathematical modeling demonstrates difficulty in the epidemiologic control of MRSA in the face of its increased prevalence in the community and the increasingly daunting tasks for hospital infection-control programs [162]. An effective vaccine will be the only effective long-term solution.

Acknowledgments

Potential conflicts of interest. S.D. is a member of the speakers bureau of Pfizer and is a consultant for Therapeutic Human Monoclonals.

APPENDIX

Cassette chromosome recombinase *(ccr)* A gene necessary for the mobility of SCC that enables its site-specific integration into and precise excision from the *S. aureus* chromosome.

Genomic island Genomic islands (often abbreviated as GIS or GEIs) are horizontally acquired chromosomal regions of DNA carrying several genes encoding traits associated with increased adaptability or fitness under specific conditions. They are termed pathogenicity, fitness, symbiosis, metabolic, or resistance islands, depending on the functions encoded [163].

Housekeeping gene A gene involved in basic functions required for cell viability and constitutively expressed in most cells. Housekeeping genes evolve much more slowly than do tissue specific genes that encode proteins necessary only in selected types of cells.

Insertion sequence A DNA sequence involved in the mobilization of genetic information to and from vectors such as plasmids.

***mec* gene complex** Gene complex composed of *mecA* and its regulator genes, *mecI* and *mecR*.

mecA The gene encoding PBP2a, responsible for resistance to methicillin and other β-lactam antibiotics.

mecI The *mecA* repressor gene.

mecR1 A signal transducer gene that encodes a transmembrane receptor that responds to covalent binding of a β-lactam antibiotic and its extracellular sensor domain. Binding initiates events that lead to inactivation of the *mecI* gene repressor product by a protease, allowing expression of *mecA*.

Staphylococcal chromosome cassette (SCC) SCC (or SCC*mec*) is a mobile, 52-kb DNA cassette containing the gene that encodes resistance to methicillin *(mecA)*, as well as those

genes (*ccrA* and *ccrB* in most cases) that encode the integration and excision necessary for its recombination in the staphylococcal chromosome, in addition to insertion sequences.

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Throat Swabs Are Necessary to Reliably Detect Carriers of *Staphylococcus aureus*

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The anterior nares are the most important screening site of colonization with *Staphylococcus aureus*. We screened 2966 individuals for *S. aureus* carriage with swabs of both nares and throat. A total of 37.1% of persons were nasal carriers, and 12.8% were solely throat carriers. Screening of throat swabs significantly increases the sensitivity of detection among carriers by 25.7%.

The anterior nares are considered to be the primary colonization site of *Staphylococcus aureus* [1–3]. Approximately 30% of the healthy population carries *S. aureus* in their anterior nares [4, 5]. Carriage of *S. aureus* in the nose appears to play a key role in the epidemiology and pathogenesis of infection and is associated with an increased risk of infectious complications after surgery in patients with end-stage renal failure and in those with intravascular devices [1, 6]. Approximately 80% of invasive nosocomial infections are of endogenous origin in nasal carriers [7, 8].

The emergence of methicillin-resistant *S. aureus* (MRSA) in hospitals and in the community has triggered many screening programs to identify carriers of *S. aureus*—in particular, MRSA. Early identification of carriers is a crucial step in MRSA prevention programs; this is especially true for "search and destroy" strategies, which are recommended in The Netherlands [9]. Screening of all persons who are admitted to the hospital is currently being debated in the United States.

Most *S. aureus* screening programs that include MRSA require obtainment of a swab specimen from the anterior nares only; a swab specimen from the throat is not yet considered to be standard. The additional yield of culturing the throat is considered to be negligible, because it adds discomfort for the patient and cost to the health care system without significantly increased sensitivity. This belief is based on the observation that throat carriers of *S. aureus* are likely to carry *S. aureus* in the nares as well. However, colonization of the throat but not of the nares may be more common than is currently acknowledged.

Publications from the 1940s reported throat colonization rates of 4%–63% [3]. A recent study confirmed the observation that the throat may be selectively colonized and escape current routine screening programs [10].

Unrecognized carriers may spread MRSA and render infection-control programs futile. Therefore, we questioned the practice of screening of the anterior nares alone and evaluated the additional benefit of screening both the nares and the throat in 4 different study populations.

Patients and methods. We collected data from 4 different groups of individuals. The first group included patients and health care workers who were screened after exposure to an MRSA carrier during the years 2000–2005. Since 1997, this procedure has been part of the hospital's policy for prevention of the spread of MRSA. The second group consisted of health care workers who participated in a trade fair for medical and hospital equipment (the Internationale Fachmesse für Arzt- und Spitalbedorf convention at an exhibition center in Zurich, Switzerland) on 26–29 October 2004 and who volunteered to participate in a prevalence survey of *S. aureus* carriage among the Swiss population. The third group included healthy blood donors who were screened for *S. aureus* in the year 2005. Group 4 consists of a large sample of nasal and throat cultures that were pooled in the laboratory; separate results are not available. This group consists of patients and health care workers, as in group 1.

MRSA carriers were analyzed separately to avoid any potential bias, because it is unknown whether MRSA has the same colonization pattern as methicillin-susceptible *S. aureus* (MSSA). Screening was performed by infection-control nurses or physicians after appropriate training. The study was approved by the human subjects committee of the University of Basel (Switzerland).

Specimens were obtained with a sterile polyester fiber–tipped swab that had been moistened with sterile saline; samples were taken from the anterior nares (5 rotations in each anterior nostril) and from the posterior wall of the pharynx using a

Received 16 February 2007; accepted 20 April 2007; electronically published 5 July 2007.

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Clinical Infectious Diseases 2007; 45:475–7

1058-4838/2007/4504-0012$15.00
DOI: 10.1086/520016

Table. 1. Rates o ion of *Staphylococcus aureus* from the anteri s and the throat.

Variable	Groups 1–3	Group 1	Group 2	Group 3	Group 4
No. of persons screened	2966	832	634	1500	2075
No. with *S. aureus* carriage	1480	369	304	807	1082
Overall rate of positivity, %	49.9	44.4	47.9	53.8	52.1
Nares cultures					
No. of persons with positive results	1100	301	237	562	...
Overall rate of positivity, %	37.1	36.2	37.4	37.5	...
Overall rate of positivity among carriers, %	74.3	81.5	77.9	69.6	...
Nares and throat cultures					
Positive results of both					
No. of persons	650	188	119	343	...
Overall rate of positivity among carriers, %	43.9	50.9	39.1	42.5	...
Positive results of nares cultures and negative results of throat cultures					
No. of persons	450	113	118	219	...
Overall rate of positivity among carriers, %	30.4	30.6	38.8	27.1	...
Negative results of nares cultures and positive results of throat cultures					
No. of persons	380	68	67	245	...
Overall rate of positivity, %	12.8	8.2	10.6	16.3	...
Overall rate of positivity among carriers, %	25.7	18.4	22.0	30.4	...

NOTE. Group 1, persons who underwent *S. aureus* screening during hospital stay; group 2, health care workers; group 3, blood donors; group 4, patients and health care workers for whom swabs from the nares and throat were pooled and for whom separate results were unavailable.

second swab. Swabs were sent to the laboratory in a transport tube (M40 Transystem; Copan) and were processed within 24 h. For culture, a selective enrichment broth (brain heart infusion broth with 6% NaCl) was inoculated. After incubation at 35°C overnight, the broth was subcultured onto both chromogenic agar for *S. aureus* (Chromagar Staph.aureus; Hy Laboratories) and Columbia agar with 5% sheep blood (Becton Dickinson). Plates were read after 24 and 48 h, and colonies that were suspected of being *S. aureus* were further analyzed. *S. aureus* was identified on the basis of various traits, such as typical growth on the chromogenic medium and/or blood agar and detection of clumping factor, protein A, and capsular antigens (Pastorex Staph-Plus; Bio-Rad). *S. aureus* isolates were tested for oxacillin resistance by using an oxacillin disk, an oxacillin screening agar plate, or, more recently, a cefoxitin disk, in accordance with guidelines issued by the Clinical and Laboratory Standards Institute (formerly NCCLS). If results were equivocal or if MRSA was suspected, additional tests were performed, as follows: the presence of aurease was determined using Rapidec staph (bioMérieux), the MRSA-Screen (Denka Seiken) was used to detect penicillin-binding protein 2a, and PCR was used to detect the *mecA* and *femA* genes; also, a comprehensive antibiogram was performed in accordance with the Clinical and Laboratory Standards Institute guidelines.

Results. A total of 5041 persons were included in our study. Three groups (groups 1–3), which included a total of 2966 individuals, were screened for *S. aureus* carriage, with separate results for nose and throat carriage. A fourth group (group 4) consisted of 2075 individuals for whom data from nares and throat swabs were pooled in the laboratory. The average age was 50 ± 21 years, and 50.4% of the subjects were female. In groups 1–3, a total of 1480 individuals (49.9%) tested positive for *S. aureus* (table 1). A total of 37.1% of the study population (in groups 1–3) had nasal carriage of *S. aureus*, with or without positive throat culture results. A total of 380 persons (12.8% of the study population and 25.7% of the *S. aureus* carriers) were colonized in the throat alone. Thus, screening of the throat significantly increased the sensitivity by 25.7%. The anterior nares were the site most frequently colonized with *S. aureus*, with the exception of the group of blood donors; among blood donors, the throat swab cultures yielded *S. aureus* more frequently than cultures of swab specimens from the nares. The rate of *S. aureus* carriage in group 4 (i.e., the pooled results group) was 52.1%, which is similar to that observed with the combined results for nares and throat swab cultures in groups 1–3.

A subset analysis was performed for 37 subjects with MRSA carriage (0.74% of all individuals screened). In 23 MRSA carriers, separate results were available for cultures of throat and nasal swab specimens. The additional yield of throat cultures was comparable with the results described for MSSA: 5 of 23 (22% of all MRSA carriers versus 25.7% of all MSSA carriers).

Discussion. To our knowledge, t[illegible] the largest study to have evaluated the importance of the throat in *S. aureus* carriage. The additional throat swab cultures increased the yield from 37% (cultures of nares swabs only) to almost 50% (cultures of nares and throat swabs combined), an increase of sensitivity by 25.7%. Results for group 4 (the pooled specimen group)—separate cultures of swab specimens from nares and the throat were not performed—corroborated the results for groups 1–3, with a prevalence of *S. aureus* carriage of 49.9% and 52.1%, respectively. Therefore, pooling culture results for swabs from nares and the throat may be an appropriate method to optimize the yield of *S. aureus*–positive while saving the expenses of additional cultures.

Today, *S. aureus* screening is mainly performed to identify MRSA carriers. Unidentified throat carriers may spread MRSA, explaining, in part, why many decolonization schemes are prone to failure. Throat carriage even triggered a large outbreak of MRSA infection, which was traced back to a health care worker who was solely colonized in the throat. Routine nasal screening failed to identify this carrier [11]. Admission screening of selected patients or of all patients that aims to control MRSA infection is performed in many hospitals, but screening focuses on the nares along in most institutions [9]. However, throat swab specimens have been obtained routinely in The Netherlands for decades as part of the successful search-and-destroy policy, which is outlined in their national guidelines (http://www.wip.nl).

Our data confirm the results of previous studies that the anterior nares are the single most colonized site with *S. aureus*. The rate of carriage was higher in the throat than in the nares only among blood donors (group 3). The finding may be related to the fact that only 1 trained, highly motivated investigator obtained all of these swab specimens. Untrained investigators may find it difficult to screen the posterior wall of the throat while avoiding patient discomfort. Alternatively, throat carriage may indeed be more common among healthy individuals than among individuals who are exposed to the health care system, but such a hypothesis requires confirmation by other investigators in different, non–health care populations.

Overall, the prevalence of carriage was ~50%, which is higher than the rate reported in most other studies (25%–35%) [5]. Several factors may explain this discrepancy. First, in other studies, throat carriage was not taken into account. In fact, the rate of nasal carriage (with data from throat cultures excluded) was comparable at a rate of 37.1%. Second, enrichment broth may have additionally increased the sensitivity of the culture [12]. Third, only specially trained health care workers obtained the swab specimens, so samples were obtained from posterior wall of the throat and not the mouth.

The addition of t[illegible] cultures to cultures of swabs from the anterior nares significantly increased the sensitivity of screening by 25.7%. Overall, 37.1% of subjects had nasal carriage of *S. aureus*, but 12.8% of the individuals had throat carriage alone, and these subjects would have escaped traditional screening methods. Therefore, any screening for *S. aureus*—in particular, screening for MRSA—should include both cultures of swabs samples from the anterior nares and the throat. Pooling the samples can maintain the additional expenses associated with throat screening while maintaining sensitivity.

Acknowledgments

Financial support. The Swiss National Science Foundation (3200BO-104179).

Potential conflicts of interest. One year after completion of the study, A.T. accepted a position at F. Hoffmann–La Roche. All other authors: no conflicts.

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Cutaneous Leishmaniasis during Pregnancy: Exuberant Lesions and Potential Fetal Complications

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Cutaneous leishmaniasis affects millions of people worldwide. After observations of atypical lesions in pregnant women at the health centers of Corte de Pedra, Brazil, 9 years of records were reviewed, and 26 pregnant patients were identified. A retrospective case-control study revealed that lesions in pregnant women were much larger than those in nonpregnant patients in an age- and sex-matched group (mean area, 6.08 cm^2 vs. 1.46 cm^2; $P = .008$), and many lesions had an exophytic nature. Despite foregoing treatment until after delivery, response to pentavalent antimony therapy was favorable (rate of cure with 1 course of treatment, 85%). High rates of preterm births (10.5%) and stillbirths (10.5%) were reported. Cutaneous leishmaniasis during pregnancy produces distinct lesions and may have adverse fetal effects.

Worldwide, leishmaniasis affects >12 million people in 88 countries, with a yearly incidence of 2 million cases [1]. The majority of cases are cutaneous leishmaniasis (CL), which is most common in adolescents and young adults from rural areas of extreme poverty [2]—a population with a high fertility rate. Pregnancy is associated with improvement of most inflammatory diseases [3] and an increased susceptibility to many infectious agents, including *Malaria* species [4] and *Listeria monocytogenes* [5]. Moreover, during pregnancy, many infections are associated with adverse fetal outcomes [6]. In the case of leishmaniasis, infection with the viscerotropic form has been described during pregnancy, resulting in vertical transmission and fetal loss when treatment failure occurs [7]. After occasional observations of atypical CL during pregnancy, we retrospectively reviewed all cases of CL and mucocutaneous leishmaniasis (ML) seen at a reference center, identifying gravid patients (a standard screening question). We report clinical aspects of these cases, including lesion size and impact on pregnancy outcome. In addition, a retrospective case-control study comparing lesion size and response to therapy was performed.

Methods. The study was performed at the Corte de Pedra Reference Center for Tegumentary Leishmaniasis in Bahia, Brazil, which has been in operation for >20 years [2]. Yearly, >600 patients are treated for CL and ML at this center.

We manually reviewed charts for all patients with CL or ML who were seen at the referral center during the period 1997–2005, selecting patients who were pregnant and had signs of leishmaniasis. Cases were defined by inclusion criteria of a definite diagnosis of CL or ML as the combination of a compatible lesion and (1) biopsy results showing amastagotes or compatible histopathologic findings, (2) positive culture results from a lesion aspirate specimen, or (3) positive Leishmanin test results. Exclusion criteria were incomplete documentation of pregnancy or of postpartum follow-up. Control subjects were age-matched (within 5 years of age) and sex-matched; the 2 consecutive patients with definite leishmaniasis who were evaluated after each case patient were chosen as control subjects. Probable CL or ML was defined as a compatible lesion with lack of definitive test results.

At the initial visit, patient weight, lesion size and location, and the number of lesions were recorded, and past medical history was evaluated in a standard manner by 1 nurse. All women of childbearing age were evaluated for pregnancy. Leishmanin testing was performed at the initial visit. The initial lesion size was the size of the lesion recorded at the initial visit. The maximum lesion size was the size of the largest documented lesion. All patients found to be pregnant were followed up clinically without treatment for definitive leishmaniasis (i.e., pentavalent antimony compounds) until after delivery.

This study was approved by the Committee of Ethics of The Federal University of Bahia (Salvador, Brazil) and the institutional review board of Weill Medical College of Cornell University (New York, NY). Laboratory studies were performed in the university laboratory using standard commercial techniques. Histopathologic examination was performed in the pa-

Received 12 January 2007; accepted 18 April 2007; electronically published 5 July 2007.

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Clinical Infectious Diseases 2007; 45:478–82

1058-4838/2007/4504-0013$15.00
DOI: 10.1086/520017

thology department. Slides were examined by 2 readers (D.R.F. and W.L.T.), who examined each slide for dermal and epidermal changes, the nature of the inflammatory infiltrate, and the presence of amastigote forms. The isolates were characterized at the *Leishmania* Collection of the Oswaldo Cruz Institute (Rio de Janeiro, Brazil) by multilocus enzyme electrophoresis, as described elsewhere [8].

Data were entered into Excel (Microsoft). Lesion areas were calculated as ellipses. The Mann-Whitney *U* test (Wilcoxon rank sum test) and Pearson rank test were performed using Stata, version 7.0 (Stata). $P < .05$ was considered to be statistically significant.

Results. We identified 27 pregnant patients among ~4200 people with suspicion of leishmaniasis. Of the 27 pregnant patients, there were 8 patients with probable leishmaniasis and 18 with definite leishmaniasis. One patient was excluded because of lack of postpartum follow-up information.

The characteristics of 26 patients with leishmaniasis during pregnancy are presented in table 1. Lesions appeared at a mean of 18-weeks gestation (95% CI, 13–21 weeks). Descriptions of vegetative, exophytic, or atypical lesions were found in 11 (42%) of 26 patient charts (figure 1). No manifestations of CL developed prior to pregnancy in any of the patients. Exophytic lesions were nonsignificantly correlated with trimester of pregnancy ($P = .338$, by Pearson rank test; $R^2 = 0.046$).

Lesions showed documented postpartum improvement in 3 patients prior to treatment; nonetheless, these patients subsequently received standard treatment (figure 2). Two patients (7.7%) initiated pentavalent antimony treatment during the first trimester but stopped treatment when pregnancy was discovered (after 7 days of treatment in 1 patient and after 13 days of treatment in the other patient). Both patients continued to have active lesions throughout their pregnancy, and neither woman had an adverse fetal outcome.

Nineteen patients provided information regarding pregnancy complications: 2 (10.5%) of 19 patients delivered preterm, 2 (10.5%) experienced a stillbirth, and 15 (79%) reported normal deliveries (table 1). Cutaneous lesions in patients who expe-

Table 1. Clinical and laboratory findings for 26 pregnant patients with probable and definite leishmaniasis, compared with findings for 36 nonpregnant control subjects with definite cutaneous leishmaniasis.

	Patients with cutaneous leishmaniasis	
Variable	Pregnant patients ($n = 26$)	Nonpregnant control subjects ($n = 36$)
Clinical finding		
Disseminated lesions[a]	3/26 (11.5)	0
Mucosal disease	2/26 (7.7)	0
Recurrent disease	2/26 (7.7)	0
Exophytic lesions documented	11/26 (42.3)	0
Week of pregnancy at lesion appearance (range)	18 (13–21)	NA
Treatment		
Glucantime		
One 20-day course	22/26 (84.6)	29/36 (80.5)
Two 20-day courses	2/26 (7.7)	7/36 (19.5)
Topical paramomycin	2/26 (7.7)[b]	0
No treatment	1/26 (3.4)	0
Azithromycin	2/26 (7.7)[c]	0
Fetal effects		
Preterm birth	2/19 (10.5)	NA
Stillbirth	2/19 (10.5)	NA
Reported normal birth	15/19 (79.0)	NA
Laboratory finding		
Positive culture result	7/11 (63.6)	3/7 (42.8)
Compatible biopsy result	11/11 (100)	4/4 (100)
Amastigotes	2/11 (18)	0

NOTE. Data are no. (%) of patients, unless otherwise indicated. NA, not applicable.

[a] Defined as >10 lesions.

[b] One patient subsequently received 1 course of glucantime therapy.

[c] Both patients received 1 course of glucantime therapy.

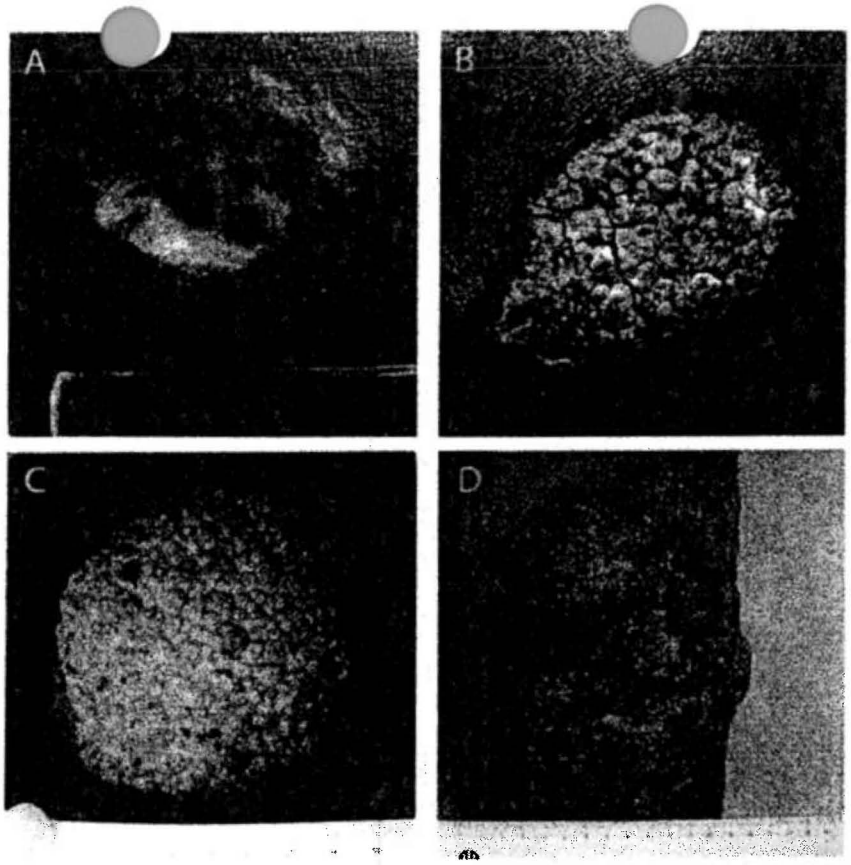

Figure 1. Appearance of cutaneous leishmaniasis during pregnancy. *A*, Typical, well-demarcated ulcer with raised borders on a patient's leg. *B*, Mildly raised, verrucous lesion on a patient's back. Massive, vegetative lesions on a patient's buttock *(C)* and thigh *(D)*. Rulers represent centimeters.

rienced a preterm birth or stillbirth did not differ from those in patients who experienced normal deliveries with respect to clinical characteristics or trimester of onset of infection.

Biopsy specimens from pregnant individuals had an inflammatory exudate that was more intense than that typically found in CL, with a predominance of neutrophils, which is not typically observed. Culture results were positive for *Leishmania* species in 7 of 11 patients examined. Five specimens were no longer viable. Two specimens were typed as *Leishmania braziliensis* by multilocus enzyme electrophoresis.

Eighteen patients with definite leishmaniasis were compared with 36 age- and sex-matched control subjects. No difference was found between pregnant patients and nonpregnant control subjects with regard to the median size of the leishmanin delayed-type hypersensitivity test result (induration, 1.77 cm^2 [interquartile range (IQR), 1.13–2.53 cm^2] vs. 1.77 cm^2 [IQR, 0.80–2.98 cm^2]), median duration of lesions prior to the first visit (1.25 months [IQR, 1.0–2.0 months] vs. 1.0 month [IQR, 1.0–2.0 months]), median number of lesions (1.0 lesions [IQR, 1.0–2.0 lesions] vs. 1.0 lesion [IQR, 1.0–2.0 lesions]), and median number of treatment courses (1.0 course [IQR, 1.0–2.0 courses] vs. 1.0 course [IQR, 1.0–2.0 courses]). Both median initial lesion area (6.08 cm^2 [IQR, 1.88–12.01 cm^2] vs. 1.46 cm^2 [IQR, 0.79–3.78 cm^2]; $P = .008$, by Mann-Whitney *U* test) and median maximal lesion area (14.46 cm^2 [IQR, 5.50–54.95 cm^2] vs. 1.46 cm^2 [IQR, 0.79–3.78 cm^2]; $P < .001$, by Mann-Whitney *U* test) were significantly larger among pregnant women than among control subjects.

Discussion. This study demonstrates the influence of pregnancy on the clinical manifestations of CL in a region with *L. braziliensis* transmission. Patients who presented with CL while pregnant had much larger lesions than did nonpregnant women (median initial lesion area, 6.08 cm^2 vs. 1.46 cm^2), despite showing no difference in disease duration. Lesion size was also larger among our patients than among patients seen in a historical cohort from the same region who did not receive treatment (median lesion area, 4 cm^2; IQR, 3–5 cm^2) [9]. In contrast to the typical presentation of a well-demarcated ulcer with raised borders, lesions were frequently of a cauliflower appearance, which raised concern for other diseases, such as chromomycosis, yaws, or neoplasms. Although not previously reported, more-exuberant CL involving other species, including *Leishmania major*, has been observed during pregnancy in Northern Africa (H. Louzir, personal communication).

In a C57BL/6 mouse *L. major* model, larger CL lesions occurred during pregnancy, which correlated with decreased Th1

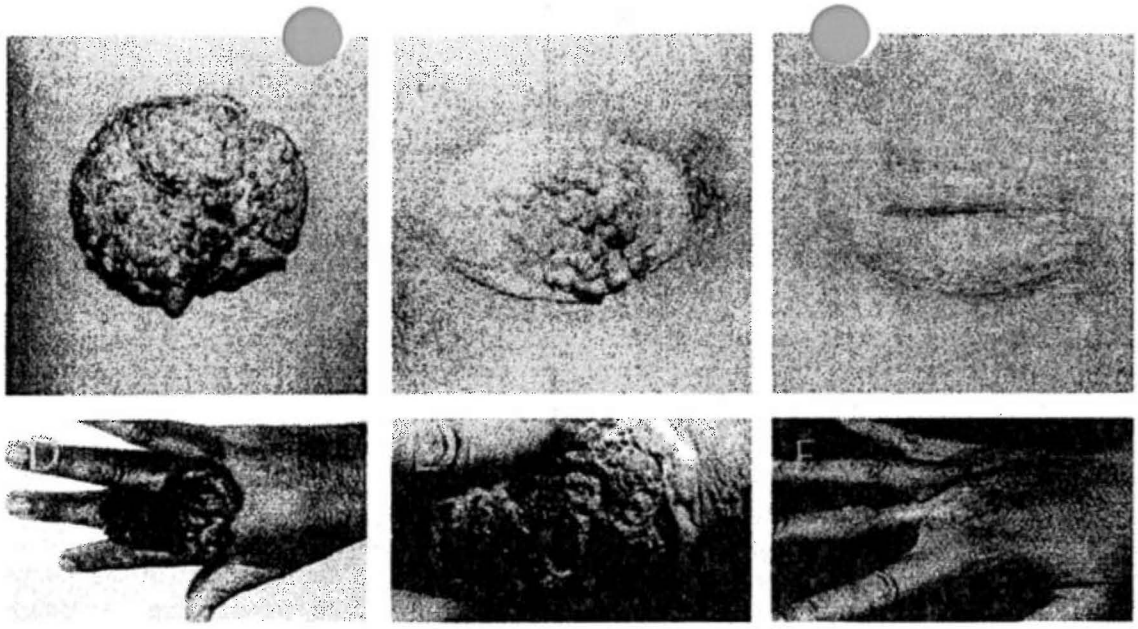

Figure 2. Spontaneous improvement of cutaneous leishmaniasis postpartum. Raised, atypical lesions seen during pregnancy (*A* and *D*), 1–2 months postpartum prior to treatment (*B* and *E*), and after 1 course of pentavalent antimony treatment (*C* and *F*).

cytokine production [10]. The human cell-mediated immune response is altered during pregnancy [11], with an overcompensation immediately after delivery. Because the main histopathological difference in lesions in pregnant women with typical lesions was increased, neutrophilic infiltration and fibrinoid necrosis, differential neutrophil signaling, or activation may play a specific role in development of atypical lesions.

Standard treatment of CL caused by *L. braziliensis* is 20 days of intravenous pentavalent antimony compound, which is potentially abortogenic. Because of this concern, only 2 patients received antimony during pregnancy (the 2 patients stopped treatment after they realized they were pregnant). Of note, these patients experienced full-term deliveries of healthy infants, although their lesions were not cured until after delivery. Because spontaneous cure has been reported to occur after delivery [9], the merit of different treatments cannot be evaluated. No patients in this study were cured while pregnant. No patients developed mucosal disease, although the small sample size limits generalizations.

An unexpected finding was the high rate of preterm births and stillbirths. Various maternal infections, including malaria [4], listeriosis [5], and visceral leishmaniasis [7], are associated with fetal complications. In a murine model of CL, cutaneous infections increased the rate of implantation failure and fetal reabsorption [12]. In northeastern Brazil as a whole, infant mortality is high (~38 of 1000 infants die per year) [13]. The rates observed in this study are 3-fold higher than the normal rates for the region; however, the small size of this study limits conclusions regarding adverse fetal outcome.

This study is limited, because we did not measure the host immune response, including HIV seropositivity, which could modify disease presentation. In addition, our study was retrospective and, therefore, had no formalized protocol for treatment or data collection.

CL during pregnancy is characterized by larger lesions with a highly atypical, exophytic appearance. No therapy is known to cure disease during pregnancy, although postpartum cure has been found to be complete. CL during pregnancy has a notably different clinical presentation and may increase the risk of fetal complications. It is important for physicians who are caring for patients in regions where disease is endemic to recognize this presentation.

Acknowledgments

We thank E. Cupolillo and the Leishmania Collection of the Oswaldo Cruz Institute (Rio de Janeiro, Brazil), for performing multilocus enzyme electrophoresis identification of *Leishmania braziliensis*; M. Glesby, for statistical and editorial suggestions; and W. Johnson, for research guidance.

Financial support. National Institutes of Health (T32 AI07613 to D.J.M.); E.M.C. is supported by the Brazilian Foundation for Support of Research.

Potential conflicts of interest. All authors: no conflicts.

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MAJOR ARTICLE

Methicillin-Resistant *Staphylococcus aureus* (MRSA) Nares Colonization at Hospital Admission and Its Effect on Subsequent MRSA Infection

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Background. Asymptomatic colonization with methicillin-resistant *Staphylococcus aureus* (MRSA) has been described as a risk factor for subsequent MRSA infection. MRSA is an important nosocomial pathogen but has currently been reported in patients without typical risk factors for nosocomial acquisition. This study was designed to evaluate the impact of asymptomatic nares MRSA colonization on the development of subsequent MRSA infection. The incidence of MRSA infection was examined in patients with and patients without MRSA or methicillin-susceptible *S. aureus* (MSSA) colonization at admission to the hospital and in those who developed colonization during hospitalization.

Methods. Patients admitted to 5 representative hospital units were prospectively evaluated. Nares samples were obtained for culture at admission and during hospitalization. Laboratory culture results were monitored to identify all MRSA infections that occurred during the study period and 1 year thereafter.

Results. Of the 758 patients who had cultures of nares samples performed at admission, 3.4% were colonized with MRSA, and 21% were colonized with MSSA. A total of 19% of patients with MRSA colonization at admission and 25% who acquired MRSA colonization during hospitalization developed infection with MRSA, compared with 1.5% and 2.0% of patients colonized with MSSA ($P < .01$) and uncolonized ($P < .01$), respectively, at admission. MRSA colonization at admission increased the risk of subsequent MRSA infection, compared with MSSA colonization (relative risk [RR], 13; 95% confidence interval [CI], 2.7–64) or no staphylococcal colonization (RR, 9.5; 95% CI, 3.6–25) at admission. Acquisition of MRSA colonization also increased the risk for subsequent MRSA infection, compared with no acquisition (RR, 12; 95% CI, 4.0–38).

Conclusion. MRSA colonization of nares, either present at admission to the hospital or acquired during hospitalization, increases the risk for MRSA infection. Identifying MRSA colonization at admission could target a high-risk population that may benefit from interventions to decrease the risk for subsequent MRSA infection.

Methicillin-resistant *Staphylococcus aureus* (MRSA) has become a progressively more important human pathogen since its initial description in 1961 [1] and the first documented outbreak of infection in 1968 [2]. The most recent data from the National Nosocomial Infections Surveillance System of the Centers for Disease Control and Prevention showed in August 2003 that MRSA on average accounts for 57% of *S. aureus* isolates causing nosocomial infection in intensive care units (ICUs) [3]. This is higher than the reported prevalence of 35%–50% for 1995–1999 [4]. Risk factors for MRSA colonization have been well described [5]. Rates of colonization or infection with MRSA vary by geographic location, type of health care facility, and the specific population being studied. In acute-care settings, the prevalence of MRSA colonization varies depending on patient location within the facility. The reported prevalence of MRSA infection or colonization in the ICU has been 4%–8% [6, 7]. The prevalence of MRSA colonization in the general inpatient setting has been reported to be 0.18%–7.2% [8–10], with a prevalence of nosocomial acquisition of up to 1.7% [11, 12]. Community-acquired colonization has recently been de-

Received 31 December 2003; accepted 14 April 2004; electronically published 27 August 2004.

The views expressed are those of the authors and do not reflect the official policy or position of the Department of the Army, the Department of Defense, or the US government.

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Clinical Infectious Diseases 2004; 39:776–82

1058-4838/2004/3906-0004

scribed as an important reservoir of MRSA, with a reported prevalence of 1.3%–2% [13, 14].

Whether MRSA is more virulent than methicillin-susceptible *S. aureus* (MSSA) is a controversial issue. There have been those whose findings support increased virulence of MRSA, compared with MSSA [15–17], those who demonstrate no difference in virulence [18–20], and still others whose conclusions are equivocal [21]. Those who argue that MRSA is more virulent than MSSA have demonstrated higher mortality associated with MRSA bacteremia in analyses that controlled for other factors [15–17]. Other investigators have demonstrated that inappropriate antimicrobial therapy, comorbid conditions, and advanced patient age—rather than methicillin resistance—account for increased mortality associated with MRSA bacteremia [18–20]. However, there are studies in which MRSA infection or colonization were demonstrated as leading to increased risk of subsequent MRSA infection during the same hospitalization [22, 23] and up to 18 months after hospital discharge [24]. The reported rate of subsequent MRSA infection after identification of MRSA colonization is ~30% [24–26]. This increased risk of infection with MRSA has led some to recommend screening all patients [12, 24] or those at highest risk [27, 28] for colonization at admission to the hospital. This study was designed to measure the prevalence of MRSA colonization at admission to our institution (Brooke Army Medical Center; Ft. Sam Houston, TX) and to determine its impact on subsequent MRSA infection.

METHODS

Data were obtained from a prospective observational study of subjects who were admitted to 5 systematically chosen representative inpatient hospital units. The study was approved by the Brooke Army Medical Center institutional review board. All patients admitted between 1 June 2002 and 31 August 2002 were eligible for inclusion. The observed hospital units included a general medical/surgical ward, a medical ICU, a surgical ICU, a trauma ICU, and a monitored step-down unit, the patients of which, taken together, represent our typical inpatient population. The study hospital is a tertiary care military medical training center located in San Antonio, Texas, that had 203 available inpatient beds during the study period. This facility serves a patient population of active-duty and retired military personnel and their dependents. Individuals in this population receive the majority of their medical care from the military health care system in San Antonio. Additionally, the facility is a level 1 trauma center that treats a limited number of civilian trauma patients who would otherwise not be eligible for care within the system.

Nares cultures were performed within 48 h after admission to an observed hospital unit. Cultures were also performed when patients were transferred to other study units, weekly during prolonged hospital stays, and at hospital discharge. One sterile culture swab (BBL Culture Swab; Becton Dickinson) was used to sample both nares. The swab sample was streaked onto 5% sheep blood agar (BBL Stacker plates; Becton Dickinson) and colistin-nalidixic acid (CNA) agar (Columbia CNA agar with 5% sheep blood Stacker plates; Becton Dickinson) and incubated for 18–24 h at 37°C in 5% CO_2. If no growth was detected, plates were incubated for another 24 h. Colonies with β-hemolytic activity and properties consistent with those of staphylococci were screened for catalase activity (3% H_2O_2), and if they tested positive, they were then screened with a rapid slide agglutination test for coagulase and protein A (Staphaurex; Remel). Coagulase-positive organisms were confirmed with a tube coagulase test (BBL coagulase plasmas; Becton Dickinson) and were inoculated onto oxacillin screen agar (BBL stacker plates). Susceptibility testing of MRSA isolates was conducted by Vitek system GPS-105 cards (bioMerieux).

Information recorded for study patients included age, sex, length of hospital stay, and number of nares cultures completed. If *S. aureus* was detected in the admission culture, the patient was identified as having been initially colonized with either MRSA or MSSA. If the admission culture was negative for *S. aureus* but results of a subsequent nares culture during the course of hospitalization were positive, the patient was identified as having acquired MRSA or MSSA colonization. Patients without *S. aureus* identified in any nares culture during hospitalization were identified as having not been colonized with *S. aureus.*

All patients included in the study were followed to determine whether they developed clinical infection with MRSA. Patients were followed during the 3-month study period and for 1 year thereafter, through 31 August 2003. MRSA infection was defined as recovery of the organism from either normally sterile sites (blood samples or urine specimens without a Foley catheter in place) or nonsterile sites concomitant with a diagnosis of infection by the primary physician caring for the patient. Nonsterile sites included indwelling vascular catheters, skin and soft tissue, and sputum. All patients included in the study also had their names compared with those from the list of patients previously known to have infection or colonization with MRSA in our hospital.

The precision of relative risks for MRSA infection was determined by the method for calculating 95% CIs described by Altman [29]. Statistical significance (i.e., the *P* value) was calculated for the difference in rates of MRSA infection by Fisher's exact test [30]. The hypothesis that MRSA infection was dependent on age was evaluated with the independent-sample Student's *t* test. The hypothesis that MRSA infection was dependent on length of stay was evaluated with the Mann-Whitney rank sum test. Difference in descriptive statistics among evaluated patients and excluded patients was completed with the Mann-Whitney rank sum test.

Table 1. Demographic and clinical characteristics of 758 admitted patients for whom cultures of nares were performed to assess methicillin-resistant *Staphylococcus aureus* (MRSA) colonization status.

Study unit	Sex, no. of patients with MRSA/total no. in unit (%)		Age, mean years (range)	Length of stay, days	
	Male	Female		Mean	Median (range)
Medical/surgical	157/347 (45)	190/347 (55)	49 (17–87)	3.9	2 (1–40)
Intensive care					
Medical	53/96 (55)	43/96 (45)	65 (18–101)	6.6	3 (1–96)
Surgical	50/67 (75)	17/67 (25)	46 (8–84)	14	8 (1–85)
Trauma	54/74 (73)	20/74 (27)	59 (18–101)	10	7 (1–63)
Step-down	88/174 (51)	86/174 (49)	67 (20–93)	5.2	3 (1–67)
Total	402/758 (53)	356/758 (47)	56 (8–101)	6.1	3 (1–96)

RESULTS

During the study period, 758 of 990 patients admitted to the observed units had nares cultures performed within 48 h after admission to the hospital. The mean age was higher for patients admitted to the medical ICU, the trauma ICU, and the monitored step-down unit (table 1; $P < .01$). Among patients admitted to the surgical and trauma ICUs, the mean and median length of stay was longer ($P < .01$) and there were proportionally more men ($P < .03$). Cultures were performed an average of 1.7 times (range, 1–6 times) for each patient during hospitalization. There were no significant differences with respect to sex ($P = .223$) or length of stay ($P = .163$) for patients who did not have a culture completed within 48 h of admission, and thus these are not included in the evaluation. Patients who were not included in the evaluation were less frequently admitted to a medical-surgical ward (22% vs. 45%; $P < .01$) and were more frequently admitted to the telemetry unit (47% vs. 23%) than were patients who were included. They were older (mean age, 60 years; $P < .01$) than those who were included in the study.

Of the 758 study patients, 163 were initially colonized with *S. aureus*. Twenty-six patients (3.4%; 95% CI, 2.1–4.7) were colonized with MRSA, and 137 (21%; 95% CI, 18–24) were colonized with MSSA (table 2). The incidence of subsequent MRSA infection for those initially colonized with MRSA was close to 10 times the incidence for patients colonized with MSSA or not colonized with *S. aureus* at admission ($P < .01$ for both) (table 3). The relative risk (RR) for developing MRSA infection was much higher for those colonized with MRSA at admission, compared with those colonized with MSSA (RR, 13; 95% CI, 2.7–64) or those not colonized with *S. aureus* (RR, 9.5; 95% CI, 3.6–25) at admission. Patients who subsequently developed MRSA infection were older (mean age, 69 years; range, 29–91 years; $P = .015$) and were admitted for a longer period (mean length of stay, 16 days; range, 1–67 days; $P < .01$). They also tended to be admitted to a monitored unit ($P = .10$). Table 4 describes the infections that occurred in these patients, including the time of onset and whether they occurred during the same or a future hospitalization.

In addition to presenting with colonization at admission, there were patients who acquired colonization during the study period. There were 394 patients who had ⩾1 nares culture completed during hospitalization, of whom 25 had a change in their nares colonization status. Twelve (3.0%) of these patients acquired MRSA, 3 of whom were initially colonized with MSSA. Five patients (2.0%) were in the medical-surgical ward, none were in the medical ICU, 1 (2.4%) was in the surgical ICU, 4 (8.9%) were in the trauma ICU, and 2 (4.3%) were in the monitored step-down unit. Of these patients, 25% later developed MRSA infection. The relative risk for developing MRSA infection for patients who acquired MRSA colonization was also higher, compared with those who were not colonized with *S. aureus* (RR, 12; 95% CI, 4.0–38; $P < .01$).

There was 1 patient who developed infection with MRSA who was known to have previous infection with MRSA. This patient

Table 2. *Staphylococcus aureus* colonization in patients for whom nares were cultured at admission.

Study unit	*S. aureus* colonization status, no. of patients/total no. screened in unit (%)	
	MRSA	MSSA
Medical/surgical	7/347 (2.0)	57/300 (19)
Intensive care		
Medical	7/96 (7.3)	18/90 (20)
Surgical	2/67 (3.0)	16/57 (28)
Trauma	3/74 (4.1)	13/68 (19)
Step-down	7/174 (4.0)	33/152 (22)
Overall	26/758 (3.4)[a]	137/667 (21)[b]

NOTE. MSSA, methicillin-susceptible *S. aureus*.

[a] 95% CI, 2.1–4.7.

[b] 95% CI, 18–24.

Table 3. Subsequent methicillin-resistant *Staphylococcus aureus* (MRSA) infection, by *S. aureus* colonization status at admission.

	MRSA colonization at admission, no. (%) of patients		MSSA colonization at admission, no. (%) of patients		No colonization at admission, no. (%) of patients	
Study unit	Total	MRSA infection	Total	MRSA infection	Total	MRSA infection
Medical/surgical	7	1 (14)	57	0 (0)	283	2 (0.7)
Intensive care						
Medical	7	2 (29)	18	1 (5.6)	71	1 (1.4)
Surgical	2	0 (0)	16	0 (0)	50	3 (6.0)
Trauma	3	0 (0)	13	0 (0)	57	2 (3.5)
Step-down	7	2 (29)	33	1 (3.0)	134	4 (3.0)
Overall	26	5 (19)[a]	137	2 (1.5)[b]	595	12 (2.0)[c]

NOTE. MSSA, methicillin-susceptible *S. aureus*.

[a] 95% CI, 3.9–34.

[b] $P < .01$ (incidence not large enough to calculate 95% CI).

[c] 95% CI, 0.9–3.1; $P < .01$.

was not colonized with MRSA at admission to the medical-surgical ward, but repeated screening later identified colonization before infection. There were 6 other patients in the study group who had previously been identified with MRSA infection. Four of these 6 patients were colonized with MRSA at admission, 1 acquired colonization during hospitalization, and 1 was never identified with MRSA colonization during the study period. This patient had 2 cultures with negative results during the hospital stay that followed the admission culture for which negative results were obtained.

Table 4. Methicillin-resistant *Staphylococcus aureus* (MRSA) infection, according to *S. aureus* colonization characteristics at admission.

Colonizing isolate, by patient no.	Infection type	Time from *S. aureus* colonization to MRSA infection, days	Hospitalization in which MRSA infection occurred[a]
MRSA			
1	Toe amputation site abscess	6	Concurrent
2	Bacteremia	7	Concurrent
3	Central catheter infection	9	Concurrent
4	Right axillary abscess	24	Future
5	Right BKA site abscess	60	Future
MSSA			
6	Bacteremia	82	Future
7	LLE soft tissue abscess	268	Future
None			
8	Bacteremia	9	Concurrent
9	Osteomyelitis	22	Concurrent
10	Bacteremia	23	Concurrent
11	Abdominal wound abscess	8	Future
12	Pneumonia	31	Future
13	Pneumonia	42	Future
14	RLE BKA site abscess	77	Future
15	LLE BKA site abscess	87	Future
16	Osteomyelitis	336	Future

NOTE. BKA, below the knee amputation; LLE, left lower extremity; MSSA, methicillin-susceptible *Staphylococcus aureus*; RLE, right lower extremity.

[a] Data limited to 1 year after the hospital stay during which MRSA colonization was initially identified.

Table 5. Antibiotic susceptibility patterns of methicillin-resistant *Staphylococcus aureus* (MRSA) isolates.

Antibiotic to which MRSA was susceptible	MRSA type, % susceptible	
	Colonizing isolates (n = 56)	Infecting isolates (n = 30)
Ampicillin	0	0
Cefazolin	4	0
Ciprofloxacin	9	13
Clindamycin	27	7
Erythromycin	4	3
Rifampin	100	90
Tetracycline	96	93
TMP-SMZ	96	97
Vancomycin	100	100

NOTE. All isolates tested positive for β-lactamase production. TMP-SMZ, trimethoprim-sulfamethoxazole.

The susceptibility patterns for MRSA isolates obtained from nares cultures and for those causing clinical infection were similar (table 5). Nares isolates from patients initially colonized with MRSA were more susceptible to tested antibiotics than were isolates from those who acquired colonization. The isolates that caused infection in patients who were initially colonized with MRSA had the exact same susceptibility patterns as the colonizing isolates from these patients. Isolates that caused infection in patients who were not colonized with *S. aureus* or in those who acquired MRSA colonization before infection tended to be more resistant to the tested antibiotics, which is consistent with patterns of hospital-acquired MRSA. The isolates of 1 of the 3 patients who acquired colonization and were later infection with MRSA also had the same susceptibility patterns. The other 2 patients had isolates that varied by either clindamycin or ciprofloxacin susceptibility only.

DISCUSSION

The prevalence of initial MRSA colonization in this study was 3.4%, with 3.0% of patients subsequently acquiring MRSA colonization. In this study, patients colonized with MRSA were at much higher risk of subsequent MRSA infection than were those colonized with MSSA or those not colonized with *S. aureus*. There was a 10-fold increase in the rate of infection between these groups, with a significant difference in relative risk. Antibiogram data for these isolates suggest that the colonizing isolates were the same isolates that subsequently caused infection in these patients.

Recent reports have demonstrated a similar increased risk of subsequent MRSA infection for MRSA-colonized patients. Huang and Platt [24] reported on subsequent MRSA infection in 209 adult patients newly identified with MRSA infection or colonization. They retrospectively identified these patients from infection-control records and found that 29% developed MRSA infections over the next 18 months. One-half of the infections occurred after discharge from the hospital. Mest et al. [31] reported on a smaller group of patients, compared with our study, who were in the surgical ICU. They screened all patients preoperatively for MRSA colonization of nares and found that 4% were colonized with MRSA. Twenty-six percent of these patients developed MRSA infection, compared with 1.3% of those who were not colonized. They hypothesized that preoperative MRSA colonization of nares significantly increased the risk for subsequent postoperative MRSA infection. Roghmann et al. [23] retrospectively studied the risk associated with MRSA colonization of ulcers and the subsequent development of MRSA infection in a cohort of patients with chronic sacral decubitus and diabetic foot ulcers. They found that 30% of ulcers were colonized with MRSA. Seventeen percent of patients with MRSA-colonized ulcers developed subsequent MRSA bacteremia, compared with only 1% of the patients without colonization. Roghmann et al. [23] reasoned that MRSA colonization of chronic ulcers increases the risk for MRSA bacteremia.

Other studies evaluated cohorts of MRSA-colonized patients. Coello et al. [22] observed a group of 479 patients colonized with MRSA. Of these patients, 11% developed MRSA infection during the course of hospitalization, but Coello et al. [22] did not compare this risk with that for noncolonized patients. They demonstrated that ICU patients had an increased risk of subsequent MRSA infection, compared with medical patients, which was similar to our results that showed that MRSA infections tended to occur in patients admitted to monitored units (table 3). Garrouste-Orgeas et al. [25] also reported on a cohort of MRSA-colonized patients who were treated in the ICU. In their study, Garrouste-Orgeas et al. [25] observed patients during hospitalization but not after discharge, and they identified MRSA colonization in 10% of medical-surgical ICU patients, with 27% developing MRSA infection, compared with <1% of noncolonized patients who developed MRSA infection during hospitalization.

The limitations of our study include the relatively small number of MRSA infections that were identified. The conclusions based on this data are statistically significant; however, a larger data set would strengthen these conclusions. A small data set may introduce sampling bias, because of the small numbers of infections found. There were also a number of patients who were not included in the study because they were not screened within 48 h after admission or not screened at all. The demographic data of this population did not differ significantly from those of patients in the study group, but the former were more frequently admitted to the medical surgical or telemetry units. It is possible that the failure to include this population could have introduced sampling error, which could affect the overall conclusions. Additional review, however, demonstrated

that this group did not have a significant number of MRSA infections that would have changed the study outcomes.

This study supports the results of previously published reports and further demonstrates the natural course of MRSA colonization of nares. Most of the previous studies identified MRSA colonization for inpatients and the associated risk for subsequent infection during the same hospitalization. As demonstrated by Huang and Platt [24], one-half of these infections occurred after hospital discharge. These studies typically retrospectively identified patients who had MRSA colonization at some point during the hospitalization—not necessarily at admission, as our study did—or observed a cohort of MRSA-colonized or -infected patients without comparing them with noncolonized patients. By sampling a group of consecutively admitted patients and observing them for >1 year, we were able to define the incidence of subsequent infection in a prospective manner.

We have demonstrated that MRSA colonization of nares, both at admission and hospital-acquired, increases the risk for subsequent MRSA infection. Our data suggest that further investigation of patients at risk for MRSA infection is warranted on the basis of the presence of MRSA colonization. It may be possible to focus infection-control measures on a high-risk group of MRSA-colonized patients to decrease the incidence of subsequent MRSA infection. This study has demonstrated that an ICU patient population would be best suited for this because it had the highest risk for MRSA colonization of nares and the highest incidence of subsequent MRSA infection.

Acknowledgment

We thank Dr. John Ward for his assistance in the statistical evaluation of collected data.

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MAJOR ARTICLE

Predicting the *Staphylococcus aureus* Nasal Carrier State: Derivation and Validation of a "Culture Rule"

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Background. To study determinants and risks of *Staphylococcus aureus* nasal carriage, adequate differentiation between the different *S. aureus* carrier states is obligatory. We set out to develop a "culture rule" capable of differentiating between persistent and intermittent or noncarriers that uses a minimum of nasal swab cultures.

Methods. In 51 healthy volunteers (derivation cohort), 12 quantitative nasal cultures were performed to establish *S. aureus* nasal carriage states. Persons with 11 or 12 cultures positive for *S. aureus* were classified as persistent carriers, and those with negative results of all cultures were classified as noncarriers. All other persons were classified as intermittent carriers. By means of logistic regression and receiver operating characteristic (ROC) curves, a culture rule was derived. This culture rule was subsequently validated in 106 participants of an ongoing study in 3882 elderly persons, again with the use of 12 quantitative nasal cultures.

Results. In both cohorts, the positive predictive value of 2 consecutive positive culture results for persistent carriage was 79%. The model best differentiating between persistent and intermittent or noncarriers used the number of positive culture results combined with the amount of *S. aureus* in these cultures. By using the outcome of 2 cultures, the areas under the ROC curves were 0.981 (95% confidence interval [CI], 0.949–1.0) for the derivation cohort and 0.936 (95% CI, 0.881–0.990) for the validation cohort.

Conclusions. Combining qualitative and quantitative results of 2 nasal swab cultures accurately predicted the persistent *S. aureus* carriage state with a reliability of 93.6%. Thus, this culture rule can be used in studies of determinants and risks of *S. aureus* nasal carriage.

Staphylococcus aureus nasal carriage is a major risk factor for both community-acquired and nosocomial infections [1–7], and the anterior nares are the primary reservoir of *S. aureus* in humans [8–10]. Three *S. aureus* nasal carriage patterns can be discerned: persistent carriage, intermittent carriage, and noncarriage [11–22]. However, no consensus has been reached on how to exactly identify these different states, but most studies use findings from 10–12 weekly nasal swab cultures [23].

The number of colony-forming units (CFUs) of *S. aureus* isolated from the anterior nares are higher in persistent than in intermittent carriers [24, 25], resulting in more extensive dispersal of staphylococci in the environment [25] and in an increased risk of *S. aureus* infection [26–28]. Bacterial variability (i.e., the number of *S. aureus* genotypes isolated in repeated cultures from one individual) is lower for persistent than for intermittent carriers [15, 22, 29], indicating that the underlying mechanisms determining persistent and intermittent carriage differs. Adequate differentiation between persistent and intermittent carriage is thus relevant for epidemiological studies.

At present, a large study of *S. aureus* nasal carriage in a population aged ≥60 years is being conducted at Erasmus Medical Center (Rotterdam, The Netherlands). The main objectives are to study determinants and risks of *S. aureus* nasal carriage. This is part of the Rotterdam Study, a population-based prospective study of chronic diseases in the elderly population. The Rotterdam Study started in 1990 with 7983 persons and has just finished its third phase, in which >4000 persons have been included. In this large survey, an efficient and reliable way

Received 16 October 2003; accepted 3 May 2004; electronically published 26 August 2004.

Presented in part: 9th International Society for Staphylococci and Staphylococcal Infections meeting, June 2000, Kolding, Denmark.

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Clinical Infectious Diseases 2004; 39:806–11

1058-4838/2004/3906-0009$15.00

to assess *S. aureus* nasal carriage was obligatory. It would be impossible to perform 10–12 weekly nasal swab cultures in all participants. Thus, we developed a "culture rule" to discriminate reliably between persistent carriage and noncarriage or intermittent carriage, with a minimum of nasal swab cultures.

Our main questions were as follows: (1) how many quantitative nasal swab cultures are needed to accurately predict persistent carriage in a cohort of healthy adult volunteers, and (2) does the derived culture rule correctly predict persistent carriage in the elderly cohort of the ongoing Rotterdam Study?

PATIENTS AND METHODS

Patient Cohorts and Microbiological Investigations

Derivation cohort. In 1988, a cohort of healthy volunteers (staff members of the departments of medical microbiology and infectious diseases and virology at Erasmus Medical Center) was formed to investigate bacterial and human factors associated with *S. aureus* nasal carriage [23]. During the period of September 1995 through March 1996, a total of 51 volunteers agreed to participate in this study. Nasal swab cultures were performed weekly for 12 weeks. All nasal swab samples were obtained for culture by one study physician (M.F.Q.K.-V.), according to the protocol below.

Validation cohort. On the basis of the results of the derivation cohort, 2 quantitative nasal swab cultures of samples obtained at 1-week intervals were performed in 3882 participants of the Rotterdam Study. While this study was ongoing, 106 participants entering the study during the period of October 1997 through April 1998 agreed to be included in the validation cohort. Persons with 2 positive or 2 negative nasal swab culture results were oversampled to estimate the predictive value of these cultures for persistent carriage and noncarriage, or for intermittent carriage. One trained research assistant visited the participants at home and performed 10 additional nasal swab cultures at 1-week intervals, according to protocol.

The study was approved by the Medical Ethics Review Committee of the Erasmus Medical Center, University Medical Center, Rotterdam. Informed consent was obtained from all participants.

Definitions

S. aureus nasal carriage state was assessed by means of the results of nasal swab cultures 3–12, as follows: persistent carrier, 9 or 10 of 10 cultures were positive for *S. aureus;* noncarrier, no positive culture results; and intermittent carrier, all intermediate numbers of positive culture results.

Microbiological Procedures

Nasal swab cultures were performed according to a standard operating procedure, as described elsewhere [23]. Nasal swabs specimens were obtained with sterile cotton-wool swabs (Transwab; Medical Wire and Equipment). Both the left and right anterior nares were swabbed by rubbing the swab 4 times around the inside of each nostril while applying an even pressure and rotating the swab without interruption. The swabs were immediately placed in Stuart transport medium and kept at 4°C until inoculation (within 24 h).

Swabs were then cultured quantitatively on phenol-red mannitol salt agar (PHMA) and in phenol red mannitol salt broth (PHMB). The flasks with transport media containing the nasal swab were vortexed for 15 s. The swab was then pressed firmly against the wall of the flask with a sterile pincette and cultured in 8 mL of PHMB. Subsequently, 500 μL of the remaining bacterial suspension was inoculated evenly onto a large PHMA culture plate (diameter, 14 cm). Another PHMA culture plate (diameter, 8.5 cm) was divided into 3 sectors, which were inoculated with 10 μL of the original bacterial suspension, 10 μL of a 1:10 diluted bacterial suspension, and 1 μL of the 1:10 diluted bacterial suspension, respectively. The PHMB was incubated at 37°C for 7 days; the PHMA culture plates were incubated at 37°C for 48 h and at room temperature for 5 days. Both were interpreted after 7 days of incubation. If, after 7 days, no *S. aureus* had grown on the PHMA but the PHMB demonstrated a yellow color, a PHMA culture plate (diameter, 8.5 cm) was inoculated with 10 μL of PHMB and incubated as before. Culture results were recorded as 0 (no *S. aureus*), 1 (*S. aureus* only on the PHMB culture plate), 2 (2–9 CFU), 3 (10–99 CFU), 4 (100–999 CFU), or 5 ($\geq$1000 CFU).

Identification of *S. aureus* was based on colony morphology on the PHMA culture. Suspected colonies were cultured overnight on Columbia blood agar plates (Becton-Dickinson). A catalase test and a latex agglutination test (Staphaurex Plus; Murex) were then performed. All *S. aureus* isolates were stored at −70°C in glycerol-containing liquid media.

Statistical Analysis

Percentages and continuous data were compared using Fisher's exact test and the Mann-Whitney test, respectively. Logistic regression was performed, and receiver operating characteristic (ROC) curves were constructed for different tests and combinations of tests (number of positive cultures, ^{10}log-transformed CFUs [^{10}log {CFU + 1}] and the geometric mean CFUs of $\geq$2 cultures [e.g., {3}/2]) to study their ability to discriminate between persistent carriage and noncarriage or intermittent carriage [30]. Culture results of the derivation cohort were added as independent covariates to a logistic regression model with our "gold standard" diagnosis of persistent carriage or not (derived from 10 consecutive cultures) as binary outcome variate.

The right side of the regression equation was [$\beta 0 + \beta 1 \times$ number of positive cultures + $\beta 2 \times$ geometric mean of CFUs]. Fitting the model gave us $\beta 0$ to $\beta 2$. Then we calculated the odds of persistent carriage for all persons of the validation cohort by adding their respective culture outcomes in the formula: odds =

[e($\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs)]. Subsequently, the probability of persistent carriage was obtained by [odds/(1 + odds)]. We choose the midpoint between 0 and 1 as the cut point. Areas under the ROC curves (AUC) and the corresponding SE were estimated by a nonparametric method (2-sample Wilcoxon test) [31, 32]. Differences between AUCs of the different test combinations were compared by the method of Hanley and McNeil [33].

RESULTS

Fifty-one persons were included in the derivation cohort (19 men [37%] and 32 women [63%]), with a mean age 29 years (range, 20–52 years). Twenty (39%) participants were classified as noncarriers, 16 (31%) were classified as intermittent carriers, and 15 (29%) were classified as persistent carriers (derivation cohort; table 1). Positive predictive values for persistent carriage, derived from regression models that included the results of cultures 1 and 2, ranged from 0.79 in a model containing the qualitative outcome only, to 0.88 in a model including both qualitative and quantitative results (figure 1*A*). The use of the results of only 1 culture (either 1 or 2) produced a positive predictive value of only 0.69.

The validation cohort consisted of a subset of 106 participants of the Rotterdam Study cohort (44 men [42%] and 62 women [58%]), with a mean age 73 years (range, 62–89 years). For the present study, persons with 1 positive and 1 negative culture result were less informative. Two positive culture results could either indicate persistent or intermittent carriage. Possibly, the number of CFUs of *S. aureus* cultured could differentiate between persistent and intermittent carriage. Persons with 2 negative culture results could help to assess the predictive value for true noncarriage. Therefore, after initial random inclusion of participants, we decided to oversample persons with 2 positive or 2 negative screening culture results. Fifty-seven participants (54%) were classified as noncarriers, 17 (16%) were classified as intermittent carriers, and 32 (30%) were classified as persistent carriers (validation cohort; table 1). In 1 participant, both screening culture results were negative, and the results of cultures 3–12 were all positive. The most probable explanation for this would be either sample handling mistakes or a laboratory error. Because exclusion of this person did not significantly alter the data, and because mistakes happen in real life, it was decided not to exclude this person's data from analysis. The positive predictive value derived from regression models that included the results of cultures 1 and 2 was 0.79 in a model containing the qualitative outcome only, as well as in a model including also the quantitative results (figure 1*B*). The use of the results of only 1 culture (either 1 or 2) produced a positive predictive value of 0.74.

The numbers of CFUs of *S. aureus* were significantly higher in the validation than in the derivation cohort (figure 2). The median geometric mean in intermittent and persistent carriers were 1.4 (range, 0.3–3.3) and 3.6 (range, 1.9–3.9) in the validation versus 1.0 (range, 0.3–2.0) and 1.8 (range, 0.9–3.2) in the derivation cohort ($P = .001$ and $P < .001$), respectively. Persistent carriers had significantly higher numbers of CFUs of *S. aureus* in their positive nasal swab cultures than did intermittent carriers (figure 2): 1.8 CFUs (range, 0.9–3.2 CFUs) versus 0.98 CFUs (range, 0.30–2.0 CFUs; $P = .001$) in the derivation cohort and 3.6 CFUs (range, 1.9–3.9 CFUs) versus 1.4 CFUs (range, 0.30–3.3 CFUs; $P < .001$) in the validation cohort (figure 2).

Table 1. Classification of the *Staphylococcus aureus* nasal carrier state based on results of the first 2 cultures, compared with results of cultures 3–12, for derivation and validation cohorts.

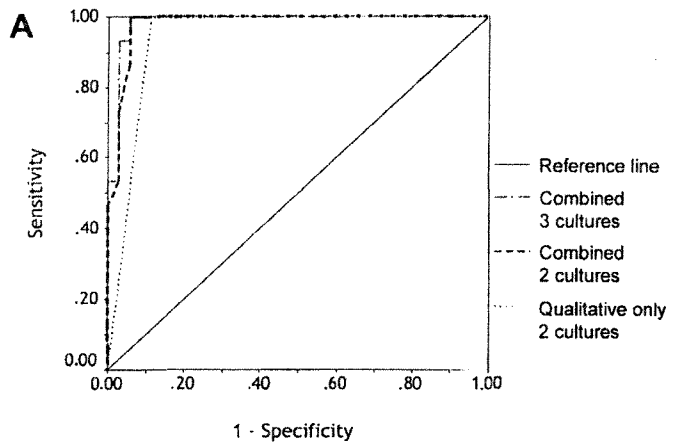
Cohort	Results of cultures 1 and 2: Both negative	1 Positive and 1 negative	Both positive	Total
Derivation cohort				
Noncarrier	19	1	...	20
Intermittent carrier	7	5	4	16
Persistent carrier	...	...	15	15
Total	26	6	19	51
Validation cohort				
Noncarrier	53	4	...	57
Intermittent carrier	7	2	8	17
Persistent carrier	1	...	31	32
Total	61	6	39	106

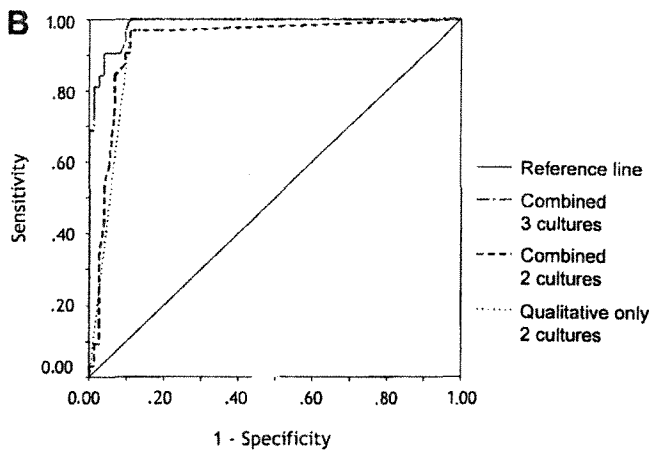
NOTE. Data are no. of subjects. *S. aureus* carrier status is based on results of cultures 3–12. For the validation cohort, persons for whom the results of both culture 1 and 2 were positive or negative were oversampled (see Patients and Methods). Therefore, the distribution of the different carrier states does not represent the population prevalence.

In the derivation cohort, logistic regression showed that the model best differentiating between persistent carriage and noncarriage or intermittent carriage used qualitative culture results in combination with quantitative data. The model that used the results of 2 cultures performed significantly better than a model that used the results of only 1 culture. Adding the results of a third or fourth culture did not significantly improve the model. Results from the ROC analysis showed that all tests used had good performance (all AUCs were >0.9), with the combined model being slightly—but not significantly—better than the qualitative result of 2 nasal swab cultures (figure 1*A*).

In the validation cohort, 2 qualitative culture results (positive or negative) discriminated similarly between persistent carriage and noncarriage or intermittent carriage as the combined qualitative and quantitative results. All logistic regression models were significantly improved by adding data on a third culture. However, in the ROC analysis, the differences between the models were small. Adding data on a third (but not a fourth) culture only significantly improved the model when both qualitative and quantitative culture results were used (figure 1*B*).

The AUCs that used the combination of qualitative culture





Test	No. of cultures	Predictive values		ROC analysis	
		PV+	PV-	AUC	95% CI
No. of positive culture results	1	0.69	0.95	0.903*	0.810-0.968
	2	*0.79*	*1.0*	*0.944*	*0.881-1*
	3	0.88	1.0	0.972	0.927-1
Geometric mean no. of CFUs	2	0.85	0.89	0.973	0.936-1
	3	0.92	0.92	0.983	0.954-1
Combined	*2*	*0.88*	*1.0*	*0.981*	*0.949-1*
	3	*0.88*	*1.0*	*0.985*	*0.957-1*

Test	No. of cultures	Predictive values		ROC analysis	
		PV+	PV-	AUC	95% CI
Qualitative culture results (no. of positive culture results)	1	0.74	0.95	0.901	0.840-0.960
	2	*0.79*	*0.99*	*0.929*	*0.873-0.985*
	3	0.88	0.96	0.967	0.934-1
Quantitative culture results (geometric mean no. of CFUs)	2	0.83	0.91	0.936	0.881-0.990
	3	0.84	0.93	0.976	0.953-0.999
Combined	*2*	*0.79*	*0.99*	*0.936*	*0.881-0.990*
	3	*0.85*	*0.96*	*0.986**	*0.971-1*

Figure 1. *A*, Receiver operating characteristic (ROC) curve illustrating the predictive value of different tests for the persistent *Staphylococcus aureus* nasal carrier state in the derivation cohort. *Area under the ROC (AUC) of 2 versus 1 cultures ($P < .05$). *B*, ROC curve illustrating the predictive value of different tests for the persistent *S. aureus* nasal carrier state in the validation cohort. *AUC of 3 versus 2 cultures in the combined test ($P < .05$). PV+, positive predictive value; PV−, negative predictive value.

results and the geometric mean CFUs of 2 cultures were 0.981 (95% CI, 0.949–1) for the derivation cohort and 0.936 (95% CI, 0.881–0.990) for the validation cohort, respectively (figure 1). The logistic regression equation that uses the combination of qualitative culture results and the geometric mean of CFUs from 2 cultures could be written as follows: probability of persistent *S. aureus* nasal carriage = $e(\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs$)/1 + e(\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs). In the derivation cohort, the respective values of $\beta 0$, $\beta 1$, and $\beta 2$ were −20.171, 9.341, and 1.661. In the validation cohort these values were −4.572, 2.563, and 0.274, respectively.

When a cutoff of 0.50 was used, above which probability persons were classified as persistent carriers, it followed from the logistic regression equation from the derivation cohort that a person was a persistent carrier only if both cultures were positive with a geometric mean of ≥0.9 (~8 CFUs per culture). This culture rule, when applied to the validation cohort, had a positive predictive value of 0.78, a negative predictive value of 0.96, and an AUC of the corresponding ROC curve of 0.936 (95% CI, 0.881–0.990).

DISCUSSION

We examined the diagnostic value of 2 weekly quantitative nasal swab cultures to predict the *S. aureus* nasal carriage state and developed a culture rule to enable adequate differentiation between persistent carriage and intermittent carriage among those individuals with 2 positive screening culture results.

We used logistic regression and ROC analysis to derive a culture rule under ideal laboratory circumstances in a cohort of healthy adult volunteers. Strictly speaking, the derivation cohort actually was more of an exploratory data set to help select the variables in the model, but not the actual predictions. The culture rule was subsequently validated under real-life conditions in a subset of elderly participants of the Rotterdam Study.

In the derivation cohort, the best test combined qualitative culture results (number of positive culture results) with quantitative data (geometric mean number of CFUs of *S. aureus* in nasal swab cultures). In the validation cohort, however, the simple qualitative culture result when data on 2 cultures were used performed as well as the more complicated culture rule. The culture rule performed slightly less well in the validation

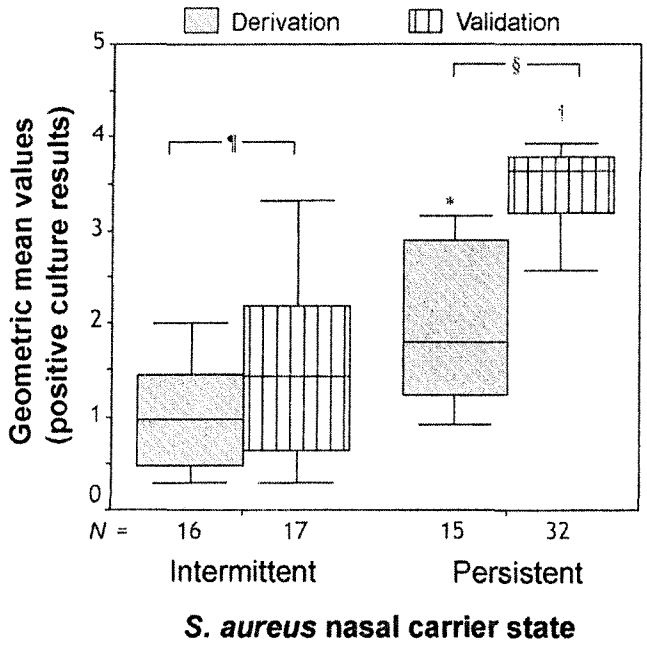


Figure 2. Geometric mean (^{10}log) number of colony-forming units (CFUs) of *Staphylococcus aureus* in positive cultures in intermittent versus persistent carriers from both cohorts. *Boxes,* median, quartile, and extreme values; *persistent versus intermittent carriers in derivation cohort ($P = .001$); †, persistent versus intermittent carriers in validation cohort ($P < .001$); ¶, intermittent carriers, derivation versus validation cohort ($P = .001$); §, persistent carriers, derivation versus validation cohort ($P < .001$).

cohort (AUC, 0.981 in the derivation and 0.936 in the validation cohort, respectively). In the ideal laboratory situation, one trained physician performed all nasal swab cultures in a cohort of healthy individuals. In the real-life situation of large-scale epidemiologic surveys, misclassification of the carrier state could have occurred for a variety of logistic reasons, such as differing nasal culturing techniques of study physicians, sample-handling mistakes, and laboratory errors. In theory, many of these "errors" are preventable but can never be totally eradicated. The fact that in the validation cohort the first 2 cultures were obtained at the Rotterdam Study research center by various study physicians, whereas cultures 3–12 in the validation cohort were performed by one trained person, certainly affected culture results: when cultures 3 and 4 of the validation cohort were used, instead of cultures 1 and 2, the AUC was increased from 0.936 to 0.996.

Misclassification of the carrier state could also have occurred because of factors associated with individual participants of the Rotterdam Study. Culture results will potentially have been influenced by the use of medication (recent courses of antibiotic therapy), institutionalization (recent hospital admissions), and underlying diseases, as well as other unknown determinants.

We confirm earlier data that showed that the number of CFUs of *S. aureus* in the anterior nares was higher in persistent carriers than in intermittent carriers [24, 25]. We also found a striking difference in the amount of *S. aureus* in the nose of persistent carriers between young, healthy volunteers and healthy, elderly participants. No previous data are available regarding age and the number of CFUs of *S. aureus* in the noses of persistent carriers. From the Rotterdam Study (3851 persons), the high numbers of CFUs (median geometric mean, 2.8) in elderly persistent carriers are confirmed (data not shown), but the underlying mechanisms of this finding remain to be elucidated. The differences in the number of CFUs in persistent carriers in both cohorts will have affected the performance of the derived culture rule in the validation cohort. When applying this culture rule to other patient populations, it will need to be validated in the specific population first, when possible.

Combining qualitative results with quantitative data is, in our opinion, conceptually the best choice. Incorporating quantitative data makes it possible to refine associations between potential determinants and *S. aureus* nasal carriage because not only carriers are compared with noncarriers, but carriers with low CFUs can also be compared with carriers with high CFUs in their anterior nares. Incorporating quantitative data will also make it possible to refine associations between carriage state and morbidity and mortality. However, in large-scale epidemiologic studies, simplicity will often prevail because of logistic reasons and resources. It is therefore reassuring that, in the validation cohort, the simple qualitative culture results performed as well as the more complicated culture rule.

Thus, 2 nasal swab culture of samples obtained at a 1-week interval can indeed provide sufficient information to adequately predict the *S. aureus* nasal carriage state. The use of only 1 nasal swab culture to predict the carriage state, as is often done, cannot be recommended on the basis of our data because it will lead to misclassification of the carriage state. On the other hand, the addition of a third or fourth quantitative nasal swab culture only minimally improved test performance. Of importance, no persons whose first 2 culture results were positive were found to be noncarriers. The finding of 2 negative screening culture results in 1 person with subsequent positive culture results is difficult to explain but may be attributable to sample handling mistakes or laboratory error. These results were included in the evaluation, however. One negative screening culture result virtually excludes persistent carriage. Predicting the noncarrier state from 2 nasal swab cultures is more difficult because $\geq$7 nasal swab cultures would be needed to distinguish intermittent carriers from noncarriers.

At present, data on determinants of persistent *S. aureus* nasal carriage in elderly patients in the Rotterdam Study are being analyzed by means of this culture rule. This is the first study to validate the potential of a limited number of nasal swab cultures in predicting the *S. aureus* carrier state. Because the incidence of *S. aureus* infections has increased substantially, and because of

the dramatic worldwide increase in antibiotic resistance (methicillin and, recently, even vancomycin resistance) in *S. aureus*, prevention is now more important than ever. Apart from its role in the Rotterdam Study, we hope that the presented culture rule will prove to be a helpful tool in identifying determinants of *S. aureus* nasal carriage and infections, as well as in identifying high-risk patient populations and the implementation of new methods in the prevention of *S. aureus* infections.

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Community-Associated Methicillin-Resistant *Staphylococcus aureus*: The Way to the Wound Is through the Nose

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(See the article by Kuehnert et al., on pages 172–9.)

The US microbiologist Theobald Smith is credited with the view that "disease is an accident occurring in the development of the parasitic state" [1, p. 2]. This perspective can certainly be applied to the staphylococcus, an organism replete with strategies to establish harmony with its host in the form of nasal colonization. In this issue of the *Journal of Infectious Diseases*, Kuehnert et al. [2] provide the first large population-based assessment of nasal colonization with *Staphylococcus aureus* and, more importantly, with methicillin-resistant *S. aureus* (MRSA). As the frequency of community-associated MRSA infections continues to increase, investigation into the dynamics of nasal colonization will be valuable in the creation of plausible strategies for controlling this emerging pathogen.

It is well established that, at any given time, ~30% of all persons are colonized with *S. aureus*, with the anterior nares serving as its critical niche [3]. Although colonization typically precedes infection, relatively few colonized individuals develop staphylococcal infections. There are, undoubtedly, a variety of host-organism interactions that play a role in this symbiosis; yet, much of what is known has been derived from the study of persons with clinical disease, not those in the asymptomatic carrier state.

Using the sample provided by the 2001–2002 National Health and Nutrition Examination Survey (NHANES), Kuehnert et al. assessed *S. aureus* nasal carriage in all participants ≥1 year old. Nearly 10,000 participants were enrolled; 2964 (32.4%) were colonized with *S. aureus*, of whom only 75 (0.8% of the total) harbored MRSA. These findings translate into weighted estimates of 89.4 and 2.3 million persons being colonized with *S. aureus* and MRSA, respectively, in the United States in 2001–2002. Thus, although the proportion of the US population colonized with MRSA was low, the absolute number of MRSA-colonized persons was already quite large in 2001–2002. Risk factors for MRSA colonization were age ≥60 years and being female; however, when the analysis was limited to community-associated MRSA (as determined by the presence of the staphylococcal cassette chromosome *mec* IV gene), younger children and non-Hispanic black persons were found to be at increased risk.

Kuehnert et al. also sought to understand the microbiological and molecular epidemiologic character of the colonization isolates from their study population. Their antibiotic-susceptibility data suggest what other investigators have reported for community-associated MRSA—namely, favorable resistance profiles for such agents as trimethoprim/sulfamethoxazole, rifampin, gentamicin, and vancomycin, as well as the variable presence of an inducible resistance phenotype for clindamycin. This information becomes increasingly germane to practitioners whose empirical choices of therapy for community-associated staphylococcal infections have moved away from the β-lactams. In addition, results of the analysis of the toxin repertoire were substantially different from what would be expected from simple extrapolation of data from invasive isolates; for example, although it appears that the genes for the cytolytic toxin Panton-Valentine leukocidin are found in the majority of clinical isolates of community-associated MRSA [4], its presence was less common (8.0% of MRSA) among the carriage strains in Kuehnert et al.'s population-based study, a finding

Received 12 December 2005; accepted 12 December 2005; electronically published 15 December 2005.

Potential conflicts of interest: C.B.C. has received research funding from Wyeth Pharmaceuticals (Pediatric Infectious Diseases Fellowship Award) and Nabi Biopharmaceuticals; T.R.T. has received research funding from Nabi Biopharmaceuticals.

Financial support: National Institutes of Health Mentored Clinical Scientist Award (Public Health Service Award K12 RR017697 to C.B.C.).

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The Journal of Infectious Diseases 2006; 193:169–71

0022-1899/2006/19302-0001$15.00

corroborated by subsequent local investigations [5, 6].

The carriage estimates produced by Kuehnert et al. must be interpreted in their historical context. Their results from investigation of a large, national population are quite consistent with the results of local investigations completed at the same time. In 2001, colonization studies from geographically diverse institutions found a similar frequency of MRSA nasal carriage. Studies from Chicago, IL; Nashville, TN; Charlottesville, VA; and San Francisco, CA, suggested that a small but noteworthy reservoir of MRSA carriage existed in these areas, at prevalence rates ranging from 0.6% to 2.8% [7–12]. Because these data very closely match Kuehnert et al.'s results from the NHANES population, it would seem that they were not simply local phenomena; rather, it would seem that geographically specific colonization data are important harbingers that signal trends in staphylococcal epidemiologic patterns.

All of these studies were conducted before the widespread emergence of community-associated MRSA infection, which, in some areas, now accounts for up to 75% of all community-associated staphylococcal infections in children [13]. In addition, the increased frequency of community-associated MRSA infection has been associated with reports of increased morbidity and mortality—specifically, a longer duration of fever, prolonged hospitalization, a higher incidence of pulmonary complications along with bone and joint infections, and the reemergence of a severe staphylococcal sepsis syndrome [14–16]. In 2004, to assess whether a change in the MRSA nasal colonization rate accompanied the increase in disease frequency, our group studied 500 healthy children [5]. Using the same methods that we had used in 2001, we found that 46 (9.2%) of the 500 children were colonized with MRSA. This percentage represented a >10-fold increase in the MRSA nasal colonization rate in the same community from 2001 to 2004 [5, 10]. Similarly, Pan et al. studied >300 homeless youths in the San Francisco area in 2004 and found that 6.2% of the enrolled subjects were colonized in the nares with MRSA [17]. Last, Alfaro et al. recently reported that ~22% of children admitted to Driscoll Children's Hospital in Corpus Christi, TX, in 2005 were colonized with MRSA [18]. The times—along with MRSA colonization rates—are, indeed, changing.

The question remains: To what extent does colonization with *S. aureus* (and with MRSA, in particular) confer increased risk to the host? If we are to understand the implications of Theobald Smith's assertion that disease is accidental, then we must understand just how "accident prone" the circulating strains of community-associated MRSA are. A recent study of US soldiers by Ellis et al. helps to clarify this issue [6]. Of 812 soldiers who were enrolled at the start of basic training, 24 (3%) were colonized with community-associated MRSA. Nine (38%) of the 24 soldiers developed soft-tissue infections during the 2-month study period. This rate was significantly higher than that (i.e., 28%) observed among the 229 participants colonized with methicillin-susceptible *S. aureus*, of whom only 8 (3%) developed clinical staphylococcal infections (relative risk, 10.7 [95% confidence interval, 4.6-25.2]). In a similar vein, Pan et al. [17] have suggested that, among community-associated MRSA, there are distinct populations that are successful colonizers, successful pathogens, or both. What factors govern these distinctions remain largely unknown.

These studies highlight the changing epidemiologic profile of MRSA in the community and suggest that community-associated MRSA may have acquired 2 properties that are of particular concern: first, it has the ability to colonize effectively, even in the absence of antimicrobial pressure—and potentially via mechanisms that allow them to outcompete other staphylococcal strains in the nares; second, it possesses a variety of virulence factors necessary to cause an array of disease, from simple, uncomplicated furunculosis to deep abscesses, osteomyelitis, necrotizing pneumonia, and sepsis [13–16, 19]. This combination of factors demonstrates the profound adaptability of the staphylococcus.

In light of the increasing frequency of community-associated MRSA infection, new antimicrobials are needed, particularly given the emergence of glycopeptide-resistant strains. Yet, new antimicrobials will remain fingers in the proverbial dike until a more-definitive solution can be found. Can staphylococcal colonization be prevented? If not, can we develop a strategy to prevent invasion and establishment of infection? For the better part of a century, scientists have considered the composition and application of a staphylococcal vaccine, refined over time via an improved understanding of the virulence factors specific to staphylococci. Now, stimulated by the successes that *Haemophilus influenzae* type b (Hib) vaccine and pneumococcus conjugate vaccine have had in both eliminating the carriage state (a particular success for the conjugate Hib vaccine) and preventing infection, several major pharmaceutical manufacturers have turned their attention to the creation of a staphylococcal vaccine. The appropriate components of such a vaccine (such as capsular polysaccharides, surface-exposed proteins, and/or extracellular toxins) remain an area of active research, but early successes confirm that the vaccine-based approach is a viable undertaking. For example, the persistent reduction of *S. aureus* bacteremia 40 weeks after vaccination of patients with end-stage renal disease who are undergoing dialysis highlights the potential of a vaccine-based approach to the prevention of staphylococcal disease [20]. Whether such a vaccine should be used universally—or whether it should be targeted to those with risk factors for disease or administered in persons undergoing certain medical procedures that

confer a high risk of staphylococcal wound infections—remains to be determined.

Studies of the ecological patterns of *S. aureus* colonization in the US population, such as the study conducted by Kuehnert et al., will continue to be important as we attempt to understand the evolution of antimicrobial resistance, the risk factors that predict the carriage state, and the molecular characteristics of circulating strains. Ultimately, it is hoped that such studies will provide a measure of the impact that staphylococcal vaccination has on colonization in the population.

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MAJOR ARTICLE

Predicting the *Staphylococcus aureus* Nasal Carrier State: Derivation and Validation of a "Culture Rule"

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Background. To study determinants and risks of *Staphylococcus aureus* nasal carriage, adequate differentiation between the different *S. aureus* carrier states is obligatory. We set out to develop a "culture rule" capable of differentiating between persistent and intermittent or noncarriers that uses a minimum of nasal swab cultures.

Methods. In 51 healthy volunteers (derivation cohort), 12 quantitative nasal cultures were performed to establish *S. aureus* nasal carriage states. Persons with 11 or 12 cultures positive for *S. aureus* were classified as persistent carriers, and those with negative results of all cultures were classified as noncarriers. All other persons were classified as intermittent carriers. By means of logistic regression and receiver operating characteristic (ROC) curves, a culture rule was derived. This culture rule was subsequently validated in 106 participants of an ongoing study in 3882 elderly persons, again with the use of 12 quantitative nasal cultures.

Results. In both cohorts, the positive predictive value of 2 consecutive positive culture results for persistent carriage was 79%. The model best differentiating between persistent and intermittent or noncarriers used the number of positive culture results combined with the amount of *S. aureus* in these cultures. By using the outcome of 2 cultures, the areas under the ROC curves were 0.981 (95% confidence interval [CI], 0.949–1.0) for the derivation cohort and 0.936 (95% CI, 0.881–0.990) for the validation cohort.

Conclusions. Combining qualitative and quantitative results of 2 nasal swab cultures accurately predicted the persistent *S. aureus* carriage state with a reliability of 93.6%. Thus, this culture rule can be used in studies of determinants and risks of *S. aureus* nasal carriage.

Staphylococcus aureus nasal carriage is a major risk factor for both community-acquired and nosocomial infections [1–7], and the anterior nares are the primary reservoir of *S. aureus* in humans [8–10]. Three *S. aureus* nasal carriage patterns can be discerned: persistent carriage, intermittent carriage, and noncarriage [11–22]. However, no consensus has been reached on how to exactly identify these different states, but most studies use findings from 10–12 weekly nasal swab cultures [23].

The number of colony-forming units (CFUs) of *S. aureus* isolated from the anterior nares are higher in persistent than in intermittent carriers [24, 25], resulting in more extensive dispersal of staphylococci in the environment [25] and in an increased risk of *S. aureus* infection [26–28]. Bacterial variability (i.e., the number of *S. aureus* genotypes isolated in repeated cultures from one individual) is lower for persistent than for intermittent carriers [15, 22, 29], indicating that the underlying mechanisms determining persistent and intermittent carriage differs. Adequate differentiation between persistent and intermittent carriage is thus relevant for epidemiological studies.

At present, a large study of *S. aureus* nasal carriage in a population aged ≥60 years is being conducted at Erasmus Medical Center (Rotterdam, The Netherlands). The main objectives are to study determinants and risks of *S. aureus* nasal carriage. This is part of the Rotterdam Study, a population-based prospective study of chronic diseases in the elderly population. The Rotterdam Study started in 1990 with 7983 persons and has just finished its third phase, in which >4000 persons have been included. In this large survey, an efficient and reliable way

Received 16 October 2003; accepted 3 May 2004; electronically published 26 August 2004.

Presented in part: 9th International Society for Staphylococci and Staphylococcal Infections meeting, June 2000, Kolding, Denmark.

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Clinical Infectious Diseases 2004; 39:806–11

1058-4838/2004/3906-0009$15.00

to assess *S. aureus* nasal carriage was obligatory. It would be impossible to perform 10–12 weekly nasal swab cultures in all participants. Thus, we developed a "culture rule" to discriminate reliably between persistent carriage and noncarriage or intermittent carriage, with a minimum of nasal swab cultures.

Our main questions were as follows: (1) how many quantitative nasal swab cultures are needed to accurately predict persistent carriage in a cohort of healthy adult volunteers, and (2) does the derived culture rule correctly predict persistent carriage in the elderly cohort of the ongoing Rotterdam Study?

PATIENTS AND METHODS

Patient Cohorts and Microbiological Investigations

Derivation cohort. In 1988, a cohort of healthy volunteers (staff members of the departments of medical microbiology and infectious diseases and virology at Erasmus Medical Center) was formed to investigate bacterial and human factors associated with *S. aureus* nasal carriage [23]. During the period of September 1995 through March 1996, a total of 51 volunteers agreed to participate in this study. Nasal swab cultures were performed weekly for 12 weeks. All nasal swab samples were obtained for culture by one study physician (M.F.Q.K.-V.), according to the protocol below.

Validation cohort. On the basis of the results of the derivation cohort, 2 quantitative nasal swab cultures of samples obtained at 1-week intervals were performed in 3882 participants of the Rotterdam Study. While this study was ongoing, 106 participants entering the study during the period of October 1997 through April 1998 agreed to be included in the validation cohort. Persons with 2 positive or 2 negative nasal swab culture results were oversampled to estimate the predictive value of these cultures for persistent carriage and noncarriage, or for intermittent carriage. One trained research assistant visited the participants at home and performed 10 additional nasal swab cultures at 1-week intervals, according to protocol.

The study was approved by the Medical Ethics Review Committee of the Erasmus Medical Center, University Medical Center, Rotterdam. Informed consent was obtained from all participants.

Definitions

S. aureus nasal carriage state was assessed by means of the results of nasal swab cultures 3–12, as follows: persistent carrier, 9 or 10 of 10 cultures were positive for *S. aureus;* noncarrier, no positive culture results; and intermittent carrier, all intermediate numbers of positive culture results.

Microbiological Procedures

Nasal swab cultures were performed according to a standard operating procedure, as described elsewhere [23]. Nasal swabs specimens were obtained with sterile cotton-wool swabs (Transwab; Medical Wire and Equipment). Both the left and right anterior nares were swabbed by rubbing the swab 4 times around the inside of each nostril while applying an even pressure and rotating the swab without interruption. The swabs were immediately placed in Stuart transport medium and kept at 4°C until inoculation (within 24 h).

Swabs were then cultured quantitatively on phenol-red mannitol salt agar (PHMA) and in phenol red mannitol salt broth (PHMB). The flasks with transport media containing the nasal swab were vortexed for 15 s. The swab was then pressed firmly against the wall of the flask with a sterile pincette and cultured in 8 mL of PHMB. Subsequently, 500 μL of the remaining bacterial suspension was inoculated evenly onto a large PHMA culture plate (diameter, 14 cm). Another PHMA culture plate (diameter, 8.5 cm) was divided into 3 sectors, which were inoculated with 10 μL of the original bacterial suspension, 10 μL of a 1:10 diluted bacterial suspension, and 1 μL of the 1:10 diluted bacterial suspension, respectively. The PHMB was incubated at 37°C for 7 days; the PHMA culture plates were incubated at 37°C for 48 h and at room temperature for 5 days. Both were interpreted after 7 days of incubation. If, after 7 days, no *S. aureus* had grown on the PHMA but the PHMB demonstrated a yellow color, a PHMA culture plate (diameter, 8.5 cm) was inoculated with 10 μL of PHMB and incubated as before. Culture results were recorded as 0 (no *S. aureus*), 1 (*S. aureus* only on the PHMB culture plate), 2 (2–9 CFU), 3 (10–99 CFU), 4 (100–999 CFU), or 5 (≥1000 CFU).

Identification of *S. aureus* was based on colony morphology on the PHMA culture. Suspected colonies were cultured overnight on Columbia blood agar plates (Becton-Dickinson). A catalase test and a latex agglutination test (Staphaurex Plus; Murex) were then performed. All *S. aureus* isolates were stored at −70°C in glycerol-containing liquid media.

Statistical Analysis

Percentages and continuous data were compared using Fisher's exact test and the Mann-Whitney test, respectively. Logistic regression was performed, and receiver operating characteristic (ROC) curves were constructed for different tests and combinations of tests (number of positive cultures, ^{10}log-transformed CFUs [^{10}log {CFU + 1}] and the geometric mean CFUs of ≥2 cultures [e.g., {3}/2]) to study their ability to discriminate between persistent carriage and noncarriage or intermittent carriage [30]. Culture results of the derivation cohort were added as independent covariates to a logistic regression model with our "gold standard" diagnosis of persistent carriage or not (derived from 10 consecutive cultures) as binary outcome variate.

The right side of the regression equation was [$\beta 0 + \beta 1 \times$ number of positive cultures + $\beta 2 \times$ geometric mean of CFUs]. Fitting the model gave us $\beta 0$ to $\beta 2$. Then we calculated the odds of persistent carriage for all persons of the validation cohort by adding their respective culture outcomes in the formula: odds =

[e($\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs)]. Subsequently, the probability of persistent carriage was obtained by [odds/(1 + odds)]. We choose the midpoint between 0 and 1 as the cut point. Areas under the ROC curves (AUC) and the corresponding SE were estimated by a nonparametric method (2-sample Wilcoxon test) [31, 32]. Differences between AUCs of the different test combinations were compared by the method of Hanley and McNeil [33].

RESULTS

Fifty-one persons were included in the derivation cohort (19 men [37%] and 32 women [63%]), with a mean age 29 years (range, 20–52 years). Twenty (39%) participants were classified as noncarriers, 16 (31%) were classified as intermittent carriers, and 15 (29%) were classified as persistent carriers (derivation cohort; table 1). Positive predictive values for persistent carriage, derived from regression models that included the results of cultures 1 and 2, ranged from 0.79 in a model containing the qualitative outcome only, to 0.88 in a model including both qualitative and quantitative results (figure 1*A*). The use of the results of only 1 culture (either 1 or 2) produced a positive predictive value of only 0.69.

The validation cohort consisted of a subset of 106 participants of the Rotterdam Study cohort (44 men [42%] and 62 women [58%]), with a mean age 73 years (range, 62–89 years). For the present study, persons with 1 positive and 1 negative culture result were less informative. Two positive culture results could either indicate persistent or intermittent carriage. Possibly, the number of CFUs of *S. aureus* cultured could differentiate between persistent and intermittent carriage. Persons with 2 negative culture results could help to assess the predictive value for true noncarriage. Therefore, after initial random inclusion of participants, we decided to oversample persons with 2 positive or 2 negative screening culture results. Fifty-seven participants (54%) were classified as noncarriers, 17 (16%) were classified as intermittent carriers, and 32 (30%) were classified as persistent carriers (validation cohort; table 1). In 1 participant, both screening culture results were negative, and the results of cultures 3–12 were all positive. The most probable explanation for this would be either sample handling mistakes or a laboratory error. Because exclusion of this person did not significantly alter the data, and because mistakes happen in real life, it was decided not to exclude this person's data from analysis. The positive predictive value derived from regression models that included the results of cultures 1 and 2 was 0.79 in a model containing the qualitative outcome only, as well as in a model including also the quantitative results (figure 1*B*). The use of the results of only 1 culture (either 1 or 2) produced a positive predictive value of 0.74.

The numbers of CFUs of *S. aureus* were significantly higher in the validation than in the derivation cohort (figure 2). The median geometric mean in intermittent and persistent carriers were 1.4 (range, 0.3–3.3) and 3.6 (range, 1.9–3.9) in the validation versus 1.0 (range, 0.3–2.0) and 1.8 (range, 0.9–3.2) in the derivation cohort ($P = .001$ and $P < .001$), respectively. Persistent carriers had significantly higher numbers of CFUs of *S. aureus* in their positive nasal swab cultures than did intermittent carriers (figure 2): 1.8 CFUs (range, 0.9–3.2 CFUs) versus 0.98 CFUs (range, 0.30–2.0 CFUs; $P = .001$) in the derivation cohort and 3.6 CFUs (range, 1.9–3.9 CFUs) versus 1.4 CFUs (range, 0.30–3.3 CFUs; $P < .001$) in the validation cohort (figure 2).

Table 1. Classification of the *Staphylococcus aureus* nasal carrier state based on results of the first 2 cultures, compared with results of cultures 3–12, for derivation and validation cohorts.

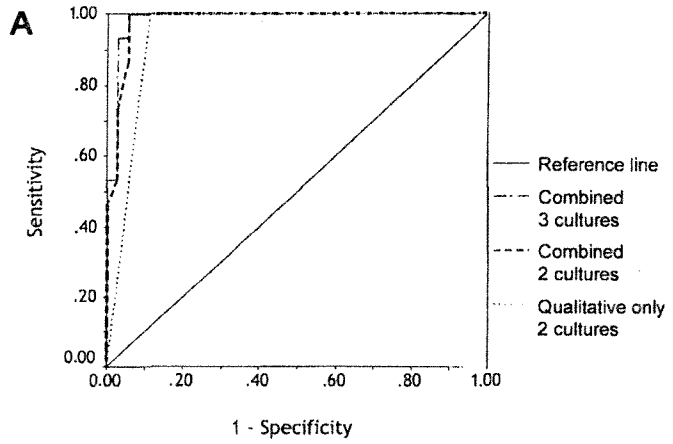
Cohort	Results of cultures 1 and 2: Both negative	1 Positive and 1 negative	Both positive	Total
Derivation cohort				
Noncarrier	19	1	...	20
Intermittent carrier	7	5	4	16
Persistent carrier	...	...	15	15
Total	26	6	19	51
Validation cohort				
Noncarrier	53	4	...	57
Intermittent carrier	7	2	8	17
Persistent carrier	1	...	31	32
Total	61	6	39	106

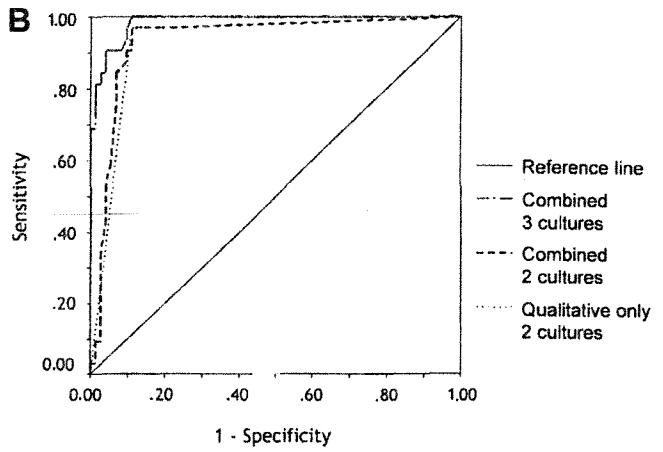
NOTE. Data are no. of subjects. *S. aureus* carrier status is based on results of cultures 3–12. For the validation cohort, persons for whom the results of both culture 1 and 2 were positive or negative were oversampled (see Patients and Methods). Therefore, the distribution of the different carrier states does not represent the population prevalence.

In the derivation cohort, logistic regression showed that the model best differentiating between persistent carriage and noncarriage or intermittent carriage used qualitative culture results in combination with quantitative data. The model that used the results of 2 cultures performed significantly better than a model that used the results of only 1 culture. Adding the results of a third or fourth culture did not significantly improve the model. Results from the ROC analysis showed that all tests used had good performance (all AUCs were >0.9), with the combined model being slightly—but not significantly—better than the qualitative result of 2 nasal swab cultures (figure 1*A*).

In the validation cohort, 2 qualitative culture results (positive or negative) discriminated similarly between persistent carriage and noncarriage or intermittent carriage as the combined qualitative and quantitative results. All logistic regression models were significantly improved by adding data on a third culture. However, in the ROC analysis, the differences between the models were small. Adding data on a third (but not a fourth) culture only significantly improved the model when both qualitative and quantitative culture results were used (figure 1*B*).

The AUCs that used the combination of qualitative culture





Test	No. of cultures	Predictive values		ROC analysis	
		PV+	PV-	AUC	95% CI
No. of positive culture results	1	0.69	0.95	0.903*	0.810-0.968
	2	***0.79***	***1.0***	***0.944***	***0.881-1***
	3	0.88	1.0	0.972	0.927-1
Geometric mean no. of CFUs	2	0.85	0.89	0.973	0.936-1
	3	0.92	0.92	0.983	0.954-1
Combined	***2***	***0.88***	***1.0***	***0.981***	***0.949-1***
	3	***0.88***	***1.0***	***0.985***	***0.957-1***

Test	No. of cultures	Predictive values		ROC analysis	
		PV+	PV-	AUC	95% CI
Qualitative culture results (no. of positive culture results)	1	0.74	0.95	0.901	0.840-0.960
	2	***0.79***	***0.99***	***0.929***	***0.873-0.985***
	3	0.88	0.96	0.967	0.934-1
Quantitative culture results (geometric mean no. of CFUs)	2	0.83	0.91	0.936	0.881-0.990
	3	0.84	0.93	0.976	0.953-0.999
Combined	***2***	***0.79***	***0.99***	***0.936***	***0.881-0.990***
	3	***0.85***	***0.96***	***0.986****	***0.971-1***

Figure 1. *A*, Receiver operating characteristic (ROC) curve illustrating the predictive value of different tests for the persistent *Staphylococcus aureus* nasal carrier state in the derivation cohort. *Area under the ROC (AUC) of 2 versus 1 cultures ($P < .05$). *B*, ROC curve illustrating the predictive value of different tests for the persistent *S. aureus* nasal carrier state in the validation cohort. *AUC of 3 versus 2 cultures in the combined test ($P < .05$). PV+, positive predictive value; PV−, negative predictive value.

results and the geometric mean CFUs of 2 cultures were 0.981 (95% CI, 0.949–1) for the derivation cohort and 0.936 (95% CI, 0.881–0.990) for the validation cohort, respectively (figure 1). The logistic regression equation that uses the combination of qualitative culture results and the geometric mean of CFUs from 2 cultures could be written as follows: probability of persistent *S. aureus* nasal carriage = $e(\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs$)/1 + e(\beta 0 + \beta 1 \times$ number of positive cultures $+ \beta 2 \times$ geometric mean of CFUs). In the derivation cohort, the respective values of $\beta 0$, $\beta 1$, and $\beta 2$ were −20.171, 9.341, and 1.661. In the validation cohort these values were −4.572, 2.563, and 0.274, respectively.

When a cutoff of 0.50 was used, above which probability persons were classified as persistent carriers, it followed from the logistic regression equation from the derivation cohort that a person was a persistent carrier only if both cultures were positive with a geometric mean of ≥0.9 (~8 CFUs per culture). This culture rule, when applied to the validation cohort, had a positive predictive value of 0.78, a negative predictive value of 0.96, and an AUC of the corresponding ROC curve of 0.936 (95% CI, 0.881–0.990).

DISCUSSION

We examined the diagnostic value of 2 weekly quantitative nasal swab cultures to predict the *S. aureus* nasal carriage state and developed a culture rule to enable adequate differentiation between persistent carriage and intermittent carriage among those individuals with 2 positive screening culture results.

We used logistic regression and ROC analysis to derive a culture rule under ideal laboratory circumstances in a cohort of healthy adult volunteers. Strictly speaking, the derivation cohort actually was more of an exploratory data set to help select the variables in the model, but not the actual predictions. The culture rule was subsequently validated under real-life conditions in a subset of elderly participants of the Rotterdam Study.

In the derivation cohort, the best test combined qualitative culture results (number of positive culture results) with quantitative data (geometric mean number of CFUs of *S. aureus* in nasal swab cultures). In the validation cohort, however, the simple qualitative culture result when data on 2 cultures were used performed as well as the more complicated culture rule. The culture rule performed slightly less well in the validation

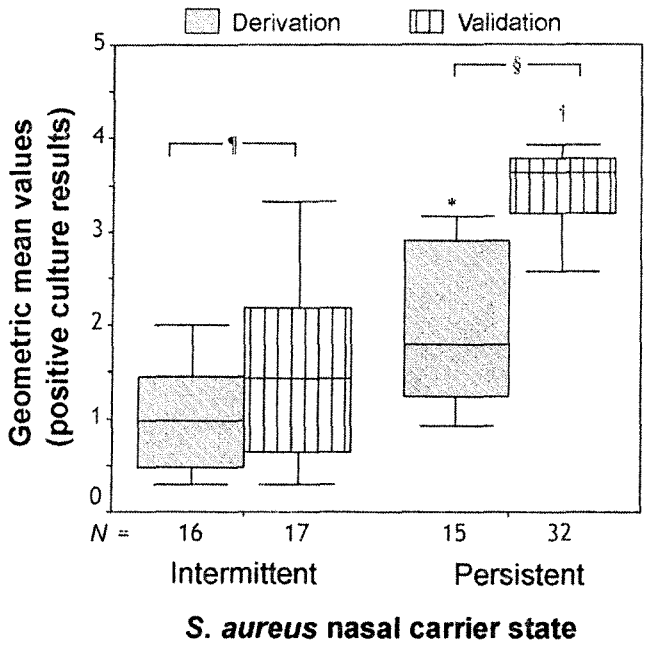


Figure 2. Geometric mean (^{10}log) number of colony-forming units (CFUs) of *Staphylococcus aureus* in positive cultures in intermittent versus persistent carriers from both cohorts. *Boxes,* median, quartile, and extreme values; *persistent versus intermittent carriers in derivation cohort ($P = .001$); †, persistent versus intermittent carriers in validation cohort ($P < .001$); ¶, intermittent carriers, derivation versus validation cohort ($P = .001$); §, persistent carriers, derivation versus validation cohort ($P < .001$).

cohort (AUC, 0.981 in the derivation and 0.936 in the validation cohort, respectively). In the ideal laboratory situation, one trained physician performed all nasal swab cultures in a cohort of healthy individuals. In the real-life situation of large-scale epidemiologic surveys, misclassification of the carrier state could have occurred for a variety of logistic reasons, such as differing nasal culturing techniques of study physicians, sample-handling mistakes, and laboratory errors. In theory, many of these "errors" are preventable but can never be totally eradicated. The fact that in the validation cohort the first 2 cultures were obtained at the Rotterdam Study research center by various study physicians, whereas cultures 3–12 in the validation cohort were performed by one trained person, certainly affected culture results: when cultures 3 and 4 of the validation cohort were used, instead of cultures 1 and 2, the AUC was increased from 0.936 to 0.996.

Misclassification of the carrier state could also have occurred because of factors associated with individual participants of the Rotterdam Study. Culture results will potentially have been influenced by the use of medication (recent courses of antibiotic therapy), institutionalization (recent hospital admissions), and underlying diseases, as well as other unknown determinants.

We confirm earlier data that showed that the number of CFUs of *S. aureus* in the anterior nares was higher in persistent carriers than in intermittent carriers [24, 25]. We also found a striking difference in the amount of *S. aureus* in the nose of persistent carriers between young, healthy volunteers and healthy, elderly participants. No previous data are available regarding age and the number of CFUs of *S. aureus* in the noses of persistent carriers. From the Rotterdam Study (3851 persons), the high numbers of CFUs (median geometric mean, 2.8) in elderly persistent carriers are confirmed (data not shown), but the underlying mechanisms of this finding remain to be elucidated. The differences in the number of CFUs in persistent carriers in both cohorts will have affected the performance of the derived culture rule in the validation cohort. When applying this culture rule to other patient populations, it will need to be validated in the specific population first, when possible.

Combining qualitative results with quantitative data is, in our opinion, conceptually the best choice. Incorporating quantitative data makes it possible to refine associations between potential determinants and *S. aureus* nasal carriage because not only carriers are compared with noncarriers, but carriers with low CFUs can also be compared with carriers with high CFUs in their anterior nares. Incorporating quantitative data will also make it possible to refine associations between carriage state and morbidity and mortality. However, in large-scale epidemiologic studies, simplicity will often prevail because of logistic reasons and resources. It is therefore reassuring that, in the validation cohort, the simple qualitative culture results performed as well as the more complicated culture rule.

Thus, 2 nasal swab culture of samples obtained at a 1-week interval can indeed provide sufficient information to adequately predict the *S. aureus* nasal carriage state. The use of only 1 nasal swab culture to predict the carriage state, as is often done, cannot be recommended on the basis of our data because it will lead to misclassification of the carriage state. On the other hand, the addition of a third or fourth quantitative nasal swab culture only minimally improved test performance. Of importance, no persons whose first 2 culture results were positive were found to be noncarriers. The finding of 2 negative screening culture results in 1 person with subsequent positive culture results is difficult to explain but may be attributable to sample handling mistakes or laboratory error. These results were included in the evaluation, however. One negative screening culture result virtually excludes persistent carriage. Predicting the noncarrier state from 2 nasal swab cultures is more difficult because ≥ 7 nasal swab cultures would be needed to distinguish intermittent carriers from noncarriers.

At present, data on determinants of persistent *S. aureus* nasal carriage in elderly patients in the Rotterdam Study are being analyzed by means of this culture rule. This is the first study to validate the potential of a limited number of nasal swab cultures in predicting the *S. aureus* carrier state. Because the incidence of *S. aureus* infections has increased substantially, and because of

the dramatic worldwide increase in antibiotic resistance (methicillin and, recently, even vancomycin resistance) in *S. aureus*, prevention is now more important than ever. Apart from its role in the Rotterdam Study, we hope that the presented culture rule will prove to be a helpful tool in identifying determinants of *S. aureus* nasal carriage and infections, as well as in identifying high-risk patient populations and the implementation of new methods in the prevention of *S. aureus* infections.

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Counsel for Defendants

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiffs, vs. POCATELLO HEALTH SERVICES, INC. a Nevada Corporation d/b/a POCATELLO CARE AND REHABILITATION CENTER and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC. d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **MEMORANDUM IN SUPPORT OF PLAINTIFF'S MOTION TO STRIKE THE AFFIDAVIT OF DR. COFFMAN**

COMES NOW Plaintiff, by and through the undersigned counsel, and submits this Memorandum in Support of Plaintiff's Motion to Strike the Affidavit of Dr. Coffman.

I. INTRODUCTION

In support of Defendant's motion for summary judgment, Defendant offered the Affidavit of Dr. Coffman. As will be asserted in greater detail in the remainder of this Memorandum, ¶¶ 12, 14, 22, 23, 24, 25, 26, and 27 of Dr. Coffman's affidavit must be stricken or, in the alternative, not considered by the Court in determining Defendant's motion for summary judgment.

II. STANDARD OF REVIEW

IRCP 56(e) provides, in pertinent part, as follows:

> Supporting and opposing affidavits shall be made on personal knowledge, shall set forth such facts as would be admissible in evidence, and shall show affirmatively that the affiant is competent to testify to the matters stated therein.

The question of admissibility of affidavits under Rule 56(e) is a threshold question to be analyzed before reviewing motions for summary judgment, and a court must look at the affidavit to determine if it alleges facts, which if true, would render the testimony admissible. *Foster v. Traul*, 145 Idaho 24, 28, 175 P.3d 186, 190 (2007).

Expert testimony offered in a medical malpractice case, "like any other case, is governed by the rules of evidence regarding the opinion testimony of lay witnesses and experts under *Idaho Rules of Evidence 701 and 702."* IRE 702 provides: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

However, expert testimony that is based on speculation, is not admissible under Rule 702. Speculation, as it relates to expert testimony is defined as "the art of theorizing about a matter as to which evidence is not sufficient for certain knowledge." *Karlson v. Harris,* 140 Idaho 561, 564, 97 P.3d 428, 432 (2004).

> An expert opinion that is speculative or unsubstantiated by facts in the record is inadmissible because it would not assist the trier of fact to understand the evidence or determine a fact that is at issue. **Expert opinion that merely suggests possibilities would only invite conjecture and may be properly excluded."**

Id. [Emphasis added][Internal citations omitted]. *See also Jones v. Crawforth,* 147 Idaho 11, 205

P.3d 660 (2009)(expert opinions are only admissible if they assist the trier of fact in understanding the evidence or determining an issue of fact); *Weeks v. E. Idaho Health Servs.*, 143 Idaho 834, 838, 153 P.3d 1180, 1184 (2007)(expert opinion that is speculative, conclusory or unsubstantiated by facts in the record does not assist the jury and is inadmissible).

III. AGRGUMENT

1. Paragraph 12 is conclusory and lacks foundation.

Paragraph 12 of Dr. Coffman's affidavit, specifically, the portions stated on page 4, Dr. Coffman does not identify how he is trained or has experience in how a technician "does not culture every micro-organism from a wound or fluid culture" and makes this conclusion that in every case, a technician does not perform a complete culture. This assertion is speculation, especially due to the fact that Dr. Coffman does not endeavor to contact the technician or obtain facts to support his unsubstantiated conclusion.

2. Paragraph 14 is inadmissible speculation.

Dr. Coffman again asserts supposition in concluding, in the last sentence of Paragraph 14 that carries over from page 4, to page 5, in his statement that "it appears" that Dr. Zimmerman's reference in his discharge summary of Judy Nield, to a negative MRSA screen refers to the culture taken, "and not an actual MRSA screening based on the lack of any MRSA screen report." Dr. Coffman goes on to speculate, "it is fair to assume that a MRSA screen was not performed." Again, Dr. Coffman speculates, and does not endeavor to produce any facts to ascertain whether a screen and culture were done.

Dr. Coffman goes on to conclude: "If Ms. Nield was not screened for MRSA, it is not possible to determine if she was MRSA colonized at the time she was admitted to Pocatello Care and

Rehab on August 25, 2007." This is again supposition and conclusory speculation. Dr. Coffman's speculation is evident by his use of "If" indicative of his conclusory speculations.

3. Paragraph 22 is inadmissible speculation.

Dr. Coffman again speculates as to whether Judy Nield was MRSA or pseudomonas colonized at the time of her admission at PCRC. Dr. Coffman's speculation is again based on his unfounded conclusion that the technicians did not properly screen or culture Judy's wounds.

4. Paragraph 23 is based on speculative "possibility."

Dr. Coffman, again, concludes, based on his speculation, whether each of Ms. Nield's wounds were cultured, leading to his conclusion, the wound culture "does not rule out the possibility Ms. Nield was colonized or infected with MRSA or pseudomonas." Dr. Coffman goes on to speculate, "[i]t is possible Ms. Nield had MRSA and/or pseudomonas in one or more, but not all of her wounds. . . it is possible the swab was taken from one of the wounds in which she did not have MRSA and/or pseudomonas." The inadmissible nature of these statements is self-evident by Dr. Coffman's continuous use of "possible", which he uses several times. Again, this is speculative and conclusory, entirely void of any facts.

5. Paragraph 24 is also based on speculation.

Dr. Coffman speculates that "[i]t is possible. . . the culture did not grow out and identify [MRSA or pseudomonas] resulting in a false negative." This conclusion is based on no facts. Again, Dr. Coffman does not endeavor to ascertain any facts to support this or his final conclusion, "It is very possible MRSA and/or pseudomonas were present in the wound that was cultured. . .but were not dominant microorganisms and were not grown out." This is again inadmissible speculation.

6. Paragraph 26 is inadmissible speculation.

Dr. Coffman concludes, without any factual bases, that Judy was potentially exposed to MRSA or pseudomonas when she had visitors. Lacking in this conclusory statement is any evidence the visitors were MRSA or pseudomonas colonized or infected.

7. Paragraph 27 is inadmissible speculation.

Dr. Coffman again asserts it is not possible to determine whether Judy's pseudomonas infection on November 9, 2007 was related to her right hip infection. Again, Dr. Coffman's admission that "it appears" Judy's infection was resolved by antibiotics and that "it appears" Judy had two different strains of pseudomonas are nothing but speculation.

Finally, Dr. Coffman's affidavit must be tempered by his admission that "it is not possible to determine whether or not Ms. Nield was MRSA or pseudomonas colonized as of the time she was admitted to [PCRC]. This conclusion speaks volumes to support that Dr. Coffman offers nothing but speculation, which is not admissible on summary judgment.

CONCLUSION

Based on the foregoing, Plaintiff respectfully requests that the Court grant her Motion to Strike the Affidavit of Dr. Coffman.

DATED this 29th day of November, 2010.

COOPER & LARSEN, CHARTERED

By _____
REED W. LARSEN

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 29th day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

Keely Duke	[✓]	U.S. Mail/Postage Prepaid
Chris D. Comstock	[ ]	Hand Delivery
HALL FARLEY OBERRECHT &BLANTON	[ ]	Overnight Mail
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IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **MOTION TO CONTINUE HEARING ON SUMMARY JUDGMENT OR IN THE ALTERNATIVE ADDITIONAL TIME TO SUPPLEMENT THE RECORD**

COMES NOW Plaintiff Judy Nield, by and through the undersigned counsel, and pursuant to I.R.C.P. 56(f), requests the Court either continue the hearing on Defendants' Motion for Summary Judgment, or allow, pursuant to I.R.C.P. 6(b), additional time in which to allow Plaintiff to supplement the record so she can procure the affidavit of Suzanne Frederick, one of her experts disclosed and identified in this case, additional time to procure and file with the Court the deposition

of Derrick Glum, a former administrator at Defendants' facility, and additional time to obtain an affidavit from her expert, Dr. Shockley.

This Motion is supported by the record herein and the Affidavit of Javier L. Gabiola in Support of Plaintiffs' Motion to Continue the Hearing on Summary Judgment filed concurrently herewith.

Oral argument is requested.

DATED this 29 day of November, 2010.

COOPER & LARSEN, CHARTERED

By: _____
REED W. LARSEN

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 29 day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

Keely E. Duke
Chris D. Comstock
Hall, Farley, Oberrecht & Blanton
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Boise, ID 83701

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Attorneys for Plaintiff

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **MEMORANDUM IN SUPPORT OF PLAINTIFF'S MOTION TO CONTINUE HEARING ON SUMMARY JUDGMENT OR IN THE ALTERNATIVE ADDITIONAL TIME TO SUPPLEMENT THE RECORD**

COMES NOW Plaintiff Judy Nield, by and through the undersigned counsel, and submits this Memorandum in Support of Plaintiff's Motion to Continue Hearing on Summary Judgment.

ARGUMENT

Plaintiff requests a continuance on Defendants' Motion for Summary Judgment, pursuant to I.R.C.P. 56(f). Rule 56(f) provides as follows:

> When affidavits are unavailable in summary judgment proceedings. Should it appear from the affidavits of a party opposing the motion that the party cannot for reasons stated present by affidavit facts essential to justify the party's opposition, the court may refuse the application for judgment or may order a continuance to permit affidavits to be obtained or depositions to be taken or discovery to be had or may make such other order as is just.

Plaintiff has made several attempts to obtain an affidavit from Suzanne Frederick, one of her experts in this matter. *See Affidavit of Javier L. Gabiola in Support of Plaintiff's Motion to Continue Hearing on Summary Judgment ("Gabiola Aff.").* For an unknown reason, Ms. Frederick has not been available, nor has she been reached by Plaintiff or her attorneys to procure her affidavit to file in support of Plaintiff's opposition to Defendants' Motion for Summary Judgment. *Id.*

Additionally, on November 16th, 2010, Plaintiff's counsel took the deposition of Defendants' former administrator, Derrick Glum, in St. George, Utah. On November 24 th, 2010, Plaintiff's counsel was notified for the first time that they would not be allowed to obtain an electronic transcript by email from the reporting firm that reported Mr. Glum's deposition without first paying for and ordering the transcript. *See Gabiola Aff., Exh. 1.* On November 26 th, 2010, Plaintiff's counsel sent a request to the reporting firm that reported Mr. Glum's deposition requesting that an e-transcript of that deposition be provided as soon as possible. *See Gabiola Aff., Exh. 2.*

Additionally, Plaintiff requests a continuance, or in the alternative, additional time to supplement the record with the affidavit of her infectious disease expert Dr. Shockley. Plaintiff's counsel has been working diligently to procure an affidavit from Dr. Shockley since approximately October 29th, 2010. *Gabiola Aff., ¶ 4.* Due to a miscommunication, Dr. Shockley's assistant did not provide him with appropriate documents for his review in order to prepare an affidavit and submit his opinions in opposition to Defendants' Motion for Summary Judgment. *Id.*

Pursuant to Rule 56(f), Plaintiff requests the Court to continue the hearing or allow Plaintiff to supplement the record with the affidavits of Ms. Frederick and Dr. Shockley and deposition testimony transcript of Derrick Glum in order to more fully and completely respond and support Plaintiff's opposition to Defendants' Motion for Summary Judgment.

DATED this 29 day of November, 2010.

COOPER & LARSEN, CHARTERED

By: _____
REED W. LARSEN

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Attorneys for Plaintiff

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **AFFIDAVIT OF JAVIER L. GABIOLA IN SUPPORT OF PLAINTIFF'S MOTION TO CONTINUE HEARING ON SUMMARY JUDGMENT OR IN THE ALTERNATIVE ADDITIONAL TIME TO SUPPLEMENT THE RECORD**

STATE OF IDAHO)
: ss.
County of Bannock)

JAVIER L. GABIOLA, being first duly sworn upon oath, deposes and states as follows:

1. I am one of the attorneys representing Plaintiff in this matter and make this Affidavit upon my own personal knowledge and information.

2. My office and its staff have been attempting and trying to obtain an affidavit from Suzanne Frederick, one of Plaintiff's healthcare and nursing experts, disclosed in this matter. Since November 8, 2010, I and my staff have been attempting to contact Ms. Frederick to obtain her signature on an affidavit, a copy of which is attached hereto as Exhibit 1, to file in opposition to Defendants' Motion for Summary Judgment. As of the date of this affidavit, for unknown reasons, neither I nor my office staff have been able to contact or get a hold of Ms. Frederick;

3. Attached hereto as Exhibit 2 is a copy of an email my paralegal received from the deposition firm that reported the deposition of Derrick Glum, the former administrator at Defendants' facility, which was taken on November 16th, 2010. On November 24h, 2010 I was first informed that an e-transcript of Mr. Glum's deposition would not be available until it was ordered and paid for. Thereafter, on November 26th, 2010 I sent a request to the reporting firm that reported Mr. Glum's deposition, providing a credit card to obtain an e-transcript of Mr. Glum's deposition. See Exhibit 3 attached hereto;

4. On approximately October 28th, 2010 I endeavored to obtain and procure an affidavit from Dr. Shockley an infectious disease expert that I wanted to retain on behalf of Plaintiff, and to obtain opinions to submit to the Court in opposition to Defendants' Motion for Summary Judgment. The documents that Dr. Shockley would need to review to prepare his opinions and affidavit, due to a miscommunication between my office and Dr. Shockley's assistant, Dr. Shockley was not given documents to review until November 19th, 2010. Based upon this, I was unable to obtain any affidavit or opinions from Dr. Shockley to file an opposition to Defendants' Motion for Summary Judgment.

FURTHER SAITH AFFIANT NAUGHT.

DATED this 29 day of November, 2010.

COOPER & LARSEN, CHARTERED

By: _____
JAVIER L. GABIOLA

SUBSCRIBED AND SWORN TO before me this 29th day of November, 2010.

KIM C. PETERSON
NOTARY PUBLIC
STATE OF IDAHO

_____
NOTARY PUBLIC FOR IDAHO
Residing at Pocatello
My Commission Expires: 11-26-13

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 29 day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

Keely E. Duke	[X]	U.S. Mail/Postage Prepaid
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Attorneys for Plaintiff

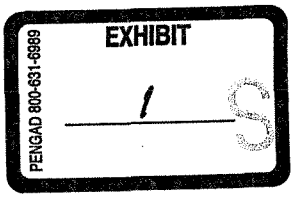
IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **AFFIDAVIT OF SUZANNE FREDERICK**

STATE OF TEXAS)
: ss
County of)

I, SUZANNE FREDERICK, being first duly sworn on oath, depose and state as follows:

1. That I am over the age of 18 and am competent to testify as to the facts set forth below.



2. That I am a Registered nurse licensed in the State of Texas. I have been practicing as a registered nurse since 1983. Attached hereto is a copy of my CV.

3. Attached hereto is a copy of my reports dated April 19, 2010, and June 10, 2010. Said reports are incorporated by reference. Attached thereto is a list of all the documents I reviewed in preparing my opinions in this matter.

4. It is my opinion that Pocatello Nursing and Rehabilitation Center nursing staff, as well as the Director of Nursing and Administrator, acted negligently and recklessly with regard to Mrs. Nield and were indifferent to her health and well-being. The nursing staff knew that their failure to meet the standards of care put Mrs. Nield at extreme risk of harm and that their failure to meet the standards would likely cause injuries to Mrs. Nield but despite this knowledge, Pocatello Nursing and Rehabilitation Center and its nursing staff still failed to meet the standard of care which caused her to develop MRSA which caused her many subsequent injuries and prolonged suffering.

5. From my review of the records, the records show that Mrs. Nield did not have MRSA or Pseudomonas when she entered Pocatello Care and Rehabilitation Center. Mrs. Nield was seen at the Wound Care & Hyperbaric Center on November 8, 2008. A physician's note on November 20, 2007 showed that a wound culture taken November 13, 2007 was positive for MRSA and pseudomonas.

6. It is also my opinion that Pocatello Nursing and Rehabilitation Center failed to follow proper infection control procedures to prevent Mrs. Nield's MRSA and pseudomonas infection. As stated above, Mrs. Nield did not have MRSA and pseudomonas when she was admitted to Pocatello Nursing and Rehabilitation Center on August 25, 2007. However, the records clearly show that she did develop MRSA and pseudomonas while she was a resident of Pocatello Nursing and Rehabilitation Center.

7. It is my professional nursing opinion that Mrs. Nield's contraction of MRSA and pseudomonas was caused by substandard nursing practice regarding infection control.

FURTHER SAITH AFFIANT NAUGHT.

DATED this _____ day of November, 2010.

_____
SUZANNE FREDERICK

SUBSCRIBED AND SWORN TO before me this _____ day of November, 2010.

(SEAL)

_____
NOTARY PUBLIC FOR TEXAS
Residing at:
My Commission expires:

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this _____ day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

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_____

Liz

From: Sherry Longo [sherry@toddolivas.com]
Sent: Wednesday, November 24, 2010 11:11 AM
To: Liz
Subject: Deposition of Derrick Glum
Attachments: DepoOrderForm_O+1.pdf

Good morning Liz,

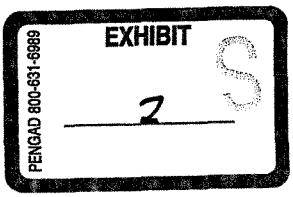
I have received the final transcript of the above mentioned deponent in my office for production. I have attached an order form if you would like to fill out the order form and return it to me signed I will be happy to forward you an e-transcript right away.

Best regards,
Sherry Longo

Todd Olivas & Associates, Inc.
41690 Enterprise Circle North
Suite 200CC
Temecula, CA 92590

(951) 296-0114 Main Line:
(951) 848-0789 Fax

http://www.toddolivas.com
sherry@toddolivas.com



********** -COMM. JOURN[illegible] ********** DATE NOV-2[illegible]10 ***** TIME 10:23 ********

MODE = MEMORY TRANSMISSION START=NOV-26 10:22 END=NOV-26 10:23

FILE NO.=452

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FAX COVER SHEET

DATE: 11-26-10

TO: Todd Olivas & Assoc

FROM: Javier Gabiola

2 PAGE(S) FAXED - INCLUDING THIS SHEET

RE: Derrick Glenn depo Nov 16, 2010

COMMENTS: Please send e-trans asap

PLEASE ADVISE IMMEDIATELY IF YOU EXPERIENCE ANY DIFFICULTIES RECEIVING THIS TRANSMISSION.

GARY L. COOPER
REED W. LARSEN

JAVIER L. GABIOLA

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FAX COVER SHEET

DATE: 11-26-10

TO: Todd Olivas & Assoc

FROM: Javier Gabiola

2 PAGE(S) FAXED - INCLUDING THIS SHEET

RE: Derrick Glum depo Nov 16, 2010

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Todd Olivas & Associates

TELEPHONE: 888-566-0253
FAX: 951-848-0789

TRANSCRIPT ORDER FORM

I understand that I am ordering the ORIGINAL & ONE CERTIFIED COPY of the deposition of the following witness(es) and agree to be responsible for the payment of said transcript(s) and any additional items, services and fees checked below:

Witness (1) Derrick Glum Nov. 16, 2010
Witness (2) _____
Witness (3) _____
Witness (4) _____
Witness (5) _____
Witness (6) _____

PLEASE CHECK ALL THAT APPLY:

- ☐ COPY OF DEPOSITION(S)
- ☐ EXHIBITS
- ☐ CONDENSED TRANSCRIPT
- ☐ ASCII/CD-ROM
- ☒ E-TRANSCRIPT
- ☐ VIDEO ☐ VIDEO SYNCH
- ☐ ADDITIONAL REQUESTS

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PREFERRED METHOD OF PAYMENT:

☐ COD PREFERRED DELIVERY DATE:

☒ CREDIT CARD
Visa MC Amex Discover
[redacted] _____
Credit Card # Exp. Date

☐ INSURANCE CARRIER
_____ Name of Carrier
_____ Address
_____ City/State/Zip
_____ Claim No.
_____ Adjuster Name

I hereby order the above services/products and understand that I will be responsible for paying the invoice.

SIGNATURE OF ATTORNEY OR AUTHORIZED REPRESENTATIVE: J. L. Gabiola
DATED: 11-25-10
PLEASE PRINT NAME: JAVIER L. GABIOLA
ATTORNEY EMAIL ADDRESS: javier@cooper-larsen.com

Reed W. Larsen, ISB # 3427
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JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **MEMORANDUM IN OPPOSITION TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT**

COMES NOW Plaintiff Judy Nield ("Judy"), by and through the undersigned counsel, submits this Memorandum in Opposition to Defendants Pocatello Care and Rehabilitation Center's (PCRC) Motion for Summary Judgment.

INTRODUCTION

Judy is a 68 year old long-time resident of Chubbuck. For over three years, Judy has been

bed bound, as she has no leg below her left knee, nor does she have any right hip bone below her hip. Judy's situation is entirely due to PCRC's negligence and breach of the standard of care. PCRC's conduct is best described as reckless and a gross violation of the type of care a health care giving facility should have given Judy, which PCRC did not do. PCRC infected and/or colonized Judy with Methicillin-Resistant Staphylococcus Aureus ("MRSA") and pseudomonas aeruginosa ("PA"). It is not disputed that prior to her admission to PCRC, Judy tested negative for MRSA and PA. Apporixmately 3 months after her admission, Judy contracted MRSA and PA, based on tests done November 9th, 2007. Judy was infected and/or colonized with MRSA and PA at PCRC as a result of its negligent, reckless conduct and its breach of the standard of care in failing to prevent the spread of MRSA and PA to Judy.

PCRC's request for summary judgment is improper, as it based on speculation, nothing more. PCRC asserts Judy ***could*** have been a carrier of MRSA or PA or that someone other than PCRC ***may have*** exposed her to MRSA and PA and that there is no evidence Judy contracted MRSA or PA due to PCRC"s negligence or breach of the standard of care. The lynchpin of PCRC's speculative motion is their expert, Dr. Coffman, who, in his deposition testified, when asked whether he could rule out Judy contracted MRSA at PCRC: **"I can't rule out where she got it from"** and **"Well, I don't think we can tell."** Dr. Coffman also, as to PA, concluded he does not know where, when or how Judy acquired it.

On the other hand, Judy's treating physician and expert, Dr. Hugh Selznick, opined that to a reasonable degree of medical probability, Judy contracted MRSA and PA from PCRC. Dr. Selznick concluded "the etiology of [Judy's MRSA infection] was poor infection control measure by the staff at Pocatello Care & Rehabilitation Center. . . and it is my opinion Ms. Nield also

sustained left lower extremity pseudomonas wound infection while hospitalized at Pocatello Care & Rehabilitation Center as evident per 11/9/07 culture results." Further, Judy's other experts, reviewed this matter, Sid Gerber, an expert in healthcare administration, as well a residential care nurse, Suzanne Frederick, both opined that Judy contracted MRSA and PA due to PCRC's breach of the standard of care from its failure to prevent the transmission of disease and infection. Mr. Gerber characterized PCRC's conduct as "gross violations", "reckless" and "unjustifiable." Further Ms. Frederick concluded PCRC's failures to provide adequate care and prevent the spread of MRSA and PA to Judy "increas[ed] the risk of harm, causing injury and unnecessary pain and suffering to Mrs. Nield, as well as MRSA/Pseudomonas infection."

PCRC is not entitled to summary judgment, as there is a genuine issue of material fact Judy contracted MRSA and PA due to the negligence and breach of the standard of care committed by PCRC.

STATEMENT OF FACTS

1. On August 21st, 2007, Judy was taken to the ER department at Portneuf Medical Center ("PMC"). At the time, Judy was suffering from four open wounds on her left leg, as well as cellulitis, and other medical conditions. *See Affidavit of Reed W. Larsen ("Larsen Aff."), Exhibit A (history and physical from PMC).* While at PMC, Judy was tested for MRSA and PA, and the test results were negative for those infections. *Larsen Aff., Exh. B. (Test results August 21-23, 2007).*

2. Judy was admitted to PCRC on August 25th, 2007, to recuperate enough to have surgery as her medical providers planned to operate on her hip so that she could have a hip replacement, as well as other prosthetic procedures done. *Larsen Aff., Exh. C (PCRC admission records).*

3. Upon admission to PCRC, PCRC's wound care nurse knew Judy's physician ordered that

Judy have daily wound assessments. *Larsen Aff., Exh., D (PCRC record-Maxfield).* Despite this, PCRC's nurses did not do daily skin assessments *Larsen Aff., Exh. E (weekly skin assessment and ulcer pressure sore sheets).* PCRC's medical staff generated cryptic medical records, which did not identify or document accurately Judy's four open wounds in her left leg. *Larsen Aff., Exh. F (Suzanne Frederick 4-19-10 Report, pp. 9-13; Affidavit of Sid Gerber¶¶ 4-5, Gerber Report, pp. 6-7.* In fact, Judy's weekly skin assessments, which certainly were not daily, were started upon her admission and then ended on September 18th, 2007, such that all documentation on two of Judy's wounds stopped at that time, and the largest wound on her left leg stopped on October 22nd, 2007, three weeks prior to her being positively cultured for MRSA and PA. *Larsen Aff., Exh. F (Frederick Report, pp. 9-10; Gerber Report, p. 7, ¶ 3.* This deficiency was admitted to by one of Judy's wound care nurses, Joyce Maxfield, who testified Judy's wound care records could have been more accurate. *Larsen Aff., Exh. G (Joyce Maxfield Deposition), p. 77, ll. 12-22.*

4. On November 13th, 2007, Judy's left leg wounds were cultured. *Larsen Aff., Exh. H (November 13, 2007 test reports).* The test results showed Judy was positive with infections of MRSA and PA. *Id.* This was a trivial matter, to PCRC's former administrator, Derrick Glum, who testified that "it was not warranted" for PCRC to conduct an investigation as to how Judy acquired MRSA and PA while she was at PCRC.[1]

5. PCRC did not do any testing or screening for MRSA or PA of Judy prior to her admission to its facility, nor during her stay there.

6. PCRC had in place, while Judy was a resident, an "Infection Control Policy and Procedure

[1]Judy has requested a copy of Mr. Glum's deposition transcript, from his deposition on November 16, 2010, which will be produced to the Court upon receipt.

Manual (Manual)." *Larsen Aff., Exh. I.* However, not everyone at PCRC was given a copy of the policy, which PCRC's directors of nursing and staff developer admitted. *Larsen Aff., Exh. G (Maxfield Depo.), p. 21, ll. 18 to p. 22, l. 2; Exh. J (LaRee Dunn Deposition), p. 26, l. 10-15.* PCRC's manual required that its staff do a self evaluation to insure its employees were following policies regarding infection control practices. *Larsen Aff., Exh. I, p. 992.* Further, PCRC's manual had "Compliance Rounds Forms" which were to be filled out to monitor universal precautions and documentation of infections. *Id., pp. 1118-1119.* However, the Director of Nursing during Judy's residency, testified that she "did not recall" using the Compliance Rounds Forms at PCRC and "didn't recall ever seeing this [compliance rounds forms] before." *Larsen Aff., Exh. K (Marjorie Brim Deposition), p. 25, l. 21 to p. 26, l. 5.* Further, as to the staff self evaluation form PCRC's staff were required to perform every six months, the Director of Nursing testified those forms did not look familiar to her. *Id., Exh. K, p. 26, l. 12-19.* PCRC's Director of Nursing was in charge of monitoring its staff to ensure they complied with its infection control prevention procedures. *Id., Exh. K, p. 24, l. 22 to p. 25, l. 1.*

7. PCRC's failure to monitor its medical caregivers, to see if they were following basic infection prevention procedures, such as handwashing, is evident from the testimony of Ms. Maxfield, one of Judy's nurses who provided wound care, who admitted that she did not wash her hands prior to gloving, itself a violation of PCRC's manual. PCRC's manual required that, to prevent the spread of infection, the caregiver was first required to obtain gloves, open the package, without touching the gloves, and wash hands and then put on the gloves. *Larsen Aff., Exh. I, p. 991.* Ms. Maxfield did not do this, which the Department of Health and Welfare documented in its survey on January 24, 2008. *Larsen Aff., Exh. M (January 24, 2008 survey of PCRC).* In that report, DHW

documented nurse, LN(A), which was Ms. Maxfield, prior to putting on her gloves, did not wash her hands, did not remove contaminated gloves, did not wash a wound guide prior to treating a resident who had MRSA. *Id., Exh. G (Maxfield Deposition), p. 46, l. 20, l. 25; p. 49, l. 14 to p. 50, l. 5; p. 53, l. 13 to p. 55, l. 20; Exh. M, p. 82-86.* DHW found PCRC failed to follow its policies on preventing infection and the spread of infection. *Id., Exh. M, p. 85.* Further, DHW sent a letter to PCRC's then adminstrator, Derrick Glum, notifying him PCRC was cited for improper infection control, for failure to provide proper wound care using proper clean technique and universal precautions on a resident who had MRSA. *Larsen Aff., Exh. N (DHW 2-19-10 Letter to Derrick Glum), p. 3.* PCRC did not follow its own hand washing policy, which it characterized as "the most important single procedure for preventing nosocomial infections." *Larsen Aff., Exh. I, p. 1002.*

8. Judy testified in her deposition that her room was not clean, smelled of urine, there was mold in the bathroom, and feces in the bed and sink, for weeks. *Larsen Aff., Exh. O (Judy Nield Deposition), p. 127, l. 21 to p. 128, l. 13.* Judy also witnessed the nurses failing to wash their hands, and did not have gloves on, before they came into her room. *Id., p. 131, l.14 to p. 132, l. 9.* The nurses admitted to Judy that it was too hard to put on gloves or wash their hands, and Judy witnessed that **60% of the time**, the nurses were not washing their hands or putting on gloves. *Id., p. 131, l. 10 to p. 132, l. 9.*[Emphasis added].

9. Judy testified she was housed next to a resident who had MRSA, and witnessed him walking in the hallway. *Id., p. 139, l. 3-p. 140, l. 12.* Judy was also told by CNAs at PCRC that PCRC was "working us to death" and that "[t]here's not even enough of us to cover." *Id., p. 161, ll. 18 to 21.* Judy also recounted that she would be left in a wheelchair for eight straight hours to get a pain pill. *Id., p. 161, l. 22 to p. 162, l. 17.*

10. Judy's observations of the MRSA resident are confirmed by the DHW 2-19-2008 letter it sent to Mr. Glum. *Larsen Aff., Exh. N, p. 3, ¶ 3.* That letter confirmed, by PCRC's admission, that while Judy was at PCRC, there were residents diagnosed with MRSA. *See also, Affidavit of Dr. Selznick, September 19, 2009 report, p. 13, ¶ 5.*

11. Further, as for PA, the DHW 1-24-2008 survey report noted that in **August of 2007**, there was a patient at PCRC who was treated for wound care and "pseudomonas cellulitis of both knees." *Larsen Aff., Exh. M, p. 32; Affidavit of Dr. Selznick, September 17, 2009 report, p. 13, ¶ 4.*[Emphasis added].

12. Judy's observation, and the PCRC nurses saying that they did not always wash or glove is copacetic with PCRC's expert, Dr. Coffman's opinion that:

> And when it's [hand washing] done–it's interesting, when people do self-evaluation, self-reporting on hand washing, it's always close to 100 percent. But when they're actually observed doing it, yeah, 70, 72 percent, **60 percent, at some facilities 50 percent**.

Larsen Aff., Exh. P (Dr. Coffman Deposition),p. 64, ll. 17-22 [Emphasis added].

13. More telling from Dr. Coffman is that, during his deposition testimony, he admitted that he could not rule out where Judy contracted MRSA. Specifically, Dr. Coffman testified:

> Q. So if PCRC didn't follow infection control procedure, how are you able to rule out that Judy Nield did not contract MRSA at PCRC?
> ***
> A. **Well, I don't think we can tell. . . .And we don't know where it came from**. It had a susceptibility pattern that was sort of more consistent with the community-acquired strain than a hospital strain. So it makes you think it might have come from outside. But we just don't know.
> Q. **Well, if PCRC is being cited for not following infection control procedure, so I mean they didn't follow that, would you be able to rule out that Judy didn't contract MRSA from PCRC?**
> **A. I can't rule out where she got it from.**

Larsen Aff., Exh. P (Dr. Coffman Deposition), p. 69, l. 18 to p. 3.[Emphasis added]. Further, Dr. Coffman's own affidavit amplifies that he cannot determine when Judy contracted MRSA or PA: **"[I]t is not possible to determine when, where or how Ms. Nield became infected with MRSA or pseudomonas."** *See Affidavit of Thomas J. Coffman, MD in Support of Defendant Pocatello Health Services, Inc. DBA Pocatello Care and Rehabilitation Center's Motion for Summary Judgment, ¶ 28.*

14. On the other hand, Dr. Hugh Selznick, Judy's treating physician, opined that, to a reasonable degree of medical probability, Judy contracted MRSA and PA from PCRC. Dr. Selznick concluded "the etiology of [Judy's MRSA infection] was poor infection control measure by the staff at Pocatello Care & Rehabilitation Center. . . and it is my opinion Ms. Nield also sustained left lower extremity pseudomonas wound infection while hospitalized at Pocatello Care & Rehabilitation Center as evident per 11/9/07 culture results." *Affidavit of Hugh Selznick, September 17, 2009 Report, p. 17, 3rd and 4th Paragraphs.*

15. Further, Judy's other experts who have reviewed this matter, Sidney Gerber, an expert in healthcare administration, as well as Suzanne Frederick, a residential care nurse, both opined that PCRC failed to comply with state and federal regulations and standard of care to prevent the transmission of disease and infection, leading to Judy's contracting of MRSA and PA. Both Mr. Gerber and Ms. Frederick reviewed the January 24th, 2008 survey of PCRC by the Department of Health & Welfare, which found that the staff at PCRC failed to follow proper infection control prevention procedures, such as hand washing, which was the result of PCRC failing to properly instruct and train its employees on infection control and prevention measures. *Larsen Aff., Exh. Q (1-24-10 Survey report from the Idaho Department of Health and Welfare, pp. 82-86); Exh. R*

(Suzanne Frederick 4-19-10 & 6-10-10 Reports, pp. 9-13; Affidavit of Sid Gerber¶¶ 4-5, Gerber Report, pp. 6-7. Further, Ms. Frederick concludes that the January 24th, 2008 Department of Health & Welfare review established that the nurses at PCRC, during wound care failed to follow the professional practice standards and facility policies to prevent infections, as nurses repeatedly failed to wash their hands at appropriate times during wound care procedures and follow proper precautions with a resident that had MRSA. *See Larsen Aff., Exh. R, pp. 10-11.* Mr. Gerber also concluded that PCRC failed to provide an adequate and sufficient, in addition to competent, nursing staff to provide necessary care to prevent Judy from contracting MRSA and PA from PCRC. According to Mr. Gerber, the nursing staff at PCRC "were not compliant with the ordinary standard of care and protocols established to prevent the spread of infection and in [Mr. Gerber's expert opinion], were reckless in not complying with essential and fundamental precautions established universally when nursing staff are in physical contact with all patients or residents i.e. routine had washing regardless of predisposition or risk factors involving MRSA." *See Affidavit of Sid Gerber, Gerber Report, p. 8.* Mr. Gerber further characterized PCRC's conduct as

> [G]ross violations and significant deviations from the standard of care that they were responsible and obligated to provide to Ms. Nield, . . resulting in Ms. Nield's injuries and causing her deterioration and needless suffering. . . . Furthermore, under these circumstances, such conduct in my opinion is unjustifiable.

Gerber Aff., Gerber Report, p.9.

Ms. Frederick further opined that

> [T]he Director of Nursing and nursing staff of Pocatello Nursing and Rehabilitation Center and its owners, managers, and agents failed to adhere to applicable standards of care and violated state and federal nursing home regulations in addition to facility policies and procedures in their care and treatment of Mrs. Nield thereby increasing the risk of harm, causing injury and unnecessary pain and suffering to Mrs. Nield, as

well as MRSA infection.

Larsen Aff., Exh. R, p. 10-11.

16. Additionally, Dr. Selznick concluded that due to PCRC's actions and omissions in transmitting MRSA and PA to Judy, Judy had to have her left leg amputated below the knee, surgery on her right hip. *See Dr. Selznick Aff., ¶¶ 4-10.*

ARGUMENT

A. JUDY CONTRACTED MRSA AND PA FROM PCRC THEREBY PRECLUDING SUMMARY JUDGMENT.

1. Standard of review in medical malpractice cases.

Pursuant to IRCP 56(c), summary judgment is appropriate, "if the pleadings, affidavits, and discovery documents on file with the court, read in a light most favorable to the nonmoving party, demonstrate no material issue of fact such that the moving party is entitled to a judgment as a matter of law." *Cramer v. Slater*, 146 Idaho 868, 873, 204 P.3d 508, 513 (2009)(citation omitted). "The burden of proving the absence of a material fact is upon the moving party. *Id.* All disputed facts are to be construed liberally in favor of the nonmoving party, and all reasonable inferences that can be drawn from the record are to be drawn in favor of the nonmoving party. *Id.* (Citation omitted). "If reasonable people might reach a different conclusion from conflicting inferences based on the evidence then the motion must be denied." *Id.* "If the evidence is conflicting on material issues or supports conflicting inferences, or if reasonable minds could reach different conclusions, summary judgment must be denied." *Id.* (Citation omitted).

As to the issue of proximate cause, the court in *Cramer, supra,* a medical malpractice case, stated

the following:

> The question of proximate cause is one of fact and almost always for the jury. . . . [P]roximate cause is one of fact to be submitted to the jury and not a question of law for the court; if, upon all the facts and circumstances, there is a reasonable chance or likelihood of the conclusions of reasonable (people) differing, the question is one for the jury.

Cramer v. Slater, supra, 146 Idaho at 875, 204 P.3d at 515 (2009(*citing, Sisters of the Holy Cross,* 126 Idaho 1036, 1041, 895 P.2d. 1229, 1234 (Ct. App. 1995)).

A plaintiff is not required, in a medical malpractice action, to prove proximate cause beyond a reasonable doubt or that such must be proven by expert testimony. As stated by the court in *Sheridan v. St. Luke's Reg'l Med. Ctr.*, 135 Idaho 775, 25 P.3d 88 (2001)

> Unlike the elements of duty and breach of duty, there is no statutory requirement explicitly stating proximate cause in medical malpractice cases must be shown by direct expert testimony. Therefore, testimony admissible to show proximate cause in a medical malpractice case, like any other case, is governed by the rules of evidence regarding opinion testimony by lay witnesses and experts under Idaho Rules of Evidence 701 and 702.

Sheridan, supra. Further, the court held:

> Furthermore, according to our precedent, proximate cause can be shown from a "chain of circumstances from which the ultimate fact required to be established is reasonably and naturally inferable.
> * * *
> [A plaintiff] was not required to prove his case beyond a reasonable doubt, nor by direct and positive evidence. It was only necessary that he show a chain of circumstances from which the ultimate fact required to be established is reasonably and naturally inferable. "If the rule of law is as contended for by defendant and appellant, and it is necessary to demonstrate conclusively and beyond the possibility of a doubt that the negligence resulted in the injury, it would never be possible to recover in a case of negligence in the practice of a profession which is not an exact science. [Internal citations omitted].

Sheridan, supra.

2. Judy can and has established she did not have MRSA or PA prior to her admission to PCRC.

As the expert opinions of Dr. Selznick, Dr. Gerber, and Suzanne Frederick clearly establish, Judy contracted MRSA and PA from PCRC. As a reminder, summary judgment is not appropriate where there are affidavits or opinions from which reasonable minds could conclude or reach different conclusions. Further, under the summary judgment standard, the court is precluded from weighing the evidence and is to accept all facts offered by Judy, as well as the opinions from her experts, as true, and to look at the facts posed by and opinions held by PCRC experts as not true. Given that Judy's treating doctor and expert, Dr. Selznick, concluded that Judy contracted MRSA and PA from PCRC, PCRC is not entitled to summary judgment.

3. PCRC's motion is based on speculation as to whether Judy "could" have been MRSA or PA positive/carrier when she was admitted to its facility, that she may have had the infections in her wounds or contracted it from another source

PCRC offers the speculative opinions from their key expert, Dr. Coffman, who testified that he could not rule out where Judy contracted MRSA, and in his affidavit that he did not know when, where or how Judy acquired MRSA and PA. Summary Judgment is not allowed based on the supposition of Dr. Coffman.[2]

PCRC offers no evidence showing it they tested Judy to determine if she was colonized with MRSA or PA prior to or during her stay at its facility. PCRC offers no evidence to show that the screening done prior to her admisstion to its facility "may" have proven a false negative or fails to show that each wound was tested. PCRC fails to offer any evidence in the record to support its supposition that Judy "could" have acquired MRSA or PA from a visitor or from Portneuf Medical

[2]Judy incorporates herein by reference her Memorandum in Support of Motion to Strike Affidavit of Dr. Coffman, filed concurrently with this Memorandum.

Center. Again, PCRC certainly had the ability to screen or test Judy to rule out whether she was MRSA/PA colonized or positive upon her admission to its facility but did not do so.

It is axiomatic that the defendant asserting an affirmative defense has the burden of proving the defense. *See, Chandler v. Hayden*, 147 Idaho 765, 771, 215 P.3d 485, 491 (2009)(nonmoving defendant has the burden of supporting a claimed affirmative defense on a motion for summary judgment). Further, as IRCP 56(e) requires evidence be admissible before the court can consider such in deciding a motion for summary judgment. IRE 401 and 402 preclude the Court's consideration of PCRC's speculation and supposition. IRE 401 provides:

> "Relevant Evidence" means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.

Further, IRE 402 requires the exclusion of irrelevant evidence:

> All relevant evidence is admissible except as otherwise provided by these rules or by other rules applicable in the courts of this state. Evidence which is not relevant is not admissible.

Here, PCRC asserts its affirmative defense, albeit based on pure speculation, that Judy may have been MRSA/PA positive or colonized or acquired MRSA and PA from other people or entities. PCRC offers no evidence Judy was MRSA or PA colonized prior to her admission there, nor any evidence Judy acquired the infections elsewhere. PCRC's administrator admitted in deposition that PCRC did not do an investigation as to how Judy acquired MRSA or PA. PCRC did not test Judy at any time prior or during her stay. All of this was confirmed by PCRC's own expert, Dr. Coffman, who admitted he cannot determine "when, where or how Judy became infected with MRSA or pseudomonas."

The evidence in the record, as concluded by Dr. Selznick and Mr. Gerber and Ms. Frederick

supports the conclusion Judy contracted MRSA and PA due to PCRC's conduct and/or omissions. Her preadmission testing showed her to be negative for MRSA and PA. The evidence shows PCRC and its nursing staff did not follow proper infection prevention procedures. The evidence shows Judy was housed near MRSA and PA infected residents while she was there. At the very least, summary judgment is not appropriate.

Again, taking as true what Judy and her experts' facts and opinions are, which the court must do under summary judgment, it is clear summary judgment should not be allowed. It is up to the jury to decide the issue of whether Judy contracted MRSA and PA from PCRC and as a result of PCRC's negligence and breach of the standard of care.

B. JUDY HAS ESTABLISHED SHE WAS INFECTED AND/OR COLONIZED WITH MRSA AND PA DUE TO PCRC'S NEGLIGENCE AND BREACH OF THE STANDARD OF CARE.

Again, as all of Judy's experts opined, Dr. Selznick, Mr. Gerber, and Ms. Frederick, Judy contracted MRSA and PA from PCRC. *See Dr. Selznick Affidavit, September 18, 2009 report, pp. 13-18; Gerber Aff., Gerber Report, pp. 6-9, and Frederick Reports, Exhibit R to the Larsen Aff., pp. 9-13.* Mr. Gerber and Ms. Frederick concluded, PCRC failed to provide adequately trained staff, and an adequate number of staff, which resulted in Judy contracting MRSA and PA from PCRC. Again, Judy's initial requirements at PCRC were to have daily wound assessments. PCRC did them weekly and also incompetently as they failed to properly document the size of the wound, what the wound looked like, and any other identification of the wound and in the weekly skin assessments and the ulcer sore sheets. PCRC completely stopped documentation of two of the wounds on September 18, 2007, and the largest wound on October 22, 2007, a few weeks prior to Judy testing positive for MRSA and PA. Furthermore, PCRC was found in violation of state and federal standards by the

Department of Health and Welfare on January 24, 2008. The Department of Health and Welfare found that the staff at PCRC could not demonstrate proper infection control policies and procedures when handling patients that had MRSA. Moreover, there is evidence Judy was housed in a room next to a patient that had MRSA and that there was a PA infected patient at PCRC while Judy was there. *Larsen Affidavit, Exhibits M and N.* Judy also testified that she witnessed nurses exiting the MRSA patient's room without any gloves on or washing their hands. *Larsen Aff., Exh. O, p. 127, l. 21 to p. 128, l. 13; p. 131, l.14 to p. 132, l. 9; p. 131, l. 10 to p. 132, l. 9.* As a result, summary judgment must be denied.

C. DR. SELZNICK OPINED JUDY'S PA INFECTION RESULTED IN HER RIGHT HIP INFECTION.

Contrary to PCRC's unfounded conclusion, Judy has retained experts, more specifically her treating physician, Dr. Hugh Selznick, who unequivocally opined that she contracted MRSA and PA from PCRC. Also, Dr. Selznick concluded that Judy's pseudomonas infection resulted in her right prosthetic hip infection requiring surgery in May and June of 2008. In that regard, Dr. Selznick concluded:

> It is also my opinion that the right hip joint aspiration confirms pseudomonas which is also related to Pocatello Care & Rehabilitation Center. It is my opinion that the colonization of pseudomonas took place during her hospitalization and stay at Pocatello Care & Rehabilitation Center. It is my opinion the aspiration confirmed pseudomonas infection of the right hip was indeed related as well to pseudomonas colonization during her hospitalization at Pocatello Care & Rehabilitation Center. Again, the 11/9/07 left lower extremity would cultures did grow out moderate pseudomonas aeruglnosa. It is my opinion that her right hip two-stage revision surgery should be attributed to Pocatello Care & Rehabilitation Center hospitalization, colonization and subsequent infection with pseudomonas. After the two stage revision, she developed recurrent prosthesis right hip infection and all of that treatment for that condition should be related to her stay and subsequent infection while at Pocatello Care & Rehabilitation Center.

Affidavit of Dr. Selznick, ¶ *6.* As a result, PCRC is not entitled to summary judgment.

D. JUDY HAS PRESENTED EXPERT TESTIMONY ESTABLISHING CAUSATION.

PCRC asserts it is entitled to summary judgment because Judy has no expert testimony from an infectious disease expert to show PCRC's conduct or omissions caused her to contract MRSA and PA. PCRC cites to no case supporting this unfounded position that Judy needs expert testimony from an infectious disease expert. As stated earlier by the court in *Sheridan v. St. Luke's Reg'l Med. Ctr.*, 135 Idaho 775, 25 P.3d 88 (2001)

> Unlike the elements of duty and breach of duty, **there is no statutory requirement explicitly stating proximate cause in medical malpractice cases must be shown by direct expert testimony.** Therefore, testimony admissible to show proximate cause in a medical malpractice case, like any other case, is governed by the rules of evidence regarding opinion testimony by lay witnesses and experts under Idaho Rules of Evidence 701 and 702.

Sheridan, supra. [Emphasis added]. Further, the court held:

> Furthermore, according to our precedent, **proximate cause can be shown from a "chain of circumstances from which the ultimate fact required to be established is reasonably and naturally inferable.**
> * * *
> [A plaintiff] was not required to prove his case beyond a reasonable doubt, nor by direct and positive evidence. **It was only necessary that he show a chain of circumstances from which the ultimate fact required to be established is reasonably and naturally inferable. "If the rule of law is as contended for by defendant and appellant, and it is necessary to demonstrate conclusively and beyond the possibility of a doubt that the negligence resulted in the injury, it would never be possible to recover in a case of negligence in the practice of a profession which is not an exact science.** [Internal citations omitted].

Sheridan, supra.

Additionally, there is no requirement that Judy have an infectious disease expert. *See, Foster*

v. Traul, 145 Idaho 24, 29, 175 P.3d 186, 191 (2007)(there is no requirement that an expert witness be board-certified in the same specialty as the defendant in a malpractice action)).

PCRC's position is belied by the fact that Dr. Selznick, a medical physician who has been practicing in Idaho since 1993, concluded Judy contracted MRSA and PA from PCRC. PCRC's position is also ironic, since its expert, Dr. Coffman concluded he does not know where Judy contracted MRSA or PA and admitted he could not rule out where she got it. The record shows that Judy has met her burden on summary judgment, and that PCRC's motion should be denied.

CONCLUSION

Based on the foregoing, plaintiff Judy Nield respectfully requests the Court deny PCRC's Motion for Summary Judgment.

DATED this 24 day of November, 2009.

COOPER & LARSEN, CHARTERED

By _____
REED W. LARSEN

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 24 day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

Keely E. Duke
Chris D. Comstock
Hall, Farley, Oberrecht & Blanton
P.O. Box 1271
Boise, ID 83701

[ ] U.S. Mail/Postage Prepaid
[ ] Hand Delivery
[ ] Overnight Mail
[ ] Facsimile: 208-395-8585

Reed W. Larsen, ISB # 3427
Javier L. Gabiola, ISB # 5448
COOPER & LARSEN, CHARTERED
151 North 3rd Avenue, 2nd Floor
P. O. Box 4229
Pocatello, ID 83205-4229
Telephone: (208) 235-1145
Facsimile: (208) 235-1182

Attorneys for Plaintiff

IN THE DISTRICT COURT OF THE SIXTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF BANNOCK

JUDY NIELD, Plaintiff, vs. POCATELLO HEALTH SERVICES, INC., a Nevada corporation, d/b/a POCATELLO CARE AND REHABILITATION CENTER, and JOHN DOES I-X, acting as agents and employees of POCATELLO HEALTH SERVICES, INC., d/b/a POCATELLO CARE AND REHABILITATION CENTER, Defendants.	Case No. CV-09-3869-PI **AFFIDAVIT OF REED W. LARSEN IN SUPPORT OF PLAINTIFF'S OPPOSITION TO DEFENDANTS' MOTION FOR SUMMARY JUDGMENT**

STATE OF IDAHO)
: ss
County of Bannock)

I, REED W. LARSEN, being first duly sworn on oath, depose and state as follows:

1. I am Plaintiff Judy Nield's attorney and make this affidavit upon my own personal knowledge and information.

2. Attached hereto as Exhibit A is a copy of Judy Nield's discharge summary and medical records from Portneuf Medical Center from August 21 to 25, 2007.

3. Attached hereto as Exhibit B is a copy of wound cultures and tests taken of Judy Nield at Portneuf Medical Center on August 21, 2007.

4. Attached hereto as Exhibit C is a copy of Pocatello Care and Rehabilitation Center's records of admission.

5. Attached hereto as Exhibit D is a copy of Resident Care Plan Skin Integrity, Actual or Potential records from Pocatello Care and Rehabilitation Center.

6. Attached hereto as Exhibit E are Non-Pressure Ulcer Site Sheets and weekly skin assessment records of Judy Nield from Pocatello Care and Rehabilitation Center.

7. Attached hereto as Exhibit F is a copy of the reports of Suzanne Frederick dated April 19, 2010, and June 10, 2010.

8. Attached hereto as Exhibit G is a copy of the transcript of the deposition of Joyce Maxfield.

9. Attached hereto as Exhibit H is a copy cultures tests from Portneuf Medical Center dated November 9, 2007.

10. Attached hereto as Exhibit I is a copy of Pocatello Care and Rehabilitation Center's Infection Control Policy and Procedure Manual.

11. Attached hereto as Exhibit J is a copy of the deposition transcript of LaRee Dunn.

12. Attached hereto as Exhibit K is a copy of the deposition transcript of Marjorie Brim.

13. Attached hereto as Exhibit L is a copy of excerpts from the Department of Health and Human Service's survey dated January 24, 2008.

14. Attached hereto as Exhibit M is a copy of a letter from the Idaho Department of Health and Welfare to Derrick Glum, former Administrator of Pocatello Care and Rehabilitation Center dated February 19, 2008.

15. Attached hereto as Exhibit N is a copy of a deposition transcript of Judy Nield.

16. Attached hereto as Exhibit O is a copy of a deposition transcript of Dr. Jeffrey Coffman.

FURTHER SAITH AFFIANT NAUGHT.

DATED this 29 day of November, 2009.

REED W. LARSEN

SUBSCRIBED AND SWORN TO before me this 29th day of November, 2010.

(SEAL)

KIM C. PETERSON
NOTARY PUBLIC
STATE OF IDAHO

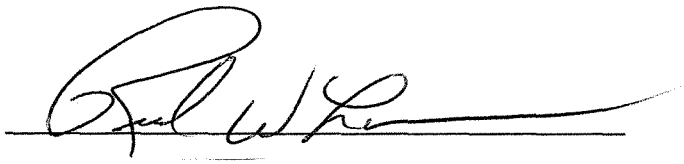
Kim C. Peterson
NOTARY PUBLIC FOR IDAHO
Residing at: Bannock Co
My Commission expires: 11-26-13

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 29 day of November, 2010, I served a true and correct copy of the above and foregoing document to the following person(s) as follows:

Keely E. Duke
Chris D. Comstock
Hall, Farley, Oberrecht & Blanton
P.O. Box 1271
Boise, ID 83701

[X] U.S. Mail/Postage Prepaid
[ ] Hand Delivery
[ ] Overnight Mail
[ ] Facsimile: 208-395-8585



PORTNEUF MEDICAL CENTER
651 Memorial Drive
Pocatello, Idaho 83201
(208) 239-1000

DISCHARGE SUMMARY

PT NAME: NIELD, JUDY			ROOM: MS-0003-1
PT DOB: [redacted]	PT AGE: 65Y		MR: 125192
ADMIT: 08/21/2007			ACCT: 3865462
DISCH: 08/25/2007			DD: 08/25/2007
ATTN PHYS: JONATHAN CREE, M.D.			TD: 1235
			DT: 08/27/2007

ATTENDING PHYSICIAN: DR. DAN JONES; DR. JONATHAN CREE

PRIMARY CARE PHYSICIAN: None.

DISCHARGE DIAGNOSES
1. Left lower extremity cellulitis.
2. Right hip pain.
3. Left hip dislocation.
4. Newly diagnosed diabetes.
5. Hypothyroidism.
6. Hypertension.

PAST MEDICAL HISTORY
1. DVT one year ago in the left leg.
2. Bilateral hip replacements.

ALLERGIES
No known drug allergies.

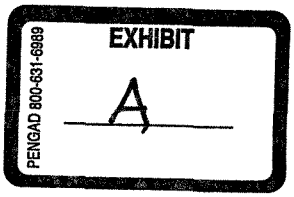
DISCHARGE MEDICATIONS
1. Colace 100 mg p.o. two times daily for constipation.
2. Synthroid 0.05 mg p.o. daily for hypothyroidism.
3. Lovenox 40 mg subcutaneously daily for DVT prophylaxis.
4. Naprosyn 500 mg p.o. two times daily p.r.n. pain.
5. Lantus 20 units subcutaneously every night for diabetes.
6. Cephazolin 1000 mg IV every 8 hours times six weeks for cellulitis.
7. Morphine 2 to 4 mg IV every 2 hours p.r.n. pain.
8. Phenergan 6.25 mg IV every 4 hours p.r.n. nausea.
9. Metformin 500 mg p.o. every night for diabetes.

FOLLOWUP INSTRUCTIONS
Orthopedics consult for applying definitive management of prosthetic joints. M.D. will call.

CONSULTATIONS
Dr. Newhouse, Orthopedics

PROCEDURES
Fluoroscopic-guided right hip arthrocentesis.

CONTINUED



DISCHARGE SUMMARY

NAME: NIELD, JUDY
ADMIT: 08/21/2007

MR: 125192
DD: 08/25/2007
DT: 08/27/2007

DIAGNOSTIC TESTS
X-ray AP pelvis and lateral right hip show shallow acetabular configuration with uncovering of the lateral stent component arthroplasty. No acute fracture or dislocation involving right hip. AP film which also reveals a fracture dislocation involving the left hip with superior dislocation of the femoral component and displacement at the level of the acetabular fracture.

HISTORY OF PRESENT ILLNESS
This pleasant 65-year-old Caucasian female presents to the Emergency Room with worsening oozing and redness of her left lower extremity. She had a history of a DVT in this left leg approximately one year ago. She states that she had an ulceration over this leg and that she had popped it approximately three months ago. Apparently this leg is swollen at this time, but it is normally swollen secondary to this history of DVT that she had. The patient took Coumadin for six months and then stopped for treatment of DVT. The patient denies any fevers or chills. She basically has no pain in this area, but she attributes that to she has no feeling in the left lower extremity at all secondary to her hip replacement in the past. She also does report a little bit of back pain, but this is nothing new.

HOSPITAL COURSE
The patient was admitted to Med-Surg overflow and placed on contact isolation in case she had MRSA. She was placed on IV antibiotics and improved considerably. She had her pain controlled with morphine and Naprosyn. Wound culture of the left lower extremity grew out klebsiella sensitive to Ancef; this is the IV medication that she will be placed on long-term for this infection. Also, an aspiration of the right hip showed only white blood cells but did not grow any bacteria. Blood cultures were negative for any organisms times two. The patient had a hemoglobin A1c that showed an elevated level of 6.6%. I did start her on Lantus and a mild sliding scale of NovoLog, and her sugars improved. I believe that she is an undiagnosed diabetic and will start her on metformin for her time over at the skilled nursing facility. I believe Lantus and metformin will be a good combination for her to control her blood sugars. She does need to have her left and right hip arthroplasties revised as they are unstable, and actually her left hip is completely dislocated. She is non-weightbearing at this time, and she does need revision of these types of arthroplasties at the University of Utah as we are not able to do those here.

DISCHARGE SUMMARY

NAME: NIELD, JUDY
ADMIT: 08/21/2007

MR: 125192
DD: 08/25/2007
DT: 08/27/2007

We will get a hold of Orthopedics here to help us to make this referral happen. MRSA screen negative.

Ryan Zimmerman MD
FP-RES RYAN ZIMMERMANN, MD

\: lh /: 374 ID: 0014097780
JOB: 278354 TIME: 0524

fx: KENNETH E. NEWHOUSE, M.D. (00975)
>

3:36 08/22/2007

PORTNEUF MEDICAL CENTER
651 Memorial Drive
Pocatello, Idaho 83201
(208) 239-1000

HISTORY AND PHYSICAL

PT NAME: NIELD, JUDY
ROOM: MS-0003-1
MR: 125192
ADMIT: 08/21/2007
ACCT: 3865462
DISCH:
PT TYPE: I
ATTN PHYS: JONATHAN CREE, M.D.
DD: 08/21/2007
PT DOB: [redacted] PT AGE: 65Y
TD: 1924
DT: 08/22/2007

CHIEF COMPLAINT
Left leg infection.

HISTORY OF PRESENT ILLNESS
The patient is a 65-year-old female with a previous history of DVT with chronic edema and some ulceration in her left lower extremity as well as being insensate from the knee down, who presents to the Emergency Room with worsening oozing and redness in her left lower extremity. The patient reports that approximately three months ago, she had a clear blister posteriorly of her distal left lower extremity. They popped the ulceration, and since then that area has been getting progressively worse and has proceeded to move around toward the front. The patient reports that her leg is normally incredibly swollen. Today it is much better as she was on her back with her leg elevated all day yesterday. The swelling has been going on since the DVT she had approximately one year ago in this left leg. The patient was on Coumadin for six months and then requested not to be on it any longer. The patient denies any fevers. The patient has no pain in this area, so denies any pain. Again she has no feeling, so no numbness or tingling in that area. The patient denies any weakness, any weight changes. The patient has a bilateral hip prosthesis and does report increased pain in her right hip prosthesis and that is why she was actually on her back yesterday was because of the pain in this right hip.

The patient has been having Home Health come for the last week or so to help with dressing changes and the patient reports that approximately four to five weeks ago, she was on antibiotics for a few days. They were leftover antibiotics that she had from a dental procedure previously.

PAST MEDICAL HISTORY
Remarkable for the DVT as stated above, hypothyroidism, and the patient has had bilateral hip replacements. The patient has not had any colonoscopies or colon cancer screening.

SOCIAL HISTORY
The patient is widowed. She lives alone. She has about a 15 pack/year history of tobacco in the distant past and has occasional alcohol use.

CODE STATUS
DNR/DNI.

MEDICATIONS
The patient is on.
1. Hydrocodone 10/325 p.o. every 4 hours p.r.n. pain.
2. Diclofenac 50 mg p.o. every day for pain.
3. Levothyroxine 50 mcg p.o. daily.

FAMILY HISTORY
No blood clots in the family history. The patient reports that her mother had colon cancer in her mid-30's.

ALLERGIES
No known drug allergies.

REVIEW OF SYSTEMS
The patient has been in a wheelchair for approximately the last three months due to the swelling and pain and difficulty walking due to the feeling in this left leg and weakness and pain in the right leg. The patient denies any weight changes. The patient denies any night sweats, any weakness, any chest pain, any shortness of breath, no cough.

PHYSICAL EXAMINATION
VITAL SIGNS: Temperature 98.8, pulse 96, blood pressure 165/83, respirations 20 and the patient was satting 95% on room air.
GENERAL: The patient is in no acute distress. She is awake, alert, and oriented. She is pleasant and cooperative during the exam.
HEENT: Pupils are equal, round, and reactive to light and accommodation. Sclerae and conjunctivae are normal. Mouth and pharynx are without lesions or exudate. Tympanic membranes were unable to be visualized bilaterally due to cerumen. Hearing to finger rub was intact.
NECK: Soft and supple, no lymphadenopathy, no thyromegaly, no carotid bruits.
HEART: Regular rate and rhythm, no murmurs, rubs, or gallops.
LUNGS: Clear to auscultation, no wheezes, rales or rhonchi.
ABDOMEN: Abdomen appeared to be mildly distended, was nontender, no peritoneal signs.
EXTREMITIES: The patient had trace pitting edema in the left lower extremity. The patient was insensate from approximately the knee down. The patient from the mid-shin down had erythema, but no warmth. There was superficial ulcerations around much of the distal lower leg. The largest being posteriorly, approximately 6 to 7 cm. There was granulation tissue and vascular tissue on all of these. There were some areas of oozing and it was a clear to yellowish serous discharge. Pulses were present bilaterally at the posterior fibula and posterior tibia and dorsalis pedis. Sensation was intact everywhere other than in this left lower extremity.

LABORATORY
White count was 7.6, hemoglobin 13.7, hematocrit 40.6, platelets 229. BMP revealed a glucose of 177, creatinine 1.0, and electrolytes were fine. The patient's albumin was a little bit low at 3.1. The rest of her liver function tests were otherwise normal.

The patient had a venous and arterial ultrasound of her left extremity. The arterial ultrasound showed an abnormal wave form consistent with proximal arterial disease, likely at the iliacs or distal abdominal aorta. The venous ultrasound showed disease in the common femoral vein consistent with a chronic DVT.

ASSESSMENT AND PLAN
1. Left lower extremity cellulitis. I believe that there is a cellulitic component to the patient's infection. However, I believe that is not the greatest component. The patient has chronic edema ulcerations on and off, most recently for the last three months. The patient has arterial and venous disease and so this is more of a picture of arterial and venous disease. However, given the patient's poor circulation, she is at high risk for infectious disease and I suspect that there is some component of infectious disease here. The patient also has elevated sugar, so it is a worry that the patient may be a diabetic or borderline diabetic and also has bilateral artificial hips. Given all of this, I feel that it would be in the patient's best interest to be admitted for IV antibiotics at least until cultures are back. We will admit the patient on Primaxin 500 mg every 8 hours IV, as well as Vancomycin 1 gram every 24 hours IV. Wound and blood cultures were sent in the Emergency Room. The patient has been seen in the past by hyperbarics. Hyperbarics will be consulted for further evaluation of this wound and in preparation for further outpatient treatment.
2. Right hip pain. It is unlikely being that the patient is afebrile and has a normal white count that the patient has seeded one of the artificial joints. However, I will check an ESR and a CRP. If these are normal, that will be very reassuring. I will also check an x-ray of this right hip to look for any signs and symptoms of inflammation or instability there.
3. Elevated sugars. If the patient had more signs of this being a systemic infection, could easily be ascribed to that. However, those were not present. If the ESR is normal, it makes these sugars more worrisome. I will check a hemoglobin A1c and check a fasting glucose in the morning with a BMP for further evaluation of this.
4. Hypothyroidism. The patient will continue on her outpatient dose and a TSH will be checked in the a.m.
5. Hypertension. The patient does not have a diagnosis of hypertension, but had blood pressure up to 165/83. This will continue to be followed in the hospital and if it continues to be elevated, the pain will likely need to be started on an

antihypertensive at discharge or possibly with followup as an outpatient.

6. Prophylaxis. The patient is at high risk for deep venous thrombosis having had a previous deep venous thrombosis and has poor flow in this left leg. The patient will be given Lovenox 40 mg subcu daily. The patient is low risk for gastrointestinal prophylaxis, so a proton pump inhibitor will not be prescribed.

FP-RES BRANDON MICKELSEN, D.O.

\: arb /: 793 ID: 001408973
JOB: 277764 TIME: 0305

Hospital Course -

Patient admitted to MS-overflow. Newly diagnosed diabetic requiring Lantus + sliding scale. Pain well controlled on Naprosyn + Morphine. Cultures grew out Klebsiella sensitive to Ancef. Pt will require ortho consult for definitive management of prosthetic joints.

Ryan Zimmerman MD

15:04 08/23/2007

PORTNEUF MEDICAL CENTER
651 Memorial Drive
Pocatello, Idaho 83201
(208) 239-1000

CONSULTATION REPORT

PT NAME: NIELD, JUDY
PT DOB: [redacted] PT AGE: 65Y
ADMIT: 08/21/2007
DISCH:

ROOM: MS-0003-1
MR: 125192
ACCT: 3865462
PT TYPE: I
DD: 08/23/2007
TD: 1441
DT: 08/23/2007

CONSULTING PHYSICIAN: KENNETH E. NEWHOUSE, M.D.

REQUESTING PHYSICIAN:

DATE OF CONSULTATION: 08/23/2007

IDENTIFICATION
A 65-year-old female.

CHIEF COMPLAINT
Cellulitis and right hip pain.

HISTORY
The patient does have a fairly long complicated history in which she had bilateral total hip replacements done approximately 13 years ago done by Dr. William Mott, now deceased.

The patient evidently had some sort of sciatic nerve injury to the left hip at or around the time of surgery and since the time of surgery she has had difficulty with feeling in her left leg and moving her ankle up and down.

The patient was ambulatory until about two years ago when she evidently fell coming out of a grocery store. She was at that point seen and evaluated by Dr. B.J. Blair. The patient states she had radiographs of her spine. She is not sure if she had radiographs of her hip but was at any rate given a reasonably clean bill of health and did reasonably well until about three months ago when, without any type of insult or injury whatsoever, she lost the ability to ambulate.

She has evidently been dealing with chronic cellulitis in her lower extremities, treated with hyperbarics, p.o. antibiotics and the like. She presented to the hospital approximately 36 hours ago with increasing pain and soreness in her right hip as well as increasing cellulitis. She was admitted to the hospital and started on IV antibiotics. I was consulted approximately 24 hours after her admission because of right hip pain. Radiographs had been obtained (they were not evaluated by a clinician at that point). I was asked to see her, wondering whether or not her right hip could be infected.

The patient's past medical history is well documented in the clinic notes but from an orthopedic standpoint again, she says she has not

ambulated for approximately three months and she states she really is not having no pain at all in her left leg.

Examination of her left leg shows the left leg is at least 2 inches shorter contrary to her right leg and general range of motion causes her very little discomfort. She has a fair amount of cellulitis and open blistering of her left lower extremity. It should also be noted she has essentially no sensation in her left foot and calf area.

Examination of the right leg shows she is grossly neurovascular intact. She has much less cellulitis and open areas on the right leg but has fair amount of pain both laterally and anteriorly with range of motion of her hip.

Radiographs were reviewed. The radiographs consist of an AP pelvis. The patient has a fracture dislocation of her left total hip replacement. The cup has been disassembled from the native acetabulum and there is a central acetabular fracture. The hip is dislocated with the femoral head sitting at least two inches proximal to the native acetabulum. There also appears to be some loosening of the right hip acetabular component but the hip is grossly located, the cup is somewhat vertical.

This is a difficult problem that I believe the patient has what appears to be a Charcot left leg and at least a chronic dislocation and injury to this without any evidence of trauma whatsoever.

The patient could also have seeded both of her hips, the left and the right, with her cellulitis and is now complaining of pain and loosening of the right hip. On the other hand, she simply could have a loose acetabulum which could be causing her discomfort.

Antibiotics are started prior to any type of aspiration and therefore any aspiration studies we get are equivocal.

On a positive note, the patient is not septic at this point.

I think medical management at this point should consist of continuing with antibiotics but I have recommended last evening, when I saw the patient, aspiration of her hip. At the time of this dictation this still has not been done yet. This is scheduled.

Unfortunately the results of this aspiration are going to be compromised because of starting the antibiotics. However, if we obtain a considerable amount of white blood cells we can assume that the hip is infected.

Unfortunately, if the hip is infected I think the only option would be a two stage exchange. Given the fact that the patient has Charcot hip on

the other side and the fracture is noted in the disassembly of the components, this would basically give her no lower extremity on which she can stand.

With respects to operative treatment for the left leg this would be difficult. Revision could be performed but given the fact that she has a Charcot leg she very likely may end up with similar circumstances in the future.

In any event, I think this should probably be done by a total joint revision specialist. We will await the aspiration results and discuss this further.

I have discussed this case at length with Dr. Routson as well as Dr. Zimmerman and they concur with this plan.

KENNETH E. NEWHOUSE, M.D.

\: db /: 975 ID: 001409310
JOB: 278063 TIME: 1436

fx: KENNETH E. NEWHOUSE, M.D. (00975)
>

LABORATORY
White count was 7.6, hemoglobin 13.7, hematocrit 40.6, platelets 229. BMP revealed a glucose of 177, creatinine 1.0, and electrolytes were fine. The patient's albumin was a little bit low at 3.1. The rest of her liver function tests were otherwise normal.

The patient had a venous and arterial ultrasound of her left extremity. The arterial ultrasound showed an abnormal wave form consistent with proximal arterial disease, likely at the iliacs or distal abdominal aorta. The venous ultrasound showed disease in the common femoral vein consistent with a chronic DVT.

ASSESSMENT AND PLAN

1. Left lower extremity cellulitis. I believe that there is a cellulitic component to the patient's infection. However, I believe that is not the greatest component. The patient has chronic edema ulcerations on and off, most recently for the last three months. The patient has arterial and venous disease and so this is more of a picture of arterial and venous disease. However, given the patient's poor circulation, she is at high risk for infectious disease and I suspect that there is some component of infectious disease here. The patient also has elevated sugar, so it is a worry that the patient may be a diabetic or borderline diabetic and also has bilateral artificial hips. Given all of this, I feel that it would be in the patient's best interest to be admitted for IV antibiotics at least until cultures are back. We will admit the patient on Primaxin 500 mg every 8 hours IV, as well as Vancomycin 1 gram every 24 hours IV. Wound and blood cultures were sent in the Emergency Room. The patient has been seen in the past by hyperbarics. Hyperbarics will be consulted for further evaluation of this wound and in preparation for further outpatient treatment.
2. Right hip pain. It is unlikely being that the patient is afebrile and has a normal white count that the patient has seeded one of the artificial joints. However, I will check an ESR and a CRP. If these are normal, that will be very reassuring. I will also check an x-ray of this right hip to look for any signs and symptoms of inflammation or instability there.
3. Elevated sugars. If the patient had more signs of this being a systemic infection, could easily be ascribed to that. However, those were not present. If the ESR is normal, it makes these sugars more worrisome. I will check a hemoglobin A1c and check a fasting glucose in the morning with a BMP for further evaluation of this.
4. Hypothyroidism. The patient will continue on her outpatient dose and a TSH will be checked in the a.m.
5. Hypertension. The patient does not have a diagnosis of hypertension, but had blood pressure up to 165/83. This will continue to be followed in the hospital and if it continues to be elevated, the pain will likely need to be started on an

antihypertensive at discharge or possibly with followup as an outpatient.

6. Prophylaxis. The patient is at high risk for deep venous thrombosis having had a previous deep venous thrombosis and has poor flow in this left leg. The patient will be given Lovenox 40 mg subcu daily. The patient is low risk for gastrointestinal prophylaxis, so a proton pump inhibitor will not be prescribed.

FP-RES BRANDON MICKELSEN, D.O.

\: arb /: 793
JOB: 277764

ID: 001408973
TIME: 0305

MIELD, JUDY
5/26/42 F 065 8/21/07
3865462
CREE, JONATHAN
00125192

Faculty Admit/Progress Note

Date: 8/21/07 Time: 23:52 a.m. (p.m.)
Attending: Wright / Cree
Resident: Mickelson
CC/Dx: Venous stasis ulcer with cellulitis (L) leg (R) hip pain s/p hip replacement
Interval History (1-3 elements for 221/222, 4+ elements for 223 or admit)
Increasing leg swelling & ulceration for ~3 mos [illegible] with home health dressing changes & elevation, worse recently, felt [illegible] today.
chronic numbness (L) leg since hip replacement. (L) DVT 2 yrs ago [illegible] & post phlebitic syndrome since. Poor wound [illegible] to heal
PFSH (One for 223, PMHx for admit) As above, Hypothyroid, chronic neck & back pain, DVT (L) 2 yrs ago, s/p (R) hip replacement, [illegible] ETOH, [illegible]

ROS: Check if not an issue, Circle if problematic, (One system for 222, 2-9 systems for 223)				☑ Resident admit note reviewed
General	☑ Chills	☐ Poor appetite	☑ Weakness	
Cardiac	☑ Chest Pain	☐ Palpitations	☐ Diaphoresis	
Pulmonary	☑ Cough	☐ Wheezing	☑ Labored breathing	☑ Concur with resident
GI	☑ N/V	☐ Diarrhea	☑ Ab pain	Fam Hx, Soc Hx & ROS
Psychiatric	☐ Depression	☐ Anxiety	☐ Insomnia	
Other:	Has pain in (R) hip with movement. No sensation (L) leg.			

PHYSICAL EXAM: Check findings or make note. (221 - 1-5, 222 = 6-11, 223 = 12+) 97% RA

Vitals:	T 97.0 P 80 BP 119/76	RR 20 Wt.	I/O
General	A&O NAD		**ADDITIONAL FINDINGS**
Head	☑ Normocephalic	☐ No traumatic wound/crepitis	
Eyes	☐ PERRL ☑ EOMI ☑ Conjunctivae clear		
ENT	☑ Ext structures well formed ☐ Normal teeth/lips/gums	☐ EACs/TMs clear ☑ Pharynx pink & moist	
Neck	☐ Supple/full ROM	☑ Nodes/thyroid not enlarged	
Back	☐ Normal curvature	☑ CVA/SP non-tender	
Lungs	☑ Symmet excursion	☑ Clear ausc ☐ Clear percuss	
CV	☑ RRR ☐ Normal S1, S2, no M/G/R ☐ Neck veins flat		
Ab	☑ Nrl contour ☑ Active BS	☑ Content soft/non-tender	
GU	☐ Normal ___ on Inspection	☐ No masses/tenderness	
Ext	☐ Full ROM ☐ No edema	☐ Nrl pulses/perfusion	(L) leg bandages - bandages not removed
Skin	☐ No rash or breakdown	☐ Warm & dry	
Neuro	☐ DTRs 2+/sym	☐ Motor 5/5	No sensation or movement (L) foot
MS	☑ Oriented x3 ☑ Appropriate affect ☐ Recall 3 items @ 5 min		

IMAGING	EKG	LABS
		WBC 7.6, Glu 171, CMP [illegible] CRP 15.4, ESR 52.

(231 - Responding to RX, 232 - Poor resp/minor complications, 233 - Unstable/major complications)

Problems & Plans

1. Cellulitis, venous stasis ulcer - Start IV antibiotics - Hyperbaric wound consult, Elevate leg
2. (R) hip pain - no injury, s/p hip replacement, X-ray [illegible] [illegible] [illegible] in [illegible] [illegible] ROM [illegible] X-ray.

1) VTE prophylaxis
2) Stress ulcer prophylaxis

I personally supervised Dr. Mickelson E & M Signed: [signature]

ISU STUDENT ED
WORKSHEET

DOC NO ED00053 (01/08/07) SD

08/24/2007 FRI 14:30 FAX 208 239 1939 PORTNEUF EMERGENCY ROOM 003/012

PCRC00016

3:36 08/22/2007

PORTNEUF MEDICAL CENTER
651 Memorial Drive
Pocatello, Idaho 83201
(208) 239-1000

HISTORY AND PHYSICAL

PT NAME: NIELD, JUDY
ROOM: MS-0003-1
MR: 125192
ADMIT: 08/21/2007
ACCT: 3865462
DISCH:
PT TYPE: I
ATTN PHYS: JONATHAN CREE, M.D.
DD: 08/21/2007
PT DOB: [redacted] PT AGE: 65Y
TD: 1924
DT: 08/22/2007

CHIEF COMPLAINT
Left leg infection.

HISTORY OF PRESENT ILLNESS
The patient is a 65-year-old female with a previous history of DVT with chronic edema and some ulceration in her left lower extremity as well as being insensate from the knee down, who presents to the Emergency Room with worsening oozing and redness in her left lower extremity. The patient reports that approximately three months ago, she had a clear blister posteriorly of her distal left lower extremity. They popped the ulceration, and since then that area has been getting progressively worse and has proceeded to move around toward the front. The patient reports that her leg is normally incredibly swollen. Today it is much better as she was on her back with her leg elevated all day yesterday. The swelling has been going on since the DVT she had approximately one year ago in this left leg. The patient was on Coumadin for six months and then requested not to be on it any longer. The patient denies any fevers. The patient has no pain in this area, so denies any pain. Again she has no feeling, so no numbness or tingling in that area. The patient denies any weakness, any weight changes. The patient has a bilateral hip prosthesis and does report increased pain in her right hip prosthesis and that is why she was actually on her back yesterday was because of the pain in this right hip.

The patient has been having Home Health come for the last week or so to help with dressing changes and the patient reports that approximately four to five weeks ago, she was on antibiotics for a few days. They were leftover antibiotics that she had from a dental procedure previously.

PAST MEDICAL HISTORY
Remarkable for the DVT as stated above, hypothyroidism, and the patient has had bilateral hip replacements. The patient has not had any colonoscopies or colon cancer screening.

SOCIAL HISTORY
The patient is widowed. She lives alone. She has about a 15 pack/year history of tobacco in the distant past and has occasional alcohol use.

CODE STATUS
DNR/DNI.

MEDICATIONS
The patient is on.
1. Hydrocodone 10/325 p.o. every 4 hours p.r.n. pain.
2. Diclofenac 50 mg p.o. every day for pain.
3. Levothyroxine 50 mcg p.o. daily.

FAMILY HISTORY
No blood clots in the family history. The patient reports that her mother had colon cancer in her mid-30's.

ALLERGIES
No known drug allergies.

REVIEW OF SYSTEMS
The patient has been in a wheelchair for approximately the last three months due to the swelling and pain and difficulty walking due to the feeling in this left leg and weakness and pain in the right leg. The patient denies any weight changes. The patient denies any night sweats, any weakness, any chest pain, any shortness of breath, no cough.

PHYSICAL EXAMINATION
VITAL SIGNS: Temperature 98.8, pulse 96, blood pressure 165/83, respirations 20 and the patient was satting 95% on room air.
GENERAL: The patient is in no acute distress. She is awake, alert, and oriented. She is pleasant and cooperative during the exam.
HEENT: Pupils are equal, round, and reactive to light and accommodation. Sclerae and conjunctivae are normal. Mouth and pharynx are without lesions or exudate. Tympanic membranes were unable to be visualized bilaterally due to cerumen. Hearing to finger rub was intact.
NECK: Soft and supple, no lymphadenopathy, no thyromegaly, no carotid bruits.
HEART: Regular rate and rhythm, no murmurs, rubs, or gallops.
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ABDOMEN: Abdomen appeared to be mildly distended, was nontender, no peritoneal signs.
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Radiographs were reviewed. The radiographs consist of an AP pelvis. The patient has a fracture dislocation of her left total hip replacement. The cup has been disassembled from the native acetabulum and there is a central acetabular fracture. The hip is dislocated with the femoral head sitting at least two inches proximal to the native acetabulum. There also appears to be some loosening of the right hip acetabular component but the hip is grossly located, the cup is somewhat vertical.

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Antibiotics are started prior to any type of aspiration and therefore any aspiration studies we get are equivocal.

On a positive note, the patient is not septic at this point.

I think medical management at this point should consist of continuing with antibiotics but I have recommended last evening, when I saw the patient, aspiration of her hip. At the time of this dictation this still has not been done yet. This is scheduled.

Unfortunately the results of this aspiration are going to be compromised because of starting the antibiotics. However, if we obtain a considerable amount of white blood cells we can assume that the hip is infected.

Unfortunately, if the hip is infected I think the only option would be a two stage exchange. Given the fact that the patient has Charcot hip on

the other side and the fracture is noted in the disassembly of the components, this would basically give her no lower extremity on which she can stand.

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In any event, I think this should probably be done by a total joint revision specialist. We will await the aspiration results and discuss this further.

I have discussed this case at length with Dr. Routson as well as Dr. Zimmerman and they concur with this plan.

KENNETH E. NEWHOUSE, M.D.

\: db /: 975 ID: 001409310
JOB: 278063 TIME: 1436

fx: KENNETH E. NEWHOUSE, M.D. (00975)
>

Portneuf MEDICAL CENTER
EST CAMPUS
MEMORIAL DRIVE
POCATELLO, IDAHO 83201
EAST CAMPUS
777 HOSPITAL WAY
POCATELLO, IDAHO 83201

CLINICAL LABORATORY

COLLEGE OF AMERICAN PATHOLOGISTS CERTIFIED
COPY TO MEDICAL RECORDS

PATHOLOGIST:
S.M. SKOUMAL, M.D.

DOC NO 180001 (11/06)
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/21/2007 23:52 PAGE: 1
NIELD,JUDY MR 125192
05/26/1942(65Y F) BN 3865462 MS

ORDERED BY: MICKELSEN, BRANDON FP-RES
COLLECTED ON: 08/21/2007 @ 21:00 ACCESSION: L0847973

MICROBIOLOGY/SEROLOGY

ANAEROBE CULTURE ACC #: L0847973
Source: WOUND,LEFT LEG Set-up: 08/21/2007 2345
Status: FINAL
RESULTS
NO ANAEROBES ISOLATED IN 48 HOURS

EXHIBIT
B
PENGAD 800-631-6989

H-HIGH L-LOW #-SIGNIFICANT CHANGE FROM PREVIOUS RESULT UNK-UNKNOWN NA-NOT APPLICABLE ND-NOT DONE PND-PENDING ★-FOOTNOTE

ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/21/2007 23:53 PAGE: 1
NIELD,JUDY MR 125192
05/26/1942(65Y F) BN 3865462 MS

ORDERED BY: BRADBURY, ANDREW
COLLECTED ON: 08/21/2007 @ 21:00 ACCESSION: L0847960

MICROBIOLOGY/SEROLOGY

WOUND CULTURE ACC #: L0847960
Source: WOUND,LEFT LEG Set-up: 08/21/2007 2345
Status: FINAL
GRAM STAIN
1+ WBC'S - 1+ GRAM NEGATIVE RODS
1+ GRAM POSITIVE COCCI
RESULTS
MODERATE GRAM POSITIVE COCCI
MODERATE COAG-NEG STAPH SPECIES
MODERATE BETA HEMOLYTIC STREPTOCOCCI,NOT GROUP A,B OR D
(NO FURTHER IDENTIFICATION)

LIGHT GRAM NEGATIVE RODS
LIGHT KLEBSIELLA PNEUMONIAE

ANTIMICROBICS	KLEBSIELLA PNEUMONIAE MIC uG/ML BLD	UR
AMOXICILLIN/K CLAVULANATE	<=8/4	S
AMPICILLIN	16	I
AMPICILLIN/SULBACTAM	<=8/4	S
AZTREONAM	<=8	S
CEFAZOLIN	<=8	S
CEFTAZIDIME	<=1	S
CEFTRIAXONE	<=8	S
CEFUROXIME	<=4	S
CIPROFLOXACIN	<=1	S
ERTAPENEM	<=2	S
GENTAMICIN	<=1	S
IMIPENEM	<=4	S
LEVOFLOXACIN	<=2	S
PIPERACILLIN/TAZABACTAM	<=16	S
TETRACYCLINE	<=4	S
TRIMETHOPRIM/SULFAMETHOX	<=2/38	S

REPORT CONTINUED ON NEXT FORM

Portneuf MEDICAL CENTER
WEST CAMPUS MEMORIAL DRIVE POCATELLO, IDAHO 83201
EAST CAMPUS 777 HOSPITAL WAY POCATELLO, IDAHO 83201

CLINICAL LABORATORY

COLLEGE OF AMERICAN PATHOLOGISTS CERTIFIED

CONTINUE
S.M. SKOUMAL, M.D.

DOC NO. LB00011 (11/06)
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/21/2007 23:53 PAGE: 2

NIELD,JUDY
05/26/1942(65Y F)

MR 125192
BN 3865462 MS

ORDERED BY: BRADBURY, ANDREW
COLLECTED ON: 08/21/2007 @ 21:00 ACCESSION: L0847960

MICROBIOLOGY/SEROLOGY

WOUND CULTURE
Source: WOUND,LEFT LEG
Status: FINAL

ACC #: L0847960
Set-up: 08/21/2007 2345

S=Susceptible I=Intermediate R=Resistant N/R=Not Reported
BLANK=Drug not advisable BLAC=Beta Lac Pos TFG=Thymidine dependant
INTERPRETATIONS BASED ON APPROX. ADULT ATTAINABLE BLOOD/URINE LEVELS.
IB APPEARS IN PLACE OF INTERP W/ORG'S W/KNOWN INDUCIBLE B-LACTAMASES.
S.aureus and Coag neg Staph species tested for Inducible Resistance
to Clindamycin, results reported as MIC interpretation

Portneuf MEDICAL CENTER
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CLINICAL LABORATORY

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PATHOLOGIST:
S.M. SKOUMAL, M.D

DOC NO LB0001: (11/06
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/23/2007 18:47 PAGE: 1
NIELD,JUDY MR 125192
05/26/1942(65Y F) BN 3865462 MS

ORDERED BY: CREE, JONATHAN
COLLECTED ON: 08/23/2007 @ 13:30 ACCESSION: L0848712

MISCELLANEOUS

MISC FLUID CELL COUNT			
FLUID TYPE	SYNOVIAL		
VOLUME	3	mL	
APPEARANCE	YELLOW, CLOUDY		CLEAR
RBC count	10250	per uL	
WBC'S	3	uL	(0-25)

** Test performed at: WEST

Portneuf MEDICAL CENTER
ST CAMPUS
MEMORIAL DRIVE
POCATELLO, IDAHO 83201
EAST CAMPUS
777 HOSPITAL WAY
POCATELLO, IDAHO 83201

CLINICAL LABORATORY

COLLEGE OF AMERICAN PATHOLOGISTS CERTIFIED
COPY TO MEDICAL RECORDS

PATHOLOGIST:
S.M. SKOUMAL, M.D.

DOC. NO. LB00011 (11/06)
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/23/2007 06:59 PAGE: 1
NIELD,JUDY
[redacted] 65Y F)
MR 125192
BN 3865462 MS

ORDERED BY: ZIMMERMANN, RYAN, FP--RES
COLLECTED ON: 08/23/2007 @ 06:00 ACCESSION: L0848159

CHEMISTRY

CRP	17.1	H	mg/dL	(0.1-0.9)

The assay used in PMC lab has an extended range. It is therefore useful for assessing both high sensitive CRP (hsCRP) AND traditional less sensitive CRP. High sensitivity assays for CRP may add to the predictive value of other markers used to assess the risk of cardiovascular and peripheral vascular disease. Low sensitive CRP may be useful for the detection and evaluation of infection, tissue injury, inflammatory disorders and associated diseases.
Separate reference ranges are listed with hsCRP and CRP results.
** Test performed at: WEST

CLINICAL LABORATORY

COLLEGE OF AMERICAN PATHOLOGISTS CERTIFIED
COPY TO MEDICAL RECORDS

PATHOLOGIST:
S.M. SKOUMAL, M.D.

DOC NO L800011 (11/06)
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/23/2007 17:38 PAGE: 1
NIELD,JUDY MR 125192
05/26/1942(65Y F) BN 3865462 MS

ORDERED BY: CREE, JONATHAN
COLLECTED ON: 08/23/2007 @ 13:30 ACCESSION: L0848708

MICROBIOLOGY/SEROLOGY

BODY FLUID CULTURE ACC #: L0848708
Source: BODY FLUID,SYNOVIAL Set-up: 08/23/2007 1736
Status: FINAL
GRAM STAIN
2+ WBC'S - NO ORGANISMS SEEN
RESULTS
SOURCE IS RT HIP
NO GROWTH IN 24 HOURS
NO GROWTH IN 48 HOURS

Portneuf MEDICAL CENTER
WEST CAMPUS
MEMORIAL DRIVE
POCATELLO, IDAHO 83201
EAST CAMPUS
777 HOSPITAL WAY
POCATELLO, IDAHO 83201

CLINICAL LABORATORY

COLLEGE OF AMERICAN PATHOLOGISTS CERTIFIED
COPY TO MEDICAL RECORDS

PATHOLOGIST:
S.M. SKOUMAL, M.D

DOC. NO. LB00011 (11/06
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ATTENDING PHYS:
CREE, JONATHAN

** FINAL** REPORTED: 08/23/2007 17:38 PAGE: 1
NIELD,JUDY MR 125192
05/26/1942(65Y F) BN 3865462 MS

ORDERED BY: ZIMMERMANN, RYAN, FP--RES
COLLECTED ON: 08/23/2007 @ 16:05 ACCESSION: L0848620

MICROBIOLOGY/SEROLOGY

ANAEROBE CULTURE ACC #: L0848620
Source: JOINT,HIP Set-up: 08/23/2007 1736
Status: FINAL
RESULTS
SOURCE IS RT HIP
NO GROWTH ANAEROBICALLY IN 48 HOURS

POCATELLO CARE & REHAB CENTER

Record of Admission

Date: 08/31/07
Time: 10:53:15

First Name	Middle	Last Name		
JUDY		NIELD		Insert Photo
Admit # 1	Gen F	BirthDate [redacted]	Age 65	M/S M
Race White		Phone (208)237-4079		
Address 260 ADAMS STREET			M/R # 223538	

City	ST	Zip Code	Admit Date	ReAdmit Date	Return Date
CHUBBUCK	ID	83202 -	08/25/07 14:00	/ / : :	/ / : :

Soc Sec #	Medicare #	Medicaid #	Payor	Care Level
[redacted]			MEDICARE A	Skilled

PLACE OF BIRTH:	PRIOR STAY
RELIGION	OTHER INSURANCE
OCCUPATION	POLICY #
ADMIT FROM: PMC	AUTHORIZATION #
QUALIFYING STAY 08/21/2007 - 08/25/2007	MCR PART D

	Phone	Address	City	St.	Zip
Attending Physician JONES, DANIEL	(208)282-4700 F(208)282-4696	465 Memorial Dr	Pocatello	ID	83201
Alternate Physician					
Hospital					
Funeral Home					
Dentist					
Pharmacy					
Ambulance					
Primary Contact Barbara Larson Friend	H(208)232-5320				
Financial Contact Judy Nield Self	H(208)237-4079	260 ADAMS STREET	Chubbuck	ID	83202
Contact					

Admitting Diagnosis
682.6 - CELLULITIS OF LEG *** 835.00 - DISLOCAT HIP NOS-CLOSED *** 719.7 - DIFFICULTY IN WALKING *** 250.00 - DIABETES MELLITUS WITHOUT MENTION OF COMPLICATION, *** 244.9 - HYPOTHYROIDISM NOS *** V57.1 - PHYSICAL THERAPY NEC *** V57.21 - ENCNTR OCCUPATNAL THRPY ***

Allergies
NKDA

EXHIBIT C

PENGAD 800-631-6989

PDP Carrier:

PDP Plan:

Building:Memorial Floor:Floor 1 Hall:Hall A Room:Room 01 Bed:Room 01a

Name: JUDY NIELD RM/BED / ADM # 1 M.R. # 223538

ICD9: 682.6 **Type:** Admission **Date:** 08/25/2007 **P/S** Primary
Description: CELLULITIS OF LEG

ICD9: 835.00 **Type:** Admission **Date:** 08/25/2007 **P/S** Secondary
Description: DISLOCAT HIP NOS-CLOSED

ICD9: 719.7 **Type:** Admission **Date:** 08/25/2007 **P/S**
Description: DIFFICULTY IN WALKING

ICD9: 250.00 **Type:** Admission **Date:** 08/25/2007 **P/S**
Description: DIABETES MELLITUS WITHOUT MENTION OF COMPLICATION,

ICD9: 244.9 **Type:** Admission **Date:** 08/25/2007 **P/S**
Description: HYPOTHYROIDISM NOS

ICD9: V57.1 **Type:** Admission **Date:** 08/25/2007 **P/S** **Resolved:** 09/24/2007
Description: PHYSICAL THERAPY NEC

ICD9: V57.21 **Type:** Admission **Date:** 08/25/2007 **P/S** **Resolved:** 09/12/2007
Description: ENCNTR OCCUPATNAL THRPY

Comprehensive Resident Assessment

Admission Date: 8/25/1 Time: 1400 Transported By: Cart

Accompanied By: CHudson RN Age: _____ Sex: F

T: 97.8 P 80 (Reg ✓ Irreg ___) R 16 B/P 131/70 Weight 150 Height: 5 ft 4 in

Attending Physician notified of admission: [✓] Yes [ ] No Time 1400 AM / PM Date: 8/25/07

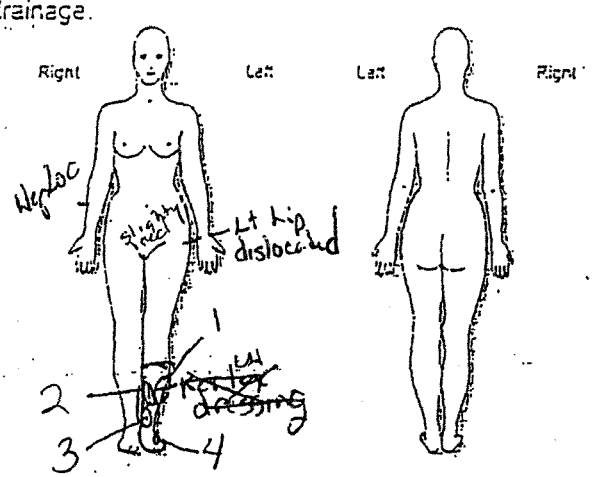
Allergies (with reaction): Medications _____

Allergies: Food NONE

Other _____

Date of last chest x-ray or PPD: ___/___/___ Results for TB: [ ] Positive [ ] Negative

Skin Condition: Indicate below all body marks such as old or recent scars (Surgical and other) bruises, discolorations, abrasions, pressure ulcers or any questionable markings. Indicate size, depth (in. cms), color and drainage.



Comments:
Lt Lower leg numb.

Special Treatments & Procedures:
Mepilex sponges to Open areas one Lt lower leg & foot.
#1 11cm long 10cm at widest point
#2 9cm x 9cm
#3 5cm x 4cm
#4 2cm x 2cm

General Skin Condition: [ ] Reddened [ ] Pale [ ] Jaundiced [ ] Cyanotic [ ] Ashen [✓] Dry [ ] Moist [ ] Oily [✓] Warm [ ] Cold [ ] Edema [ ] Site of Edema

Paralysis/Paresis: site: _____

Contracture: site: _____

Congenital anomolies: _____

Prosthesis: [ ] Glasses [ ] Dentures – Upper [ ] Dentures – Lower [ ] Hearing Aide [ ]

Other: _____

Functional Status

Transfers: – able to transfer

[ ] Independently
[ ] 1 person assist
[ ] 2 person assist
[✓] Total assist

Ambulation – able to ambulate

[ ] Independently
[ ] 1 person assist
[ ] 2 person assist
[ ] with device. _____
[ ] Wheelchair only
[ ] Wheelchair/propels self
[✓] Bed rest

Weight bearing – able to bear

[ ] Full weight
[ ] Partial weight
[✓] Non-weight bearing

Supportive devices used

[ ] Elastic hose [ ] Footboard
[ ] Bed cradle [ ] Air mattress
[ ] Sheepskin [ ] Egg crate
[ ] Hand rolls [ ] Trapeze
[ ] Sling

Traction: Where _____
When _____
Other _____

Judy Reed Jones B-38

Resident name: Physician: Room/Bed: Admit Date: Birth Date:

Residents Name: Judy Nield

Admitting Physician: Dr. Zimmerman

Attending Physician: Dr. Jones

Primary Diagnosis: 1) Cellulitis

Secondary Diagnosis: 2) (L) hip dislocation + (R) hip pain
2) Newly Dx Diabetes

POCATELLO CARE & REHABILITATION

Admit to: (Skilled) Intermediate

Certification - Medicare Patients Only (struck through: Medicare)

I certify that post-hospital skilled nursing services are required to be given on an inpatient basis are required because of the above named patient's need for skilled nursing care on a continuing basis for the condition(s) for which he/she was receiving inpatient hospital services prior to his/her transfer or discharge to the facility.

Date: 8/25/07 M.D. Signature: Ryan Zimmerman MD

Facility Standing Orders

- 2 Step PPD Test
- Pneumovax on admission if indicated
- Annual influenza vaccine
- Follow Bowel and Bladder protocol
- Follow Skin protocol
- Follow facility protocol to discontinue orders for medication or treatments not used in 60 days.
- Dental/Vision/Podiatry consults PRN
- Tylenol 325 1-2 tabs every four hours PRN for mild post-op chronic pain: moderate or severe pain use other pain meds per M.D.
- May go off premises with Family and/or Staff for therapeutic activities

Rehab Potential: X Good __ Fair __ Poor

Diet: Diabetic.

Allergies: NKDA

CPR Status: DNR / I

Labs:

Oxygen at Ø LPM

Nasal canula Mask Other

Dressing Changes: Left Lower Extremity

Type of Dressing:

Treatments: Associated Diagnosis:

Medications: **Associated Diagnosis:**

✓ Colace 100 mg PO 2x daily constipation
✓ Synthroid 0.05 mg PO daily Hypothyroid
✓ Lovenox 40 mg SC daily DVT prophylaxis
✓ Naprosyn 500 mg PO 2x daily prn pain
✓ Lantus 20 units SC q hs newly dx diabetes
✓ Cefazolin 1000 mg IV q 8° x 6 weeks
✓ Morphine 2-4 mg IV q 2° prn pain
Phenergan 6.25 mg IV q 4° prn nausea
~~Novolog~~
✓ Metformin 500 mg PO q hs DM

Orthopedics consult for planning definitive management of prosthetic joints. MD will call.

Therapy (please check all applicable therapies)

X PT Eval & Tx Wt bearing status NWB
X OT Eval & Tx
O ST Eval & Tx
O Swallow Evaluation

Admit orders

Noted [signature]

Noted 8/25/07 1800 [signature]

M.D. Signature: Ryan Zimmerman MD

Date:

PCRC00011