

ADIL BUSINESS SYSTEMS, INC.

EMPLOYEE HANDBOOK

Year - 2026



**55 Mineola Blvd.
Suite 3
Mineola, NY- 11501
www.adil.com**

TABLE OF CONTENTS

SECTION 1: WELCOME AND INTRODUCTION	1
1.1. Message from the CEO	1
1.2. Company Background & Description	2
1.3. Company Mission & Vision.....	2
1.4. Company Contact Information.....	2
1.5. Employee Handbook Terms.....	2
1.6. A Word about this Handbook	3
SECTION 2: LAWS AND PRACTICES	4
2.1. Equal Employment Opportunity (EEO).....	4
2.2. Americans with Disabilities Act.....	4
2.3. Immigration Law	5
2.4. At-Will Employment	5
2.5. Harassment and Discrimination Policy	5
2.6. General Safety and OSHA	7
SECTION 3: COMPANY POLICIES AND PROCEDURES	8
3.1. Code of Ethics	8
3.2. Conflict of Interests.....	8
3.3. Non-Compete/ Non-Solicitation Policy	8
3.4. Outside Employment	8
3.5. Relationship With Competitors	9
3.6. Code of Professional Conduct.....	9
3.7. Confidentiality	10
3.8. Employee Relations Philosophy	11
3.9. Communications and Open Door Policy	11
3.10. Certification and Licensing	11
3.11. Provisional/ Introductory Period	11
3.12. Work Schedules and Time Cards	12
3.13. Breaks and Meal Periods	12
3.14. Attendance, Punctuality, and Reporting Absences	12
3.15. Inclement Weather/ Emergencies	13
3.16. Personnel Records.....	13
3.17. Expense Policy.....	13
3.18. Zero Tolerance or Workplace Violence Prevention Policy	14
3.19. Dress Code and Public Image.....	14
3.20. Safety in the Workplace	14
3.21. Smoking Policy.....	15
3.22. Information Security Policy.....	15
3.23. Drug and Alcohol Free Workplace	16
3.24. General Policies	17
SECTION 4: EMPLOYEES WORKING AT THE CLIENT SITE.....	19
4.1. Employment	19
4.2. What is Expected of You	19
4.3. When to Contact Adil.....	20
SECTION 5: YOUR PAY AND PROGRESS	21
5.1. Employment Classifications	21
5.2. Payroll Policies & Paycheck Deductions.....	21

5.3. Direct Deposit.....	22
5.4. Recording Your Time	22
5.5. On Call	22
5.6. Overtime.....	23
5.7. Performance Reviews	23
SECTION 6: HOLIDAYS, PTO, AND OTHER LEAVE	24
6.1. Holidays.....	24
6.2. Paid Time Off (PTO)	24
6.3. Family and Medical leave.....	25
6.4. Maternity Leave.....	26
6.5. Bereavement Leave	26
6.6. Jury Duty & Court Appearance.....	27
6.7. Voting Leave	27
6.8. Break Time for Nursing Mothers	27
6.9. Personal Time Off- Brief Periods.....	27
6.10. Military Service Leave	28
SECTION 7: BENEFITS	29
7.1. Group Health Insurance	29
7.2. Continuation of Insurance under COBRA	30
7.3. Workers Compensation.....	30
7.4. Referral Bonus	30
SECTION 8: TRAVEL AND BUSINESS EXPENSES	31
8.1. Travel Expense Policy.....	31
8.2. Approval of Travel and Reimbursements	31
SECTION 9: SEPARATION FROM EMPLOYMENT.....	34
9.1. Resignation- Termination of Employment by the Employee	34
9.2. Dismissal- Termination of Employment by the Employer.....	34
9.3. Automatic Dismissal.....	34
9.4. Layoff and Recall.....	35
9.5. Company Property, Expense Reports, and Final Paycheck	35
9.6. Exit Interview	35
SECTION 10: ARBITRATION AND CHOICE OF LAW	39
SECTION 11: EMERGENCY CONTACTS.....	41
SECTION 12: MEDICAL CHECKLIST	41
SECTION 13: CORONAVIRUS DISEASE 2019 (COVID -19).....	42
SECTION 14: PATIENT RIGHTS.....	44
SECTION 15: COMPLAINT AND GRIEVANCE POLICY AND PROCEDURE PROTECTED EALT INFORMATION.....	46
SECTION 16: ADEMENTIA.....	47
SECTION 17: CODE OF ETHICS	59
SECTION 18: PROVISIONS	63
SECTION 19: HAZARD AND VULNERABILITY ASSESSMENT	64
SECTION 20: ADIL FLOAT POLICY	68
SECTION 21: NATIONAL PATIENT SAFETY GOALS.	69
SECTION 22: CDC GUIDELINES AND SAFE DATA.	70
SECTION 23: BREACH OF CONTRACT POLICY.	126
EMPLOYEE HANDBOOK ACKNOWLEDGEMENT.....	128

SECTION 1: WELCOME AND INTRODUCTION

1.1. Message from the CEO

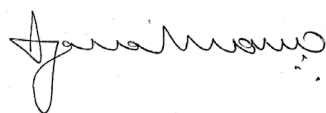
Welcome to Adil Business Systems, Inc. We are pleased you have joined our team and wish you every success here.

As an employee of Adil, the importance of your contribution cannot be overstated. You will quickly discover that at Adil, we are committed to quality and unparalleled customer satisfaction in all aspects of our business. Our goal is to provide the finest-quality services to our clients and to do so efficiently and economically. You are an important part of this process because your work directly influences our reputation. We believe that each employee contributes directly to Adil's growth and success, and hope you will take pride in being a member of our team.

Starting a new job is exciting, but at times can be overwhelming. This Employee Handbook will provide you information about the general administrative policies and procedures at Adil and also assist you in becoming familiar with some of the privileges and obligations of your employment. The policies and procedures presented within this Handbook are for information and illustrative purposes only. This Handbook does not create, express, or imply legally enforceable contractual obligations on behalf of Adil concerning any terms, conditions, or privileges of your employment. Additionally, your employment at Adil is at-will that can be terminated at any time, with or without reason or notice by either the employer or the employee.

At Adil, we value our employees, their contribution, and want them to succeed in their careers. We want you to know that you, as part of our team, are our most important and greatest asset. We could not accomplish what we do everyday without our employees. We are glad you have joined us, and hope your experience here will be challenging, enjoyable, and rewarding.

Sincerely,

A handwritten signature in black ink, appearing to read 'J. Ram Ajjarapu', with a stylized flourish at the end.

J. Ram Ajjarapu
Chief Executive Officer

1.2. Company Background & Description

Adil Business Systems, Inc. was established in 1989 with a vision to assist its clients conceptualize and realize their business initiatives. Since its inception, Adil has made a mark as one of the most reputed professional services company in the United States. Adil has been very successful in the highly competitive professional services market place by providing miscellaneous consulting based services. Over the years, Adil has earned a reputation of being an innovative and dependable partner by delivering cost effective, sustainable, and business-oriented services and solutions to our customers and partners.

1.3. Company Mission & Vision

Mission: At Adil, it is our mission to support, manage, and improve our clients' operations with the highest level of professionalism and efficiency.

Vision: Our vision is to be the world's leader in providing highest quality consulting and staffing solutions services to public and private institutions all over the world.

1.4. Company Contact Information

Locations: **New York (Corporate Headquarters)**
55 Mineola Blvd, Suite 3, Mineola, NY- 11501
Phone: 212-683-5096

New Jersey
169 Ramapo Valley Rd, Ste ML104, Oakland, NJ,07436
Phone: 267-697-1022 Ext: 402

Rhode Island
873 Warwick Ave, Warwick, RI 02888
Phone: 401-331-0755

Website: www.adil.com

Email: info@adil.com

1.5. Employee Handbook Terms

Employer: Adil Business Systems, Inc. is the employer of all full-time, part-time, and temporary employees and may also be addressed as "Adil" or the "Company".

Employee: An individual employed, provided compensation, and has his or her work directed and evaluated by Adil.

Client: Any organization using the services of Adil. The term also includes any third party that the Company is/was soliciting to be a customer at any time during the twelve month period preceding the termination of an Employee's employment here under for any reason.

Handbook: The Employee Handbook, which is a compilation of personnel policies, practices, and procedures currently in effect at Adil.

1.6. A Word about this Handbook

This Employee Handbook contains information about the Company and its employment policies and practices. You are expected to read this Handbook within one week of its receipt and direct any questions concerning any of the policies, procedures, your employment, or benefits to your Supervisor or Human Resources. The "Employee Handbook Acknowledgement Form" must be signed and returned to the Human Resources within one week of the receipt of this Handbook.

The provisions of this Employee Handbook are for information and illustrative purposes only. This Handbook does not constitute a contract for employment between Adil Business Systems, Inc. and its employees nor it is intended to create a contract guaranteeing that you will be employed for any specific period of time or for any specific type of work.

Employees of the Company are considered "at-will", and therefore, either the employee or the Company may terminate the employment relationship at any time with or without cause or notice. No person other than the President/CEO or by designee approved by President has authority to enter into any agreement for employment for any specified period of time and any such agreement must be in writing.

Except for the policy of at-will employment, the Company reserves the right to modify the provisions of this handbook at any time without further notice. No oral statements or representations can change the provisions of this Employee Handbook. The policies outlined in this Employee Handbook should be regarded as management guidelines only, which in a developing business will require changes from time to time at the discretion of the Company. The Company retains the right to make decisions involving employment as needed to conduct its work in a manner that is beneficial to the employees and the Company.

This Employee Handbook supersedes and replaces any and all prior Employee Handbooks and any inconsistent verbal or written policy statements. The contents of this Handbook are confidential and proprietary in nature and are not be divulged to anyone inside or outside the Company unless they have been authorized to receive it.

As the Company operates in various states, all policies and workplace practices will be in full compliance with all applicable state laws. If you should have any questions regarding applicable state laws, you should contact the Human Resources for further details.

SECTION 2: LAWS AND PRACTICES

2.1. Equal Employment Opportunity (EEO)

Adil is committed to provide equal employment opportunity in all of our employment practices to all qualified applicants and employees regardless of an individual's race, religion, color, gender, age, sexual orientation, gender expression/identity, national origin, disability, military status, family status, or any other status or condition protected by applicable federal, state, or local laws, except where a bona fide occupational qualification applies. This policy extends to all aspects of the employment relationship, including, but not limited to recruitment, interviewing, hiring, job assignments, training, compensation, promotion, benefits, discipline, use of facilities, participation in Adil sponsored activities, termination, and all other terms, conditions, and privileges of employment.

Each employee has the responsibility to report unlawful discrimination, whether the source of the discrimination is a co-worker, a manager, the employee of a client, or the employee of a vendor. Further, employees have a responsibility to report unlawful discrimination whether they are the person unlawfully discriminated against or merely observe the unlawful discriminatory behavior. Supervisors who become aware of unlawful discrimination, regardless of the source, must take immediate appropriate action. Employees can raise concerns and make reports without fear of reprisal. Anyone found to be engaging in any type of unlawful discrimination in violation of this policy will be subject to disciplinary action, up to and including termination of employment. You may discuss equal employment opportunity related questions with the Human Resources.

2.2. Americans with Disabilities Act

Adil is committed to complying with the Americans with Disabilities Act Amendments Act (ADAAA) of 2008, the Americans with Disabilities Act (ADA) of 1990, and its related Section 504 of the Rehabilitation Act of 1973, as applicable. The ADA requires employers to provide a reasonable accommodation to qualified individuals with known disabilities in all aspects of employment, unless the accommodation would cause an undue hardship to the employer.

A "qualified individual" is a person with a disability who meets the skill, education, experience, training, and other job-related requirements of position, and who, with or without a reasonable accommodation, can perform the essential functions of the position. ADA defines "disability" as a physical or mental impairment that substantially limits one or more of the major life activities of such individual; a record of such impairment; or being regarded as having such an impairment. "Major life activities" include but are not limited to caring for oneself, performing manual tasks, seeing, hearing, eating, sleeping, walking, standing, lifting, bending, speaking, breathing, learning, reading, concentrating, thinking, communicating, and working. All employees, including employees with serious or life-threatening illnesses, must maintain acceptable performance standards.

Adil makes every effort to ensure that qualified individuals with a disability are not discriminated against in any terms, conditions, or privileges of employment. An applicant or employee in need of a reasonable accommodation should provide a written notice to the Human Resources to enable the individual and the Company to work together to determine that an appropriate reasonable accommodation exists. Also, when appropriate, we may need your permission to

obtain additional information from your physician or other medical or rehabilitation professionals. An employee's medical information is confidential. Disclosure of employee medical information is restricted to limited situations where a Supervisor has a job-related reason to know it. Employees who disclose employee medical information without proper authorization will be subject to disciplinary action, up to and including discharge.

2.3. Immigration Law

In compliance with the Immigration Reform and Control Act of 1986 (IRCA), Immigration Act of 1990, and the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, Adil verifies the identity and employment authorization of each person hired. Adil only employs individuals who are legally authorized to work in the United States. Furthermore, Adil does not continue to employ any individual whose legal right to work in the United States has been terminated.

E-Verify is an internet-based employment verification system operated by the Department of Homeland Security (DHS) in conjunction with the Social Security Administration (SSA). Form I-9 from the system is used to verify your identity and employment eligibility. Each new employee, as a condition of employment, must complete the Employment Eligibility Verification Form 1-9 and present documentation establishing identity and employment eligibility. If you cannot verify your right to work in the United States within three days of hire, the Company is required by law to terminate your employment.

If an employee is authorized to work in this country for a limited period, the individual will be required to submit proof of renewed employment eligibility prior to expiration of that period to remain employed by the Company.

2.4. At-Will Employment

Adil Business Systems, Inc. is an at-will employer. This means that regardless of any provision in this Employee Handbook, either you or the Company may terminate the employment relationship at any time, for any reason, with or without cause or notice. Nothing in this employee handbook or in any document or statement, written or oral, shall limit the right to terminate employment at will. Any employment relationship other than at-will must be set out in writing and signed by the President of the Company. Except for an employment contract, any document or statement, written or oral, prior, current, or future that conflicts with the employment at-will policy is void.

2.5. Harassment and Discrimination Policy

Adil is proud of its work environment in which all employees are treated with respect, dignity, and courtesy. Adil does not and will not tolerate any type of discrimination or harassment of our employees, applicants for employment, or our customers. At Adil, all employees have the right to work in an environment free from any type of illegal discrimination or harassment, including racial and sexual harassment. The Company will not allow any form of harassment in the work environment, on its worksites, in its vehicles, in or near its facilities, or at company-sponsored events. Adil also strives to protect employees, to the extent possible, from reported harassment by non-employees in the workplace, including customers, clients, and suppliers.

The term harassment includes, but is not limited to, slurs, jokes, and other verbal or physical conduct relating to a person's race, religion, color, gender (including pregnancy), age, sexual orientation, gender expression/identity, national origin, disability, military status, family status, or any other status or condition protected by applicable federal, state, or local laws that unreasonably interferes with a person's work performance or creates an intimidating, hostile work environment.

Sexual harassment is defined as unwelcome or unwanted sexual advances, requests for sexual favors, and other verbal, non-verbal, or physical conduct of a sexual nature when (1) submission to or rejection of this conduct by an individual is used explicitly or implicitly as a factor in decisions affecting hiring, evaluation, promotion, or other aspects of employment; or (2) this conduct substantially interferes with an individual's employment or creates an intimidating, hostile, or offensive work environment. Examples of sexual harassment include, but are not limited to, unwanted sexual advances; demands for sexual favors in exchange for favorable treatment or continued employment; repeated sexual jokes, flirtations, advances, or propositions; verbal abuse of a sexual nature; graphic commentary about an individual's body, sexual prowess, or sexual deficiencies; leering; whistling; touching; pinching; assault; coerced sexual acts; suggestive insulting; obscene comments, gesture, text messages, voice messages, and emails; and display in the work place of sexually suggestive objects or pictures. The Company will not allow any form of sexual harassment in the work environment, on its worksites, in its vehicles, in or near its facilities, or at company-sponsored events.

Racial harassment is defined as all inappropriate conduct and activity taken against an individual because of his or her race and/or national origin. Examples of racial harassment include, but are not limited to, racial comments, racial jokes or emails, treatment of an individual differently because of his or her race, and all other activities defined by Title VII of the U.S. Civil Rights Acts of 1964.

Employees should be aware that the use of e-mail, voice mail, or other electronic messaging systems, or the Internet, might give rise to liability for harassment. Employees may not generate, should not receive, and must not forward, any message or graphic that might be taken as offensive based on sex, gender, or other protected characteristic. Employees receiving offensive messages or graphics over the Company's computer equipment should report those messages to the Human Resources. Employees are reminded that Adil's computers and the data generated on, stored in, or transmitted to or from the Company's computers remain the property of Adil for all purposes. Adil retains the right to monitor its computers, computer systems, and networks to ensure compliance with this requirement.

If you believe that you have been subjected to unlawful harassment of any kind, you are responsible for reporting the harassment immediately to your Supervisor or the Human Resources. Every report of harassment will be investigated promptly and impartially, with every effort to maintain employee confidentiality. All employees are expected to cooperate fully with any ongoing investigation regarding a harassment incident. Employees who believe they have been unjustly charged with harassment can defend themselves verbally or in writing at any stage of the investigation. If the Company finds that its policy has been violated, it will take appropriate corrective and remedial action, up to and including termination of employment. If an employee makes a report to any of the members of management and the Supervisor either does not respond or does not respond in a manner the employee deems satisfactory or consistent with this policy, the employee is required to report the situation to one of the other members of management designated in this policy to receive complaints.

Any employee who makes a good faith complaint, or who cooperates in the investigation of any complaint, will not be retaliated against or discharged because of the complaint. Anyone who engages in such retaliatory behavior will be subject to disciplinary action, up to and including termination. The Company will investigate all such reports as confidentially as possible. Adverse action will not be taken against an employee because he or she, in good faith, reports or participates in the investigation of a violation of this policy.

Adil is committed to enforcing its policy at all levels within the Company, and any employee who engages in prohibited discrimination or harassment will be subject to discipline, up to and including termination of employment. If you should have any questions regarding this policy, you should contact the Human Resources.

2.6. General Safety and OSHA

Safety is a priority at Adil and we strive to provide a clean, hazard-free, and safe environment in accordance with the Occupational Safety and Health Act (OSHA) of 1970. As an employee, you are expected to take part in maintaining this environment. You should observe all posted safety rules; adhere to all safety instructions provided by your Supervisor, and use safety equipment when required. It is your responsibility to learn the location of all safety and emergency equipment, as well as the safety and/or emergency phone numbers. If your job site does not have the Material Safety Data Sheets (MSDS) for all of the chemicals you are required to work with, or if you do not understand your MSDS's, you should notify your Supervisor or Human Resources immediately.

OSHA also requires us to keep records of all the illnesses and accidents that occur on the job and provides for your right to know about any health hazards that might be present on the job.

Worker's Compensation Insurance pursuant to the laws of the state(s) in which we operate covers all work related accidents. The State Workers' Compensation Act requires that you report any illness or injury caused by the workplace. Employees are encouraged to report all workplace accidents, injuries, potential safety hazards, safety suggestions, and health and safety related issues immediately to the Supervisor. You may seek help from outside emergency response agencies as well, if required. You must complete an Employee's Claim for Worker's Compensation Benefits Form if you have an injury irrespective of requirement of medical attention. You can obtain the required forms from the Human Resources.

SECTION 3: COMPANY POLICIES AND PROCEDURES

3.1. Code of Ethics

Ethics is a core value at Adil. That means qualities such as integrity, individual responsibility, and accountability matter every bit as much as bottom-line results. Doing right and doing well are inseparable. Adil expects the highest standards of ethical conduct and fair dealing from each employee, officer, director, volunteer, and all others associated with the Company. Our reputation is a valuable asset, and we must continually earn the trust, confidence and respect of our suppliers, members, customers, and community. All our activities are to be conducted in compliance and spirit of all laws and regulations. You are charged with the responsibility of understanding the applicable laws, recognizing potential dangers and knowing when to seek legal advice.

In general, the use of good judgment, based on high ethical principles, will guide you with respect to lines of acceptable conduct. If a situation arises where it is difficult to determine the proper course of action, the matter should be discussed with the Supervisor or the Human Resources. Compliance with this policy is the responsibility of all employees. Disregarding or failing to comply with this standard of business ethics and conduct could lead to disciplinary action, up to and including termination of employment.

3.2. Conflict of Interests

All Adil employees have an obligation to conduct business within guidelines that prohibit actual or potential conflicts of interest. Therefore, employees must never use their positions with the Company, or any of its clients, for private gain, to advance personal interests or to obtain favors or benefits for themselves, members of their families or any other individuals, companies or business entities. Employees of the Company shall conduct their personal affairs such that their duties and responsibilities to the Company are not jeopardized and/or legal questions do not arise with respect to their association or work with the Company.

3.3. Non-Compete/ Non-Solicitation Policy

Adil prohibits and condones current and former employees from engaging in direct or indirect competition with the company. Competition is defined as soliciting or accepting employment by, or rendering professional services to, any person or organization that is or was a client of Adil during the term of the employee's work with Adil and for a period of twelve months from the date that the employee was last employed by the Company.

3.4. Outside Employment

Because of Adil's obligations to its clients, the company must be aware of any concurrent employment that you may have to determine whether or not it presents a potential conflict of interest. Serving on any public or government board or commission qualifies as employment for purposes of this policy, regardless of whether such service is compensated. Before pursuing employment outside of Adil, employees are required to provide details of the involvement with the other employer and obtain a written approval from the Human Resources. Failing to obtain approval as described may cause for a disciplinary action, up to and including termination.

Employees, who are on any leave of absence, including Family and Medical Leave Act (FMLA) leave or Workers' Compensation leave, are prohibited from pursuing employment during their absence.

3.5. Relationship With Competitors

In order to compete effectively and fairly in the marketplace with our many competitors, Adil Business Systems Inc. must remain alert to changes in services and products offered to the public by our competitors. Employees may not, however, seek to gain this information improperly. For example, it is prohibited to hire an employee of a competitor to gain access to that competitor's trade secrets or proprietary information. Similarly, an employee or former employee is prohibited from providing such confidential information to our competitors.

Both federal and state laws prohibit conspiracies or agreements that unreasonably restrain trade. Formal or informal understandings or agreements between competitors concerning the pricing of services or limitations on the output of services are unlawful and may not be discussed by an employee with any competitor.

3.6. Code of Professional Conduct

Adil expects its employees to adhere to a standard of professional conduct and integrity. This ensures that the work environment is safe, comfortable, and productive. General cooperation between coworkers and supervisors is expected. In addition to complying with Company policies and job specific requirements, you are also expected to obey the rules and regulations of Adil Business Systems, Inc. job and client sites.

It is not possible to list all the forms of behavior or conduct that are considered to be unacceptable in the workplace. In most instances, your own good judgment will tell you what is the right thing to do. Below are some examples of conduct that are not acceptable and may result in disciplinary action, up to and including termination of employment:

- Violations of any of the Company laws and practices
- Dishonesty, including, but not limited to: willful falsification of any pay, time, employment record
- Soliciting or accepting gifts (money, services or merchandise) in connection with Company business.
- Theft or inappropriate and unauthorized possession of Company property
- Violating any of the Company's rules regarding drugs and alcohol and/or fitness-for-duty
- Deliberate damage to or destruction of property belonging to the Company or any of its stakeholders
- Insubordination, which is defined as refusal to obey a supervisor's instructions or willful disobedience when directed to perform work
- Unethical or illegal conduct in the course of your employment
- Reckless disregard for or willful violation of any safety or security rules
- Participation in a fight or other physical altercation on Company premises and work sites
- Gross neglect of duties or job responsibilities
- Excessive tardiness, absenteeism, or unacceptable patterns of absenteeism
- Unauthorized absence from work
- Gambling or loan-sharking while on Company premises

3.7. Confidentiality

During your employment at Adil, you may have access to confidential and/or proprietary information and knowledge about our business policies, clients, other employees, procedures, and methods. The protection of confidential business information and trade secrets are vital to the interests and the success the Company. Information that pertains to Adil's business, including all non-public information concerning the Company, its vendors and suppliers, is strictly confidential. Such confidential information includes, but is not limited to, the following:

- The business operations of Company, including any elements of its strategic plan (whether or not formally documented), unique creative marketing procedures, confidential reports, and technologies that directly relate to profitability and business.
- The internal structure of Company including, without limitation, the size of Company or number of personnel
- Employee information and compensation data
- Information related to our customers, suppliers, contractors, and subcontractors including without limitation names, addresses, contracts, terms, volume, etc.
- Pricing, credit, and financial information
- Information including without limitation, trade secrets, technical data, sales figures and forecasts, marketing analyses, and studies, and any pending projects and proposals

All papers and records of every kind, including all memoranda, lists, tapes, notes, designs, plans, data, and other documents, whether made by employee or not, relating to the business and affairs of Company or to any business or field of investigation of Company which shall at any time come into possession or control of employee, shall be the sole and exclusive property of the Company and shall be surrendered to the Company at any time upon request but no later than upon cessation of employee's employment, along with any copies of any such documents.

You must protect confidential information that may include, but not limited to, trade secrets, client lists and company financial information by taking the precautionary measures including but not limited to:

- Discuss work matters only with other Adil employees who have a specific business reason to know or have access to such information
- Do not discuss work matters in public places
- Monitor and supervise visitors to Adil to ensure that they do not have access to confidential information
- Destroy hard copies of documents containing confidential information that are not otherwise to be retained, filed or archived
- Secure confidential information in desk drawers and cabinets at the end of every business day

Cooperation is particularly important due to our obligation to protect the security of our clients' and our own confidential information. If at any time you are uncertain as to whether you can properly divulge information or answer questions, please consult the Human Resources.

Violation of this policy during your employment may result in disciplinary action, up to and including possible termination. In addition to any other rights and remedies available to the Company, it may be entitled to an injunction to be issued by any court of competent jurisdiction restraining an employee from committing any further violation of such covenants. By accepting employment, Adil employees consent to the issuance of such an injunction without need of a bond or showing of actual damages.

3.8. Employee Relations Philosophy

Adil Business Systems Inc. seeks to foster and maintain a productive and healthy working environment. This can only be accomplished through the cooperation of our employees. Employees are expected to treat each other with mutual respect. Adil is also committed to provide the best possible climate for maximum development and goal achievement for all employees. Our practice is to treat each employee as an individual. We seek to develop a spirit of teamwork with individuals working together to attain a common goal.

To maintain an atmosphere where these goals can be accomplished, we provide a comfortable and progressive workplace. Most importantly, we have a workplace where communication is open, and problems can be discussed and resolved in a mutually respectful atmosphere. We firmly believe that with direct communication, we can continue to resolve any difficulties that may arise and develop a mutually rewarding relationship.

3.9. Communications and Open Door Policy

In the Scenario when Adil needs to contact you, it may do so directly or by enabling voice, text, or e-mail messages. Adil may also use an automated communication system to relay work-related information such as job opportunities, reminders, and other informational messages.

Adil has an "open door" policy and is here to support both our customers and our employees. We value each employee and strive to provide a positive work experience. Employees are encouraged to bring any workplace concerns or problems they might have or know about to the Supervisor or the Human Resources. The bottom line is, we can't respond to problems if we do not know they exist. You are also encouraged to offer ideas and/or constructive criticism to your supervisors or the Human Resources. We also encourage you to take part in project teams or problem-solving teams and cost reduction projects. Your participation in continuous improvement is essential to the success of the Company.

3.10. Certification and Licensing

The Human Resources will inform you if there is any licensing, certification or testing requirements for your job. It is the responsibility of the employee to ensure that licenses and certifications are active and current all time. If an employee's license or certification becomes invalid, the employee must notify his/her immediate supervisor and the Human Resources. Having a lapsed license or certification may be grounds for disciplinary action, up to and including termination of employment. The Company is not entitled to pay an Employee for any license or certification renewal.

3.11. Provisional/ Introductory Period

All new employees are subject to an introductory period at the beginning of their employment. The introductory period is intended to give you the opportunity to demonstrate your ability to achieve a satisfactory level of performance and to determine whether the new position meets your expectations. In the event that the job performance is evaluated as being unsatisfactory, you may be terminated without prejudice at any time for any reason during the provisional period. During said provisional period, you may or may not be eligible for some of the benefits offered by the Company to regular employees. In most cases, this introductory period will last

for ninety days from the date of hire. Throughout this time, your performance will be monitored, and you will receive periodic feedback regarding your performance. At the end of your introductory period, a decision will be made, at Adil's discretion, about granting you a regular employee status, extending your introductory period, or terminating the employment relationship.

Generally, any requests for paid time off will not be granted during the introductory period. At the Company's discretion, paid or unpaid time may be granted provided that the time was discussed and approved prior to start of your employment. If an extended leave of absence was granted, the length of the absence will automatically extend the introductory period. Your successful completion of this evaluation period does not result in any change in the employment at-will relationship as described in this Handbook.

3.12. Work Schedules and Time Cards

Work schedules for employees vary throughout the Company based on specific contracts assigned or job responsibilities. Your Supervisor and/or the Human Resources will advise you of your work schedule. A regular workweek for full-time regular employees normally consists of at least 40 hours of work scheduled over 5 workdays, Monday through Friday. When possible, you will be advised of future assignments in advance, so you will have ample time to prepare for the assignment. Once you have begun an assignment you will report directly to your Supervisor for all matters relating to its completion.

Your Supervisor may require that you keep track of your days at work, and your vacation time and other time off on a time sheet. A new time card or time sheet should be used for each time period. Time sheets must be completed accurately. Your signature on your time sheet is required to certify its accuracy as a record of the time actually worked. Falsification of time sheet can lead to disciplinary action, up to and including termination. Furthermore, the falsification of a time sheet is a fraudulent act for which an employee may be prosecuted.

3.13. Breaks and Meal Periods

The Company offers all employees the opportunity to take rest periods and meal periods during the course of a workday and in accordance with all state laws. All breaks and meal periods must be scheduled in advance and approved by the Supervisor or the Human Resources.

3.14. Attendance, Punctuality, and Reporting Absences

The Company believes that a good record of attendance and punctuality is an essential component of good work performance. It is important for you to report to work on time as scheduled and to avoid unnecessary absences. We recognize that illness or other circumstances beyond your control may cause you to be absent from work from time to time. However, excessive absenteeism or frequent tardiness puts an unnecessary strain on your co-workers and can have a negative impact on the image and success of the Company. If, for any reason, you are unable to report for work on time, or are unable to remain at work until the end of your normal workday, you must notify your Supervisor directly before your regular starting time. All time off, must be requested in advance and should be submitted in writing as outlined in the appropriate categories, except for sick leave. Excessive absences may result in disciplinary action, up to and including termination.

3.15. Inclement Weather/ Emergencies

The Company will make every effort to notify employees in advance when it is not necessary to report to work. These circumstances may include inclement weather, fire, flood, power outage, lack of work, etc. When the decision is made to close, open late or close early, employees will receive official notification directly from their Supervisor. For employees that are assigned to a contract, specific job site procedures for inclement weather or emergencies will be followed.

Generally, on days when there is a delayed opening or business hours are shortened due to severe inclement weather or emergency, employees who are present at work on that day will receive pay in accordance with applicable state and federal wage and hour laws. However, if, due to inclement weather or emergency, you fail to report for work on a day when the Company is open, or you request to leave early when the Company remains open, you must receive approval from your Supervisor. Additional information regarding the Inclement Weather and Emergencies Policy can be obtained from the Human Resources.

3.16. Personnel Records

It is important that the personnel records of the Company be accurate at all times. In order to avoid problems with your benefit eligibility, tax liability, or our ability to communicate with you regarding shift changes and the like, Adil requires that you will promptly notify the Human Resources of any change in your name, home address, telephone number, number of dependents, or any other information pertinent to your employment with the Company. All new employees must complete and return the "Employee Information Form" to the Human Resources with seven days of receipt of this Handbook.

In response to valid requests to verify employment, for business references, or for credit purposes, the company will release employment status, i.e., active or terminated, job title, and dates of employment. Additional information regarding employment will be released upon written authorization from the employee. Additional information may also be released pursuant to subpoena or other legal obligation.

Upon request, you may inspect your own personnel file and in accordance with applicable state laws. Inspections will be held on corporate premises in the presence of a corporate official. Contact the Human resources to arrange a time to view these records.

3.17. Expense Policy

It is the policy of the Company to reimburse staff for reasonable and necessary expenses incurred on behalf of the Company. Under no circumstances shall expenses for personal items be charged to or temporarily funded by the Company. To claim a reimbursement, please sign your reimbursement form and forward it to your Supervisor for review. Once approved, your Supervisor will submit it to the Finance Department for the payment. Please attach all bills or vouchers as proofs. Do not submit your reimbursements and your vouchers separately. Ensure to categorize the expenses in the proper account heads with descriptions. Reimbursements will be dispersed on an average of three weeks after the submitted expenses are verified and submitted for processing. The Company will also reject any expenses rejected by the client. For reimbursement of travel related expenses, refer to Section 8: Travel and Business Expenses.

3.18. Zero Tolerance or Workplace Violence Prevention Policy

Adil has a zero-tolerance policy concerning threats, intimidation, and violence of any kind in the workplace either committed by or directed to our employees. Employees are not permitted to bring weapons of any kind into the company premises or to company events. Any employee who is suspected of possessing a weapon will be subject to a search at the Company's discretion. Such searches may include, but not be limited to, the employee's personal belongings, desk and workspace.

If you receive or overhear any threatening communications from an employee or outside third party or witness an employee or outside third party with a weapon of any kind, report it to the Supervisor immediately. Do not engage in either physical or verbal confrontation with a potentially violent individual. If you encounter an individual who is threatening immediate harm to an employee or visitor to our premises, contact an emergency agency (such as 911) immediately. All reports of work-related threats will be kept confidential to the extent possible, investigated, and documented. Employees are expected to report and participate in an investigation of any suspected or actual cases of workplace violence and will not be subjected to disciplinary consequences for such reports or cooperation. Violations of this policy, including your failure to report or fully cooperate in investigation, may result in disciplinary action, up to and including termination.

3.19. Dress Code and Public Image

As an employee of Adil, we expect you to present a clean, safe, and professional appearance when you represent us, whether you are in or outside of the office. Your attire should be consistent with the type of work you are performing, as well as being appropriate for the position you hold, and the image that the Company seeks to project. Clothing must be tailored, neat, and clean. Good personal grooming and hygiene are also essential and should contribute to a professional appearance. If you have further questions about your expected attire, please discuss with your Supervisor. As always, please use common sense in your choice of business attire. Any employee who violates the dress code policy or arrives at work without appropriate work attire will be subject to disciplinary action, up to and including termination.

3.20. Safety in the Workplace

Each employee is expected to follow safety precautions and practice safety awareness by thinking defensively, anticipating unsafe situations, and reporting unsafe conditions immediately. If you are injured or become sick at work, no matter how slightly, you must inform the Human Resources immediately. You are to familiarize yourself with the locations, contents, and use of first aid and firefighting equipment. If your job duties require safety equipment that has not been provided, contact your jobsite supervisor or Human Resources before performing the job for which you need the safety equipment.

You are expected to observe all applicable safety requirements, to make sure that you have all available safety equipment, to use the safety equipment provided, to practice safety at all times, and to report immediately any unsafe or hazardous conditions to your Supervisor. It is a job requirement that you help detect and eliminate unsafe conditions or acts at all times. A violation of a safety precaution is in itself an unsafe act and may lead to disciplinary action, up to and including termination.

3.21. Smoking Policy

Our goal is to provide a healthy and pleasant work environment for all employees. The Company prohibits any form of tobacco use on the Company office premises, except in designated outdoor areas. Employees should limit their smoking breaks so as not to compromise productivity. Smoke breaks are considered a "rest period" and are to be taken according to Company policy. Employees working at client site must comply with the smoking policies and any state or local regulations at the client location. Employees must direct questions on client-specific smoking policies or regulations to the Human Resources. Any violations of the Company's smoking policy will be subject to disciplinary actions up to and including termination of employment.

3.22. Information Security Policy

Adil is committed to safeguard the integrity and confidentiality of our information and security systems, as well as those entrusted to us by our client and suppliers. "Information" is any form of data created, stored, or transmitted electronically or on paper format. "Information systems" are assets, such as computer hardware, computer files and records, software, magnetic media, and internal/external communication systems.

As a condition of employment, employees are expected to safeguard these systems from unauthorized use, disclosure, modification, destruction, or loss. Employees may use our Systems to communicate internally with co-workers or externally with clients, suppliers, vendors, advisors, and other business acquaintances for business purposes. Access to the Internet is given principally for work-related activities or approved educational/training activities. All information that is created, stored, or transmitted on the Company or its clients' systems is the property of Adil or its clients.

The employee responsibilities and obligations regarding Information Security include but are not limited to the following:

- Do not access, download, or distribute material that is illegal, or which others may find offensive or objectionable, such as material that is pornographic, discriminatory, harassing, or an incitement to violence.
- Use workplace information systems for business purposes only, and not for inappropriate purposes such as illegal activity, gambling, posting on social media, soliciting or engaging in unauthorized commercial activities.
- Do not duplicate, delete, or disclose the Company's, or its clients' proprietary or confidential information or remove information or information systems without proper authorization.
- Keep your passwords confidential and do not share them with others. You will be held accountable for all actions performed with your username and password.
- Do not use software that would provide unauthorized access to the workplace computers or would disrupt the equipment in any way.
- Do not expect privacy when using the Company's or its clients' information systems. All electronic files and e-mail sent, received, or stored in Adil or its clients' information systems are the property of Adil or its client, and as such, subject to monitoring.
- The Company reserves the right to monitor, audit, and terminate employees' access to information and information systems at any time without notice.

- Except as authorized by your Supervisor in the course of your work duties, do not access the computer(s), email account(s), or files of any other Company employee.
- Respect and comply with copyright, trademark, and similar laws, and use such protected information in compliance with applicable legal standards.
- Report suspected violations of the Information Security Policy to the Company or its client's HR Department.

Employees violating any terms of this policy may be subject to disciplinary action up to, and including, termination of employment and/or pursuit of criminal prosecution or civil remedies. If you have questions about the acceptable use of our Systems or the content of electronic communications, contact the Human Resources for advance clarification.

3.23. Drug and Alcohol Free Workplace

Adil takes seriously the problem of drug and alcohol abuse and is committed to providing a work place free of such substances. It is a condition of your employment and continued employment with Adil that you comply with the drug and alcohol free work place policy.

Employees are prohibited from unlawfully consuming, distributing, possessing, selling, or using controlled substances on any property or vehicle owned by the Company. In addition, employees may not be under the influence of any controlled substance, such as drugs or alcohol, while at work, on company premises or engaged in company business. Prescription drugs or over-the-counter medications, taken as prescribed, are an exception to this policy. In cases where the use of alcohol or drugs poses a threat to the safety of other people or property, you must report the violation. Employees who violate this policy will be subject to disciplinary action, up to and including termination.

In accordance with the Drug-Free Workplace Act of 1988, employees must notify the Supervisor and the Human Resources of any criminal drug statute conviction for a violation occurring within the workplace within five days of such conviction.

Consistent with its fair employment policy, the Company maintains a policy of non-discrimination and reasonable accommodation with respect to recovering addicts and alcoholics, and those having a medical history reflecting treatment for substance abuse conditions. We encourage employees to seek assistance before their drug and alcohol use renders them unable to perform their essential job functions or jeopardizes the health and safety of themselves, or others. The Company will attempt to assist its employees through referrals to rehabilitation, appropriate leaves of absence and other measures, consistent with the Company's policies and applicable federal, state or local laws.

As part of the Company's policy to ensure a drug and alcohol free workplace, within the limits of applicable federal and state laws, the Company reserves the right, in its sole discretion, to test for drugs and alcohol. Some such situations may include, but not be limited, to the following:

- In conjunction with an offer of employment with the Company
- Where there are reasonable grounds for believing an employee is under the influence of alcohol or drugs
- As part of an investigation of any accident in the workplace in which there are reasonable grounds to suspect alcohol and/or drugs contributed to the accident
- On a random basis, where allowed by statute

- As a follow-up to a rehabilitation program, where allowed by statute
- As necessary for the safety of employees, customers, or the general public where allowed by statute.

Any employee who, as a result of drug testing and screening, is found to have detectable levels or identifiable trace quantities of alcohol or a prohibited drug in his or her system, without an explanation satisfactory to the Company, will be considered in violation of this policy, will be removed from Company property or jobsite, and will be subject to disciplinary action which includes participation in a rehabilitation program or termination of employment. If employment is continued, such employees may be required to submit to random drug screens and/or to participate in and successfully complete a substance abuse program.

The Company further reserves the right to take any and all appropriate and lawful actions necessary to enforce this drug and alcohol free workplace policy including, but not limited to, the inspection of Company issued lockers, desks or other suspected areas of concealment, as well as an employee's personal property when the Company has reasonable suspicion to believe that the employee has violated this drug and alcohol policy.

Additional information regarding the Company's Drug and Alcohol policy can be obtained from the Human Resources.

3.24. General Policies

1. **Workspace:** A clean, orderly workspace provides an environment conducive to working efficiently. Employees should keep in mind that their workspace is part of a professional environment that portrays the Company's overall dedication to providing quality service to its clients. Therefore, your workspace should be clean, organized and free of items that are not required to perform your job.

2. **Personal Property:** The Company is not responsible for loss or damage to personal property. Valuable personal items, such as purses and all other valuables should not be left in areas where theft might occur.

3. **Reference Checks:** Our Company will not honor any oral requests for references. All requests must be in writing. Generally, we will only confirm our employees' dates of employment, salary history and job title. Under no circumstances should an employee provide another individual with information regarding current or former employees of our Company. If you receive a request for reference information, please forward it to the Human Resources.

4. **Distribution of Material:** To avoid unnecessary annoyances and work interruptions, solicitation by an employee of another employee is prohibited while either person is on working time. Employee distribution of literature, including handbills, in work areas during the work hours of any employee involved is prohibited. Trespassing, soliciting or distribution of literature by non-employees on these premises is prohibited at all times.

5. **Visitors:** To provide for the safety and security of employees and the facilities of Adil, only authorized visitors are allowed in the workplace. If you notice the presence of any unauthorized individual(s) on Company premises, you should notify your Supervisor immediately.

6. Recording Devices in the Workplace: Employees are prohibited from having any form of recording or photography device in the workplace and from recording or photographing fellow employees in the workplace or during working time. Violations of this policy may result in a disciplinary action including the possibility of discharge, immediate removal of the recording device and/or the employee from the workplace, and retention of the recording device for inspection by the Company and/or legal authorities. Limited exceptions will apply when the employee in possession of the recording device has been provided advance written authorization to use the recording device by an authorized member of corporate management and the recording device is being used in an authorized manner to further corporate business.

7. Social Media: We encourage you to use good judgment when communicating via social media. While posting on social media, make it clear that the views expressed are yours alone. Do not purport to represent the views of the Company in any fashion. Do not disclose confidential or proprietary information regarding the Company or your coworkers that could subject the Company to legal liability. If the Company is subjected to government investigation or financial liability based on your disclosures, the Company may seek to hold you personally responsible.

8. Office Equipment: You will be provided with the necessary equipment to do your job. Certain equipment is assigned to employees depending on the needs of the job, such as a calculator, personal computer, printer, and access to central computers and servers. This equipment is the property of the Company and cannot be removed from the office without prior authorization. You are expected to treat this equipment with care and report any malfunctions immediately to staff members equipped to diagnose the problem and take corrective action. Any items or packages taken out of the work place are subject to inspection at any time. Likewise, any personal locker or storage space provided to you in the office is also subject to inspection at any time. Use of radios, audio headsets, and televisions, Company owned or otherwise, is at the discretion of the Manager, and – if allowed – must be used in a manner that does not interfere with the safety of the work place or with the ability of others to perform their work.

9. Phone System and Cellphones: Company telephone system is principally for work-related activities only. However, Incidental and occasional personal use is permitted. This privilege should not be abused and must not affect the employee's performance of employment-related activities. Personal use of the office phone system to make local calls should be kept to a minimum and personal toll calls should not be made using the system. Personal cellular telephones must be turned off or set to a silent alert during working hours while on corporate premises. You should use common sense and your best judgment when making or receiving personal cellular phone calls at work. To the extent possible, employees should make personal cell phone calls during their breaks or lunch times. The use of cameras on cell phones during work hours is prohibited to protect the privacy of the Company as well as of fellow employees. However, this restriction will not apply to any recordings made in the exercise of any rights granted to an employee by federal law.

10. Miscellaneous Items: Use of Company vehicles, workplace stationery, office supplies, or postage for personal use is strictly prohibited.

Violations of the general policies may result in disciplinary action up to and including termination.

11. Returning to Work: The onboarding paperwork would need to be re-initiated if the employee has not worked for more than 6 months and the sick time will become null. The employee health paperwork would need to be cleared to start their 1st day of work to complete the orientation.

SECTION : EMPLOYEES WORKING AT THE CLIENT SITE

4.1. Employment

Adil's goal is to help you find the right opportunity to suit your employment needs. Your contract assignment will vary in duration and allow you to work within your interest levels. Your role is temporary in nature and the duration of any assignment is based on the business need and may change with or without notice. On being hired and placed with one of our many clients, you will have the opportunity to build your skills and gain valuable work experience.

4.2. What is Expected of You

When you accept an assignment, you represent Adil's ever-growing team of professionals. It is important to note that Adil is your employer and not the client you are assigned to. Please discuss all your employment related issues with Adil, and not with your designated client. Failure to adhere to this guideline could result in a disciplinary action.

The Human Resources will provide you with any and all the details required prior to your first day of work at the client location. They will also let you know the proper attire and expected shift timings for your project. If the client makes any changes in your responsibilities, please contact the Human Resources immediately.

Adil expects the best from all its employees. This means demonstrating the following characteristics:

- **Responsibility** - On acceptance of any assignment, we expect you to completely fulfill your responsibilities. Please contact Human Resources immediately if you are unable to cope with the responsibilities assigned. You are solely accountable for any personal belongings taken to the workplace.
- **Reliability** – You are expected to honor your commitment to be at work on time every day, and to finish the tasks assigned to you.
- **Efficacy** – Always ensure to verify the accuracy of your work. Offer to perform additional tasks when appropriate, and inform the client of the status of your work on a regular basis.
- **Professionalism** - Keep your work area clean and organized. Do not use the client's equipment and supplies for your private use, and do not take any items that belong to the client (e.g. notes, calculators, office supplies). Also, the solicitation of employees and the general distribution of literature, products, or services are not permitted.
- **Conscientious Communication**- Keep personal phone calls to a minimum. Desist from exchanging personal e-mail and instant/text messages at work.
- **Timeliness** - Record all actual hours worked for each day worked.
- **Discretion**- Safeguard the proprietary or confidential information of any client and protect the confidential information and materials by maintaining and storing them appropriately.

4.3. When to Contact Adil

You are expected to maintain clear communication and inform the Company when any of the following situations occur:

- You are expected to be late or have an emergency that prevents you from reporting to work on time. Notify your direct supervisor at the client site as well as the Human Resources at Adil if such a situation arises.
- You are unable to complete an assignment within the stipulated timeframe. In this situation, you are required to contact Human Resources and not the client. We will inform them and make the appropriate arrangements.
- You are not satisfied with your work assignment. Do not speak with the client directly. Instead, you are required to contact Human Resources to discuss possible solutions.
- Your work duties are different or have changed from those originally described by the Company.
- The client asks you to work overtime.
- Your availability changes or you have commitments that will keep you from being available.
- You plan to take time off for a vacation or holiday.
- You have moved or your contact information has changed (e.g. Payroll Address, E-Mail Address, Phone Number).
- You feel you are being harassed at work by a supervisor or co-worker.
- You are injured at work or the work environment seems unsafe.
- You are charged with, or found guilty of, any criminal offense (where applicable by state law).
- Your assignment has ended, and/or the client wants you to return at a later date.
- The client offers to hire you directly.
- You are instructed or prevented from recording and reporting all actual hours worked, at any point in your assignment. If this occurs, you are required to immediately notify the Human Resources.

SECTION : YOU PAY AND P OG ESS

5.1. Employment Classifications

An employee is notified at the time of hire, of his or her specific status and compensation category. As per the guidelines established by the Fair Labor Standards Act (FLSA), all employees are designated as Exempt or Non-Exempt.

- **Exempt:** An employee who is paid on a salary basis and meets the qualifications for exemption from the overtime requirements of the FLSA. All Executive, Administrative, Professional, Computer-Related, Outside Sales, and Highly Compensated positions are classified as exempt by definition.
- **Non-Exempt:** An employee who is paid an hourly rate and does not meet the qualifications from the overtime requirements of the FLSA. An accurate record of hours worked must be maintained for all non-exempt employees. Adil will compensate non-exempt employees in accordance with the applicable federal and state law and regulations.

Additionally, the following groupings are used at Adil to describe the compensation category and benefits eligibility of its employees.

- **Regular Full-Time:** An employee who is regularly scheduled to work at least 40 or more hours per week and has successfully completed the introductory period. Regular full-time employees may be either non-exempt (hourly) or exempt (salaried) employees. A Full-time employee is generally eligible for all the Company provided benefits in accordance with the eligibility requirements.
- **Regular Part-Time:** An employee who is scheduled to work 10 or more hours but less than 40 hours per week and has successfully completed the introductory period. A regular part time employee may receive certain benefits provided to full time employees.
- **Temporary Employee:** An employee who is hired on an as needed basis for a specific project or a specific period of time and whose employment will terminate no later than completion of that project or period. A temporary employee is paid only for the hours worked. A temporary employee is not eligible to receive any Company paid benefits, except as required by law.
- **Provisional Employee:** An employee who is yet to complete the 90-day introductory/provisional period after first being hired.
- **Hourly W2 Employee:** An employee who is paid by the hour, and has payroll taxes automatically deducted from the paycheck by the employer.
- **Independent Contractor:** An employee who provides services to the Company under terms agreed upon by both parties and does not have payroll taxes deducted by the employer.

5.2. Payroll Practices & Paycheck Deductions

Adil is committed to paying employees on time, accurately, and in compliance with all state and federal laws, including, when applicable, the overtime pay requirements and salary pay requirements of the Fair Labor Standards Act (FLSA). Employees exempt from overtime will be notified.

The Company is required by law to make certain deductions from your paycheck each pay period. Such deductions typically include federal, state, city taxes, Social Security (FICA) taxes, and other legally required deductions (e.g., garnishments and tax levies) that have been served to Adil. Depending on the state in which you are employed and the benefits you choose, there may be additional deductions. All deductions and the amount of the deductions are listed on your pay stub. These deductions are totaled each year for you on your Form W-2, Wage and Tax Statement. If questions or concerns about any pay deductions arise, employees may discuss and resolve them with the Human Resources.

5.3. Direct Deposit

Direct deposit or electronic pay is the fastest, safest, and most reliable way to be paid where salary is deposited directly into your bank account. While being paid electronically, you do not have to worry about lost or stolen paychecks, getting to the bank on time, or paying expensive check cashing fees. If your time is submitted timely and accurately, your pay will be always available on the payday. Direct deposit is required for all employees. The Human Resources will give you the authorization form for direct deposit along with the payroll calendar. The payroll department will provide you with directions to set up an account with ADP who is our payroll service provider. With ADP, your paystub is posted electronically to a secure Internet site rather than mailed to your home. Enrollment into ADP is mandatory.

5.4. Recording Your Time

All non-exempt employees must record their hours on time sheets and submit them to the Supervisor on a weekly basis. All timesheets must be submitted no later than 12:00 PM on Monday following the end of the pay period. Late submittals of timesheets may affect payroll and cause accounting issues for the Company.

Accurately recording all your time is required in order to ensure that you are paid for all hours worked. You are responsible for maintaining your own time records. Do not allow another employee to complete the time record on your behalf, and do not sign on a time record for any other employee. You are expected to follow the established procedures in keeping an accurate record of your hours worked. Time must be recorded as follows:

- Immediately before starting your shift
- Immediately after finishing your shift
- Immediately before and after any other time away from work

Exempt employees may be required to accurately record their time worked in accordance with federal and state wage and hour law. Altering, falsifying, tampering with time records or recording time on another employee's time record may result in disciplinary action, up to and including termination of employment. If corrections or modifications are made to the time record, the Supervisor must verify the accuracy of the changes and provide his/her signature for approval.

5.5. On Call

It may be necessary for individuals in certain positions assigned to specific contracts to be available by telephone after hours during the week or on the weekend. Employees who are required to be on call will be compensated in accordance with applicable state and federal wage and hour laws.

5.6. Overtime

Due to the nature of certain positions, employees may be asked to work overtime on weekends, holidays, and/or additional hours during regular workdays. Employees are expected to fully comply with such requests. Although you will be given advance notice when feasible, this is not always possible. Exempt employees are not paid overtime for hours worked above forty hours per week. A moderate amount of expected overtime is built into your compensation package as a salaried employee.

Overtime compensation is paid to all non-exempt employees at one and one-half times their regular time rate for all hours worked in excess of 40 hours per week, unless the state or local law requires a higher rate. If you are a non-exempt employee, you are required to receive an authorization from your Supervisor prior to working overtime. Overtime pay is based on actual hours worked. Time taken for lunch or dinner is not included as time worked for purposes of computing overtime. Time off on holidays, sick leave, vacation, personal leave, training seminars or any leave of absence will not be factored in as hours worked while calculating overtime. For employees working at the client site, the overtime policy of the client will be applicable.

If you have any questions concerning overtime pay, check with the Human Resources.

5.7. Performance Reviews

Your performance at Adil is important to our success. Supervisors are strongly encouraged to discuss job performance and goals on an informal, day-to-day basis. Participation and feedback during the performance review discussions critical both to your success and to the success of the Company.

Each new or promoted employee will be given an oral or written job description that details the requirements and expectations of the new position. Performance reviews are based on job description and work performance and are normally conducted annually from the date you were hired with the exception of the three-month review at the end of provisional period. Your Supervisor will complete all performance reviews in writing on the form designated by the Company, and reviewed during a conference with you. Factors considered in your review include the quality of your job performance, your attendance, meeting the requirements of your job description, dependability, attitude, cooperation, compliance with Company employment policies, any disciplinary actions, and year-to-year improvement in overall performance.

Depending upon your performance and our Company's profitability, adjustments in your pay may be made when there has been an improvement in or sustainment of an already good performance during the review period. Any wage adjustments are not guaranteed; they are based on your accomplishments and job performance; and are at the discretion of the Company. All matters related to compensation are at the discretion of the Company's President.

SECTION 6: HOLIDAYS, PTO, AND OTHER LEAVE

6.1. Holidays

Adil corporate office is closed on the following holidays for which all regular full-time employees are paid:

- New Year's Day (January 1)
- Memorial Day (Last Monday in May)
- Independence Day (July 4)
- Labor Day (First Monday in September)
- Thanksgiving (Fourth Thursday in November)
- Christmas Day (December 25)

When a holiday falls on a weekend, either the preceding Friday or the following Monday, will be designated as the observed holiday at the discretion of the management.

All employees assigned to contracts will observe the holiday schedule of the Client. The Human Resources will provide you with the list during orientation/onboarding.

Exempt and Non-exempt employees will receive holiday pay in compliance with state and federal wage and hour laws. Full-time employees are paid eight straight time hours for each holiday. Part-time employees are paid for holidays based upon the number of straight time hours they are normally scheduled. Temporary and provisional employees are not paid for holidays unless they are specifically requested to work on the designated holiday. Hourly W2 employees are not eligible for any holiday or paid time off and will be paid against clients' approved hours only. If a holiday occurs while on a Leave of Absence (e.g. Military Leave), you will receive no pay for the holiday.

6.2. Paid Time Off (PTO)

The Company grants paid time away from work under its annual paid time off (PTO) policy. All fulltime regular employees who have successfully completed the provisional period are entitled to the following PTO per year based on the length of employment, unless a greater amount of time off is provided by your employment contract:

- Up to one year- Five days
- More than one year- Ten days

An employee may use this leave for any purpose including vacations, unpaid holidays, illness for yourself or immediate family members, or time away from work for personal matters. We realize that family emergencies may arise from time to time and request that you pre-schedule all PTO, when possible to avoid staffing issues. Employees should adhere to the notification procedures for time off that have been established at their site locations. A time off request for vacation must be submitted in writing to the Supervisor at least two weeks prior to the anticipated vacation date. Every effort will be made to accommodate vacation requests on a first-come, first-served basis; however, operational demands may not permit all requests to be honored.

Adil encourages employees to use time off as it is designed to give employees time needed away from their everyday work schedule. PTO must be used by December 31st of the calendar year. Employees at their option may carry time off forward until January 31st of next year, if requested and approved by the Supervisor before the end of December. But, unless so requested, unused PTO will be forfeited at the end of the calendar year. Employees are not entitled to pay in lieu of taking time off.

Part-time employees and Hourly W2 employees are not entitled to PTO. Employees who are not entitled to PTO may request permission from their Supervisor to take up to ten days of unpaid time off. Eligible employees who meet the required advance notice of their resignation will be paid for accrued but unused PTO, unless state law dictates otherwise. All other employees will not be paid for accrued but unused PTO upon discharge.

Industrial accidents and illness are covered by Worker's Compensation Insurance pursuant to the requirements of the laws in the state(s) in which the Company operates. The PTO policy outlined above does not apply to those illnesses or injuries that are covered by a worker's compensation policy.

6.3. Family and Medical leave

Adil has a family and medical leave policy that is in compliance with The Family and Medical Leave Act of 1993 (FMLA) that provides for an unpaid leave of absence. Eligible employees must be employed by Adil for at least twelve months and have worked at least 1250 hours during the twelve-month period prior to be eligible for FMLA leave. Adil locations with less than fifty employees within a seventy-five mile radius are not covered under this leave policy or the FMLA. Under this leave policy a total of up to twelve weeks of unpaid leave of absence is available to eligible employees under the following circumstances:

- The birth of a child, but only within the first twelve months of the birth. This may not be used in conjunction with the Maternity Leave policy or the Sick Leave policy regarding maternity.
- The placement of a child for adoption or other legal placement, within the first twelve months of the adoption or placement.
- The need to care for a child, spouse, dependent, or parent who has a serious medical condition.
- A serious health condition of the employee that makes the employee unable to perform the functions of his/her position.

Eligible employees may take FMLA leave in a single block of time, intermittently (in separate blocks of time), or by reducing the normal work schedule when medically necessary for the serious health condition of the employee or immediate family member, or in the case of a covered service member, his or her injury or illness. Eligible employees may also take intermittent or reduced-scheduled leave for military qualifying exigencies. Intermittent leave is not permitted for birth of a child, to care for a newly born child, or for placement of a child for adoption or foster care. Employees who require intermittent or reduced-schedule leave must try to schedule their leave so that it will not unduly disrupt the Company's operations.

During the unpaid leave, employees retain the same healthcare coverage and must still contribute the same amount toward medical benefits as he/she paid before the leave began. Adil will require you to repay the Company's share of the premium if you do not return from a

leave for reasons other than a continuation, recurrence, or onset of a serious health condition or other circumstances beyond your control.

Generally, upon return to Adil at the end of the leave, the employee will be restored to his/her former position with the same rights, benefits, pay and other terms and conditions which existed prior to the leave; or to an equivalent position with equivalent rights, benefits, pay, and other terms and conditions of employment. You may be denied restoration to the same or equivalent position if your position would have been eliminated and/or changed if you had remained continuously employed. "Key Employees" as defined by FMLA, may be denied restoration of employment where such restoration would cause substantial and grievous economic injury to the operations of the Company. You will be informed, at the time you request a leave if you are a "Key Employee".

If your Leave exceeds that which was approved, and/or the maximum permitted by the Company policy, your employment with Adil shall terminate. Your employment shall also terminate if, at any time during a leave, you indicate that you do not intend to return to work at the end of the leave and/or fail to respond to a request by the Company that you certify your intent to return to work at the conclusion of the leave. If the employee decides not to return to work from unpaid leave, he/she will remain on leave for the balance of the leave period and then be terminated. A birth parent may choose to use the unpaid twelve-week leave or to utilize the six-week unpaid maternity leave, but cannot use both.

Employees requesting leave for their own serious health condition or a family member's serious health condition may be required to provide medical certification thirty days in advance of the request for leave when possible. In particular, if you wish to extend your leave, additional requirements and conditions may apply. Any benefits that are based on an accrual basis will not accrue during unpaid leave under this policy. An employee on leave for his or her own serious health condition will be required to provide certification from their physician that they are able to return to work and perform the job duties to which they are returning. Additional information on FMLA leave can be obtained from the Human Resources.

6.4. Maternity Leave

Adil employees who work a minimum of twenty hours per week and have been employed by Adil continuously for twelve months are allowed up to six weeks of unpaid leave after they have given birth to or in conjunction with the adoption of a child. Additional time may be allowed under unusual circumstances and with the approval of your Supervisor.

6.5. Bereavement Leave

Regular full-time employees are eligible immediately upon hire for one paid day for the death of an immediate family member. Immediate family is defined as parent, spouse, domestic partner, children, brothers, sisters, grandparents, grandchildren, parents-in-law, and parents of domestic partners. If additional days are needed for bereavement and if approved, employees may use accrued PTO or otherwise be unpaid.

Requests for bereavement leave should be made to the Supervisor as soon as possible. Our Company reserves the right to request written verification of an employee's familial relationship to the deceased and his or her attendance at the funeral service as a condition of the bereavement pay.

6.6. Jury Duty & Court Appearance

Time off for jury duty or court appearance is granted to all employees, in accordance with applicable law. Employees summoned for jury duty are granted an unpaid leave to serve. Employees may be provided time off with pay when necessary to comply with applicable state and federal wage and hour laws.

If you are absent for jury duty or appearance in court, you must provide your Supervisor with a copy of the subpoena, jury certificate, or court order before leave is granted and again upon your return to work. We reserve the right to request proof of jury service issued by the Court upon return. The Company may request that you be excused from reporting for service as a juror or be assigned to another time if your presence at work is considered to be essential to our business operations at the time you are scheduled for service as a juror. You must report for work if you are released from jury duty or your court appearance before the end of our workday or if you are temporarily released from jury duty or court appearance. If you are not required to serve as a juror on a particular day, please contact your Supervisor as soon as possible to determine if you are needed to work that day.

An employee called to appear as a witness will be permitted time off to appear, but without pay. Employees will be permitted to use PTO when appearing as witnesses.

6.7. Voting Leave

Adil encourages all employees to vote. Most polling facilities for elections for public office have hours that are scheduled to accommodate working voters. Adil, therefore, requests that employees schedule their voting for before or after their work shifts. An employee, who expects a conflict, should notify his or her Supervisor in advance, so that schedules can be adjusted if necessary.

6.8. Break Time for Nursing Mothers

In compliance with the FLSA, Adil allows employees to take reasonable, unpaid break time as frequently as needed to express breast milk as needed for up to one year after the birth of a child. The Company will provide a place for the employee to express breast milk, other than a bathroom, that is shielded from view and free from intrusion from co-workers and the public. Employees will not be retaliated against or discriminated in any other manner for exercising their rights under this policy. For Adil locations with less than 50 employees, this policy will not apply where compliance with the policy would impose an undue hardship on the Company. All women who breastfeed their child, and who need to express milk during the working day, will work with the Human Resources to determine how best to accommodate the needs of the mother while still accomplishing the performance of her job.

6.9. Personal Time Off- Brief Periods

There may be an occasion when you need a short period of unpaid time (less than two hours) during your regular work schedule to attend to personal matters, such as closing on a home loan, obtaining transportation after an auto accident, coping with a family emergency, etc. The decision to grant any personal time off is at the discretion of the Supervisor and must be requested prior to taking the time off.

6.10. Military Service Leave

Adil complies fully with the Uniformed Services Employment and Reemployment Rights Act (USERRA). The Company grants unpaid leave for uniformed service in accordance with applicable state and federal laws. A military leave is not deemed to be a "break in service" for seniority and other benefits. The Company will continue health insurance benefits for employees engaged in military service under the same conditions as applied to other types of leaves of absence. Such benefits may terminate in accordance with the benefit plan documents, in which case continuation coverage will be provided to the employee.

Employees taking a military leave are required to give proper advance verbal or written notice to the Company. Provided that the employees comply with these and certain other requirements, their jobs will be guaranteed for their return from up to five years of military service. The returning employee will be placed in the position he or she would have attained prior to the military service, unless they are not qualified for the position. The Company may not be required to reinstate an employee if the employee is dishonorably discharged, or if the Company has experienced changes that would make the reemployment impossible or unreasonable or would create an undue hardship to the Company.

Some states may provide greater protection for employees serving in the military than federal law. Where state or local law provides military leave, the Company will provide leave in accordance with those laws. Similarly, employees whose spouses or family members are members of the armed forces, national guard or reserves may be eligible to take time off from work due to their spouse's service or return from service in accordance with applicable federal, state or local law. Accordingly, please consult the Human Resources to determine if you are eligible for additional benefits. Please also see the FMLA policy for additional leave benefits. Any questions regarding the Company's Military Leave policy, applicable state and federal laws and the continuation of benefits while on Military Leave of Absence should be directed to the Human Resources.

SECTION 7: BENEFITS

Adil provides employee benefits to all eligible employees. Except where applicable by state or federal law, the Company reserves the right in its sole discretion, to revise, modify, or discontinue policies or perks at any time without prior notice. It is your responsibility to become familiar with the most current benefits available at Adil. Benefits eligibility is dependent upon a variety of factors, including employee classification. The Human Resources can answer any questions you may have regarding the benefits for you which you are eligible.

7.1. Group Health Insurance

All regular full-time employees are eligible to participate in the Company's Medical Insurance Coverage, subject to the eligibility requirements and other terms, conditions and restrictions. If you are an eligible employee and enroll in the Group Health Insurance plan, the monthly premium costs may be shared between the Company and you, if applicable, based on the level of coverage. If you are subject to a portion of the premium, your payment will be a pre-tax deduction that will show as such on your paycheck.

To participate, you must complete an enrollment form at the time employment begins or at the time you satisfy the eligibility requirements for this benefit. The delay of a completed enrollment form could affect your coverage up to and including denial of coverage. You and your eligible dependent(s) coverage under this benefit are subject to the eligibility requirements and other terms, conditions and restrictions set forth in the applicable plan documents. If you decline insurance at the time of hire or if you do not enroll within 30 days of your date of hire, you will not be covered until the next open enrollment period.

The Human Resources upon eligibility will provide the plan documents and additional information. Refer to the actual plan document and summary plan description if you have specific questions regarding this benefit plan.

Upon discharge you may be entitled to continuation or conversion of the group medical insurance plan in accordance with the terms of the policy and/or applicable state and federal law.

Changes to insurance coverage can only be made during open enrollment or due to any life events. Employees can change their benefits coverage (i.e., adding or deleting coverage for yourself and/or dependents) within 30 days of the following qualifying life events, as defined by the Internal Revenue Service regulations:

- Change in marital status (marriage, divorce, legal separation, or annulment)
- Change in number of dependents (through birth, adoption, court order requiring coverage, or death of a dependent)
- Change in status of dependents (through marriage or age)
- Change in employment status (yours or your spouse's) that changes benefit coverage
- Employee/dependent entitlement to Medicare
- Moving out of the coverage area for your plan

Please contact the Human Resources for more information and details on any health insurance plans that are being offered.

7.2. Continuation of Insurance under COBRA

The Federal Consolidated Budget Reconciliation Act (COBRA) is the legislation that provides employees and their covered dependents the right to continue their group health care coverage after a “qualifying event” such as voluntary or some types of involuntary job loss, reduction in hours worked, death, divorce, and other life events. COBRA legislation applies to employers with twenty (20) or more employees.

Upon termination from Adil for any reason, an employee has the right to continue group medical coverage for up to 18 months. Under COBRA, you will usually pay the full cost of coverage at group rates plus an administration fee. Adil will provide you with a written notice describing rights granted under COBRA when you become eligible for coverage under Adil's group health insurance plan. For further information on COBRA and a “qualifying event”, contact the Human Resources.

7.3. Workers Compensation

Adil is committed to meeting its obligations under applicable workers' compensation acts, which provide medical, rehabilitation, and wage-replacement benefits to individuals who sustain work-related injuries or illnesses while working. All work-related accidents, injuries, and illnesses however minor, and regardless of the fact whether treatment is required or not must be reported immediately. The failure to promptly report an accident, injury, or illness may result in the loss of coverage under workers' compensation insurance.

7.4. Referral Bonus

We encourage all current and former employees to recruit new talent for our Company. If you know someone you think would be a great Adil employee, let us know. Based on our staffing needs, Adil may offer referral bonuses. Contact the Human Resources for any further details.

SECTION 8: TRAVEL AND BUSINESS EXPENSES

It is the policy of the Company to reimburse employees for all expenses necessary, reasonable, and actually incurred when *traveling* on authorized company business. The Employee is responsible for incurring only those expenses that are reasonable and necessary to conduct Company business and is responsible for complying with the requirements of this Policy. All expenses must be properly documented on a *Travel Expense* Report and submitted for approval.

If working at client site, please be familiar with the client's travel policies. All client related travel expense reports must be approved by the client to be eligible for reimbursement. Adil will also reject any expense rejected by the client. In instances where a client's travel policy conflicts with Adil's travel policy, the travel policy of the client will prevail. For example: If the client reimburses on actual expenses rather than per diem amounts, then the Adil employee would be paid according to the client's travel policy of actual expenses.

8.1. Travel Expense Policy

Employees seeking reimbursement should incur the lowest reasonable travel expense and exercise care to avoid impropriety or the appearance of impropriety. Reimbursement is allowed only when reimbursement has not been, and will not be, received from other sources. If a circumstance arises that is not specifically covered in the travel policies, the most conservative course of action should be adopted. Business travel policies are aligned with the Company's reimbursement rules. All business related travel paid with Adil funds must comply with the company travel expense policies.

8.2. Approval of Travel and Reimbursements

Travel for employee, must be authorized by the Supervisor. Employees should verify that planned travel is eligible for reimbursement before making travel arrangements. Upon completion of the trip, and within 30 days, the employee must submit a Travel Expense Report and supporting documentation to obtain the reimbursement of the expenses incurred. Reimbursements will be dispersed on an average of three weeks after the submitted expenses are verified and processed. Travel Expense Report form not submitted within this timeframe will necessitate an exception approval from the Company management. Reimbursement of travel expenses is based on documentation of reasonable and actual expenses supported by the original, itemized receipts where required. Expenses that may be reimbursed by the Company are described below:

1. Transportation Expenses- Transportation expenses shall be reimbursed based on the most economical mode of transportation and the most commonly traveled route consistent with the authorized purpose of the trip. Tickets should be procured in advance in order to obtain any available discounts.

2. Automobile Travel- A vehicle may be rented if it would be more advantageous to the Company than other means of commercial transportation, such as using a taxi. Advance reservations should be made whenever possible and a compact or economy model requested. The employee is responsible for obtaining the best available rate and discount commensurate with the requirements of the trip.

3. **Mileage Expenses-** Employees may use their private vehicle for business purposes if it is less expensive than renting a car, taking a taxi, or using alternative transportation, or if it saves time. Travel from an employee's residence to the primary work site is treated as a commuting expense and is not a reimbursable business expense. If the personal vehicle is used for Company business, you will be reimbursed as per the IRS standard mileage rate as of the dates of travel. The IRS mileage rate takes into account all actual automobile expenses such as fuel and lubrication, towing charges, repairs, replacements, tires, depreciation, insurance, etc. Under IRS regulations, travelers who claim this rate are not required to substantiate the actual costs of operating the vehicle. Travelers with physical disabilities who must use specially equipped or modified vehicles may claim reimbursement at the standard IRS rate per mile. However, if the traveler has incurred expenses higher than the standard operating costs, the traveler may seek reimbursement. The traveler must certify in a statement submitted with the Travel Expense Report that he or she incurred higher operating costs. The actual fixed and variable costs must be specified in the statement. The Company will not be responsible for any damage to an employee's personal vehicle while on Company business.

4. **Air Travel-** Coach class or any discounted class airfare shall be used in the interest of economy. Only the Company Management under special circumstances may authorize the use of business or first-class or other higher cost services.

5. **Surface Transportation Used in Lieu of Air Travel-** If advance approval has been obtained, a traveler may use surface transportation for personal reasons even though air travel is the appropriate mode of transportation. The cost of meals and lodging, parking, mileage, tolls, taxis, and ferries incurred while in transit by surface transportation may be reimbursed. Such costs shall not exceed the cost of airfare, based on the lower of the regular coach fare available for the location of travel from a standard commercial air carrier or the Company's travel program fare, plus transportation costs to and from the terminals.

6. **Conference Registration Fees-** If the conference fee was not prepaid, the Company will reimburse the fees, including business related banquets or meals that are part of the conference registration. Registration fees paid directly by an employee will not be reimbursed until the conference is completed. Original receipts to support the payment are required. Business-related banquets or meals that are part of the conference can be paid with the registration fees; however, such meals must be deducted from the employee's Per Diem allowance. Entertainment activities such as golf outings and sightseeing tours will not be reimbursed.

7. **Lodging (Commercial)-** The Company will reimburse the cost of overnight lodging expenses at reasonable, single occupancy or standard business room rates (room rate and tax only) to the employee, if the authorized travel is 45 miles or more from the employee's home or primary worksite. Exceptions to this restriction may be approved in writing at the Company's sole discretion. If the hotel or motel is the conference or convention site, reimbursement will be limited to the conference rate.

8. **Meals (Per Diem)-** Per Diem allowances are reimbursable for all in state overnight or out of state business travel that is 45 miles or more from the employee's home or primary work site. Per Diem reimbursements are based on departure and return times over the entire 24-hour day and are prorated accordingly. The Company's Per Diem rates are based on the U.S. General Services Administration Guidelines that vary by geography or the location of travel. In addition to meals these rates include incidental expenses such as laundry, dry cleaning, and service tips (i.e. meal, housekeeping, porters, etc.). Incidental expenses, unless specifically cited in this

policy, will not be reimbursed. Receipts are not required for Per Diem allowances and they are reimbursed after the trip is completed.

9. **Business Meals** - Business meals are meals with Company customers, prospects, recruits, or vendors during which substantial business discussions take place. The cost of such meals should be reasonable based on the business occasion. Original itemized receipts are required to claim reimbursement.

10. **Business Expenses**- The Company reimburses business expenses including faxes, photocopies, Internet charges, data ports, and business calls incurred while on authorized Company business travel. Original itemized receipts must be submitted.

11. **Parking & Tolls**- Original receipts are required for parking fees including airport parking totaling \$25 or more. The lodging bill can be used as a receipt when charges are included as part of the overnight stay. The policy also applies for tolls totaling \$25 or more.

12. **Miscellaneous Transportation**- Original receipts are required for taxi, bus, subway, metro, ferry, and other modes of transportation if costs are \$25.00 or more for each occurrence.

13. **Visa, Passport Fees, and Immunizations**- If international business travel is required, the Company will reimburse for these items. Original itemized receipts are required.

Anything specifically not mentioned in the policy is to be non-reimbursable and would require an exception approval.

SECTION 9: SEPARATION FROM EMPLOYMENT

9.1. Resignation- Termination of Employment by the Employee

You, as an at-will employee not subject to an employment contract, may choose to end your employment with the Company at any time, with or without good cause. You are requested to submit a notice of resignation in writing to your Supervisor or Human Resources at least two weeks prior to the date you intend for your resignation to take effect, to assist the Company in planning for your departure. Proper notice is necessary because separation procedures take time, and the notice will allow us time to prepare the necessary documents relative to your final pay and continuation/conversion of certain benefits as well as to attempt to recruit and to train a replacement. In addition, by giving proper notice, you will leave in good standing, which is to any employee's benefit.

With the exception of Company-recognized holidays, you are expected to be present as scheduled for each workday during your notice period. The Company may, in its sole discretion, decide not to have you work through your notice period. Your absence from work for a period of one scheduled workday without reporting in constitutes an abandonment of your employment and is considered to be your voluntary resignation from the Company. Leaving without notice will result in forfeiture of those benefits normally paid upon separation, which may be legally withheld by us and may result in your disqualification for Unemployment Compensation benefits.

9.2. Dismissal- Termination of Employment by the Employer

As an at-will employee not subject to an employment contract, the Company is entitled to terminate your employment at any time and for any reason or for no reason at all, regardless of your work performance or compliance with the rules set forth in this Handbook. Adil strives to work with its clients to know when assignments will end. At times, the client without notice may end assignments and accordingly, your employment relationship with Adil will end immediately. Upon termination, Employees are required to transfer their knowledge of their job tasks/duties to a designated individual. Disciplinary Action may be taken if the transfer of knowledge is not completed as per your employment agreement.

9.3. Automatic Dismissal

The commission of any offense considered serious enough by the Company, without limitation to those outlined below, will, except in extraordinary circumstances in the sole discretion of the Company's management, be followed by the immediate dismissal of that employee:

- Making false statements or omitting pertinent facts on an employment application or in an employment interview
- Threatening, assaulting, fighting with, or harassing another employee or anyone else encountered during the course of business
- Stealing or deliberately damaging the Company's or other employees' property
- Possessing a weapon at work
- Reporting to work under the influence of alcohol, narcotics, or other drugs, unless the drug was prescribed for the employee by a physician
- Falsifying or destroying the Company documents or computer files
- Conviction of a felony offense and/or imprisonment

9.4. Layoff and Recall

There may be occasions when it becomes necessary for the Company to reduce staff, due to certain business conditions or for other reasons. On such occasions, Adil will make decisions on the basis of our business needs related to employee job functions and their performance. The Supervisor will speak to you personally about your employment status as needed. If you leave the Company in good standing, you may be considered for reemployment at a later date if you meet the eligibility requirements of the position. However, in the case of rehiring, the Company may consider you to be a new employee with respect to vacation time, benefits, and seniority.

9.5. Company Property, Expense Reports, and Final Paycheck

Upon your separation or request by the Company, you must immediately return any Company or client property you may have in your possession. This includes but is not limited to: office keys or building/suite access cards, corporate credit cards, IT Equipment (cell phone and/or laptop) etc. Please note that failure to return any of the above mentioned property upon separation is considered theft, and will result in appropriate legal action in order to recover the stolen property. Remember that you must also continue to protect confidential and proprietary Company information even after you leave Adil.

All expenses incurred after your resignation must be submitted within three business days of your last day of employment.

The final paycheck will be released during the next normal pay period, except if state or local law requires a different pay period. If there are any unpaid obligations to the Company, the final paycheck will reflect the appropriate deductions. Adil reserves the right to recover any outstanding amounts owed, through all appropriate means, including deduction from the final paycheck to the fullest extent permitted by law or, if this is not possible due to legal restrictions or otherwise, legal action may be taken to recover any property or monies due to the Company.

9.6. Exit Interview

Upon termination of employment, voluntary (by the employee) or involuntary (by the employer), with or without cause in both cases, the Human Resources may choose to have an exit interview with the departing employee. During such interview, if any, you will receive preliminary information regarding post-termination benefits, continuation of coverage for which you may be eligible, and other post-employment related matters. In addition to this, the exit interview will request feedback on your experience with Adil as well as your experience with our designated client. The purpose of the exit interview is to ensure our company is performing optimally to meet the needs of our employees and clients.

SECTION 10: ARBITRATION AND CHOICE OF LAW

Adil Business Systems, Inc. anticipates a smooth and harmonious relationship with all of its employees. However, in the unfortunate event of any controversy or claim arising out of or relating to the employment relationship created between the employer Adil and the employee (you), including all topics covered in this Employee Handbook, and the interpretation of this Handbook, or any alleged breach of it, shall be settled by arbitration in accordance with the Arbitration Rules of the American Arbitration Association, with such arbitration to take place in the Country of the United States of America, State of New York with an agreed upon arbitrator.

If the parties cannot agree on an arbitrator, a court of competent jurisdiction shall appoint an arbitrator at the request of either Party. Although the parties shall initially bear the cost of arbitration equally, the prevailing party, if any as determined by the arbitrator at the request of the parties, which is hereby deemed, made, shall be entitled to reimbursement for its share of costs and reasonable attorneys' fees, as well as interest at the statutory rate. Judgment upon the award rendered by the arbitrator may be entered in any court having jurisdiction thereof. The determination of the arbitrator in such proceeding shall be final, binding, and non-appealable. In addition, the Company retains the right to seek injunctive or other relief in the case of misappropriation of trade secrets or other confidential information, or any other action by an employee, which might reasonably be expected to lead to irreparable harm to the Company.

This Handbook shall be interpreted, construed, and enforced in all respects in accordance with the laws of the State of New York.

SECTION 11: EMERGENCY CONTACTS

Adil Business Systems Inc

Maureen Kennedy 401-331-0755

Lori Mirabella 516-317-0119

*****If you call 911 as a result of a medical Emergency, please be sure to also notify building management with your name, call back number, and location so that the building engineer or security may swiftly guide the rescue to the exact location.

If the audible alarm within the building sounds, please do not call management office, unless there is something specific to report. Building management is aware of the noise, as well as the source of the alarm, whether it is false or a legitimate emergency. Please keep the telephone lines clear so that management may attend the situation as quickly and efficiently as possible.

EMERGENCY MANAGEMENT PROCEDURE

During a state of emergency and if this agency is contacted the following protocol will take place.

- Management will attempt to contact employees by phone to work with contracted facilities.
- Management will contact the appropriate facilities that require aid.
- When employees arrive safely, they will contact the supervisor for placement.
- Employees will maintain their position until released by facility.
- Management will be contacted by employees when exiting facility.

STATE FACILITIES

POLICY AND PROCEDURES

All employees will follow the policy and procedures of State Facilities

- Upon arrival the employee will check in with charge nurse on duty for assignment
- Employees will follow all policies and procedures of the facility
- Break and mealtimes will be scheduled by the nursing staff.
- When leaving facility have nurse or supervisor sign payroll slip.

SECTION 12: MEDICAL CHECKLIST

Name: _____

- | | |
|---|--------------------------|
| 1. Statement of good health (Every two years) | ☐ |
| 2. Proof of MMR vaccination | ☐ |
| 3. Up to date TB or PPD (within 1 year) or a chest x-ray performed within the last 10 years with an annual TB Questionnaire | ☐ |
| 4. Proof of Varicella vaccination | ☐ |
| 5. Proof of Hep B vaccinations or declination form | ☐ |
| 6. Up to date CPR card | ☐ |
| 7. Photo ID | ☐ |
| 8. Social Security Card | ☐ |
| 9. Up to date resume, 2 professional reference statements with phone numbers | ☐ |
| 10. Skills Checklist | ☐ |
| 11. Updated background check | ☐ |
| 12. Up to date Professional license | ☐ |
| 13. Proof of education | ☐ |
| 14. Up to date flu immunization or declination form | ☐ |
| Up to date performance evaluation | ☐ |
| | *Every year |

SECTION 13: CORONAVIRUS DISEASE 2019 (COVID -19)



P O P Y

Older Adults and people who have severe underlying medical conditions like heart or lung disease or diabetes seem to be at higher risk for developing serious complications from COVID -19 illness. More information on Are you at higher risk
Know how it spreads

- There is currently no vaccine to prevent coronavirus disease 2019(COVID -19)
- The best way to prevent illness is to avoid being exposed to this virus
- The virus is thought to spread mainly from person -person.
 - Between people who are in close contact with one another (within about 6 feet).
 - Through respiratory droplets produced when an infected person cough, sneeze or talks
 - These droplets can land in the mouths or noses of people who are nearby or possibly inhaled into the lungs
 - Some recent studies have suggested that COVID -19 may be spread by people who are not showing symptoms.

E S

- Wash your hands often with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, or sneezing.
- It's especially important to wash
 - Before eating or preparing food
 - Before touching your face
 - After using the restroom
 - After blowing your nose, coughing, or sneezing
 - After handling your mask
 - After changing a diaper
 - After caring for someone sick

Hand Hygiene

Hand hygiene protects both healthcare personnel and patients. Hand hygiene means cleaning your hands with:

- Handwashing with water and soap (e.g., plain soap or with an antiseptic).
- Antiseptic hand rub (alcohol-based foam or gel hand sanitizer).
- Surgical hand antisepsis.

Cleaning your hands reduces:

- The potential spread of deadly germs to patients.
- The spread of germs, including those resistant to antibiotics.
- The risk of healthcare personnel colonization or infection caused by germs received from the patient.

Some healthcare personnel may need to clean their hands as often as 100 times during a work shift to keep themselves, patients and staff safe. A common challenge is keeping the skin on your hands healthy and clean.

Know when to clean your hands:

- Immediately before touching a patient.
- Before performing an aseptic task such as placing an indwelling device or handling invasive medical devices.
- Before moving from work on a soiled body site to a clean body site on the same patient.
- After touching a patient or patient's surroundings.
- After contact with blood, body fluids, or contaminated surfaces.
- Immediately after glove removal.

About Handwashing

KEY POINTS

- Many diseases and conditions are spread by not washing hands with soap and clean, running water.
- Handwashing with soap is one of the best ways to stay healthy.
- If soap and water are not readily available, use a hand sanitizer with at least 60% alcohol to clean your hands.

Why it's important

Washing hands can keep you healthy and prevent the spread of respiratory and diarrheal infections. Germs can spread from person to person or from surfaces to people when you:

- Touch your eyes, nose, and mouth with unwashed hands
- Prepare or eat food and drinks with unwashed hands
- Touch surfaces or objects that have germs on them
- Blow your nose, cough, or sneeze into hands and then touch other people's hands or common objects

Key times to wash hands

You can help yourself and your loved ones stay healthy by washing your hands often, especially during these key times when you are likely to get and spread germs:

- Before, during, and after preparing food
- Before and after eating food
- Before and after caring for someone at home who is sick with vomiting or diarrhea
- Before and after treating a cut or wound
- After using the toilet
- After changing diapers or cleaning up a child who has used the toilet
- After blowing your nose, coughing, or sneezing
- After touching an animal, animal feed, or animal waste
- After handling pet food or pet treats
- After touching garbage

How it works

Washing your hands is easy, and it's one of the most effective ways to prevent the spread of germs. Follow these five steps every time.

1. **Wet** your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
2. **Lather** your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
3. **Scrub** your hands **for at least 20 seconds**. Need a timer? Hum the “Happy Birthday” song from beginning to end twice.
4. **Rinse** your hands well under clean, running water.
5. **Dry** your hands using a clean towel or an air dryer.

Use hand sanitizer when you can't use soap and water

Washing hands with soap and water is the best way to get rid of germs in most situations. If soap and water are not readily available, you can use an alcohol-based hand sanitizer that contains at least 60% alcohol. You can tell if the sanitizer contains at least 60% alcohol by looking at the product label.

SECTION 14: PATIENT RIGHTS

1. The right to considerate and respectful care that supports the right to personal dignity and to an environment which preserves that dignity and contributes to a positive self-image.
2. To obtain from your Physician complete current information concerning your diagnosis, treatment and prognosis in terms that you can understand. If it is not possible to give this information to you, this information will be given to the appropriate person in your behalf.
3. You have the right to know, by name the physician responsible for coordinating your care as well as the name of the Physician or other Practitioner who will provide the care, treatment and services.
4. To receive from your Physician information necessary to give informed consent prior to the start of any procedure or treatment. Except in emergencies, information for informed consent should include an explanation of the specific procedure or treatment of the medically significant risk involved and probable duration of your incapacitation. Where alternatives for care or treatment exist, you have the right to this information. You also have the right to know the name of the person responsible for the procedure or treatment.

5. To refuse care, treatment, and services to the permitted by law and regulation, including forgoing or withdrawing life-sustaining treatment or withholding resuscitative services and informed of the medical consequences of your actions.
6. To be informed by your Physician or his/her designee of the outcomes of any treatment or procedure whenever those outcomes differ significantly from the anticipated outcomes.
7. As a Patient of the medical facility, you can expect information about pain and pain relief measures, a concern staff committed to pain prevention and management, health professionals who respond quickly to reports of pain and your report of pain will be believed.
8. To every consideration of your privacy concerning your medical care program. Case discussion, consultation, examination and treatment are confidential and will be conducted discreetly. Those not directly involved in your care must have permission to be present.
9. To expect that all communications and records about your care will be treated as confidential.
10. To expect that within its capacity, the hospital will make reasonable response to your request for services. The hospital will provide evaluation, service and/or referral as indicated by the urgency of your care. When a transfer is indicated the hospital will provide medically complete information and explanation concerning your needs for and alternative to such transfer. The institution to which you are referred must first agree to accept you in advance for the transfer.
11. To sign a healthcare proxy under state law that designates a person to make health decisions on your behalf in the event that you are incapable of making health decisions on your own behalf or communication of those decisions.
12. To participate in the consideration of ethical issues or dilemmas that arise in your care.
13. To obtain information about the relationship of your hospital or other health care and educational institutions insofar as your care is concerned. You have the right to obtain information about any professional relationship among individuals, by name, who are treating you.
14. To be advised if the hospital proposes to engage in or perform human experimentation affecting your care or treatment. You have the right to participate to refuse participation in such research projects.
15. To expect reasonable continuity of care. You have the right to know in advance what appointment times and Physicians are available and where. You have the right to expect that the hospital will provide a mechanism to inform you of continuing health care requirements following discharge.
16. To examine and receive an explanation of your hospital bill, regardless of source of payment.
17. To know what hospital rules and regulations apply to your conduct while you are a Patient.
18. To have your cultural, psychosocial, spiritual, and personal values, beliefs, and preferences respected, including accommodating your right to pastoral and other spiritual services.
19. To be involved in decisions about your care, treatment and services to be provided.
20. To be free from mental, physical, sexual and verbal abuse, neglect and exploitation.
21. To make a formal complaint to an investigatory agency should you feel that your rights have been violated.

SECTION 15: COMPLAINT AND GRIEVANCE POLICY AND PROCEDURE PROTECTED HEALTH INFORMATION (PHI)

Purpose: To support our mission to continually improve the quality of the services we provide and to provide a process for handling complaints and grievances related to the use or disclosure of protected health information.

Definitions:

Complaint: an oral concern about our compliance with health-information privacy laws and regulations.

Grievance: a written concern about our compliance with health-information privacy laws and regulations.

Policy:

1. Complaints and grievances about PHI shall be investigated and managed in a timely and respectful manner.
2. Complaints and grievances concerning PHI and their disposition or resolution must be documented.
3. To the extent practicable any known harmful effect of a use or disclosure of PHI in violation of our policies and procedures and the requirements of applicable laws by this practice/health care facility or our business associates must be mitigated.
4. Adil will not retaliate in any way (e.g., intimidation, threatening behavior, coercion, and discrimination) against an individual lodging a complaint or grievance, or for testifying, assisting, or participating in any investigation or administrative action. Nor will any individual be asked to waive the rights permitted to him or her under state or federal privacy laws as a condition of treatment payment, enrollment, or eligibility for benefits.

Procedure for responding to a complaint:

1. Listen—communication considerations:
 - a. Actively listen. Take steps to minimize interruptions by others and interrupting the individual.
 - b. Restate your understanding of the nature of the issue.
2. Address the individual's concern if authorized and able to do so, or advise the individual that you would be happy to report the problem or that he or she may report the problem to : Lori Mirabella, Branch Mgr. 401-331-0755.
 - a. Remember confidentiality concerns (e.g., if a relative informed you of the concerns, do you have the authority to discuss the patient health care information with the relative—or do you need a signed authorization form?).
 - b. An individual has the right to request to file a written complaint to: Adil Business Systems, Inc Att: Lori Mirabella 401-331-0755
 - c. If the individual expresses a desire to complain to the Department of Health and Human Services, The Joint Commission or the Office of Civil Rights, advise the individual that “we also respect the right to file a complaint and that the practice/health care facility will not retaliate against you.”
3. Write down concerns.¹ This document should be routed to the individual responsible for oversight of complaints involving PHI. The complaint disposition or resolution should be noted in this document as well.
4. Follow up as needed (e.g., if indicated that the Privacy Officer would call the individual within the week, contact the Privacy Officer to ensure follow-up).

Responsible party:

Privacy Officer is responsible for overseeing the management and documentation requirements related to complaints and grievances regarding the use or disclosure of PHI. This individual also reviews and responds to complaints or grievances concerning PHI as needed.

Procedure for responding to a grievance or a complaint that cannot be resolved by anyone other than the Privacy Officer or the designee:

1. Respond to grievances in writing. Reply to complaints verbally—unless the individual requests otherwise or it is deemed more appropriate to respond in writing.
2. Consider confidentiality concerns (e.g., if a relative informed you of the concerns, do you have the authority to discuss the patient health care information with the relative—or do you need a signed authorization form?).
3. Notify or consult with the appropriate insurance carrier and/or legal counsel on issues involving liability and litigation potential.
4. Respond in a timely fashion (e.g., the initial response could simply be that we will investigate and inform you of the final decision if enough information is not available to make an immediate determination). A letter with the final resolution or disposition shall be sent to the individual (see also the template complaint/grievance resolution letter).
5. Notify the appropriate individual to address any pertinent employment issues (e.g., investigation, counseling, disciplinary action, or termination) according to applicable policies/procedures and state and federal laws.
6. Work to mitigate, to the extent practicable, any harmful effect that is known because of a use or disclosure of protected health information in violation of Island Hospital policies and procedures or the requirements of applicable laws by the Island Hospital or business associates.
7. Take steps to ensure that Adil will not retaliate in any way [e.g., intimidation, threatening behavior, coercion, and discrimination] against an individual lodging a complaint or grievance. Document the resolution or disposition of the grievance and maintain the information in a file labeled “In anticipation of litigation.”

SECTION 16: ADEMENTIA

The Stresses of Caregiving

Caring for an individual with Alzheimer’s disease or a related dementia can be challenging and, at times, overwhelming. Frustration is a normal and valid emotional response to many of the difficulties of being a caregiver. While some irritation may be part of everyday life as a caregiver, feeling extreme frustration can have serious consequences for you or the person you care for. Frustration and stress may negatively impact your physical health or cause you to be physically or verbally aggressive towards your loved one. If your caregiving situation is causing you extreme frustration or anger, you may want to explore some new techniques for coping.

When you are frustrated, it is important to distinguish between *what is and what is not within your power to change*. Frustration often arises out of trying to change an uncontrollable circumstance. As a caregiver of someone with dementia, you face many uncontrollable situations. Normal daily activities—dressing, bathing, and eating—may become sources of deep frustration for you. Behaviors often associated with dementia, like wandering or asking questions repeatedly, can be frustrating for caregivers but are uncontrollable behaviors for people with dementia. Unfortunately, you cannot simply change the behavior of a person suffering from dementia.

When dealing with an uncontrollable circumstance, you do control one thing: *how you respond to that circumstance*.

In order to respond without extreme frustration, you will need to:

- Learn to recognize the warnings signs of frustration.
- Intervene to calm yourself down physically.

- Modify your thoughts in a way that reduces your stress.
- Learn to communicate assertively.
- Learn to ask for help.

Warning Signs of Frustration

If you can recognize the warning signs of frustration, you can intervene and adjust your mood before you lose control. Some of the common warning signs of frustration include:

- Shortness of breath
- Knot in the throat
- Stomach cramps
- Chest pains
- Headache
- Compulsive eating
- Excessive alcohol consumption
- Increased smoking
- Lack of patience
- Desire to strike out

Calming Down Physically

When you become aware of the warning signs of frustration, you can intervene with an immediate activity to help you calm down. This gives you time to look at the situation more objectively and to choose how to respond in a more controlled way.

When you feel yourself becoming frustrated, try counting from one to ten slowly and taking a few deep breaths. If you are able, take a brief walk or go to another room and collect your thoughts. It is better to leave the situation, even for a moment, than to lose control or react in a way you will regret it. If you think someone may be offended when you leave the room, you can tell that person you need to go to the restroom. You can also try calling a friend, praying, meditating, singing, listening to music, or taking a bath. Try experimenting with different responses to find out what works best for you and the person you care for.

The regular practice of relaxation techniques can also help prepare you for frustrating circumstances. If possible, try the following relaxation exercises for at least ten minutes each day:

Sit in a comfortable position in a quiet place. Take slow, deep breaths and relax the tension in your body. While you continue to take slow, deep breaths, you may want to imagine a safe and restful place and repeat a calming word or phrase.

Modifying Your Thoughts

As you take time out to collect your thoughts, try rethinking your situation in ways that reduce frustration. How you think often affects how you feel. Of course, feelings of frustration arise from difficult circumstances. If, however, you analyze your response to a frustrating situation, you will usually find some form of *maladaptive*—or negative—thinking that has the effect of increasing your frustration, preventing you from looking at your situation objectively, or finding a better way to deal with it.

Below are six major types of unhelpful thought patterns common among caregivers. Following each unhelpful thought pattern is an example of an *adaptive*—or more helpful—thought that can be used as self-defense against frustration. Familiarizing yourself with unhelpful thought patterns and the adaptive responses can help you control your frustration.

Overgeneralization

You take one negative situation or characteristic and multiply it. For example, you're getting ready to take

the person in your care to a doctor's appointment when you discover the car battery has died. You then conclude, "This always happens; something always goes wrong."

Adaptive response: "This does not happen all the time. Usually, my car is working just fine. At times things don't happen the way I would like, but sometimes they do."

Discounting the Positive

You overlook the good things about your circumstances and yourself. For example, you might not allow yourself to feel good about caregiving by thinking, "I could do more" or "anyone could do what I do."

Adaptive response: "Caregiving is not easy. It takes courage, strength, and compassion to do what I do. I am not always perfect, but I do a lot, and I am trying to be helpful."

Jumping to Conclusions

You reach a conclusion without having all the facts. You might do this in two ways:

1. **Mindreading:** We assume that others are thinking negative thoughts about us. For example, a friend doesn't return a phone call, and we assume that he or she is ignoring us or doesn't want to talk to us.

Adaptive response: "I don't know what my friend is thinking. For all I know, she didn't get the message. Maybe she is busy or just forgot. If I want to know what she is thinking, I will have to ask her."

2. **Fortune-telling:** You predict a negative outcome in the future. For example, you will not try adult day care because you assume the person in your care will not enjoy it. You think, "He will never do that. Not a chance!"

Adaptive response: "I cannot predict the future. I don't think he is going to like it, but I won't know for sure unless I try."

"Should" Statements

You try to motivate yourself using statements such as "I should call Mother more often" or "I shouldn't go to a movie because Mom might need me." What you think you "should" do is in conflict with what you want to do. You end up feeling guilty, depressed, or frustrated.

Adaptive response: "I would like to go to a movie. It's okay for me to take a break from caregiving and enjoy myself. I will ask a friend or neighbor to check in on Mom."

Labeling

You identify yourself or other people with one characteristic or action. For example, you put off doing the laundry and think, "I am lazy."

Adaptive response: "I am not lazy. Sometimes I don't do as much as I could, but that doesn't mean I am lazy. I often work hard and do the best that I can. Even I need a break sometimes."

Personalizing

You take responsibility for a negative occurrence that is beyond your control. For example, you might blame yourself when the person in your care requires hospitalization or placement in a facility.

Adaptive response: "Mom's condition has gotten to the point where I can no longer take care of her myself. It is her condition and not my shortcomings that require her to be in a nursing home."

Using the “Triple-Column Technique”

Unhelpful thought patterns are usually ingrained reactions or habits. To modify your negative thoughts, you will have to learn to recognize them, know why they are false, and talk back to them.

One helpful way to practice using more adaptive thinking processes is to use the “triple-column technique.” Draw two lines down the center of a piece of paper to divide the paper into thirds. When you are feeling frustrated, take a personal “time out” and write your negative thoughts in the first column.

In the second column, try to identify the type of unhelpful pattern from the six examples above. In the third column, talk back to your negative thoughts with a more positive point of view. See below for examples.

Negative Thoughts

Thought Patterns

Adaptive Thoughts

(Caregiver burns dinner.) “I can’t do anything right!”

Overgeneralization

I’m not perfect, but nobody is perfect. Sometimes I make mistakes, and sometimes I do things well.

(Caregiver has coffee with a friend and spouse has accident at home.) “I’m selfish and rotten! If I had been home, he wouldn’t have fallen.”

Labeling; personalizing

I’m not selfish or rotten. I do a lot to take care of my husband, but I need to take care of myself as well. He might have fallen even if I had been home.

(Brother does not show up to take your Dad to the doctor.) “I knew I couldn’t trust him. I should just do it myself next time.”

Jumping to conclusions; should statements

I don’t know why he didn’t come, but I need his help, so we’ll have to find ways for him to share the burden of Dad’s care.

Communicating Assertively

Good communication can reduce frustration by allowing you to express yourself while helping others to understand your limits and needs. *Assertive* communication is different from passive or aggressive communication. When you communicate passively, you may be keeping your own needs and desires inside to avoid conflict with others. While this may seem easier on the surface, the long-term result may be that others feel they can push you around to get their way.

When you communicate aggressively, you may be forcing your needs and desires onto others. While this allows you to express your feelings, aggressive communication generally makes others more defensive and less cooperative.

When you communicate assertively, you express your own needs and desires while respecting the needs and desires of others. Assertive communication allows both parties to engage in a dignified discussion about the issue at hand.

Keys to assertive communication are:

- Respecting your own feelings, needs, and desires.
- Standing up for your feelings without shaming, degrading, or humiliating the other person.
- Using “I” statements rather than “you” statements. For example, say, “I need a break” or “I would like to talk to you and work this out” instead of “You are irresponsible” or “You never help out!”
- Not using “should” statements. For example, say, “It’s important to me that promises be kept,” instead of “You should keep your promise.”

The Critical Step: Asking for Help

You cannot take on all the responsibilities of caregiving by yourself. It is essential that you ask for and accept help. Discuss your needs with family members and friends who might be willing to share caregiving responsibilities. People will not realize you need help if you do not explain your situation and ask for assistance. Remember, you have the right to ask for help and express your needs.

When to say “Yes”

Don't be afraid to say “Yes” if someone offers to help. Say “Yes” at the moment a person offers to help rather than saying “Maybe” and waiting until you are in a fix. Have a list handy of errands or tasks you need help with. Keep in mind that people feel useful and gratified when they are able to help others.

When to say “No”

Often, caregivers are pulled in multiple directions. In addition to the demands of caregiving, you may feel compelled to meet the demands of your immediate and extended family, your friends, and your employer. Learn how to say “No” to the demands of others when you are overwhelmed or need a break. It is your right to say “No” to extra demands on your time without feeling guilty.

Learning Effective Communication Techniques for Dementia Caregiving

Many families find it frustrating to communicate with a loved one who has dementia. The person with dementia may repeat questions over and over or mistake you for someone else. It is important to remember that the person with dementia cannot control behavior caused by their disease. They do not need to be corrected or grounded in “reality.” You can distract them or just agree with them as a way to reduce your frustration.

It can be helpful, however, to learn more about dementia and effective communication techniques which will ease your frustration. For example, use simple, direct statements, and place yourself close when speaking to a person with a cognitive disorder. Try not to argue about unimportant things such as what the date is. Allow extra time to accomplish tasks such as dressing. Remember, people with dementia often react more to our feelings than to our words. Finding ways to be calm can help you to gain cooperation. See FCA's fact sheet *Caregiver's Guide to Understanding Dementia Behaviors* for more helpful strategies.

Self-Care to Prevent Frustration

Caregiving can be tiring and stressful. When you're caring for others, it's easy to forget to care for yourself. While it may be difficult to find time to focus on yourself and your needs, it is very important that you do so to prevent frustration and burnout. FCA's Fact Sheet: *Taking Care of YOU: Self-Care for Caregivers* offers additional information.

Here are three steps to taking better care of YOU:

1. Make Time for Yourself

You may feel guilty about needing or wanting time out for rest, socialization, and fun. However, everyone deserves regular and ongoing breaks from work, including caregivers. “Respite” providers can give you the opportunity to take the breaks you need. Respite breaks may be provided by in-home help, adult day care, “friendly visitor” programs, friends and neighbors, or other means. The important point is to allow yourself to take a break from caregiving. See Resources at the end of this fact sheet for organizations that might help you give yourself time off from caregiving.

2. Take Care of Yourself

Although caregiving may make it difficult to find time for yourself, it is important to eat well, exercise, get a good night's sleep, and attend to your own medical needs.

When you do not take care of yourself, you are prone to increased anxiety, depression, frustration, and physical distress that will make it more difficult to continue providing care.

3. Seek Outside Support

Sharing your feelings with a counselor, pastor, a support group, or with another caregiver in a similar situation can be a great way to release stress and get helpful advice. You may want to contact the organizations under Resources at the end of this fact sheet, or look in the community services section at the front of the *Yellow Pages*, under Counseling or Senior Services, to find services to help you get some caregiver support. The FCA fact sheet on *Community Care Options* also offers information.

Resources

Family Caregiver Alliance

National Center on Caregiving

(415) 434-3388 | (800) 445-8106

Website: www.caregiver.org

Email: info@caregiver.org

FCA Care Journey: www.caregiver.org/carejourney

Family Care Navigator: www.caregiver.org/family-care-navigator

Family Caregiver Alliance (FCA) seeks to improve the quality of life for caregivers through education, services, research, and advocacy. Through its National Center on Caregiving, FCA offers information on current social, public policy, and caregiving issues and provides assistance in the development of public and private programs for caregivers. For residents of the greater San Francisco Bay Area, FCA provides direct support services for caregivers of those with Alzheimer's disease, stroke, traumatic brain injury, Parkinson's, and other debilitating disorders that strike adults.

FCA Fact and Tip Sheets

A listing of all facts and tips is available online at www.caregiver.org/fact-sheets.

Caregiver's Guide to Understanding Dementia Behaviors

Hiring In-Home Help

Taking Care of YOU: Self-Care for Family Caregivers

Caregiving at Home: A Guide to Community Resources

Other Organizations and Links

Alzheimer's Association

www.alz.org

National Volunteer Caregiving Network

www.nvcnetwork.org

Visit website to find volunteer caregiving assistance.

ARCH National Respite Network and Resource Center

www.archrespite.org

Visit website to find local respite providers.

Eldercare Locator

eldercare.acl.gov

Visit website or call to find your local Area Agency on Aging and services for the elderly and caregivers, including respite care providers.

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Understanding Dementia

Introduction

Caring for a loved one with dementia poses many challenges for families and caregivers. People with dementia from conditions such as Alzheimer's and related diseases have a progressive biological brain disorder that makes it more and more difficult for them to remember things, think clearly, communicate with others, and take care of themselves. In addition, dementia can cause mood swings and even change a person's personality and behavior. This fact sheet provides some practical strategies for dealing with the troubling behavior problems and communication difficulties often encountered when caring for a person with dementia.

Ten Tips for Communicating with a Person with Dementia

We aren't born knowing how to communicate with a person with dementia—but we can learn. Improving your communication skills will help make caregiving less stressful and will likely improve the quality of your relationship with your loved one. Good communication skills will also enhance your ability to handle the difficult behavior you may encounter as you care for a person with a dementing illness.

1. **Set a positive mood for interaction.** Your attitude and body language communicate your feelings and thoughts more strongly than your words do. Set a positive mood by speaking to your loved one in a pleasant and respectful manner. Use facial expressions, tone of voice, and physical touch to help convey your message and show your feelings of affection.
2. **Get the person's attention.** Limit distractions and noise—turn off the radio or TV, close the curtains or shut the door, or move to quieter surroundings. Before speaking, make sure you have her attention; address her by name, identify yourself by name and relation, and use nonverbal cues and touch to help keep her focused. If she is seated, get down to her level and maintain eye contact.
3. **State your message clearly.** Use simple words and sentences. Speak slowly, distinctly, and in a reassuring tone. Refrain from raising your voice higher or louder; instead, pitch your voice lower. If she doesn't understand the first time, use the same wording to repeat your message or question. If she still doesn't understand, wait a few minutes and rephrase the question. Use the names of people and places instead of pronouns (he, she, they) or abbreviations.
4. **Ask simple, answerable questions.** Ask one question at a time; those with yes or no answers work best. Refrain from asking open-ended questions or giving too many choices. For example, ask, "Would you like to wear your white shirt or your blue shirt?" Better still, show her the choices—visual prompts and cues also help clarify your question and can guide her response.
5. **Listen with your ears, eyes, and heart.** Be patient in waiting for your loved one's reply. If she is struggling for an answer, it's okay to suggest words. Watch for nonverbal cues and body language, and respond appropriately. Always strive to listen for the meaning and feelings that underlie the words.
6. **Break down activities into a series of steps.** This makes many tasks much more manageable. You can encourage your loved one to do what he can, gently remind him of steps he tends to forget, and assist with steps he's no longer able to accomplish on his own. Using visual cues, such as showing him with your hand where to place the dinner plate, can be very helpful.
7. **When the going gets tough, distract and redirect.** If your loved one becomes upset or agitated, try changing the subject or the environment. For example, ask him for help or suggest going for a walk. It is important to connect with the person on a feeling level, before you redirect. You might say, "I see you're feeling sad—I'm sorry you're upset. Let's go get something to eat."
8. **Respond with affection and reassurance.** People with dementia often feel confused, anxious, and unsure of themselves. Further, they often get reality confused and may recall things that never really occurred. Avoid trying to convince them they are wrong. Stay focused on the feelings they are demonstrating (which are real) and respond with verbal and physical expressions of comfort, support, and

reassurance. Sometimes holding hands, touching, hugging, and praise will get the person to respond when all else fails.

9. **Remember the good old days.** Remembering the past is often a soothing and affirming activity. Many people with dementia may not remember what happened 45 minutes ago, but they can clearly recall their lives 45 years earlier. Therefore, avoid asking questions that rely on short-term memory, such as asking the person what they had for lunch. Instead, try asking general questions about the person's distant past—this information is more likely to be retained.
10. **Maintain your sense of humor.** Use humor whenever possible, though not at the person's expense. People with dementia tend to retain their social skills and are usually delighted to laugh along with you.

Handling Troubling Behavior

Some of the greatest challenges of caring for a loved one with dementia are the personality and behavior changes that often occur. You can best meet these challenges by using creativity, flexibility, patience, and compassion. It also helps to not take things personally and maintain your sense of humor.

To start, consider these ground rules:

We cannot change the person. The person you are caring for has a brain disorder that shapes who he has become. When you try to control or change his behavior, you'll most likely be unsuccessful or be met with resistance. It's important to:

- Try to accommodate the behavior, not control the behavior. For example, if the person insists on sleeping on the floor, place a mattress on the floor to make him more comfortable.
- Remember that we **can change our behavior** or the physical environment. Changing our own behavior will often result in a change in our loved one's behavior.

Check with the doctor first. Behavioral problems may have an underlying medical reason: perhaps the person is in pain or experiencing an adverse side effect from medications. In some cases, like incontinence or hallucinations, there may be some medication or treatment that can assist in managing the problem.

Behavior has a purpose. People with dementia typically cannot tell us what they want or need. They might do something, like take all the clothes out of the closet on a daily basis, and we wonder why. It is very likely that the person is fulfilling a need to be busy and productive. Always consider what need the person might be trying to meet with their behavior—and, when possible, try to accommodate them.

Behavior is triggered. It is important to understand that all behavior is triggered—it occurs for a reason. It might be something a person did or said that triggered a behavior, or it could be a change in the physical environment. The root to changing behavior is disrupting the patterns that we create. Try a different approach, or try a different consequence.

What works today, may not tomorrow. The multiple factors that influence troubling behaviors, and the natural progression of the disease process, mean that solutions that are effective today may need to be modified tomorrow—or may no longer work at all. The key to managing difficult behaviors is being creative and flexible in your strategies to address a given issue.

Get support from others. You are not alone—there are many others caring for someone with dementia. Locate your nearest Area Agency on Aging, the local chapter of the Alzheimer's Association, a [California Caregiver Resource Center](#), or visit the Family Care Navigator (www.caregiver.org/family-care-navigator) to find support groups, organizations, and services that can help you. Expect that, like the loved one you are caring for, you will have good days and bad days. Develop strategies for coping with the bad days.

The following is an overview of the most common dementia-associated behaviors, with suggestions that may be useful in handling them. You'll find additional resources listed at the end of this fact sheet.

Wandering

People with dementia walk seemingly aimlessly, for a variety of reasons, such as boredom, medication side effects, or to look for “something” or someone. They also may be trying to fulfill a physical need—thirst, hunger, a need to use the toilet, or exercise. Discovering the triggers for wandering are not always easy, but they can provide insights to dealing with the behavior.

- Make time for regular exercise to minimize restlessness.
- Consider installing new locks that require a key. Position locks high or low on the door; many people with dementia will not think to look beyond eye level. Keep in mind fire and safety concerns for all family members; the lock(s) must be accessible to others and not take more than a few seconds to open.
- Try a barrier like a curtain or colored streamer to mask the door. A “stop” sign or “do not enter” sign also may help.
- Place a black mat or paint a black space on your front porch; this may appear to be an impassable hole to the person with dementia.
- Add “child-safe” plastic covers to doorknobs.
- Consider installing a home security system or monitoring system designed to keep watch over someone with dementia. Also available are new digital devices that can be worn like a watch or clipped on a belt that use global positioning systems (GPS) or other technology to track a person’s whereabouts or locate him if he wanders off.
- Put away essential items such as the confused person’s coat, purse, or glasses. Some individuals will not go out without certain articles.
- Have your relative wear an ID bracelet and sew ID labels in their clothes. Always have a current photo available should you need to report your loved one missing. Consider leaving a copy on file at the police department or registering the person with the Alzheimer’s Association Safe Return program or other emergency tracking service.
- Tell neighbors about your relative’s wandering behavior, and make sure they have your phone number.

Incontinence

The loss of bladder or bowel control often occurs as dementia progresses. Sometimes accidents result from environmental factors; for example, someone can’t remember where the bathroom is located or can’t get to it in time. If an accident occurs, your understanding and reassurance will help the person maintain dignity and minimize embarrassment.

- Establish a routine for using the toilet. Try reminding the person or assisting her to the bathroom every two hours.
- Schedule fluid intake to ensure the confused person does not become dehydrated. Know that some drinks (coffee, tea, cola, or beer) have more of a diuretic effect than others. Limit fluid intake in the evening before bedtime.
- Use signs (with illustrations) to indicate which door leads to the bathroom.
- A commode, obtained at any medical supply store, can be left in the bedroom at night for easy access.
- Incontinence pads and products can be purchased at the pharmacy or supermarket. A urologist may be able to prescribe a special product or treatment.
- Use easy-to-remove clothing with elastic waistbands or velcro closures, and provide clothes that are easily washable.

Agitation

Agitation refers to a range of behaviors associated with dementia, including irritability, sleeplessness, and verbal or physical aggression. Often these types of behavior problems progress with the stages of dementia, from mild to more severe. Agitation may be triggered by a variety of things, including environmental factors, fear, and fatigue. Most often, agitation is triggered when the person experiences “control” being taken from him or her.

- Reduce noise, clutter, or the number of persons in the room.
- Maintain structure by keeping the same routines. Keep household objects and furniture in the same places. Familiar objects and photographs offer a sense of security and can suggest pleasant memories.
- Reduce caffeine intake, sugar, and other foods that cause spikes in energy.

- Try gentle touch, soothing music, reading, or walks to quell agitation. Speak in a reassuring voice. Do not try to restrain the person during a period of agitation.
- Keep dangerous objects out of reach.
- Allow the person to do as much for himself as possible—support his independence and ability to care for himself.
- Acknowledge the confused person's anger over the loss of control in his life. Tell him you understand his frustration.
- Distract the person with a snack or an activity. Allow him to forget the troubling incident. Confronting a confused person may increase anxiety.

Repetitive Speech or Actions (Perseveration)

People with dementia will often repeat a word, statement, question, or activity over and over. While this type of behavior is usually harmless for the person with dementia, it can be annoying and stressful to caregivers. Sometimes the behavior is triggered by anxiety, boredom, fear, or environmental factors.

- Provide plenty of reassurance and comfort, both in words and in touch.
- Try distracting with a snack or activity.
- Avoid reminding them that they just asked the same question. Try ignoring the behavior or question, and instead try refocusing the person into an activity such as singing or "helping" you with a chore.
- Don't discuss plans with a confused person until immediately prior to an event.
- You may want to try placing a sign on the kitchen table, such as, "*Dinner is at 6:30*" or "*Lois comes home at 5:00*" to remove anxiety and uncertainty about anticipated events.
- Learn to recognize certain behaviors. An agitated state or pulling at clothing, for example, could indicate a need to use the bathroom.

Paranoia

Seeing a loved one suddenly become suspicious, jealous, or accusatory is unsettling. Remember, what the person is experiencing is very real to them. It is best not to argue or disagree. This, too, is part of the dementia—try not to take it personally.

- If the confused person suspects money is "missing," allow her to keep small amounts of money in a pocket or handbag for easy inspection.
- Help them look for the "missing" object and then distract them into another activity. Try to learn where the confused person's favorite hiding places are for storing objects, which are frequently assumed to be "lost." Avoid arguing.
- Take time to explain to other family members and home-helpers that suspicious accusations are a part of the dementing illness.
- Try nonverbal reassurances like a gentle touch or hug. Respond to the feeling behind the accusation and then reassure the person. You might try saying, "*I see this frightens you; stay with me, I won't let anything happen to you.*"

Sleeplessness/Sundowning

Restlessness, agitation, disorientation, and other troubling behavior in people with dementia often get worse at the end of the day and sometimes continue throughout the night. Experts believe this behavior, commonly called *sundowning*, is caused by a combination of factors, such as exhaustion from the day's events and changes in the person's biological clock that confuse day and night.

- Increase daytime activities, particularly physical exercise. Discourage inactivity and napping during the day.
- Watch out for dietary culprits, such as sugar, caffeine, and some types of junk food. Eliminate or restrict these types of foods and beverages to early in the day. Plan smaller meals throughout the day, including a light meal, such as half a sandwich, before bedtime.
- Plan for the afternoon and evening hours to be quiet and calm; however, *structured, quiet activity is important*. Perhaps take a stroll outdoors, play a simple card game, or listen to soothing music together.

- Turning on lights well before sunset and closing the curtains at dusk will minimize shadows and may help diminish confusion. At minimum, keep a nightlight in the person's room, hallway, and bathroom.
- Make sure the house is safe: block off stairs with gates, lock the kitchen door and/or put away dangerous items.
- As a last resort, consider talking to the doctor about medication to help the agitated person relax and sleep. Be aware that sleeping pills and tranquilizers may solve one problem and create another, such as sleeping at night but being more confused the next day.
- It's essential that you, the caregiver, get enough sleep. If your loved one's nighttime activity keeps you awake, consider asking a friend or relative, or hiring someone, to take a turn so that you can get a good night's sleep. Catnaps during the day also might help.

Eating/Nutrition

Ensuring that your loved one is eating enough nutritious foods and drinking enough fluids is a challenge. People with dementia literally begin to forget that they need to eat and drink. Complicating the issue may be dental problems or medications that decrease appetite or make food taste "funny." The consequences of poor nutrition are many, including weight loss, irritability, sleeplessness, bladder or bowel problems, and disorientation.

- Make meal and snack times part of the daily routine and schedule them around the same time every day. Instead of three big meals, try five or six smaller ones.
- Make mealtimes a special time. Try flowers or soft music. Turn off loud radio programs and the TV.
- Eating independently should take precedence over eating neatly or with "proper" table manners. Finger foods support independence. Pre-cut and season the food. Try using a straw or a child's "sippy cup" if holding a glass has become difficult. Provide assistance only when necessary and allow plenty of time for meals.
- Sit down and eat with your loved one. Often they will mimic your actions, and it makes the meal more pleasant to share it with someone.
- Prepare foods with your loved one in mind. If they have dentures or trouble chewing or swallowing, use soft foods or cut food into bite-size pieces.
- If chewing and swallowing are issues, try gently moving the person's chin in a chewing motion or lightly stroking their throat to encourage them to swallow.
- If loss of weight is a problem, offer nutritious high-calorie snacks between meals. Breakfast foods high in carbohydrates are often preferred. On the other hand, if the problem is weight gain, keep high-calorie foods out of sight. Instead, keep handy fresh fruits, veggie trays, and other healthy low-calorie snacks.

Bathing

People with dementia often have difficulty remembering "good" hygiene, such as brushing teeth, toileting, bathing, and regularly changing their clothes. From childhood we are taught these are highly private and personal activities; to be undressed and cleaned by another can feel frightening, humiliating, and embarrassing. As a result, bathing often causes distress for both caregivers and their loved ones.

- Think historically of your loved one's hygiene routine — did she prefer baths or showers? Mornings or nights? Did she have her hair washed at the salon or do it herself? Was there a favorite scent, lotion, or powder she always used? Adopting—as much as possible—her past bathing routine may provide some comfort. Remember that it may not be necessary to bathe every day—sometimes twice a week is sufficient.
- If your loved one has always been modest, enhance that feeling by making sure doors and curtains are closed. Whether in the shower or the bath, keep a towel over her front, lifting to wash as needed. Have towels and a robe or her clothes ready when she gets out.
- Be mindful of the environment, such as the temperature of the room and water (older adults are more sensitive to heat and cold) and the adequacy of lighting. It's a good idea to use safety features such as non-slip floor bath mats, grab-bars, and bath or shower seats. A hand-held shower might also be a good feature to install. Remember—people are often afraid of falling. Help them feel secure in the shower or tub.
- Never leave a person with dementia unattended in the bath or shower. Have all the bath things you need laid out beforehand. If giving a bath, draw the bath water first. Reassure the person that the water is warm—perhaps pour a cup of water over her hands before she steps in.

- If hair washing is a struggle, make it a separate activity. Or, use a dry shampoo.
- If bathing in the tub or shower is consistently traumatic, a towel bath provides a soothing alternative. A *bed bath* has traditionally been used with only the most frail and bed-ridden patients, soaping up a bit at a time in their beds, rinsing off with a basin of water, and drying with towels. A growing number of nurses in and out of facilities, however, are beginning to recognize its value and a variation—the “towel bath”—for others as well, including people with dementia who find bathing in the tub or shower uncomfortable or unpleasant. The towel bath uses a large bath towel and washcloths dampened in a plastic bag of warm water and no-rinse soap. Large bath-blankets are used to keep the patient covered, dry and warm while the dampened towel and washcloths are massaged over the body.

Additional Problem Areas

- Dressing is difficult for most dementia patients. Choose loose-fitting, comfortable clothes with easy zippers or snaps and minimal buttons. Reduce the person’s choices by removing seldom-worn clothes from the closet. It’s common for people with dementia to continue layering on clothes even though they are fully dressed. To facilitate dressing and support independence, lay out one article of clothing at a time, in the order it is to be worn. Remove soiled clothes from the room. Don’t argue if the person insists on wearing the same thing again.
- Hallucinations (seeing or hearing things that others don’t) and delusions (false beliefs, such as someone is trying to hurt or kill another) may occur as the dementia progresses. State simply and calmly your perception of the situation, but avoid arguing or trying to convince the person that their perceptions are wrong. Keep rooms well-lit to decrease shadows, and offer reassurance and a simple explanation if the curtains move from circulating air, or if a loud noise such as a plane or siren is heard. Distractions may help. Depending on the severity of symptoms, you might consider medication.
- Sexually inappropriate behavior, such as masturbating or undressing in public, lewd remarks, unreasonable sexual demands, even sexually aggressive behavior, may occur during the course of the illness. Remember, this behavior is caused by the disease. Develop an action plan to follow before the behavior occurs, i.e., what you will say and do if the behavior happens at home, around other relatives, friends, or paid caregivers. If you can, identify what triggers the behavior.
- Verbal outbursts such as cursing, arguing, and threatening often are expressions of anger or stress. React by staying calm and reassuring. Validate your loved one’s feelings and then try to distract or redirect his attention to something else.
- “Shadowing” is when a person with dementia imitates and follows the caregiver, or constantly talks, asks questions, and interrupts. Like sundowning, this behavior often occurs late in the day and can be irritating for caregivers. Comfort the person with verbal and physical reassurance. Distraction or redirection might also help. Giving your loved one a job such as folding laundry might help to make her feel needed and useful.
- People with dementia may become uncooperative and resistant to daily activities such as bathing, dressing, and eating. Often this is a response to feeling out of control, rushed, afraid, or confused by what you are asking of them. Break each task into steps and, in a reassuring voice, explain each step before you do it. Allow plenty of time. Find ways to have them assist to their ability in the process, or follow with an activity that they can perform.
- Even with these many potential challenges, it’s important to remember that these behaviors are often coping tactics for a person with deteriorating brain function. There’s no question that dealing with these behaviors can make caregiving especially challenging.

Resources

Family Caregiver Alliance

National Center on Caregiving

(415) 434-3388 | (800) 445-8106

Website: www.caregiver.org

Email: info@caregiver.org

FCA CareJourney: www.caregiver.org/carejourney

Family Care Navigator: www.caregiver.org/family-care-navigator

Family Caregiver Alliance (FCA) seeks to improve the quality of life for caregivers through education, services, research, and advocacy. Through its National Center on Caregiving, FCA offers information on

current social, public policy, and caregiving issues and provides assistance in the development of public and private programs for caregivers. For residents of the greater San Francisco Bay Area, FCA provides direct support services for caregivers of those with Alzheimer's disease, stroke, traumatic brain injury, Parkinson's, and other debilitating health conditions that strike adults

SECTION 17: CODE OF ETHICS

Integrity: Maintain honesty and clear communication in the workplace.

Teamwork: Work together to get the job done

Objectivity: Don't make career decisions based on whom you like the best.

Confidentiality: Maintain Client and Patient Confidence at all times.

Growth: Always pursue professional growth

What is the Code of Ethics for Healthcare

The Code of Ethics for Healthcare (Code) is the definitive standard for ethical nursing practice. This essential resource guides nurses as they make patient care and practice decisions in today's complex healthcare environment. The Code also supports Healthcare workers in maintaining their professional integrity in all care settings. Anchored in nursing's moral traditions, the Code emphasizes the profession's 21st Century imperative to advance social justice and health equity.

Life and death decisions are a part of nursing, and ethics are therefore fundamental to the integrity of the nursing profession. Every day, Healthcare workers support each other to fulfill their ethical obligations to patients and the public, but in an ever-changing world – there are increased challenges. Learn more about how the Code of Ethics for Healthcare, or “the Code”, is a vital tool for healthcare workers now and in the future.

Code of Ethics for Nurses

The revision of the Code was informed by a panel of nurses selected from various practice settings, geographic locations, and differing levels of expertise. After a revised code was drafted, it was posted for public comments to which over 6,300 responses were received from 3,000 individuals. The contributions of these individuals are gratefully acknowledged.

The American Nurses Association is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation.

A L E :

DEFINITIONS:

- ☐ Ethics - moral principles, morally right, a standard of conduct.
- ☐ Ethicist - a specialist in ethics.
- ☐ Dilemma - any situation requiring a choice between unpleasant alternatives.

Most ethicists say there are seven ETHICAL PRINCIPLES:

- ☐ Beneficence - doing good, caring.
- ☐ Non-maleficence - doing no harm.
- ☐ Justice - being fair.
- ☐ Autonomy - respecting the patient's right to make decisions.
- ☐ Loyalty (Fidelity) - keeping promises.
- ☐ Veracity - telling the truth.
- ☐ Confidentiality - keeping the patient's information private.

Some say that all ethical decisions are based on the economic, or money, interest of the provider and of society. In other words, what will the decision cost and is it worth it?

Here are ways you can PUT THESE ETHICAL PRINCIPLES INTO PRACTICE:

- ☐ Respect the culture and customs of your patients.
- ☐ Be truthful in all communication.
- ☐ Do not speak badly of patients, coworkers or the Agency.
- ☐ Avoid exploitation of relationships for personal advantage.
- ☐ Do not discriminate.
- ☐ Assure confidentiality of patients - do not talk about them to others who do not have "the need to know."
- ☐ Assure autonomy of patients - let them participate in deciding their care and treatment.

THINK ABOUT THESE SAMPLES OF ETHICAL DILEMMAS:

- ☐ ? Your elderly patient, who is disoriented, needs a blood transfusion. Her son has medical power as an attorney. (See "A Brief Look-Advance Directives.") He is a devout Jehovah's Witness who doesn't believe in blood transfusions, and she is a Methodist. What's the right thing to do?
- ☐ ? You are the Home Health Aide for a patient who is receiving insulin twice a day. She told you she had just eaten a large piece of strawberry shortcake. She asked you not to tell the nurse. What's the right thing to do?

By the way, there may not be a "right" answer to any of these!

A Brief Look at Ethics

Quiz

Employee: _____ Date: _____

Graded By (RN): _____ Grade: _____

1. Ethics means a standard of conduct. There are seven ethical principles presented in this lesson. One of them is beneficence. Beneficence means being fair.
 - a) True
 - b) False
2. Justice means being fair.
 - a) True
 - b) False
3. On the way to your patient's home, you plan to give her a bath first and then make the bed. When you arrive, she wants you to make her bed first and then give her a bath. You do it as she asked. That is an example of practicing autonomy.
 - a) True
 - b) False
4. Your patient is terminally ill and has about two months left to live. She has an out-of-hospital do not resuscitate order in place. She is choking on her food, so you call 911. The paramedics begin CPR and put in a breathing tube. Is this right?
 - a) True
 - b) False

SECTION 18: PROVISIONS

Provision 1

The nurse practices with compassion and respect for the inherent dignity, worth, and unique attributes of every person.

Provision 2

A nurse's primary commitment is to the recipient(s) of nursing care, whether an individual, family, group, community, or population.

Provision 3

The nurse establishes a trusting relationship and advocates for the rights, health, and safety of recipient(s) of nursing care.

Provision 4

Nurses have authority over nursing practice and are responsible and accountable for their practice consistent with their obligations to promote health, prevent illness, and provide optimal care.

Provision 5

The nurse has moral duties to self as a person of inherent dignity and worth including an expectation of a safe place to work that fosters flourishing, authenticity of self at work, and self-respect through integrity and professional competence.

Provision 6

Nurses, through individual and collective effort, establish, maintain, and improve the ethical environment of the work setting that affects nursing care and the well-being of nurses.

Provision 7

Nurses advance the profession through multiple approaches to knowledge development, professional standards, and the generation of policies for nursing, health, and social concerns.

Provision 8

Nurses build collaborative relationships and networks with nurses, other healthcare and non-healthcare disciplines, and the public to achieve greater ends.

Provision 9

Nurses and their professional organizations work to enact and resource practices, policies, and legislation to promote social justice, eliminate health inequities, and facilitate human flourishing.

Provision 10

Nursing, through organizations and associations, participates in the global nursing and health community to promote human and environmental health, well-being, and flourishing.

SECTION 19:HAZARD AND VULNERABILITY ASSESSMENT

A A D A N D U L N E A I L I T Y A S S E S S M E N T T O O L E E N T S I N O L I N G A A D O U S A T E I A L S

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)					
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Community/ Mutual Aid staff and supplies</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none
Mass Casualty Hazmat Incident (From historic events at your MC with >= 5 victims)	1	1	1	1	3	3	3
Small Casualty Hazmat Incident (From historic events at your MC with < 5 victims)	1	1	1	1	3	3	3
Chemical Exposure, External	1	1	1	1	3	3	3
Small-Medium Sized Internal Spill	1	1	1	1	3	3	3
Large Internal Spill	1	1	1	1	3	3	3
Terrorism, Chemical	1	1	1	1	3	3	3
Radiologic Exposure, Internal	1	1	1	1	3	3	3
Radiologic Exposure, External	1	1	1	1	3	3	3
Terrorism, Radiologic	1	1	1	1	3	3	3

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EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)					
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interuption of services</i>	<i>Preplanning</i>	<i>Time, effectiveness, resouces</i>	<i>Community/ Mutual Aid staff and supplies</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none
Mass Casualty Incident (trauma)	1	1	1	1	3	3	3
Mass Casualty Incident (medical/infectious)	1	1	1	1	3	3	3
Terrorism, Biological	0	0	0	1	3	3	3
VIP Situation	0	0	0	0	0	0	0
Infant Abduction	1	1	1	1	3	3	3
Hostage Situation	1	1	1	1	3	3	3
Civil Disturbance	1	1	1	1	3	3	3
Labor Action	1	1	1	1	3	3	3
Forensic Admission	0	0	0	0	0	0	0
Bomb Threat	1	1	1	1	3	3	3

A A D AND ULNE A ILITY ASSESS ENT TOOL TEC NOLOGIC E ENT S

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)					
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE
		<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Community/ Mutual Aid staff and supplies</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none
Electrical Failure	2	1	1	2	3	3	0
Generator Failure	2	1	1	2	3	3	3
Transportation Failure	1	0	0	0	0	0	0
Fuel Shortage	1	0	0	0	0	0	0
Natural Gas Failure	1	1	1	1	3	3	3
Water Failure	1	1	1	1	3	3	
Sewer Failure	1	0	1	1	3	3	3
Steam Failure	1	0	0	0	0	0	0
Fire Alarm Failure	1	1	1	1	0	0	0
Communications Failure	1	1	1	1	3	3	3
Medical Gas Failure	1	0	0	0	0	0	0
Medical Vacuum Failure	1	0	0	0	0	0	0
HVAC Failure	1	0	0	0	0	0	0
Information Systems Failure	1	1	1	1	3	3	3
Fire, Internal	1	1	1	1	3	3	3
Flood, Internal	1	1	1	1	3	3	3
Hazmat Exposure, Internal	1	1	1	1	3	3	3
Supply Shortage	1	1	1	1	3	3	3
Structural Damage	1	1	1	1	3	3	3

*Threat increases with percentage.

A A D AND ULNE A ILITY ASSESS ENT TOOL TEC NOLOGIC E ENTS

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)					
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE
	<i>Likelihood this will occur</i>	<i>Possibility of death or injury</i>	<i>Physical losses and damages</i>	<i>Interruption of services</i>	<i>Preplanning</i>	<i>Time, effectiveness, resources</i>	<i>Community/ Mutual Aid staff and supplies</i>
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none	0 = N/A 1 = High 2 = Moderate 3 = Low or none
Hurricane	1	1	1	1	2	2	2
Tornado	1	1	1	1	2	3	3
Severe Thunderstorm	2	1	2	1	2	2	2
Snow Fall	2	1	1	1	2	2	2
Blizzard	2	1	1	1	2	2	2
Ice Storm	2	1	1	1	2	2	2
Earthquake	1	1	1	1	3	3	3
Tidal Wave	0	0	0	0	3	0	0
Temperature Extremes	1	1	1	1	2	2	2
Drought	1	1	1	0	3	3	3
Flood, External	1	1	1	1	3	3	3
Wild Fire	0	0	0	0	0	0	0
Landslide	0	0	0	0	0	0	0
Dam Inundation	0	0	0	0	0	0	0
Volcano	0	0	0	0	0	0	0
Epidemic	2	2	2	0	3	3	3
AVERAGE SCORE	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SECTION 20: ADIL FLOAT POLICY

We appreciate your decision to join Adil Business Systems, Inc.'s team of health care professionals. We strive to keep working 100% of the time you want in the specialty you desire. Since different specialties often require specific certification and experience, we find it necessary at this time to review the rules of being floated. In order for a nurse to be floated, he/she must possess at least one year of experience in the specialty area with which the facility wishes to float the nurse. It is a liability issue for you personally to accept reassignment to an area where you were not originally scheduled. Certainly, we do not encourage you to accept flotation to an area which is beyond your comfort and/or training or education level. This could potentially put a patient at risk for injury and possible complaints being made about your nursing license. It is for these reasons we must ask you to sign the agreement below.

I _____ understand that it is the policy of Adil Business Systems, Inc., to only float me to areas in which I am experienced/educated. I further understand that if I am asked to float, Adil Business Systems, Inc. will be called immediately from the nursing office and permission obtained from the staffing coordinator/director of nursing on duty to allow the change of assignment. If I fail to follow the above policy, I understand that I will be accepting full responsibility for my performance in that area and all liability related to my being floated.

S

All employees and clients having concerns regarding care and services that have not been addressed to their satisfaction and the safety and well-being of a patient, have a right to make a formal complaint by contacting the Corporate Office of Adil Business Systems @ 401-331-0755 or e-mail to info@adil.com. You may also make a formal complaint to The Joint Commission on their website www.jointcommission.org. There will be no retaliation for voicing your concerns.

SECTION 21: NATIONAL PATIENT SAFETY GOALS

Identify patients and residents correctly

NPSG.01.01.01

Use at least two ways to identify patients or residents. For example, use the patient's or resident's name and date of birth. This is done to make sure that each patient or resident gets the correct medicine and treatment.

Use medicines safely

NPSG.03.05.01

Take extra care with patients and residents who take medicines to thin their blood.

NPSG.03.06.01

Record and pass along correct information about a patient's or resident's medicines. Find out what medicines the patient or resident is taking. Compare those medicines to new medicines given to the patient or resident. Give the patient or resident written information about the medicines they need to take. Tell the patient or resident it is important to bring their up-to-date list of medicines every time they visit a doctor.

Prevent infection

NPSG.07.01.01

Use the hand cleaning guidelines from the Centers for Disease Control and Prevention or the World Health Organization. Set goals for improving hand cleaning. Use the goals to improve hand cleaning.

Prevent patients and residents from falling

NPSG.09.02.01

Find out which patients and residents are most likely to fall. For example, is the patient or resident taking any medicines that might make them weak, dizzy or sleepy? Take action to prevent falls for these patients and residents.

Prevent bed sores

NPSG.14.01.01

Find out which patients and residents are most likely to have bed sores. Take action to prevent bed sores in these patients and residents. From time to time, re-check patients and residents for bed sores.



Morbidity and Mortality Weekly Report

Recommendations and Reports

October 25, 2002 / Vol. 51 / No. RR-16

Guideline for Hand Hygiene in Health-Care Settings

**Recommendations of the Healthcare Infection Control Practices
Advisory Committee and the HICPAC/SHEA/APIC/IDSA
Hand Hygiene Task Force**

INSIDE: Continuing Education Examination

Centers for Disease Control and Prevention

SAFER • HEALTHIER • PEOPLE™

The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

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Centers for Disease Control and Prevention

Julie L. Gerberding, M.D., M.P.H.
Director

David W. Fleming, M.D.
Deputy Director for Science and Public Health

Dixie E. Snider, Jr., M.D., M.P.H.
Associate Director for Science

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CONTENTS

Part I. Review of the Scientific Data Regarding

Hand Hygiene	1
Historical Perspective.....	1
Normal Bacterial Skin Flora	2
Physiology of Normal Skin	2
Definition of Terms.....	3
Evidence of Transmission of Pathogens on Hands	4
Models of Hand Transmission	5
Relation of Hand Hygiene and Acquisition of Health-Care–Associated Pathogens	5
Methods Used To Evaluate the Efficacy of Hand-Hygiene Products.....	6
Review of Preparations Used for Hand Hygiene	8
Activity of Antiseptic Agents Against Spore-Forming Bacteria	16
Reduced Susceptibility of Bacteria to Antiseptics.....	17
Surgical Hand Antisepsis	17
Relative Efficacy of Plain Soap, Antiseptic Soap/Detergent, and Alcohols	18
Irritant Contact Dermatitis Resulting from Hand-Hygiene Measures	18
Proposed Methods for Reducing Adverse Effects of Agents	19
Factors To Consider When Selecting Hand-Hygiene Products	20
Hand-Hygiene Practices Among HCWs	21
Lessons Learned from Behavioral Theories	25
Methods Used To Promote Improved Hand Hygiene.....	26
Efficacy of Promotion and Impact of Improved Hand Hygiene.....	27
Other Policies Related to Hand Hygiene.....	29
Hand-Hygiene Research Agenda.....	30
Web-Based Hand-Hygiene Resources	30
Part II. Recommendations	31
Categories.....	31
Recommendations.....	32
Part III. Performance Indicators	34
References	34
Appendix	45
Continuing Education Activity	CE-1

Guideline for Hand Hygiene in Health-Care Settings

Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force

Prepared by
John M. Boyce, M.D.¹
Didier Pittet, M.D.²
¹*Hospital of Saint Raphael*
New Haven, Connecticut
²*University of Geneva*
Geneva, Switzerland

Summary

The Guideline for Hand Hygiene in Health-Care Settings provides health-care workers (HCWs) with a review of data regarding handwashing and hand antisepsis in health-care settings. In addition, it provides specific recommendations to promote improved hand-hygiene practices and reduce transmission of pathogenic microorganisms to patients and personnel in health-care settings. This report reviews studies published since the 1985 CDC guideline (Garner JS, Favero MS. CDC guideline for handwashing and hospital environmental control, 1985. Infect Control 1986;7:231–43) and the 1995 APIC guideline (Larson EL, APIC Guidelines Committee. APIC guideline for handwashing and hand antisepsis in health care settings. Am J Infect Control 1995;23:251–69) were issued and provides an in-depth review of hand-hygiene practices of HCWs, levels of adherence of personnel to recommended handwashing practices, and factors adversely affecting adherence. New studies of the in vivo efficacy of alcohol-based hand rubs and the low incidence of dermatitis associated with their use are reviewed. Recent studies demonstrating the value of multidisciplinary hand-hygiene promotion programs and the potential role of alcohol-based hand rubs in improving hand-hygiene practices are summarized. Recommendations concerning related issues (e.g., the use of surgical hand antiseptics, hand lotions or creams, and wearing of artificial fingernails) are also included.

Part I. Review of the Scientific Data Regarding Hand Hygiene

Historical Perspective

For generations, handwashing with soap and water has been considered a measure of personal hygiene (1). The concept of cleansing hands with an antiseptic agent probably emerged in the early 19th century. As early as 1822, a French pharmacist demonstrated that solutions containing chlorides of lime or soda could eradicate the foul odors associated with human corpses and that such solutions could be used as disinfectants and antiseptics (2). In a paper published in 1825, this pharmacist stated that physicians and other persons attending patients with contagious diseases would benefit from moistening their hands with a liquid chloride solution (2).

In 1846, Ignaz Semmelweis observed that women whose babies were delivered by students and physicians in the First Clinic at the General Hospital of Vienna consistently had a

higher mortality rate than those whose babies were delivered by midwives in the Second Clinic (3). He noted that physicians who went directly from the autopsy suite to the obstetrics ward had a disagreeable odor on their hands despite washing their hands with soap and water upon entering the obstetrics clinic. He postulated that the puerperal fever that affected so many parturient women was caused by “cadaverous particles” transmitted from the autopsy suite to the obstetrics ward via the hands of students and physicians. Perhaps because of the known deodorizing effect of chlorine compounds, as of May 1847, he insisted that students and physicians clean their hands with a chlorine solution between each patient in the clinic. The maternal mortality rate in the First Clinic subsequently dropped dramatically and remained low for years. This intervention by Semmelweis represents the first evidence indicating that cleansing heavily contaminated hands with an antiseptic agent between patient contacts may reduce health-care-associated transmission of contagious diseases more effectively than handwashing with plain soap and water.

In 1843, Oliver Wendell Holmes concluded independently that puerperal fever was spread by the hands of health personnel (1). Although he described measures that could be taken to limit its spread, his recommendations had little impact on

The material in this report originated in the National Center for Infectious Diseases, James M. Hughes, M.D., Director; and the Division of Healthcare Quality Promotion, Steve Solomon, M.D., Acting Director.

obstetric practices at the time. However, as a result of the seminal studies by Semmelweis and Holmes, handwashing gradually became accepted as one of the most important measures for preventing transmission of pathogens in health-care facilities.

In 1961, the U. S. Public Health Service produced a training film that demonstrated handwashing techniques recommended for use by health-care workers (HCWs) (4). At the time, recommendations directed that personnel wash their hands with soap and water for 1–2 minutes before and after patient contact. Rinsing hands with an antiseptic agent was believed to be less effective than handwashing and was recommended only in emergencies or in areas where sinks were unavailable.

In 1975 and 1985, formal written guidelines on handwashing practices in hospitals were published by CDC (5,6). These guidelines recommended handwashing with non-antimicrobial soap between the majority of patient contacts and washing with antimicrobial soap before and after performing invasive procedures or caring for patients at high risk. Use of waterless antiseptic agents (e.g., alcohol-based solutions) was recommended only in situations where sinks were not available.

In 1988 and 1995, guidelines for handwashing and hand antisepsis were published by the Association for Professionals in Infection Control (APIC) (7,8). Recommended indications for handwashing were similar to those listed in the CDC guidelines. The 1995 APIC guideline included more detailed discussion of alcohol-based hand rubs and supported their use in more clinical settings than had been recommended in earlier guidelines. In 1995 and 1996, the Healthcare Infection Control Practices Advisory Committee (HICPAC) recommended that either antimicrobial soap or a waterless antiseptic agent be used for cleaning hands upon leaving the rooms of patients with multidrug-resistant pathogens (e.g., vancomycin-resistant enterococci [VRE] and methicillin-resistant *Staphylococcus aureus* [MRSA]) (9,10). These guidelines also provided recommendations for handwashing and hand antisepsis in other clinical settings, including routine patient care. Although the APIC and HICPAC guidelines have been adopted by the majority of hospitals, adherence of HCWs to recommended handwashing practices has remained low (11,12).

Recent developments in the field have stimulated a review of the scientific data regarding hand hygiene and the development of new guidelines designed to improve hand-hygiene practices in health-care facilities. This literature review and accompanying recommendations have been prepared by a Hand Hygiene Task Force, comprising representatives from HICPAC, the Society for Healthcare Epidemiology of America (SHEA), APIC, and the Infectious Diseases Society of America (IDSA).

Normal Bacterial Skin Flora

To understand the objectives of different approaches to hand cleansing, a knowledge of normal bacterial skin flora is essential. Normal human skin is colonized with bacteria; different areas of the body have varied total aerobic bacterial counts (e.g., 1×10^6 colony forming units (CFUs)/cm² on the scalp, 5×10^5 CFUs/cm² in the axilla, 4×10^4 CFUs/cm² on the abdomen, and 1×10^4 CFUs/cm² on the forearm) (13). Total bacterial counts on the hands of medical personnel have ranged from 3.9×10^4 to 4.6×10^6 (14–17). In 1938, bacteria recovered from the hands were divided into two categories: transient and resident (14). Transient flora, which colonize the superficial layers of the skin, are more amenable to removal by routine handwashing. They are often acquired by HCWs during direct contact with patients or contact with contaminated environmental surfaces within close proximity of the patient. Transient flora are the organisms most frequently associated with health-care-associated infections. Resident flora, which are attached to deeper layers of the skin, are more resistant to removal. In addition, resident flora (e.g., coagulase-negative staphylococci and diphtheroids) are less likely to be associated with such infections. The hands of HCWs may become persistently colonized with pathogenic flora (e.g., *S. aureus*), gram-negative bacilli, or yeast. Investigators have documented that, although the number of transient and resident flora varies considerably from person to person, it is often relatively constant for any specific person (14,18).

Physiology of Normal Skin

The primary function of the skin is to reduce water loss, provide protection against abrasive action and microorganisms, and act as a permeability barrier to the environment. The basic structure of skin includes, from outer- to innermost layer, the superficial region (i.e., the stratum corneum or horny layer, which is 10- to 20- μ m thick), the viable epidermis (50- to 100- μ m thick), the dermis (1- to 2-mm thick), and the hypodermis (1- to 2-mm thick). The barrier to percutaneous absorption lies within the stratum corneum, the thinnest and smallest compartment of the skin. The stratum corneum contains the corneocytes (or horny cells), which are flat, polyhedral-shaped nonnucleated cells, remnants of the terminally differentiated keratinocytes located in the viable epidermis. Corneocytes are composed primarily of insoluble bundled keratins surrounded by a cell envelope stabilized by cross-linked proteins and covalently bound lipid. Interconnecting the corneocytes of the stratum corneum are polar structures (e.g., corneodesmosomes), which contribute to stratum corneum cohesion.

The intercellular region of the stratum corneum is composed of lipid primarily generated from the exocytosis of lamellar bodies during the terminal differentiation of the keratinocytes. The intercellular lipid is required for a competent skin barrier and forms the only continuous domain. Directly under the stratum corneum is a stratified epidermis, which is composed primarily of 10–20 layers of keratinizing epithelial cells that are responsible for the synthesis of the stratum corneum. This layer also contains melanocytes involved in skin pigmentation; Langerhans cells, which are important for antigen presentation and immune responses; and Merkel cells, whose precise role in sensory reception has yet to be fully delineated. As keratinocytes undergo terminal differentiation, they begin to flatten out and assume the dimensions characteristic of the corneocytes (i.e., their diameter changes from 10–12 μm to 20–30 μm , and their volume increases by 10- to 20-fold). The viable epidermis does not contain a vascular network, and the keratinocytes obtain their nutrients from below by passive diffusion through the interstitial fluid.

The skin is a dynamic structure. Barrier function does not simply arise from the dying, degeneration, and compaction of the underlying epidermis. Rather, the processes of cornification and desquamation are intimately linked; synthesis of the stratum corneum occurs at the same rate as loss. Substantial evidence now confirms that the formation of the skin barrier is under homeostatic control, which is illustrated by the epidermal response to barrier perturbation by skin stripping or solvent extraction. Circumstantial evidence indicates that the rate of keratinocyte proliferation directly influences the integrity of the skin barrier. A general increase in the rate of proliferation results in a decrease in the time available for 1) uptake of nutrients (e.g., essential fatty acids), 2) protein and lipid synthesis, and 3) processing of the precursor molecules required for skin-barrier function. Whether chronic but quantitatively smaller increases in rate of epidermal proliferation also lead to changes in skin-barrier function remains unclear. Thus, the extent to which the decreased barrier function caused by irritants is caused by an increased epidermal proliferation also is unknown.

The current understanding of the formation of the stratum corneum has come from studies of the epidermal responses to perturbation of the skin barrier. Experimental manipulations that disrupt the skin barrier include 1) extraction of skin lipids with apolar solvents, 2) physical stripping of the stratum corneum using adhesive tape, and 3) chemically induced irritation. All of these experimental manipulations lead to a decreased skin barrier as determined by transepidermal water loss (TEWL). The most studied experimental system is the treatment of mouse skin with acetone. This experiment

results in a marked and immediate increase in TEWL, and therefore a decrease in skin-barrier function. Acetone treatment selectively removes glycerolipids and sterols from the skin, which indicates that these lipids are necessary, though perhaps not sufficient in themselves, for barrier function. Detergents act like acetone on the intercellular lipid domain. The return to normal barrier function is biphasic: 50%–60% of barrier recovery typically occurs within 6 hours, but complete normalization of barrier function requires 5–6 days.

Definition of Terms

Alcohol-based hand rub. An alcohol-containing preparation designed for application to the hands for reducing the number of viable microorganisms on the hands. In the United States, such preparations usually contain 60%–95% ethanol or isopropanol.

Antimicrobial soap. Soap (i.e., detergent) containing an antiseptic agent.

Antiseptic agent. Antimicrobial substances that are applied to the skin to reduce the number of microbial flora. Examples include alcohols, chlorhexidine, chlorine, hexachlorophene, iodine, chloroxylenol (PCMX), quaternary ammonium compounds, and triclosan.

Antiseptic handwash. Washing hands with water and soap or other detergents containing an antiseptic agent.

Antiseptic hand rub. Applying an antiseptic hand-rub product to all surfaces of the hands to reduce the number of microorganisms present.

Cumulative effect. A progressive decrease in the numbers of microorganisms recovered after repeated applications of a test material.

Decontaminate hands. To Reduce bacterial counts on hands by performing antiseptic hand rub or antiseptic handwash.

Detergent. Detergents (i.e., surfactants) are compounds that possess a cleaning action. They are composed of both hydrophilic and lipophilic parts and can be divided into four groups: anionic, cationic, amphoteric, and nonionic detergents. Although products used for handwashing or antiseptic handwash in health-care settings represent various types of detergents, the term “soap” is used to refer to such detergents in this guideline.

Hand antiseptics. Refers to either antiseptic handwash or antiseptic hand rub.

Hand hygiene. A general term that applies to either handwashing, antiseptic handwash, antiseptic hand rub, or surgical hand antiseptics.

Handwashing. Washing hands with plain (i.e., non-antimicrobial) soap and water.

Persistent activity. Persistent activity is defined as the prolonged or extended antimicrobial activity that prevents or inhibits the proliferation or survival of microorganisms after application of the product. This activity may be demonstrated by sampling a site several minutes or hours after application and demonstrating bacterial antimicrobial effectiveness when compared with a baseline level. This property also has been referred to as “residual activity.” Both substantive and nonsubstantive active ingredients can show a persistent effect if they substantially lower the number of bacteria during the wash period.

Plain soap. Plain soap refers to detergents that do not contain antimicrobial agents or contain low concentrations of antimicrobial agents that are effective solely as preservatives.

Substantivity. Substantivity is an attribute of certain active ingredients that adhere to the stratum corneum (i.e., remain on the skin after rinsing or drying) to provide an inhibitory effect on the growth of bacteria remaining on the skin.

Surgical hand antisepsis. Antiseptic handwash or antiseptic hand rub performed preoperatively by surgical personnel to eliminate transient and reduce resident hand flora. Antiseptic detergent preparations often have persistent antimicrobial activity.

Visibly soiled hands. Hands showing visible dirt or visibly contaminated with proteinaceous material, blood, or other body fluids (e.g., fecal material or urine).

Waterless antiseptic agent. An antiseptic agent that does not require use of exogenous water. After applying such an agent, the hands are rubbed together until the agent has dried.

Food and Drug Administration (FDA) product categories. The 1994 FDA Tentative Final Monograph for Health-Care Antiseptic Drug Products divided products into three categories and defined them as follows (19):

- **Patient preoperative skin preparation.** A fast-acting, broad-spectrum, and persistent antiseptic-containing preparation that substantially reduces the number of microorganisms on intact skin.
- **Antiseptic handwash or HCW handwash.** An antiseptic-containing preparation designed for frequent use; it reduces the number of microorganisms on intact skin to an initial baseline level after adequate washing, rinsing, and drying; it is broad-spectrum, fast-acting, and if possible, persistent.
- **Surgical hand scrub.** An antiseptic-containing preparation that substantially reduces the number of microorganisms on intact skin; it is broad-spectrum, fast-acting, and persistent.

Evidence of Transmission of Pathogens on Hands

Transmission of health-care-associated pathogens from one patient to another via the hands of HCWs requires the following sequence of events:

- Organisms present on the patient’s skin, or that have been shed onto inanimate objects in close proximity to the patient, must be transferred to the hands of HCWs.
- These organisms must then be capable of surviving for at least several minutes on the hands of personnel.
- Next, handwashing or hand antisepsis by the worker must be inadequate or omitted entirely, or the agent used for hand hygiene must be inappropriate.
- Finally, the contaminated hands of the caregiver must come in direct contact with another patient, or with an inanimate object that will come into direct contact with the patient.

Health-care-associated pathogens can be recovered not only from infected or draining wounds, but also from frequently colonized areas of normal, intact patient skin (20–31). The perineal or inguinal areas are usually most heavily colonized, but the axillae, trunk, and upper extremities (including the hands) also are frequently colonized (23,25,26,28,30–32). The number of organisms (e.g., *S. aureus*, *Proteus mirabilis*, *Klebsiella* spp., and *Acinetobacter* spp.) present on intact areas of the skin of certain patients can vary from 100 to 10⁶/cm² (25,29,31,33). Persons with diabetes, patients undergoing dialysis for chronic renal failure, and those with chronic dermatitis are likely to have areas of intact skin that are colonized

with *S. aureus* (34–41). Because approximately 10⁶ skin squames containing viable microorganisms are shed daily from normal skin (42), patient gowns, bed linen, bedside furniture, and other objects in the patient’s immediate environment can easily become contaminated with patient flora (30,43–46). Such contamination is particularly likely to be caused by staphylococci or enterococci, which are resistant to desiccation.

Data are limited regarding the types of patient-care activities that result in transmission of patient flora to the hands of personnel (26,45–51). In the past, attempts have been made to stratify patient-care activities into those most likely to cause hand contamination (52), but such stratification schemes were never validated by quantifying the level of bacterial contamination that occurred. Nurses can contaminate their hands with 100–1,000 CFUs of *Klebsiella* spp. during “clean” activities (e.g., lifting a patient; taking a patient’s pulse, blood pressure, or oral temperature; or touching a patient’s hand, shoulder, or groin) (48). Similarly, in another study, hands were cultured of nurses who touched the groins of patients heavily colonized with *P. mirabilis* (25); 10–600 CFUs/mL of this

organism were recovered from glove juice samples from the nurses' hands. Recently, other researchers studied contamination of HCWs' hands during activities that involved direct patient-contact wound care, intravascular catheter care, respiratory-tract care, and the handling of patient secretions (51). Agar fingertip impression plates were used to culture bacteria; the number of bacteria recovered from fingertips ranged from 0 to 300 CFUs. Data from this study indicated that direct patient contact and respiratory-tract care were most likely to contaminate the fingers of caregivers. Gram-negative bacilli accounted for 15% of isolates and *S. aureus* for 11%. Duration of patient-care activity was strongly associated with the intensity of bacterial contamination of HCWs' hands.

HCWs can contaminate their hands with gram-negative bacilli, *S. aureus*, enterococci, or *Clostridium difficile* by performing "clean procedures" or touching intact areas of the skin of hospitalized patients (26,45,46,53). Furthermore, personnel caring for infants with respiratory syncytial virus (RSV) infections have acquired RSV by performing certain activities (e.g., feeding infants, changing diapers, and playing with infants) (49). Personnel who had contact only with surfaces contaminated with the infants' secretions also acquired RSV by contaminating their hands with RSV and inoculating their oral or conjunctival mucosa. Other studies also have documented that HCWs may contaminate their hands (or gloves) merely by touching inanimate objects in patient rooms (46,53–56). None of the studies concerning hand contamination of hospital personnel were designed to determine if the contamination resulted in transmission of pathogens to susceptible patients.

Other studies have documented contamination of HCWs' hands with potential health-care-associated pathogens, but did not relate their findings to the specific type of preceding patient contact (15,17,57–62). For example, before glove use was common among HCWs, 15% of nurses working in an isolation unit carried a median of 1×10^4 CFUs of *S. aureus* on their hands (61). Of nurses working in a general hospital, 29% had *S. aureus* on their hands (median count: 3,800 CFUs), whereas 78% of those working in a hospital for dermatology patients had the organism on their hands (median count: 14.3×10^6 CFUs). Similarly, 17%–30% of nurses carried gram-negative bacilli on their hands (median counts: 3,400–38,000 CFUs). One study found that *S. aureus* could be recovered from the hands of 21% of intensive-care-unit personnel and that 21% of physician and 5% of nurse carriers had $>1,000$ CFUs of the organism on their hands (59). Another study found lower levels of colonization on the hands of personnel working in a neurosurgery unit, with an average of 3 CFUs of *S. aureus* and 11 CFUs of gram-negative bacilli (16). Serial

cultures revealed that 100% of HCWs carried gram-negative bacilli at least once, and 64% carried *S. aureus* at least once.

Models of Hand Transmission

Several investigators have studied transmission of infectious agents by using different experimental models. In one study, nurses were asked to touch the groins of patients heavily colonized with gram-negative bacilli for 15 seconds — as though they were taking a femoral pulse (25). Nurses then cleaned their hands by washing with plain soap and water or by using an alcohol hand rinse. After cleaning their hands, they touched a piece of urinary catheter material with their fingers, and the catheter segment was cultured. The study revealed that touching intact areas of moist skin of the patient transferred enough organisms to the nurses' hands to result in subsequent transmission to catheter material, despite handwashing with plain soap and water.

The transmission of organisms from artificially contaminated "donor" fabrics to clean "recipient" fabrics via hand contact also has been studied. Results indicated that the number of organisms transmitted was greater if the donor fabric or the hands were wet upon contact (63). Overall, only 0.06% of the organisms obtained from the contaminated donor fabric were transferred to recipient fabric via hand contact. *Staphylococcus saprophyticus*, *Pseudomonas aeruginosa*, and *Serratia* spp. were also transferred in greater numbers than was *Escherichia coli* from contaminated fabric to clean fabric after hand contact (64). Organisms are transferred to various types of surfaces in much larger numbers (i.e., $>10^4$) from wet hands than from hands that are thoroughly dried (65).

Relation of Hand Hygiene and Acquisition of Health-Care–Associated Pathogens

Hand antisepsis reduces the incidence of health-care-associated infections (66,67). An intervention trial using historical controls demonstrated in 1847 that the mortality rate among mothers who delivered in the First Obstetrics Clinic at the General Hospital of Vienna was substantially lower when hospital staff cleaned their hands with an antiseptic agent than when they washed their hands with plain soap and water (3).

In the 1960s, a prospective, controlled trial sponsored by the National Institutes of Health and the Office of the Surgeon General demonstrated that infants cared for by nurses who did not wash their hands after handling an index infant colonized with *S. aureus* acquired the organism more often and more rapidly than did infants cared for by nurses who used hexachlorophene to clean their hands between infant

contacts (68). This trial provided evidence that, when compared with no handwashing, washing hands with an antiseptic agent between patient contacts reduces transmission of health-care-associated pathogens.

Trials have studied the effects of handwashing with plain soap and water versus some form of hand antiseptics on health-care-associated infection rates (69,70). Health-care-associated infection rates were lower when antiseptic handwashing was performed by personnel (69). In another study, antiseptic handwashing was associated with lower health-care-associated infection rates in certain intensive-care units, but not in others (70).

Health-care-associated infection rates were lower after antiseptic handwashing using a chlorhexidine-containing detergent compared with handwashing with plain soap or use of an alcohol-based hand rinse (71). However, because only a minimal amount of the alcohol rinse was used during periods when the combination regimen also was in use and because adherence to policies was higher when chlorhexidine was available, determining which factor (i.e., the hand-hygiene regimen or differences in adherence) accounted for the lower infection rates was difficult. Investigators have determined also that health-care-associated acquisition of MRSA was reduced when the antimicrobial soap used for hygienic handwashing was changed (72,73).

Increased handwashing frequency among hospital staff has been associated with decreased transmission of *Klebsiella* spp. among patients (48); these studies, however, did not quantify the level of handwashing among personnel. In a recent study, the acquisition of various health-care-associated pathogens was reduced when hand antiseptics was performed more frequently by hospital personnel (74); both this study and another (75) documented that the prevalence of health-care-associated infections decreased as adherence to recommended hand-hygiene measures improved.

Outbreak investigations have indicated an association between infections and understaffing or overcrowding; the association was consistently linked with poor adherence to hand hygiene. During an outbreak investigation of risk factors for central venous catheter-associated bloodstream infections (76), after adjustment for confounding factors, the patient-to-nurse ratio remained an independent risk factor for bloodstream infection, indicating that nursing staff reduction below a critical threshold may have contributed to this outbreak by jeopardizing adequate catheter care. The understaffing of nurses can facilitate the spread of MRSA in intensive-care settings (77) through relaxed attention to basic control measures (e.g., hand hygiene). In an outbreak of *Enterobacter cloacae* in a neonatal intensive-care unit (78), the daily number of

hospitalized children was above the maximum capacity of the unit, resulting in an available space per child below current recommendations. In parallel, the number of staff members on duty was substantially less than the number necessitated by the workload, which also resulted in relaxed attention to basic infection-control measures. Adherence to hand-hygiene practices before device contact was only 25% during the workload peak, but increased to 70% after the end of the understaffing and overcrowding period. Surveillance documented that being hospitalized during this period was associated with a fourfold increased risk of acquiring a health-care-associated infection. This study not only demonstrates the association between workload and infections, but it also highlights the intermediate cause of antimicrobial spread: poor adherence to hand-hygiene policies.

Methods Used To Evaluate the Efficacy of Hand-Hygiene Products

Current Methods

Investigators use different methods to study the *in vivo* efficacy of handwashing, antiseptic handwash, and surgical hand antiseptics protocols. Differences among the various studies include 1) whether hands are purposely contaminated with bacteria before use of test agents, 2) the method used to contaminate fingers or hands, 3) the volume of hand-hygiene product applied to the hands, 4) the time the product is in contact with the skin, 5) the method used to recover bacteria from the skin after the test solution has been used, and 6) the method of expressing the efficacy of the product (i.e., either percent reduction in bacteria recovered from the skin or log reduction of bacteria released from the skin). Despite these differences, the majority of studies can be placed into one of two major categories: studies focusing on products to remove transient flora and studies involving products that are used to remove resident flora from the hands. The majority of studies of products for removing transient flora from the hands of HCWs involve artificial contamination of the volunteer's skin with a defined inoculum of a test organism before the volunteer uses a plain soap, an antimicrobial soap, or a waterless antiseptic agent. In contrast, products tested for the preoperative cleansing of surgeons' hands (which must comply with surgical hand-antiseptics protocols) are tested for their ability to remove resident flora from without artificially contaminating the volunteers' hands.

In the United States, antiseptic handwash products intended for use by HCWs are regulated by FDA's Division of Over-the-Counter Drug Products (OTC). Requirements for *in vitro* and *in vivo* testing of HCW handwash products and surgical

hand scrubs are outlined in the FDA Tentative Final Monograph for Healthcare Antiseptic Drug Products (TFM) (19). Products intended for use as HCW handwashes are evaluated by using a standardized method (19). Tests are performed in accordance with use directions for the test material. Before baseline bacterial sampling and before each wash with the test material, 5 mL of a standardized suspension of *Serratia marcescens* are applied to the hands and then rubbed over the surfaces of the hands. A specified volume of the test material is dispensed into the hands and is spread over the hands and lower one third of the forearms. A small amount of tap water is added to the hands, and hands are completely lathered for a specified time, covering all surfaces of the hands and the lower third of the forearms. Volunteers then rinse hands and forearms under 40°C tap water for 30 seconds. Ten washes with the test formulation are required. After the first, third, seventh, and tenth washes, rubber gloves or polyethylene bags used for sampling are placed on the right and left hands, and 75 mL of sampling solution is added to each glove; gloves are secured above the wrist. All surfaces of the hand are massaged for 1 minute, and samples are obtained aseptically for quantitative culture. No neutralizer of the antimicrobial is routinely added to the sampling solution, but if dilution of the antimicrobial in the sampling fluid does not result in demonstrable neutralization, a neutralizer specific for the test formulation is added to the sampling solution. For waterless formulations, a similar procedure is used. TFM criteria for efficacy are as follows: a 2-log₁₀ reduction of the indicator organism on each hand within 5 minutes after the first use, and a 3-log₁₀ reduction of the indicator organism on each hand within 5 minutes after the tenth use (19).

Products intended for use as surgical hand scrubs have been evaluated also by using a standardized method (19). Volunteers clean under fingernails with a nail stick and clip their fingernails. All jewelry is removed from hands and arms. Hands and two thirds of forearms are rinsed with tap water (38°C–42°C) for 30 seconds, and then they are washed with a non-antimicrobial soap for 30 seconds and are rinsed for 30 seconds under tap water. Baseline microbial hand counts can then be determined. Next, a surgical scrub is performed with the test formulation using directions provided by the manufacturer. If no instructions are provided with the formulation, two 5-minute scrubs of hands and forearms followed by rinsing are performed. Reduction from baseline microbial hand counts is determined in a series of 11 scrubs conducted during 5 days. Hands are sampled at 1 minute, 3 hours, and 6 hours after the first scrubs on day 1, day 2, and day 5. After washing, volunteers wear rubber gloves; 75 mL of sampling solution are then added to one glove, and all surfaces of the hands are massaged

for 1 minute. Samples are then taken aseptically and cultured quantitatively. The other glove remains on the other hand for 6 hours and is sampled in the same manner. TFM requires that formulations reduce the number of bacteria 1 log₁₀ on each hand within 1 minute of product application and that the bacterial cell count on each hand does not subsequently exceed baseline within 6 hours on day 1; the formulation must produce a 2-log₁₀ reduction in microbial flora on each hand within 1 minute of product application by the end of the second day of enumeration and a 3-log₁₀ reduction of microbial flora on each hand within 1 minute of product use by the end of the fifth day when compared with the established baseline (19).

The method most widely used in Europe to evaluate the efficacy of hand-hygiene agents is European Standard 1500–1997 (EN 1500—Chemical disinfectants and antiseptics. Hygienic hand-rub test method and requirements) (79). This method requires 12–15 test volunteers and an 18- to 24-hour growth of broth culture of *E. coli* K12. Hands are washed with a soft soap, dried, and then immersed halfway to the metacarpals in the broth culture for 5 seconds. Hands are removed from the broth culture, excess fluid is drained off, and hands are dried in the air for 3 minutes. Bacterial recovery for the initial value is obtained by kneading the fingertips of each hand separately for 60 seconds in 10 mL of tryptic soy broth (TSB) without neutralizers. The hands are removed from the broth and disinfected with 3 mL of the hand-rub agent for 30 seconds in a set design. The same operation is repeated with total disinfection time not exceeding 60 seconds. Both hands are rinsed in running water for 5 seconds and water is drained off. Fingertips of each hand are kneaded separately in 10 mL of TSB with added neutralizers. These broths are used to obtain the final value. Log₁₀ dilutions of recovery medium are prepared and plated out. Within 3 hours, the same volunteers are tested with the reference disinfectant (60% 2-propanol [isopropanol]) and the test product. Colony counts are performed after 24 and 48 hours of incubation at 36°C. The average colony count of both left and right hand is used for evaluation. The log-reduction factor is calculated and compared with the initial and final values. The reduction factor of the test product should be superior or the same as the reference alcohol-based rub for acceptance. If a difference exists, then the results are analyzed statistically using the Wilcoxon test. Products that have log reductions substantially less than that observed with the reference alcohol-based hand rub (i.e., approximately 4 log₁₀ reduction) are classified as not meeting the standard.

Because of different standards for efficacy, criteria cited in FDA TFM and the European EN 1500 document for establishing alcohol-based hand rubs vary (1,19,79). Alcohol-based

hand rubs that meet TFM criteria for efficacy may not necessarily meet the EN 1500 criteria for efficacy (80). In addition, scientific studies have not established the extent to which counts of bacteria or other microorganisms on the hands need to be reduced to minimize transmission of pathogens in health-care facilities (1,8); whether bacterial counts on the hands must be reduced by 1 log₁₀ (90% reduction), 2 log₁₀ (99%), 3 log₁₀ (99.9%), or 4 log₁₀ (99.99%) is unknown. Several other methods also have been used to measure the efficacy of antiseptic agents against various viral pathogens (81–83).

Shortcomings of Traditional Methodologies

Accepted methods of evaluating hand-hygiene products intended for use by HCWs require that test volunteers wash their hands with a plain or antimicrobial soap for 30 seconds or 1 minute, despite the observation in the majority of studies that the average duration of handwashing by hospital personnel is <15 seconds (52,84–89). A limited number of investigators have used 15-second handwashing or hygienic hand-wash protocols (90–94). Therefore, almost no data exist regarding the efficacy of plain or antimicrobial soaps under conditions in which they are actually used by HCWs. Similarly, certain accepted methods for evaluating waterless antiseptic agents for use as antiseptic hand rubs require that 3 mL of alcohol be rubbed into the hands for 30 seconds, followed by a repeat application for the same duration. This type of protocol also does not reflect actual usage patterns among HCWs. Furthermore, volunteers used in evaluations of products are usually surrogates for HCWs, and their hand flora may not reflect flora found on the hands of personnel working in health-care settings. Further studies should be conducted among practicing HCWs using standardized protocols to obtain more realistic views of microbial colonization and risk of bacterial transfer and cross-transmission (51).

Review of Preparations Used for Hand Hygiene

Plain (Non-Antimicrobial) Soap

Soaps are detergent-based products that contain esterified fatty acids and sodium or potassium hydroxide. They are available in various forms including bar soap, tissue, leaflet, and liquid preparations. Their cleaning activity can be attributed to their detergent properties, which result in removal of dirt, soil, and various organic substances from the hands. Plain soaps have minimal, if any, antimicrobial activity. However, handwashing with plain soap can remove loosely adherent transient flora. For example, handwashing with plain soap and water for 15 seconds reduces bacterial counts on the skin by 0.6–1.1 log₁₀, whereas washing for 30 seconds reduces counts

by 1.8–2.8 log₁₀ (1). However, in several studies, handwashing with plain soap failed to remove pathogens from the hands of hospital personnel (25,45). Handwashing with plain soap can result in paradoxical increases in bacterial counts on the skin (92,95–97). Non-antimicrobial soaps may be associated with considerable skin irritation and dryness (92,96,98), although adding emollients to soap preparations may reduce their propensity to cause irritation. Occasionally, plain soaps have become contaminated, which may lead to colonization of hands of personnel with gram-negative bacilli (99).

Alcohols

The majority of alcohol-based hand antiseptics contain either isopropanol, ethanol, n-propanol, or a combination of two of these products. Although n-propanol has been used in alcohol-based hand rubs in parts of Europe for many years, it is not listed in TFM as an approved active agent for HCW handwashes or surgical hand-scrub preparations in the United States. The majority of studies of alcohols have evaluated individual alcohols in varying concentrations. Other studies have focused on combinations of two alcohols or alcohol solutions containing limited amounts of hexachlorophene, quaternary ammonium compounds, povidone-iodine, triclosan, or chlorhexidine gluconate (61,93,100–119).

The antimicrobial activity of alcohols can be attributed to their ability to denature proteins (120). Alcohol solutions containing 60%–95% alcohol are most effective, and higher concentrations are less potent (120–122) because proteins are not denatured easily in the absence of water (120). The alcohol content of solutions may be expressed as percent by weight (w/w), which is not affected by temperature or other variables, or as percent by volume (vol/vol), which can be affected by temperature, specific gravity, and reaction concentration (123). For example, 70% alcohol by weight is equivalent to 76.8% by volume if prepared at 15°C, or 80.5% if prepared at 25°C (123). Alcohol concentrations in antiseptic hand rubs are often expressed as percent by volume (19).

Alcohols have excellent in vitro germicidal activity against gram-positive and gram-negative vegetative bacteria, including multidrug-resistant pathogens (e.g., MRSA and VRE), *Mycobacterium tuberculosis*, and various fungi (120–122,124–129). Certain enveloped (lipophilic) viruses (e.g., herpes simplex virus, human immunodeficiency virus [HIV], influenza virus, respiratory syncytial virus, and vaccinia virus) are susceptible to alcohols when tested in vitro (120,130,131) (Table 1). Hepatitis B virus is an enveloped virus that is somewhat less susceptible but is killed by 60%–70% alcohol; hepatitis C virus also is likely killed by this percentage of alcohol (132). In a porcine tissue carrier model used to study antiseptic activity, 70% ethanol and 70% isopropanol were found to

TABLE 1. Virucidal activity of antiseptic agents against enveloped viruses

Ref. no.	Test method	Viruses	Agent	Results
(379)	Suspension	HIV	19% EA	LR = 2.0 in 5 minutes
(380)	Suspension	HIV	50% EA 35% IPA	LR > 3.5 LR > 3.7
(381)	Suspension	HIV	70% EA	LR = 7.0 in 1 minute
(382)	Suspension	HIV	70% EA	LR = 3.2B 5.5 in 30 seconds
(383)	Suspension	HIV	70% IPA/0.5% CHG 4% CHG	LR = 6.0 in 15 seconds LR = 6.0 in 15 seconds
(384)	Suspension	HIV	Chloroxylonol Benzalkonium chloride	Inactivated in 1 minute Inactivated in 1 minute
(385)	Suspension	HIV	Povidone-iodine Chlorhexidine	Inactivated Inactivated
(386)	Suspension	HIV	Detergent/0.5% PCMX	Inactivated in 30 seconds
(387)	Suspension/dried plasma chimpanzee challenge	HBV	70% IPA	LR = 6.0 in 10 minutes
(388)	Suspension/plasma chimpanzee challenge	HBV	80% EA	LR = 7.0 in 2 minutes
(389)	Suspension	HSV	95% EA 75% EA 95% IPA 70% EA + 0.5% CHG	LR > 5.0 in 1 minute LR > 5.0 LR > 5.0 LR > 5.0
(130)	Suspension	RSV	35% IPA 4% CHG	LR > 4.3 in 1 minute LR > 3.3
(141)	Suspension	Influenza Vaccinia	95% EA 95% EA	Undetectable in 30 seconds Undetectable in 30 seconds
(141)	Hand test	Influenza Vaccinia	95% EA 95% EA	LR > 2.5 LR > 2.5

Note: HIV = human immunodeficiency virus, EA = ethanol, LR = Log₁₀ reduction, IPA = isopropanol, CHG = chlorhexidine gluconate, HBV = hepatitis B virus, RSV = respiratory syncytial virus, HSV = herpes simplex virus, HAV = hepatitis A virus, and PCMX = chloroxylonol.

reduce titers of an enveloped bacteriophage more effectively than an antimicrobial soap containing 4% chlorhexidine gluconate (133). Despite its effectiveness against these organisms, alcohols have very poor activity against bacterial spores, protozoan oocysts, and certain nonenveloped (nonlipophilic) viruses.

Numerous studies have documented the *in vivo* antimicrobial activity of alcohols. Alcohols effectively reduce bacterial counts on the hands (14,121,125,134). Typically, log reductions of the release of test bacteria from artificially contaminated hands average 3.5 log₁₀ after a 30-second application and 4.0–5.0 log₁₀ after a 1-minute application (1). In 1994, the FDA TFM classified ethanol 60%–95% as a Category I agent (i.e., generally safe and effective for use in antiseptic handwash or HCW hand-wash products) (19). Although TFM placed isopropanol 70%–91.3% in category IIIIE (i.e., insufficient data to classify as effective), 60% isopropanol has subse-

quently been adopted in Europe as the reference standard against which alcohol-based hand-rub products are compared (79). Alcohols are rapidly germicidal when applied to the skin, but they have no appreciable persistent (i.e., residual) activity. However, regrowth of bacteria on the skin occurs slowly after use of alcohol-based hand antiseptics, presumably because of the sublethal effect alcohols have on some of the skin bacteria (135,136). Addition of chlorhexidine, quaternary ammonium compounds, octenidine, or triclosan to alcohol-based solutions can result in persistent activity (1).

Alcohols, when used in concentrations present in alcohol-based hand rubs, also have *in vivo* activity against several nonenveloped viruses (Table 2). For example, 70% isopropanol and 70% ethanol are more effective than medicated soap or nonmedicated soap in reducing rotavirus titers on fingerpads (137,138). A more recent study using the same test methods evaluated a commercially available product containing 60%

TABLE 2. Virucidal activity of antiseptic agents against nonenveloped viruses

Ref. no.	Test method	Viruses	Antiseptic	Result
(390)	Suspension	Rotavirus	4% CHG 10% Povidone-Iodine 70% IPA/0.1% HCP	LR < 3.0 in 1 minute LR > 3.0 LR > 3.0
(141)	Hand test	Adenovirus Poliovirus Coxsackie	95% EA 95% EA 95% EA	LR > 1.4 LR = 0.2–1.0 LR = 1.1–1.3
	Finger test	Adenovirus Poliovirus Coxsackie	95% EA 95% EA 95% EA	LR > 2.3 LR = 0.7–2.5 LR = 2.9
(389)	Suspension	ECHO virus	95% EA 75% EA 95% IPA 70% IPA + 0.5% CHG	LR > 3.0 in 1 minute LR ≤ 1.0 LR = 0 LR = 0
(140)	Finger pad	HAV	70% EA 62% EA foam plain soap 4% CHG 0.3% Triclosan	87.4% reduction 89.3% reduction 78.0% reduction 89.6% reduction 92.0% reduction
(105)	Finger tips	Bovine Rotavirus	n-propanol + IPA 70% IPA 70% EA 2% triclosan water (control) 7.5% povidone-iodine plain soap 4% CHG	LR = 3.8 in 30 seconds LR = 3.1 LR = 2.9 LR = 2.1 LR = 1.3 LR = 1.3 LR = 1.2 LR = 0.5
(137)	Finger pad	Human Rotavirus	70% IPA plain soap	98.9% decrease in 10 seconds 77.1%
(138)	Finger pad	Human Rotavirus	70% IPA 2% CHG plain soap	99.6% decrease in 10 seconds 80.3% 72.5%
(81)	Finger pad	Rotavirus Rhinovirus Adenovirus	60% EA gel 60% EA gel 60% EA gel	LR > 3.0 in 10 seconds LR > 3.0 LR > 3.0
(139)	Finger pad	Poliovirus	70% EA 70% IPA	LR = 1.6 in 10 seconds LR = 0.8
(200)	Finger tips	Poliovirus	Plain soap 80% EA	LR = 2.1 LR = 0.4

Note: HIV = human immunodeficiency virus, EA = ethanol, LR = Log₁₀ reduction, IPA = isopropanol, CHG = chlorhexidine gluconate, HBV = hepatitis B virus, RSV = respiratory syncytial virus, HSV = herpes simplex virus, and HAV = hepatitis A virus.

ethanol and found that the product reduced the infectivity titers of three nonenveloped viruses (i.e., rotavirus, adenovirus, and rhinovirus) by >3 logs (81). Other nonenveloped viruses such as hepatitis A and enteroviruses (e.g., poliovirus) may require 70%–80% alcohol to be reliably inactivated (82,139). However, both 70% ethanol and a 62% ethanol foam product with emollients reduced hepatitis A virus titers on whole hands or fingertips more than nonmedicated soap; both were equally as effective as antimicrobial soap containing 4% chlorhexidine gluconate in reducing reduced viral counts on hands (140). In the same study, both 70% ethanol and the 62% ethanol foam product demonstrated greater virucidal activity against poliovirus than either non-antimicrobial

soap or a 4% chlorhexidine gluconate-containing soap (140). However, depending on the alcohol concentration, the amount of time that hands are exposed to the alcohol, and viral variant, alcohol may not be effective against hepatitis A and other nonlipophilic viruses. The inactivation of nonenveloped viruses is influenced by temperature, disinfectant-virus volume ratio, and protein load (141). Ethanol has greater activity against viruses than isopropanol. Further in vitro and in vivo studies of both alcohol-based formulations and antimicrobial soaps are warranted to establish the minimal level of virucidal activity that is required to interrupt direct contact transmission of viruses in health-care settings.

Alcohols are not appropriate for use when hands are visibly dirty or contaminated with proteinaceous materials. However, when relatively small amounts of proteinaceous material (e.g., blood) are present, ethanol and isopropanol may reduce viable bacterial counts on hands more than plain soap or antimicrobial soap (142).

Alcohol can prevent the transfer of health-care-associated pathogens (25,63,64). In one study, gram-negative bacilli were transferred from a colonized patient's skin to a piece of catheter material via the hands of nurses in only 17% of experiments after antiseptic hand rub with an alcohol-based hand rinse (25). In contrast, transfer of the organisms occurred in 92% of experiments after handwashing with plain soap and water. This experimental model indicates that when the hands of HCWs are heavily contaminated, an antiseptic hand rub using an alcohol-based rinse can prevent pathogen transmission more effectively than can handwashing with plain soap and water.

Alcohol-based products are more effective for standard handwashing or hand antisepsis by HCWs than soap or antimicrobial soaps (Table 3) (25,53,61,93,106–112,119,143–152). In all but two of the trials that compared alcohol-based solutions with antimicrobial soaps or detergents, alcohol reduced bacterial counts on hands more than washing hands with soaps or detergents containing hexachlorophene, povidone-iodine, 4% chlorhexidine, or triclosan. In studies exam-

ining antimicrobial-resistant organisms, alcohol-based products reduced the number of multidrug-resistant pathogens recovered from the hands of HCWs more effectively than did handwashing with soap and water (153–155).

Alcohols are effective for preoperative cleaning of the hands of surgical personnel (1,101,104,113–119,135,143,147,156–159) (Tables 4 and 5). In multiple studies, bacterial counts on the hands were determined immediately after using the product and again 1–3 hours later; the delayed testing was performed to determine if regrowth of bacteria on the hands is inhibited during operative procedures. Alcohol-based solutions were more effective than washing hands with plain soap in all studies, and they reduced bacterial counts on the hands more than antimicrobial soaps or detergents in the majority of experiments (101,104,113–119,135,143,147,157–159). In addition, the majority of alcohol-based preparations were more effective than povidone-iodine or chlorhexidine.

The efficacy of alcohol-based hand-hygiene products is affected by several factors, including the type of alcohol used, concentration of alcohol, contact time, volume of alcohol used, and whether the hands are wet when the alcohol is applied. Applying small volumes (i.e., 0.2–0.5 mL) of alcohol to the hands is not more effective than washing hands with plain soap and water (63,64). One study documented that 1 mL of alcohol was substantially less effective than 3 mL (91). The ideal volume of product to apply to the hands is not known

TABLE 3. Studies comparing the relative efficacy (based on log₁₀ reductions achieved) of plain soap or antimicrobial soaps versus alcohol-based antiseptics in reducing counts of viable bacteria on hands

Ref. no.	Year	Skin contamination	Assay method	Time (sec)	Relative efficacy
(143)	1965	Existing hand flora	Finger-tip agar culture	60	Plain soap < HCP < 50% EA foam
(119)	1975	Existing hand flora	Hand-rub broth culture	—	Plain soap < 95% EA
(106)	1978	Artificial contamination	Finger-tip broth culture	30	Plain soap < 4% CHG < P-I < 70% EA = alc. CHG
(144)	1978	Artificial contamination	Finger-tip broth culture	30	Plain soap < 4% CHG < 70% EA
(107)	1979	Existing hand flora	Hand-rub broth culture	120	Plain soap < 0.5% aq. CHG < 70% EA < 4% CHG < alc. CHG
(145)	1980	Artificial contamination	Finger-tip broth culture	60–120	4% CHG < P-I < 60% IPA
(53)	1980	Artificial contamination	Finger-tip broth culture	15	Plain soap < 3% HCP < P-I < 4% CHG < 70% EA
(108)	1982	Artificial contamination	Glove juice test	15	P-I < alc. CHG
(109)	1983	Artificial contamination	Finger-tip broth culture	120	0.3–2% triclosan = 60% IPA = alc. CHG < alc. triclosan
(146)	1984	Artificial contamination	Finger-tip agar culture	60	Phenolic < 4% CHG < P-I < EA < IPA < n-P
(147)	1985	Existing hand flora	Finger-tip agar culture	60	Plain soap < 70% EA < 95% EA
(110)	1986	Artificial contamination	Finger-tip broth culture	60	Phenolic = P-I < alc. CHG < n-P
(93)	1986	Existing hand flora	Sterile-broth bag technique	15	Plain soap < IPA < 4% CHG = IPA-E = alc. CHG
(61)	1988	Artificial contamination	Finger-tip broth culture	30	Plain soap < triclosan < P-I < IPA < alc. CHG < n-P
(25)	1991	Patient contact	Glove-juice test	15	Plain soap < IPA-E
(148)	1991	Existing hand flora	Agar-plate/image analysis	30	Plain soap < 1% triclosan < P-I < 4% CHG < IPA
(111)	1992	Artificial contamination	Finger-tip agar culture	60	Plain soap < IPA < EA < alc. CHG
(149)	1992	Artificial contamination	Finger-tip broth culture	60	Plain soap < 60% n-P
(112)	1994	Existing hand flora	Agar-plate/image analysis	30	Plain soap < alc. CHG
(150)	1999	Existing hand flora	Agar-plate culture	N.S.	Plain soap < commercial alcohol mixture
(151)	1999	Artificial contamination	Glove-juice test	20	Plain soap < 0.6% PCMX < 65% EA
(152)	1999	Artificial contamination	Finger-tip broth culture	30	4% CHG < plain soap < P-I < 70% EA

Note: Existing hand flora = without artificially contaminating hands with bacteria, alc. CHG = alcoholic chlorhexidine gluconate, aq. CHG = aqueous chlorhexidine gluconate, 4% CHG = chlorhexidine gluconate detergent, EA = ethanol, HCP = hexachlorophene soap/detergent, IPA = isopropanol, IPA-E = isopropanol + emollients, n-P = n-propanol, PCMX = chloroxylenol detergent, P-I = povidone-iodine detergent, and N.S. = not stated.

TABLE 4. Studies comparing the relative efficacy of plain soap or antimicrobial soap versus alcohol-containing products in reducing counts of bacteria recovered from hands immediately after use of products for pre-operative cleansing of hands

Ref. no.	Year	Assay method	Relative efficacy
(143)	1965	Finger-tip agar culture	HCP < 50% EA foam + QAC
(157)	1969	Finger-tip agar culture	HCP < P-I < 50% EA foam + QAC
(101)	1973	Finger-tip agar culture	HCP soap < EA foam + 0.23% HCP
(135)	1974	Broth culture	Plain soap < 0.5% CHG < 4% CHG < alc. CHG
(119)	1975	Hand-broth test	Plain soap < 0.5% CHG < 4% CHG < alc. CHG
(118)	1976	Glove-juice test	0.5% CHG < 4% CHG < alc. CHG
(114)	1977	Glove-juice test	P-I < CHG < alc. CHG
(117)	1978	Finger-tip agar culture	P-I = 46% EA + 0.23% HCP
(113)	1979	Broth culture of hands	Plain soap < P-I < alc. CHG < alc. P-I
(116)	1979	Glove-juice test	70% IPA = alc. CHG
(147)	1985	Finger-tip agar culture	Plain soap < 70% - 90% EA
(115)	1990	Glove-juice test, modified	Plain soap < triclosan < CHG < P-I < alc. CHG
(104)	1991	Glove-juice test	Plain soap < 2% triclosan < P-I < 70% IPA
(158)	1998	Finger-tip broth culture	70% IPA < 90% IPA = 60% n-P
(159)	1998	Glove-juice test	P-I < CHG < 70% EA

Note: QAC = quaternary ammonium compound, alc. CHG = alcoholic chlorhexidine gluconate, CHG = chlorhexidine gluconate detergent, EA = ethanol, HCP = hexachlorophene detergent, IPA = isopropanol, and P-I = povidone-iodine detergent.

TABLE 5. Efficacy of surgical hand-rub solutions in reducing the release of resident skin flora from clean hands

Study	Rub	Concentration* (%)	Time (min)	Mean log reduction	
				Immediate	Sustained (3 hr)
1	<i>n-Propanol</i>	60	5	2.9 [†]	1.6 [†]
2			5	2.7 [†]	NA
3			5	2.5 [†]	1.8 [†]
4			5	2.3 [†]	1.6 [†]
5			3	2.9 [§]	NA
4		90	3	2.0 [†]	1.0 [†]
4			1	1.1 [†]	0.5 [†]
6			3	2.4 [§]	1.4 [§]
6			3	2.3 [§]	1.2 [§]
7			5	2.4 [†]	2.1 [†]
4	<i>Isopropanol</i>	70	5	2.1 [†]	1.0 [†]
6			3	2.0 [§]	0.7 [§]
5			3	1.7 ^c	NA
4			3	1.5 [†]	0.8 [†]
8			2	1.2	0.8
4		60	1	0.7 [†]	0.2
9			1	0.8	NA
10			5	1.7	1.0
7			5	2.5 [†]	2.7 [†]
8			2	1.0	1.5
11	<i>Ethanol</i>	95	2	2.1	NA
5			3	2.4 [§]	NA
12			2	1.5	NA
8			2	1.0	0.6
13			2	1.7	NA
14	<i>Ethanol + chlorhexidine gluc. (w/v)</i>	77 + 0.5	5	2.0	1.5 [¶]
8			2	0.7	1.4
8		70 + 0.5	2	0.4	1.2
15			5	1.9 [†]	0.8 [†]
16			5	1.9	NA

Note: NA = not available.

Source: Rotter M. Hand washing and hand disinfection [Chapter 87]. In: Mayhall CG, ed. Hospital epidemiology and infection control. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 1999. Table 5 is copyrighted by Lippincott Williams & Wilkins; it is reprinted here with their permission and permission from Manfred Rotler, M.D., Professor of Hygiene and Microbiology, Klinisches Institute für Hygiene der Universität Wien, Germany.

* Volume/volume unless otherwise stated.

[†] Tested according to Deutsche Gesellschaft für Hygiene, and Mikrobiologie (DGHM)-German Society of Hygiene and Microbiology method.

[§] Tested according to European Standard prEN.

[¶] After 4 hours.

and may vary for different formulations. However, if hands feel dry after rubbing hands together for 10–15 seconds, an insufficient volume of product likely was applied. Because alcohol-impregnated towelettes contain a limited amount of alcohol, their effectiveness is comparable to that of soap and water (63,160,161).

Alcohol-based hand rubs intended for use in hospitals are available as low viscosity rinses, gels, and foams. Limited data are available regarding the relative efficacy of various formulations. One field trial demonstrated that an ethanol gel was slightly more effective than a comparable ethanol solution at reducing bacterial counts on the hands of HCWs (162). However, a more recent study indicated that rinses reduced bacterial counts on the hands more than the gels tested (80). Further studies are warranted to determine the relative efficacy of alcohol-based rinses and gels in reducing transmission of health-care-associated pathogens.

Frequent use of alcohol-based formulations for hand antisepsis can cause drying of the skin unless emollients, humectants, or other skin-conditioning agents are added to the formulations. The drying effect of alcohol can be reduced or eliminated by adding 1%–3% glycerol or other skin-conditioning agents (90,93,100,101,106,135,143,163,164). Moreover, in several recent prospective trials, alcohol-based rinses or gels containing emollients caused substantially less skin irritation and dryness than the soaps or antimicrobial detergents tested (96,98,165,166). These studies, which were conducted in clinical settings, used various subjective and objective methods for assessing skin irritation and dryness. Further studies are warranted to establish whether products with different formulations yield similar results.

Even well-tolerated alcohol hand rubs containing emollients may cause a transient stinging sensation at the site of any broken skin (e.g., cuts and abrasions). Alcohol-based hand-rub preparations with strong fragrances may be poorly tolerated by HCWs with respiratory allergies. Allergic contact dermatitis or contact urticaria syndrome caused by hypersensitivity to alcohol or to various additives present in certain alcohol hand rubs occurs only rarely (167,168).

Alcohols are flammable. Flash points of alcohol-based hand rubs range from 21°C to 24°C, depending on the type and concentration of alcohol present (169). As a result, alcohol-based hand rubs should be stored away from high temperatures or flames in accordance with National Fire Protection Agency recommendations. In Europe, where alcohol-based hand rubs have been used extensively for years, the incidence of fires associated with such products has been low (169). One recent U.S. report described a flash fire that occurred as a result of an unusual series of events, which included an HCW applying an alcohol gel to her hands, immediately removing a

polyester isolation gown, and then touching a metal door before the alcohol had evaporated (170). Removing the polyester gown created a substantial amount of static electricity that generated an audible static spark when the HCW touched the metal door, igniting the unevaporated alcohol on her hands (170). This incident emphasizes the need to rub hands together after application of alcohol-based products until all the alcohol has evaporated.

Because alcohols are volatile, containers should be designed to minimize evaporation. Contamination of alcohol-based solutions has seldom been reported. One report documented a cluster of pseudoinfections caused by contamination of ethyl alcohol by *Bacillus cereus* spores (171).

Chlorhexidine

Chlorhexidine gluconate, a cationic bisbiguanide, was developed in England in the early 1950s and was introduced into the United States in the 1970s (8,172). Chlorhexidine base is only minimally soluble in water, but the digluconate form is water-soluble. The antimicrobial activity of chlorhexidine is likely attributable to attachment to, and subsequent disruption of, cytoplasmic membranes, resulting in precipitation of cellular contents (1,8). Chlorhexidine's immediate antimicrobial activity occurs more slowly than that of alcohols. Chlorhexidine has good activity against gram-positive bacteria, somewhat less activity against gram-negative bacteria and fungi, and only minimal activity against tubercle bacilli (1,8,172). Chlorhexidine is not sporicidal (1,172). It has in vitro activity against enveloped viruses (e.g., herpes simplex virus, HIV, cytomegalovirus, influenza, and RSV) but substantially less activity against nonenveloped viruses (e.g., rotavirus, adenovirus, and enteroviruses) (130,131,173). The antimicrobial activity of chlorhexidine is only minimally affected by the presence of organic material, including blood. Because chlorhexidine is a cationic molecule, its activity can be reduced by natural soaps, various inorganic anions, nonionic surfactants, and hand creams containing anionic emulsifying agents (8,172,174). Chlorhexidine gluconate has been incorporated into a number of hand-hygiene preparations. Aqueous or detergent formulations containing 0.5% or 0.75% chlorhexidine are more effective than plain soap, but they are less effective than antiseptic detergent preparations containing 4% chlorhexidine gluconate (135,175). Preparations with 2% chlorhexidine gluconate are slightly less effective than those containing 4% chlorhexidine (176).

Chlorhexidine has substantial residual activity (106,114–116,118,135,146,175). Addition of low concentrations (0.5%–1.0%) of chlorhexidine to alcohol-based preparations results in greater residual activity than alcohol alone (116,135). When used as recommended, chlorhexidine has a good safety

record (172). Minimal, if any, absorption of the compound occurs through the skin. Care must be taken to avoid contact with the eyes when using preparations with $\geq 1\%$ chlorhexidine, because the agent can cause conjunctivitis and severe corneal damage. Ototoxicity precludes its use in surgery involving the inner or middle ear. Direct contact with brain tissue and the meninges should be avoided. The frequency of skin irritation is concentration-dependent, with products containing 4% most likely to cause dermatitis when used frequently for antiseptic handwashing (177); allergic reactions to chlorhexidine gluconate are uncommon (118,172). Occasional outbreaks of nosocomial infections have been traced to contaminated solutions of chlorhexidine (178–181).

Chloroxylonol

Chloroxylonol, also known as parachlorometaxylenol (PCMX), is a halogen-substituted phenolic compound that has been used as a preservative in cosmetics and other products and as an active agent in antimicrobial soaps. It was developed in Europe in the late 1920s and has been used in the United States since the 1950s (182).

The antimicrobial activity of PCMX likely is attributable to inactivation of bacterial enzymes and alteration of cell walls (7). It has good in vitro activity against gram-positive organisms and fair activity against gram-negative bacteria, mycobacteria, and certain viruses (1,7,182). PCMX is less active against *P. aeruginosa*, but addition of ethylenediaminetetraacetic acid (EDTA) increases its activity against *Pseudomonas* spp. and other pathogens.

A limited number of articles focusing on the efficacy of PCMX-containing preparations intended for use by HCWs have been published in the last 25 years, and the results of studies have sometimes been contradictory. For example, in studies in which antiseptics were applied to abdominal skin, PCMX had the weakest immediate and residual activity of any of the agents studied (183). However, when 30-second handwashes were performed using 0.6% PCMX, 2% chlorhexidine gluconate, or 0.3% triclosan, the immediate effect of PCMX was similar to that of the other agents. When used 18 times per day for 5 consecutive days, PCMX had less cumulative activity than did chlorhexidine gluconate (184). When PCMX was used as a surgical scrub, one report indicated that 3% PCMX had immediate and residual activity comparable to 4% chlorhexidine gluconate (185), whereas two other studies demonstrated that the immediate and residual activity of PCMX was inferior to both chlorhexidine gluconate and povidone-iodine (176,186). The disparity between published studies may be associated with the various concentrations of PCMX included in the preparations evaluated and with other aspects of the formulations tested, including the

presence or absence of EDTA (7,182). PCMX is not as rapidly active as chlorhexidine gluconate or iodophors, and its residual activity is less pronounced than that observed with chlorhexidine gluconate (7,182). In 1994, FDA TFM tentatively classified PCMX as a Category II/III active agent (i.e., insufficient data are available to classify this agent as safe and effective) (19). Further evaluation of this agent by the FDA is ongoing.

The antimicrobial activity of PCMX is minimally affected by the presence of organic matter, but it is neutralized by non-ionic surfactants. PCMX, which is absorbed through the skin (7,182), is usually well-tolerated, and allergic reactions associated with its use are uncommon. PCMX is available in concentrations of 0.3%–3.75%. In-use contamination of a PCMX-containing preparation has been reported (187).

Hexachlorophene

Hexachlorophene is a bisphenol composed of two phenolic groups and three chlorine moieties. In the 1950s and early 1960s, emulsions containing 3% hexachlorophene were widely used for hygienic handwashing, as surgical scrubs, and for routine bathing of infants in hospital nurseries. The antimicrobial activity of hexachlorophene results from its ability to inactivate essential enzyme systems in microorganisms. Hexachlorophene is bacteriostatic, with good activity against *S. aureus* and relatively weak activity against gram-negative bacteria, fungi, and mycobacteria (7).

Studies of hexachlorophene as a hygienic handwash and surgical scrub demonstrated only modest efficacy after a single handwash (53,143,188). Hexachlorophene has residual activity for several hours after use and gradually reduces bacterial counts on hands after multiple uses (i.e., it has a cumulative effect) (1,101,188,189). With repeated use of 3% hexachlorophene preparations, the drug is absorbed through the skin. Infants bathed with hexachlorophene and personnel regularly using a 3% hexachlorophene preparation for handwashing have blood levels of 0.1–0.6 ppm hexachlorophene (190). In the early 1970s, certain infants bathed with hexachlorophene developed neurotoxicity (vacuolar degeneration) (191). As a result, in 1972, the FDA warned that hexachlorophene should no longer be used routinely for bathing infants. However, after routine use of hexachlorophene for bathing infants in nurseries was discontinued, investigators noted that the incidence of health-care-associated *S. aureus* infections in hospital nurseries increased substantially (192,193). In several instances, the frequency of infections decreased when hexachlorophene bathing of infants was reinstituted. However, current guidelines still recommend against the routine bathing of neonates with hexachlorophene because of its potential neurotoxic effects (194). The agent is classified by FDA TFM as not

generally recognized as safe and effective for use as an antiseptic handwash (19). Hexachlorophene should not be used to bathe patients with burns or extensive areas of susceptible, sensitive skin. Soaps containing 3% hexachlorophene are available by prescription only (7).

Iodine and Iodophors

Iodine has been recognized as an effective antiseptic since the 1800s. However, because iodine often causes irritation and discoloring of skin, iodophors have largely replaced iodine as the active ingredient in antiseptics.

Iodine molecules rapidly penetrate the cell wall of microorganisms and inactivate cells by forming complexes with amino acids and unsaturated fatty acids, resulting in impaired protein synthesis and alteration of cell membranes (195). Iodophors are composed of elemental iodine, iodide or triiodide, and a polymer carrier (i.e., the complexing agent) of high molecular weight. The amount of molecular iodine present (so-called “free” iodine) determines the level of antimicrobial activity of iodophors. “Available” iodine refers to the total amount of iodine that can be titrated with sodium thiosulfate (196). Typical 10% povidone-iodine formulations contain 1% available iodine and yield free iodine concentrations of 1 ppm (196). Combining iodine with various polymers increases the solubility of iodine, promotes sustained release of iodine, and reduces skin irritation. The most common polymers incorporated into iodophors are polyvinyl pyrrolidone (i.e., povidone) and ethoxylated nonionic detergents (i.e., poloxamers) (195,196). The antimicrobial activity of iodophors also can be affected by pH, temperature, exposure time, concentration of total available iodine, and the amount and type of organic and inorganic compounds present (e.g., alcohols and detergents).

Iodine and iodophors have bactericidal activity against gram-positive, gram-negative, and certain spore-forming bacteria (e.g., clostridia and *Bacillus* spp.) and are active against mycobacteria, viruses, and fungi (8,195,197–200). However, in concentrations used in antiseptics, iodophors are not usually sporicidal (201). In vivo studies have demonstrated that iodophors reduce the number of viable organisms that are recovered from the hands of personnel (113,145,148,152,155). Povidone-iodine 5%–10% has been tentatively classified by FDA TFM as a Category I agent (i.e., a safe and effective agent for use as an antiseptic handwash and an HCW handwash) (19). The extent to which iodophors exhibit persistent antimicrobial activity after they have been washed off the skin is unclear. In one study, persistent activity was noted for 6 hours (176); however, several other studies demonstrated persistent activity for only 30–60 minutes after washing hands with an iodophor (61,117,202). In studies in which bacterial counts

were obtained after gloves were worn for 1–4 hours after washing, iodophors have demonstrated poor persistent activity (1,104,115,189,203–208). The in vivo antimicrobial activity of iodophors is substantially reduced in the presence of organic substances (e.g., blood or sputum) (8).

The majority of iodophor preparations used for hand hygiene contain 7.5%–10% povidone-iodine. Formulations with lower concentrations also have good antimicrobial activity because dilution can increase free iodine concentrations (209). However, as the amount of free iodine increases, the degree of skin irritation also may increase (209). Iodophors cause less skin irritation and fewer allergic reactions than iodine, but more irritant contact dermatitis than other antiseptics commonly used for hand hygiene (92). Occasionally, iodophor antiseptics have become contaminated with gram-negative bacilli as a result of poor manufacturing processes and have caused outbreaks or pseudo-outbreaks of infection (196).

Quaternary Ammonium Compounds

Quaternary ammonium compounds are composed of a nitrogen atom linked directly to four alkyl groups, which may vary in their structure and complexity (210). Of this large group of compounds, alkyl benzalkonium chlorides are the most widely used as antiseptics. Other compounds that have been used as antiseptics include benzethonium chloride, cetrimide, and cetylpyridium chloride (1). The antimicrobial activity of these compounds was first studied in the early 1900s, and a quaternary ammonium compound for preoperative cleaning of surgeons’ hands was used as early as 1935 (210). The antimicrobial activity of this group of compounds likely is attributable to adsorption to the cytoplasmic membrane, with subsequent leakage of low molecular weight cytoplasmic constituents (210).

Quaternary ammonium compounds are primarily bacteriostatic and fungistatic, although they are microbicidal against certain organisms at high concentrations (1); they are more active against gram-positive bacteria than against gram-negative bacilli. Quaternary ammonium compounds have relatively weak activity against mycobacteria and fungi and have greater activity against lipophilic viruses. Their antimicrobial activity is adversely affected by the presence of organic material, and they are not compatible with anionic detergents (1,210). In 1994, FDA TFM tentatively classified benzalkonium chloride and benzethonium chloride as Category IIISE active agents (i.e., insufficient data exists to classify them as safe and effective for use as an antiseptic handwash) (19). Further evaluation of these agents by FDA is in progress.

Quaternary ammonium compounds are usually well tolerated. However, because of weak activity against

gram-negative bacteria, benzalkonium chloride is prone to contamination by these organisms. Several outbreaks of infection or pseudoinfection have been traced to quaternary ammonium compounds contaminated with gram-negative bacilli (211–213). For this reason, in the United States, these compounds have been seldom used for hand antisepsis during the last 15–20 years. However, newer handwashing products containing benzalkonium chloride or benzethonium chloride have recently been introduced for use by HCWs. A recent study of surgical intensive-care unit personnel found that cleaning hands with antimicrobial wipes containing a quaternary ammonium compound was about as effective as using plain soap and water for handwashing; both were less effective than decontaminating hands with an alcohol-based hand rub (214). One laboratory-based study reported that an alcohol-free hand-rub product containing a quaternary ammonium compound was efficacious in reducing microbial counts on the hands of volunteers (215). Further studies of such products are needed to determine if newer formulations are effective in health-care settings.

Triclosan

Triclosan (chemical name: 2,4,4'-trichloro-2'-hydroxydiphenyl ether) is a nonionic, colorless substance that was developed in the 1960s. It has been incorporated into soaps for use by HCWs and the public and into other consumer products. Concentrations of 0.2%–2% have antimicrobial activity. Triclosan enters bacterial cells and affects the cytoplasmic membrane and synthesis of RNA, fatty acids, and proteins (216). Recent studies indicate this agent's antibacterial activity is attributable to binding to the active site of enoyl-acyl carrier protein reductase (217,218).

Triclosan has a broad range of antimicrobial activity, but it is often bacteriostatic (1). Minimum inhibitory concentrations (MICs) range from 0.1 to 10 µg/mL, whereas minimum bactericidal concentrations are 25–500 µg/mL. Triclosan's activity against gram-positive organisms (including MRSA) is greater than against gram-negative bacilli, particularly *P. aeruginosa* (1,216). The agent possesses reasonable activity against mycobacterial and *Candida* spp., but it has limited activity against filamentous fungi. Triclosan (0.1%) reduces bacterial counts on hands by 2.8 log₁₀ after a 1-minute hygienic handwash (1). In several studies, log reductions have been lower after triclosan is used than when chlorhexidine, iodophors, or alcohol-based products are applied (1,61,149,184,219). In 1994, FDA TFM tentatively classified triclosan ≤1.0% as a Category II/III active agent (i.e., insufficient data exist to classify this agent as safe and effective for use as an antiseptic handwash) (19). Further evaluation of this agent by the FDA is underway. Like chlorhexidine, triclosan has persistent activity on the skin. Its activity in

hand-care products is affected by pH, the presence of surfactants, emollients, or humectants and by the ionic nature of the particular formulation (1,216). Triclosan's activity is not substantially affected by organic matter, but it can be inhibited by sequestration of the agent in micelle structures formed by surfactants present in certain formulations. The majority of formulations containing <2% triclosan are well-tolerated and seldom cause allergic reactions. Certain reports indicate that providing hospital personnel with a triclosan-containing preparation for hand antisepsis has led to decreased MRSA infections (72,73). Triclosan's lack of potent activity against gram-negative bacilli has resulted in occasional reports of contamination (220).

Other Agents

Approximately 150 years after puerperal-fever-related maternal mortality rates were demonstrated by Semmelweis to be reduced by use of a hypochlorite hand rinse, the efficacy of rubbing hands for 30 seconds with an aqueous hypochlorite solution was studied once again (221). The solution was demonstrated to be no more effective than distilled water. The regimen used by Semmelweis, which called for rubbing hands with a 4% [w/w] hypochlorite solution until the hands were slippery (approximately 5 minutes), has been revisited by other researchers (222). This more current study indicated that the regimen was 30 times more effective than a 1-minute rub using 60% isopropanol. However, because hypochlorite solutions are often irritating to the skin when used repeatedly and have a strong odor, they are seldom used for hand hygiene.

Certain other agents are being evaluated by FDA for use in health-care-related antiseptics (19). However, the efficacy of these agents has not been evaluated adequately for use in handwashing preparations intended for use by HCWs. Further evaluation of these agents is warranted. Products that use different concentrations of traditional antiseptics (e.g., low concentrations of iodophor) or contain novel compounds with antiseptic properties are likely to be introduced for use by HCWs. For example, preliminary studies have demonstrated that adding silver-containing polymers to an ethanol carrier (i.e., Surfacine®) results in a preparation that has persistent antimicrobial activity on animal and human skin (223). New compounds with good in vitro activity must be tested in vivo to determine their abilities to reduce transient and resident skin flora on the hands of HCWs.

Activity of Antiseptic Agents Against Spore-Forming Bacteria

The widespread prevalence of health-care-associated diarrhea caused by *Clostridium difficile* and the recent occurrence

in the United States of human *Bacillus anthracis* infections associated with contaminated items sent through the postal system has raised concern regarding the activity of antiseptic agents against spore-forming bacteria. None of the agents (including alcohols, chlorhexidine, hexachlorophene, iodophors, PCMX, and triclosan) used in antiseptic handwash or antiseptic hand-rub preparations are reliably sporicidal against *Clostridium* spp. or *Bacillus* spp. (120,172,224,225). Washing hands with non-antimicrobial or antimicrobial soap and water may help to physically remove spores from the surface of contaminated hands. HCWs should be encouraged to wear gloves when caring for patients with *C. difficile*-associated diarrhea (226). After gloves are removed, hands should be washed with a non-antimicrobial or an antimicrobial soap and water or disinfected with an alcohol-based hand rub. During outbreaks of *C. difficile*-related infections, washing hands with a non-antimicrobial or antimicrobial soap and water after removing gloves is prudent. HCWs with suspected or documented exposure to *B. anthracis*-contaminated items also should be encouraged to wash their hands with a non-antimicrobial or antimicrobial soap and water.

Reduced Susceptibility of Bacteria to Antiseptics

Reduced susceptibility of bacteria to antiseptic agents can either be an intrinsic characteristic of a species or can be an acquired trait (227). Several reports have described strains of bacteria that appear to have acquired reduced susceptibility (when defined by MICs established in vitro) to certain antiseptics (e.g., chlorhexidine, quaternary ammonium compounds, and triclosan) (227–230). However, because the antiseptic concentrations that are actually used by HCWs are often substantially higher than the MICs of strains with reduced antiseptic susceptibility, the clinical relevance of the in vitro findings is questionable. For example, certain strains of MRSA have chlorhexidine and quaternary ammonium compound MICs that are several-fold higher than methicillin-susceptible strains, and certain strains of *S. aureus* have elevated MICs to triclosan (227,228). However, such strains were readily inhibited by the concentrations of these antiseptics that are actually used by practicing HCWs (227,228). The description of a triclosan-resistant bacterial enzyme has raised the question of whether resistance to this agent may develop more readily than to other antiseptic agents (218). In addition, exposing *Pseudomonas* strains containing the MexAB-OprM efflux system to triclosan may select for mutants that are resistant to multiple antibiotics, including fluoroquinolones (230). Further studies are needed to determine whether reduced susceptibility to antiseptic agents is of epidemiologic

significance and whether resistance to antiseptics has any influence on the prevalence of antibiotic-resistant strains (227).

Surgical Hand Antisepsis

Since the late 1800s, when Lister promoted the application of carbolic acid to the hands of surgeons before procedures, preoperative cleansing of hands and forearms with an antiseptic agent has been an accepted practice (231). Although no randomized, controlled trials have been conducted to indicate that surgical-site infection rates are substantially lower when preoperative scrubbing is performed with an antiseptic agent rather than a non-antimicrobial soap, certain other factors provide a strong rationale for this practice. Bacteria on the hands of surgeons can cause wound infections if introduced into the operative field during surgery (232); rapid multiplication of bacteria occurs under surgical gloves if hands are washed with a non-antimicrobial soap. However, bacterial growth is slowed after preoperative scrubbing with an antiseptic agent (14,233). Reducing resident skin flora on the hands of the surgical team for the duration of a procedure reduces the risk of bacteria being released into the surgical field if gloves become punctured or torn during surgery (1,156,169). Finally, at least one outbreak of surgical-site infections occurred when surgeons who normally used an antiseptic surgical scrub preparation began using a non-antimicrobial product (234).

Antiseptic preparations intended for use as surgical hand scrubs are evaluated for their ability to reduce the number of bacteria released from hands at different times, including 1) immediately after scrubbing, 2) after wearing surgical gloves for 6 hours (i.e., persistent activity), and 3) after multiple applications over 5 days (i.e., cumulative activity). Immediate and persistent activity are considered the most important in determining the efficacy of the product. U.S. guidelines recommend that agents used for surgical hand scrubs should substantially reduce microorganisms on intact skin, contain a nonirritating antimicrobial preparation, have broad-spectrum activity, and be fast-acting and persistent (19,235).

Studies have demonstrated that formulations containing 60%–95% alcohol alone or 50%–95% when combined with limited amounts of a quaternary ammonium compound, hexachlorophene, or chlorhexidine gluconate, lower bacterial counts on the skin immediately postscrub more effectively than do other agents (Table 4). The next most active agents (in order of decreasing activity) are chlorhexidine gluconate, iodophors, triclosan, and plain soap (104,119,186,188,203,204,206,208,236). Because studies of PCMX as a surgical scrub have yielded contradictory results, further studies are needed to establish how the efficacy of this compound compares with the other agents (176,185,186).

Although alcohols are not considered to have persistent antimicrobial activity, bacteria appear to reproduce slowly on the hands after a surgical scrub with alcohol, and bacterial counts on hands after wearing gloves for 1–3 hours seldom exceed baseline (i.e., prescrub) values (1). However, a recent study demonstrated that a formulation containing 61% ethanol alone did not achieve adequate persistent activity at 6 hours postscrub (237). Alcohol-based preparations containing 0.5% or 1% chlorhexidine gluconate have persistent activity that, in certain studies, has equaled or exceeded that of chlorhexidine gluconate-containing detergents (1,118,135,237).*

Persistent antimicrobial activity of detergent-based surgical scrub formulations is greatest for those containing 2% or 4% chlorhexidine gluconate, followed by hexachlorophene, triclosan, and iodophors (1,102,113–115,159,189,203,204,206–208,236). Because hexachlorophene is absorbed into the blood after repeated use, it is seldom used as a surgical scrub.

Surgical staff have been traditionally required to scrub their hands for 10 minutes preoperatively, which frequently leads to skin damage. Several studies have demonstrated that scrubbing for 5 minutes reduces bacterial counts as effectively as a 10-minute scrub (117,238,239). In other studies, scrubbing for 2 or 3 minutes reduced bacterial counts to acceptable levels (156,205,207,240,241).

Studies have indicated that a two-stage surgical scrub using an antiseptic detergent, followed by application of an alcohol-containing preparation, is effective. For example, an initial 1- or 2-minute scrub with 4% chlorhexidine gluconate or povidone-iodine followed by application of an alcohol-based product has been as effective as a 5-minute scrub with an antiseptic detergent (114,242).

Surgical hand-antisepsis protocols have required personnel to scrub with a brush. But this practice can damage the skin of personnel and result in increased shedding of bacteria from the hands (95,243). Scrubbing with a disposable sponge or combination sponge-brush has reduced bacterial counts on the hands as effectively as scrubbing with a brush (244–246). However, several studies indicate that neither a brush nor a

sponge is necessary to reduce bacterial counts on the hands of surgical personnel to acceptable levels, especially when alcohol-based products are used (102,117,159,165,233,237,247,248). Several of these studies performed cultures immediately or at 45–60 minutes postscrub (102,117,233,247,248), whereas in other studies, cultures were obtained 3 and 6 hours postscrub (159,237). For example, a recent laboratory-based study using volunteers demonstrated that brushless application of a preparation containing 1% chlorhexidine gluconate plus 61% ethanol yielded lower bacterial counts on the hands of participants than using a sponge/brush to apply a 4% chlorhexidine-containing detergent preparation (237).

Relative Efficacy of Plain Soap, Antiseptic Soap/Detergent, and Alcohols

Comparing studies related to the *in vivo* efficacy of plain soap, antimicrobial soaps, and alcohol-based hand rubs is problematic, because certain studies express efficacy as the percentage reduction in bacterial counts achieved, whereas others give $\log_{10}$ reductions in counts achieved. However, summarizing the relative efficacy of agents tested in each study can provide an overview of the *in vivo* activity of various formulations intended for handwashing, hygienic handwash, antiseptic hand rub, or surgical hand antisepsis (Tables 2–4).

Irritant Contact Dermatitis Resulting from Hand-Hygiene Measures

Frequency and Pathophysiology of Irritant Contact Dermatitis

In certain surveys, approximately 25% of nurses report symptoms or signs of dermatitis involving their hands, and as many as 85% give a history of having skin problems (249). Frequent and repeated use of hand-hygiene products, particularly soaps and other detergents, is a primary cause of chronic irritant contact dermatitis among HCWs (250). The potential of detergents to cause skin irritation can vary considerably and can be ameliorated by the addition of emollients and humectants. Irritation associated with antimicrobial soaps may be caused by the antimicrobial agent or by other ingredients of the formulation. Affected persons often complain of a feeling of dryness or burning; skin that feels “rough;” and erythema, scaling, or fissures. Detergents damage the skin by causing denaturation of stratum corneum proteins, changes in intercellular lipids (either depletion or reorganization of lipid moieties), decreased corneocyte cohesion, and decreased stratum corneum water-binding capacity (250,251). Damage

* In a recent randomized clinical trial, surgical site infection rates were monitored among patients who were operated on by surgical personnel who cleaned their hands preoperatively either by performing a traditional 5-minute surgical hand scrub using 4% povidone-iodine or 4% antiseptic antimicrobial soap, or by washing their hands for 1 minute with a non-antimicrobial soap followed by a 5-minute hand-rubbing technique using an alcohol-based hand rinse containing 0.2% metronidazole. The incidence of surgical site infections was virtually identical in the two groups of patients. (Source: Parienti JJ, Thibon P, Heller R, et al. for Members of the Antiseptic Chirurgicale des Mains Study Group. Hand-rubbing with an aqueous alcoholic solution vs traditional surgical hand-scrubbing and 30-day surgical site infection rates: a randomized equivalence study. JAMA 2002;288:722–7).

to the skin also changes skin flora, resulting in more frequent colonization by staphylococci and gram-negative bacilli (17,90). Although alcohols are among the safest antiseptics available, they can cause dryness and irritation of the skin (1,252). Ethanol is usually less irritating than n-propanol or isopropanol (252).

Irritant contact dermatitis is more commonly reported with iodophors (92). Other antiseptic agents that can cause irritant contact dermatitis (in order of decreasing frequency) include chlorhexidine, PCMX, triclosan, and alcohol-based products. Skin that is damaged by repeated exposure to detergents may be more susceptible to irritation by alcohol-based preparations (253). The irritancy potential of commercially prepared hand-hygiene products, which is often determined by measuring transepidermal water loss, may be available from the manufacturer. Other factors that can contribute to dermatitis associated with frequent handwashing include using hot water for handwashing, low relative humidity (most common in winter months), failure to use supplementary hand lotion or cream, and the quality of paper towels (254,255). Shear forces associated with wearing or removing gloves and allergy to latex proteins may also contribute to dermatitis of the hands of HCWs.

Allergic Contact Dermatitis Associated with Hand-Hygiene Products

Allergic reactions to products applied to the skin (i.e., contact allergies) may present as delayed type reactions (i.e., allergic contact dermatitis) or less commonly as immediate reactions (i.e., contact urticaria). The most common causes of contact allergies are fragrances and preservatives; emulsifiers are less common causes (256–259). Liquid soaps, hand lotions or creams, and “udder ointments” may contain ingredients that cause contact allergies among HCWs (257,258).

Allergic reactions to antiseptic agents, including quaternary ammonium compounds, iodine or iodophors, chlorhexidine, triclosan, PCMX, and alcohols have been reported (118,167,172,256,260–265). Allergic contact dermatitis associated with alcohol-based hand rubs is uncommon. Surveillance at a large hospital in Switzerland, where a commercial alcohol hand rub has been used for >10 years, failed to identify a single case of documented allergy to the product (169). In late 2001, a Freedom of Information Request for data in the FDA’s Adverse Event Reporting System regarding adverse reactions to popular alcohol hand rubs in the United States yielded only one reported case of an erythematous rash reaction attributed to such a product (John M. Boyce, M.D., Hospital of St. Raphael, New Haven, Connecticut, personal communication, 2001). However, with increasing use of such products by HCWs, true allergic reactions to such products likely will be encountered.

Allergic reactions to alcohol-based products may represent true allergy to alcohol, allergy to an impurity or aldehyde metabolite, or allergy to another constituent of the product (167). Allergic contact dermatitis or immediate contact urticarial reactions may be caused by ethanol or isopropanol (167). Allergic reactions can be caused by compounds that may be present as inactive ingredients in alcohol-based hand rubs, including fragrances, benzyl alcohol, stearyl or isostearyl alcohol, phenoxyethanol, myristyl alcohol, propylene glycol, parabens, and benzalkonium chloride (167,256,266–270).

Proposed Methods for Reducing Adverse Effects of Agents

Potential strategies for minimizing hand-hygiene–related irritant contact dermatitis among HCWs include reducing the frequency of exposure to irritating agents (particularly anionic detergents), replacing products with high irritation potential with preparations that cause less damage to the skin, educating personnel regarding the risks of irritant contact dermatitis, and providing caregivers with moisturizing skin-care products or barrier creams (96,98,251,271–273). Reducing the frequency of exposure of HCWs to hand-hygiene products would prove difficult and is not desirable because of the low levels of adherence to hand-hygiene policies in the majority of institutions. Although hospitals have provided personnel with non-antimicrobial soaps in hopes of minimizing dermatitis, frequent use of such products may cause greater skin damage, dryness, and irritation than antiseptic preparations (92,96,98). One strategy for reducing the exposure of personnel to irritating soaps and detergents is to promote the use of alcohol-based hand rubs containing various emollients. Several recent prospective, randomized trials have demonstrated that alcohol-based hand rubs containing emollients were better tolerated by HCWs than washing hands with non-antimicrobial soaps or antimicrobial soaps (96,98,166). Routinely washing hands with soap and water immediately after using an alcohol hand rub may lead to dermatitis. Therefore, personnel should be reminded that it is neither necessary nor recommended to routinely wash hands after each application of an alcohol hand rub.

Hand lotions and creams often contain humectants and various fats and oils that can increase skin hydration and replace altered or depleted skin lipids that contribute to the barrier function of normal skin (251,271). Several controlled trials have demonstrated that regular use (e.g., twice a day) of such products can help prevent and treat irritant contact dermatitis caused by hand-hygiene products (272,273). In one study, frequent and scheduled use of an oil-containing lotion improved skin condition, and thus led to a 50% increase in

handwashing frequency among HCWs (273). Reports from these studies emphasize the need to educate personnel regarding the value of regular, frequent use of hand-care products.

Recently, barrier creams have been marketed for the prevention of hand-hygiene–related irritant contact dermatitis. Such products are absorbed to the superficial layers of the epidermis and are designed to form a protective layer that is not removed by standard handwashing. Two recent randomized, controlled trials that evaluated the skin condition of caregivers demonstrated that barrier creams did not yield better results than did the control lotion or vehicle used (272,273). As a result, whether barrier creams are effective in preventing irritant contact dermatitis among HCWs remains unknown.

In addition to evaluating the efficacy and acceptability of hand-care products, product-selection committees should inquire about the potential deleterious effects that oil-containing products may have on the integrity of rubber gloves and on the efficacy of antiseptic agents used in the facility (8,236).

Factors To Consider When Selecting Hand-Hygiene Products

When evaluating hand-hygiene products for potential use in health-care facilities, administrators or product-selection committees must consider factors that can affect the overall efficacy of such products, including the relative efficacy of antiseptic agents against various pathogens (Appendix) and acceptance of hand-hygiene products by personnel (274,275). Soap products that are not well-accepted by HCWs can be a deterrent to frequent handwashing (276). Characteristics of a product (either soap or alcohol-based hand rub) that can affect acceptance by personnel include its smell, consistency (i.e., “feel”), and color (92,277,278). For soaps, ease of lathering also may affect user preference.

Because HCWs may wash their hands from a limited number of times per shift to as many as 30 times per shift, the tendency of products to cause skin irritation and dryness is a substantial factor that influences acceptance, and ultimate usage (61,98,274,275,277,279). For example, concern regarding the drying effects of alcohol was a primary cause of poor acceptance of alcohol-based hand-hygiene products in hospitals in the United States (5,143). However, several studies have demonstrated that alcohol-based hand rubs containing emollients are acceptable to HCWs (90,93,98,100,101,106,143,163,164,166). With alcohol-based products, the time required for drying may also affect user acceptance.

Studies indicate that the frequency of handwashing or antiseptic handwashing by personnel is affected by the accessibility of hand-hygiene facilities (280–283). In certain health-care

facilities, only one sink is available in rooms housing several patients, or sinks are located far away from the door of the room, which may discourage handwashing by personnel leaving the room. In intensive-care units, access to sinks may be blocked by bedside equipment (e.g., ventilators or intravenous infusion pumps). In contrast to sinks used for handwashing or antiseptic handwash, dispensers for alcohol-based hand rubs do not require plumbing and can be made available adjacent to each patient's bed and at many other locations in patient-care areas. Pocket carriage of alcohol-based hand-rub solutions, combined with availability of bedside dispensers, has been associated with substantial improvement in adherence to hand-hygiene protocols (74,284). To avoid any confusion between soap and alcohol hand rubs, alcohol hand-rub dispensers should not be placed adjacent to sinks. HCWs should be informed that washing hands with soap and water after each use of an alcohol hand rub is not necessary and is not recommended, because it may lead to dermatitis. However, because personnel feel a “build-up” of emollients on their hands after repeated use of alcohol hand gels, washing hands with soap and water after 5–10 applications of a gel has been recommended by certain manufacturers.

Automated handwashing machines have not been demonstrated to improve the quality or frequency of handwashing (88,285). Although technologically advanced automated handwashing devices and monitoring systems have been developed recently, only a minimal number of studies have been published that demonstrate that use of such devices results in enduring improvements in hand-hygiene adherence among HCWs. Further evaluation of automated handwashing facilities and monitoring systems is warranted.

Dispenser systems provided by manufacturers or vendors also must be considered when evaluating hand-hygiene products. Dispensers may discourage use by HCWs when they 1) become blocked or partially blocked and do not deliver the product when accessed by personnel, and 2) do not deliver the product appropriately onto the hands. In one hospital where a viscous alcohol-based hand rinse was available, only 65% of functioning dispensers delivered product onto the caregivers' hands with one press of the dispenser lever, and 9% of dispensers were totally occluded (286). In addition, the volume delivered was often suboptimal, and the product was sometimes squirted onto the wall instead of the caregiver's hand.

Only limited information is available regarding the cost of hand-hygiene products used in health-care facilities (165,287). These costs were evaluated in patient-care areas at a 450-bed community teaching hospital (287); the hospital spent \$22,000 (\$0.72 per patient-day) on 2% chlorhexidine-containing preparations, plain soap, and an alcohol hand rinse. (287) When

hand-hygiene supplies for clinics and nonpatient care areas were included, the total annual budget for soaps and hand antiseptic agents was \$30,000 (approximately \$1 per patient-day). Annual hand-hygiene product budgets at other institutions vary considerably because of differences in usage patterns and varying product prices. One researcher (287) determined that if non-antimicrobial liquid soap were assigned an arbitrary relative cost of 1.0, the cost per liter would be 1.7 times as much for 2% chlorhexidine gluconate detergent, 1.6–2.0 times higher for alcohol-based hand-rub products, and 4.5 times higher for an alcohol-based foam product. A recent cost comparison of surgical scrubbing with an antimicrobial soap versus brushless scrubbing with an alcohol-based hand rub revealed that costs and time required for preoperative scrubbing were less with the alcohol-based product (165). In a trial conducted in two critical-care units, the cost of using an alcohol hand rub was half as much as using an antimicrobial soap for handwashing (\$0.025 versus \$0.05 per application, respectively) (166).

To put expenditures for hand-hygiene products into perspective, health-care facilities should consider comparing their budget for hand-hygiene products to estimated excess hospital costs resulting from health-care-associated infections. The excess hospital costs associated with only four or five health-care-associated infections of average severity may equal the entire annual budget for hand-hygiene products used in inpatient-care areas. Just one severe surgical site infection, lower respiratory tract infection, or bloodstream infection may cost the hospital more than the entire annual budget for antiseptic agents used for hand hygiene (287). Two studies provided certain quantitative estimates of the benefit of hand-hygiene-promotion programs (72,74). One study demonstrated a cost saving of approximately \$17,000 resulting from reduced use of vancomycin after the observed decrease in MRSA incidence in a 7-month period (72). In another study that examined both direct costs associated with the hand-hygiene promotion program (increased use of hand-rub solution and poster production) and indirect costs associated with health-care-personnel time (74), costs of the program were an estimated \$57,000 or less per year (an average of \$1.42 per patient admitted). Supplementary costs associated with the increased use of alcohol-based hand-rub solution averaged \$6.07 per 100 patient-days. Based on conservative estimates of \$2,100 saved per infection averted and on the assumption that only 25% of the observed reduction in the infection rate was associated with improved hand-hygiene practice, the program was substantially cost-effective. Thus, hospital administrators must consider that by purchasing more effective or more acceptable hand-hygiene products to improve hand-hygiene practices, they

will avoid the occurrence of nosocomial infections; preventing only a limited number of additional health-care-associated infections per year will lead to savings that will exceed any incremental costs of improved hand-hygiene products.

Hand-Hygiene Practices Among HCWs

In observational studies conducted in hospitals, HCWs washed their hands an average of five times per shift to as many as 30 times per shift (Table 6) (17,61,90,98,274,288); certain nurses washed their hands ≤ 100 times per shift (90). Hospitalwide surveillance of hand hygiene reveals that the average number of handwashing opportunities varies markedly between hospital wards. For example, nurses in pediatric wards had an average of eight opportunities for hand hygiene per hour of patient care compared with an average of 20 for nurses in intensive-care units (11). The duration of handwashing or hygienic handwash episodes by HCWs has averaged 6.6–24.0 seconds in observational studies (Table 7) (17,52,59,84–87,89,249,279). In addition to washing their

TABLE 6. Handwashing frequency among health-care workers

Ref. no.	Year	Avg. no./time period	Range	Avg. no./hr
(61)	1988	5/8 hour	N.S.	
(89)	1984	5–10/shift	N.S.	
(96)	2000	10/shift	N.S.	
(273)	2000	12–18/day	2–60	
(98)	2000	13–15/8 hours	5–27	1.6–1.8/hr
(90)	1977	20–42/8 hours	10–100	
(391)	2000	21/12 hours	N.S.	
(272)	2000	22/day	0–70	
(88)	1991			1.7–2.1/hr
(17)	1998			2.1/hr
(279)	1978			3/hr
(303)	1994			3.3/hr

Note: N.S. = Not Stated.

TABLE 7. Average duration of handwashing by health-care workers

Ref. no.	Year	Mean/median time
(392)	1997	4.7–5.3 seconds
(303)	1994	6.6 seconds
(52)	1974	8–9.3 seconds
(85)	1984	8.6 seconds
(86)	1994	<9 seconds
(87)	1994	9.5 seconds
(88)	1991	<10 seconds
(294)	1990	10 seconds
(89)	1984	11.6 seconds
(300)	1992	12.5 seconds
(59)	1988	15.6–24.4 seconds
(17)	1998	20.6 seconds
(279)	1978	21 seconds
(293)	1989	24 seconds

hands for limited time periods, personnel often fail to cover all surfaces of their hands and fingers (288).

Adherence of HCWs to Recommended Hand-Hygiene Practices

Observational Studies of Hand-Hygiene Adherence. Adherence of HCWs to recommended hand-hygiene procedures has been poor, with mean baseline rates of 5%–81% (overall average: 40%) (Table 8) (71,74,86,87,276,280,281,283,285,289–313). The methods used for defining adherence (or non-adherence) and those used for conducting observations vary considerably among studies, and reports do not provide

detailed information concerning the methods and criteria used. The majority of studies were conducted with hand-hygiene adherence as the major outcome measure, whereas a limited number measured adherence as part of a broader investigation. Several investigators reported improved adherence after implementing various interventions, but the majority of studies had short follow-up periods and did not confirm whether behavioral improvements were long-lasting. Other studies established that sustained improvements in handwashing behavior occurred during a long-term program to improve adherence to hand-hygiene policies (74,75).

TABLE 8. Hand-hygiene adherence by health-care workers (1981–2000)

Ref. no.	Year	Setting	Before/ after	Adherence baseline	Adherence after intervention	Intervention
(280)	1981	ICU	A	16%	30%	More convenient sink locations
(289)	1981	ICU	A	41%	—	
		ICU	A	28%	—	
(290)	1983	All wards	A	45%	—	Performance feedback
(281)	1986	SICU	A	51%	—	
		MICU	A	76%	—	
(276)	1986	ICU	A	63%	92%	Wearing overgown
(291)	1987	PICU	A	31%	30%	
(292)	1989	MICU	B/A	14%/28%*	73%/81%	
		MICU	B/A	26%/23%	38%/60%	Feedback, policy reviews, memo, and posters
(293)	1989	NICU	A/B	75%/50%	—	
(294)	1990	ICU	A	32%	45%	
(295)	1990	ICU	A	81%	92%	Alcohol rub introduced
(296)	1990	ICU	B/A	22%	30%	
(297)	1991	SICU	A	51%	—	
(298)	1991	Pedi OPDs	B	49%	49%	Signs, feedback, and verbal reminders to physicians
(299)	1991	Nursery and NICU	B/A†	28%	63%	
(300)	1992	NICU/others	A	29%	—	Inservices first, then group feedback
(71)	1992	ICU	N.S.	40%	—	
(301)	1993	ICUs	A	40%	—	
(87)	1994	Emergency Room	A	32%	—	Automated handwashing machines available
(86)	1994	All wards	A	32%	—	
(285)	1994	SICU	A	22%	38%	
(302)	1994	NICU	A	62%	60%	No gowning required
(303)	1994	ICU Wards	AA	30%/29%	—	
(304)	1995	ICU Oncol Ward	A	56%	—	
(305)	1995	ICU	N.S.	5%	63%	Lectures, feedback, and demonstrations
(306)	1996	PICU	B/A	12%/11%	68%/65%	
(307)	1996	MICU	A	41%	58%	
(308)	1996	Emergency Dept	A	54%	64%	Routine wearing of gowns and gloves
(309)	1998	All wards	A	30%	—	
(310)	1998	Pediatric wards	B/A	52%/49%	74%/69%	
(311)	1999	MICU	B/A	12%/55%	—	Feedback, movies, posters, and brochures
(74)	2000	All wards	B/A	48%	67%	
(312)	2000	MICU	A	42%	61%	
(283)	2000	MICU	B/A	10%/22%	23%/48%	Posters, feedback, administrative support, and alcohol rub
		CTICU	B/A	4%/13%	7%/14%	
(313)	2000	Medical wards	A	60%	52%	

Note: ICU = intensive care unit, SICU = surgical ICU, MICU = medical ICU, PICU = pediatric ICU, NICU = neonatal ICU, Emerg = emergency, Oncol = oncology, CTICU = cardiothoracic ICU, and N.S. = not stated.

* Percentage compliance before/after patient contact.

† After contact with inanimate objects.

Factors Affecting Adherence. Factors that may influence hand hygiene include those identified in epidemiologic studies and factors reported by HCWs as being reasons for lack of adherence to hand-hygiene recommendations. Risk factors for poor adherence to hand hygiene have been determined objectively in several observational studies or interventions to improve adherence (11,12,274,292,295,314–317). Among these, being a physician or a nursing assistant, rather than a nurse, was consistently associated with reduced adherence (Box 1).

In the largest hospitalwide survey of hand-hygiene practices among HCWs (11), predictors of poor adherence to recommended hand-hygiene measures were identified. Predictor variables included professional category, hospital ward, time of day/week, and type and intensity of patient care, defined as the number of opportunities for hand hygiene per hour of patient care. In 2,834 observed opportunities for hand hygiene, average adherence was 48%. In multivariate analysis, nonadherence was lowest among nurses and during weekends

BOX 1. Factors influencing adherence to hand-hygiene practices*

Observed risk factors for poor adherence to recommended hand-hygiene practices

- Physician status (rather than a nurse)
- Nursing assistant status (rather than a nurse)
- Male sex
- Working in an intensive-care unit
- Working during the week (versus the weekend)
- Wearing gowns/gloves
- Automated sink
- Activities with high risk of cross-transmission
- High number of opportunities for hand hygiene per hour of patient care

Self-reported factors for poor adherence with hand hygiene

- Handwashing agents cause irritation and dryness
- Sinks are inconveniently located/shortage of sinks
- Lack of soap and paper towels
- Often too busy/insufficient time
- Understaffing/overcrowding
- Patient needs take priority
- Hand hygiene interferes with health-care worker relationships with patients
- Low risk of acquiring infection from patients
- Wearing of gloves/beliefs that glove use obviates the need for hand hygiene
- Lack of knowledge of guidelines/protocols
- Not thinking about it/forgetfulness
- No role model from colleagues or superiors
- Skepticism regarding the value of hand hygiene
- Disagreement with the recommendations
- Lack of scientific information of definitive impact of improved hand hygiene on health-care–associated infection rates

Additional perceived barriers to appropriate hand hygiene

- Lack of active participation in hand-hygiene promotion at individual or institutional level
- Lack of role model for hand hygiene
- Lack of institutional priority for hand hygiene
- Lack of administrative sanction of noncompliers/rewarding compliers
- Lack of institutional safety climate

* **Source:** Adapted from Pittet D. Improving compliance with hand hygiene in hospitals. *Infect Control Hosp Epidemiol* 2000;21:381–6.

(Odds Ratio [OR]: 0.6; 95% confidence interval [CI] = 0.4–0.8). Nonadherence was higher in intensive-care units compared with internal medicine wards (OR: 2.0; 95% CI = 1.3–3.1), during procedures that carried a high risk of bacterial contamination (OR: 1.8; 95% CI = 1.4–2.4), and when intensity of patient care was high (21–40 handwashing opportunities — OR: 1.3; 95% CI = 1.0–1.7; 41–60 opportunities — OR: 2.1; 95% CI = 1.5–2.9; >60 opportunities — OR: 2.1; 95% CI = 1.3–3.5). The higher the demand for hand hygiene, the lower the adherence; on average, adherence decreased by 5% ($\pm$ 2%) for each increase of 10 opportunities per hour when the intensity of patient care exceeded 10 opportunities per hour. Similarly, the lowest adherence rate (36%) was found in intensive-care units, where indications for hand hygiene were typically more frequent (on average, 20 opportunities per patient-hour). The highest adherence rate (59%) was observed in pediatrics wards, where the average intensity of patient care was lower than in other hospital areas (an average of eight opportunities per patient-hour). The results of this study indicate that full adherence to previous guidelines may be unrealistic, and that facilitated access to hand hygiene could help improve adherence (11,12,318).

Perceived barriers to adherence with hand-hygiene practice recommendations include skin irritation caused by hand-hygiene agents, inaccessible hand-hygiene supplies, interference with HCW-patient relationships, priority of care (i.e., the patients' needs are given priority over hand hygiene), wearing of gloves, forgetfulness, lack of knowledge of the guidelines, insufficient time for hand hygiene, high workload and understaffing, and the lack of scientific information indicating a definitive impact of improved hand hygiene on health-care-associated infection rates (11,274,292,295,315–317). Certain perceived barriers to adherence with hand-hygiene guidelines have been assessed or quantified in observational studies (12,274,292,295,314–317) (Box 1).

Skin irritation by hand-hygiene agents constitutes a substantial barrier to appropriate adherence (319). Because soaps and detergents can damage skin when applied on a regular basis, HCWs must be better informed regarding the possible adverse effects associated with hand-hygiene agents. Lack of knowledge and education regarding this subject is a barrier to motivation. In several studies, alcohol-based hand rubs containing emollients (either isopropanol, ethanol, or n-propanol in 60%–90% vol/vol) were less irritating to the skin than the soaps or detergents tested. In addition, the alcohol-based products containing emollients that were tested were at least as tolerable and efficacious as the detergents tested. Also, studies demonstrate that several hand lotions have reduced skin scaling and cracking, which may reduce microbial shedding from the hands (67,272,273).

Easy access to hand-hygiene supplies, whether sink, soap, medicated detergent, or alcohol-based hand-rub solution, is essential for optimal adherence to hand-hygiene recommendations. The time required for nurses to leave a patient's bedside, go to a sink, and wash and dry their hands before attending the next patient is a deterrent to frequent handwashing or hand antisepsis (11,318). Engineering controls could facilitate adherence, but careful monitoring of hand-hygiene behavior should be conducted to exclude the possible negative effect of newly introduced handwashing devices (88).

The impact of wearing gloves on adherence to hand-hygiene policies has not been definitively established, because published studies have yielded contradictory results (87,290,301,320). Hand hygiene is required regardless of whether gloves are used or changed. Failure to remove gloves after patient contact or between "dirty" and "clean" body-site care on the same patient must be regarded as nonadherence to hand-hygiene recommendations (11). In a study in which experimental conditions approximated those occurring in clinical practice (321), washing and reusing gloves between patient contacts resulted in observed bacterial counts of 0–4.7 log on the hands after glove removal. Therefore, this practice should be discouraged; handwashing or disinfection should be performed after glove removal.

Lack of 1) knowledge of guidelines for hand hygiene, 2) recognition of hand-hygiene opportunities during patient care, and 3) awareness of the risk of cross-transmission of pathogens are barriers to good hand-hygiene practices. Furthermore, certain HCWs believe they have washed their hands when necessary, even when observations indicate they have not (89,92,295,296,322).

Perceived barriers to hand-hygiene behavior are linked not only to the institution, but also to HCWs' colleagues. Therefore, both institutional and small-group dynamics need to be considered when implementing a system change to secure an improvement in HCWs' hand-hygiene practice.

Possible Targets for Hand-Hygiene Promotion

Targets for the promotion of hand hygiene are derived from studies assessing risk factors for nonadherence, reported reasons for the lack of adherence to recommendations, and additional factors perceived as being important to facilitate appropriate HCW behavior. Although certain factors cannot be modified (Box 1), others can be changed.

One factor that must be addressed is the time required for HCWs to clean their hands. The time required for traditional handwashing may render full adherence to previous guidelines unrealistic (11,12,318) and more rapid access to hand-hygiene materials could help improve adherence. One study conducted in an intensive-care unit demonstrated that it took

nurses an average of 62 seconds to leave a patient's bedside, walk to a sink, wash their hands, and return to patient care (318). In contrast, an estimated one fourth as much time is required when using alcohol-based hand rub placed at each patient's bedside. Providing easy access to hand-hygiene materials is mandatory for appropriate hand-hygiene behavior and is achievable in the majority of health-care facilities (323). In particular, in high-demand situations (e.g., the majority of critical-care units), under hectic working conditions, and at times of overcrowding or understaffing, HCWs may be more likely to use an alcohol-based hand rub than to wash their hands (323). Further, using alcohol-based hand rubs may be a better option than traditional handwashing with plain soap and water or antiseptic handwash, because they not only require less time (166,318) but act faster (1) and irritate hands less often (1,67,96,98,166). They also were used in the only program that reported a sustained improvement in hand-hygiene adherence associated with decreased infection rates (74). However, making an alcohol-based hand rub available to personnel without providing ongoing educational and motivational activities may not result in long-lasting improvement in hand-hygiene practices (313). Because increased use of hand-hygiene agents might be associated with skin dryness, the availability of free skin-care lotion is recommended.

Education is a cornerstone for improvement with hand-hygiene practices. Topics that must be addressed by educational programs include the lack of 1) scientific information for the definitive impact of improved hand hygiene on health-care-associated infection and resistant organism transmission rates; 2) awareness of guidelines for hand hygiene and insufficient knowledge concerning indications for hand hygiene during daily patient care; 3) knowledge concerning the low average adherence rate to hand hygiene by the majority of HCWs; and 4) knowledge concerning the appropriateness, efficacy, and understanding of the use of hand-hygiene and skin-care-protection agents.

HCWs necessarily evolve within a group that functions within an institution. Possible targets for improvement in hand-hygiene behavior not only include factors linked to individual HCWs, but also those related to the group(s) and the institution as a whole (317,323). Examples of possible targets for hand-hygiene promotion at the group level include education and performance feedback on hand-hygiene adherence; efforts to prevent high workload, downsizing, and understaffing; and encouragement and provision of role models from key members in the work unit. At the institutional level, targets for improvement include 1) written guidelines, hand-hygiene agents, skin-care promotions and agents, or hand-hygiene facilities; 2) culture or tradition of adherence; and 3)

administrative leadership, sanction, support, and rewards. Several studies, conducted in various types of institutions, reported modest and even low levels of adherence to recommended hand-hygiene practices, indicating that such adherence varied by hospital ward and by type of HCW. These results indicate educational sessions may need to be designed specifically for certain types of personnel (11,289,290,294,317,323).

Lessons Learned from Behavioral Theories

In 1998, the prevailing behavioral theories and their applications with regard to the health professions were reviewed by researchers in an attempt to better understand how to target more successful interventions (317). The researchers proposed a hypothetical framework to enhance hand-hygiene practices and stressed the importance of considering the complexity of individual and institutional factors when designing behavioral interventions.

Although behavioral theories and secondary interventions have primarily targeted individual workers, this practice might be insufficient to produce sustained change (317,324,325). Interventions aimed at improving hand-hygiene practices must account for different levels of behavior interaction (12,317,326). Thus, the interdependence of individual factors, environmental constraints, and the institutional climate must be taken into account in the strategic planning and development of hand-hygiene campaigns. Interventions to promote hand hygiene in hospitals should consider variables at all these levels. Various factors involved in hand-hygiene behavior include intention, attitude towards the behavior, perceived social norm, perceived behavioral control, perceived risk for infection, hand-hygiene practices, perceived role model, perceived knowledge, and motivation (317). The factors necessary for change include 1) dissatisfaction with the current situation, 2) perception of alternatives, and 3) recognition, both at the individual and institutional level, of the ability and potential to change. Although the latter implies education and motivation, the former two necessitate a system change.

Among the reported reasons for poor adherence with hand-hygiene recommendations (Box 1), certain ones are clearly associated with the institution or system (e.g., lack of institutional priority for hand hygiene, administrative sanctions, and a safety climate). Although all of these reasons would require a system change in the majority of institutions, the third requires management commitment, visible safety programs, an acceptable level of work stress, a tolerant and supportive attitude toward reported problems, and belief in the efficacy

of preventive strategies (12,317,325,327). Most importantly, an improvement in infection-control practices requires 1) questioning basic beliefs, 2) continuous assessment of the group (or individual) stage of behavioral change, 3) intervention(s) with an appropriate process of change, and 4) supporting individual and group creativity (317). Because of the complexity of the process of change, single interventions often fail. Thus, a multimodal, multidisciplinary strategy is likely necessary (74,75,317,323,326).

Methods Used To Promote Improved Hand Hygiene

Hand-hygiene promotion has been challenging for >150 years. In-service education, information leaflets, workshops and lectures, automated dispensers, and performance feedback on hand-hygiene adherence rates have been associated with transient improvement (291,294–296,306,314).

Several strategies for promotion of hand hygiene in hospitals have been published (Table 9). These strategies require education, motivation, or system change. Certain strategies are based on epidemiologic evidence, others on the authors' and other investigators' experience and review of current knowledge. Some strategies may be unnecessary in certain circumstances, but may be helpful in others. In particular, changing the hand-hygiene agent could be beneficial in institutions or hospital wards with a high workload and a high demand for hand hygiene when alcohol-based hand rubs are not available (11,73,78,328). However, a change in the recommended hand-hygiene agent could be deleterious if introduced during winter, at a time of higher hand-skin irritability, and if not accompanied by the provision of skin-care products (e.g., pro-

TECTIVE creams and lotions). Additional specific elements should be considered for inclusion in educational and motivational programs (Box 2).

Several strategies that could potentially be associated with successful promotion of hand hygiene require a system change (Box 1). Hand-hygiene adherence and promotion involve factors at both the individual and system level. Enhancing individual and institutional attitudes regarding the feasibility of making changes (self-efficacy), obtaining active participation of personnel at both levels, and promoting an institutional safety climate represent challenges that exceed the current perception of the role of infection-control professionals.

Whether increased education, individual reinforcement technique, appropriate rewarding, administrative sanction, enhanced self-participation, active involvement of a larger number of organizational leaders, enhanced perception of health threat, self-efficacy, and perceived social pressure (12,317,329,330), or combinations of these factors can improve HCWs' adherence with hand hygiene needs further investigation. Ultimately, adherence to recommended hand-hygiene practices should become part of a culture of patient safety where a set of interdependent quality elements interact to achieve a shared objective (331).

On the basis of both these hypothetical considerations and successful, actual experiences in certain institutions, strategies to improve adherence to hand-hygiene practices should be both multimodal and multidisciplinary. However, strategies must be further researched before they are implemented.

TABLE 9. Strategies for successful promotion of hand hygiene in hospitals

Strategy	Tool for change*	Selected references†
Education	E (M, S)	(74,295,306,326,393)
Routine observation and feedback	S (E, M)	(74,294,306,326,393)
Engineering control		
Make hand hygiene possible, easy, and convenient	S	(74,281,326,393)
Make alcohol-based hand rub available	S	(74)
(at least in high-demand situations)	S	(74,283,312)
Patient education	S (M)	(283,394)
Reminders in the workplace	S	(74,395)
Administrative sanction/rewarding	S	(12,317)
Change in hand-hygiene agent	S (E)	(11,67,71,283,312)
Promote/facilitate skin care for health-care-workers' hands	S (E)	(67,74,274,275)
Obtain active participation at individual and institutional level	E, M, S	(74,75,317)
Improve institutional safety climate	S (M)	(74,75,317)
Enhance individual and institutional self-efficacy	S (E, M)	(74,75,317)
Avoid overcrowding, understaffing, and excessive workload	S	(11,74,78,297,396)
Combine several of above strategies	E, M, S	(74,75,295,306,317,326)

*The dynamic of behavioral change is complex and involves a combination of education (E), motivation (M), and system change (S).

†Only selected references have been listed; readers should refer to more extensive reviews for exhaustive reference lists (1,8,317,323,397).

BOX 2. Elements of health-care worker educational and motivational programs**Rationale for hand hygiene**

- Potential risks of transmission of microorganisms to patients
- Potential risks of health-care worker colonization or infection caused by organisms acquired from the patient
- Morbidity, mortality, and costs associated with health-care–associated infections

Indications for hand hygiene

- Contact with a patient's intact skin (e.g., taking a pulse or blood pressure, performing physical examinations, lifting the patient in bed) (25,26,45,48,51,53)
- Contact with environmental surfaces in the immediate vicinity of patients (46,51,53,54)
- After glove removal (50,58,71)

Techniques for hand hygiene

- Amount of hand-hygiene solution
- Duration of hand-hygiene procedure
- Selection of hand-hygiene agents
 - Alcohol-based hand rubs are the most efficacious agents for reducing the number of bacteria on the hands of personnel. Antiseptic soaps and detergents are the next most effective, and non-antimicrobial soaps are the least effective (1,398).
 - Soap and water are recommended for visibly soil hands.
 - Alcohol-based hand rubs are recommended for routine decontamination of hands for all clinical indications (except when hands are visibly soiled) and as one of the options for surgical hand hygiene.

Methods to maintain hand skin health

- Lotions and creams can prevent or minimize skin dryness and irritation caused by irritant contact dermatitis
- Acceptable lotions or creams to use
- Recommended schedule for applying lotions or creams

Expectations of patient care managers/administrators

- Written statements regarding the value of, and support for, adherence to recommended hand-hygiene practices
- Role models demonstrating adherence to recommended hand hygiene practices (399)

Indications for, and limitations of, glove use

- Hand contamination may occur as a result of small, undetected holes in examination gloves (321,361)
- Contamination may occur during glove removal (50)
- Wearing gloves does not replace the need for hand hygiene (58)
- Failure to remove gloves after caring for a patient may lead to transmission of microorganisms from one patient to another (373).

Efficacy of Promotion and Impact of Improved Hand Hygiene

The lack of scientific information of the definitive impact of improved hand hygiene on health-care–associated infection rates is a possible barrier to appropriate adherence with hand-hygiene recommendations (Box 1). However, evidence supports the belief that improved hand hygiene can reduce health-care–associated infection rates. Failure to perform appropriate hand hygiene is considered the leading cause of

health-care–associated infections and spread of multiresistant organisms and has been recognized as a substantial contributor to outbreaks.

Of nine hospital-based studies of the impact of hand hygiene on the risk of health-care–associated infections (Table 10) (48,69–75,296), the majority demonstrated a temporal relationship between improved hand-hygiene practices and reduced infection rates.

In one of these studies, endemic MRSA in a neonatal intensive-care unit was eliminated 7 months after introduction of a new

TABLE 10. Association between improved adherence with hand-hygiene practice and health-care–associated infection rates

Year	Ref. no.	Hospital setting	Results	Duration of follow-up
1977	(48)	Adult ICU	Reduction in health-care–associated infections caused by endemic <i>Klebsiella</i> spp.	2 years
1982	(69)	Adult ICU	Reduction in health-care-associated infection rates	N.S.
1984	(70)	Adult ICU	Reduction in health-care–associated infection rates	N.S.
1990	(296)	Adult ICU	No effect (average hand hygiene adherence improvement did not reach statistical significance)	11 months
1992	(71)	Adult ICU	Substantial difference between rates of health-care–associated infection between two different hand-hygiene agents	8 months
1994	(72)	NICU	Elimination of MRSA, when combined with multiple other infection-control measures. Reduction of vancomycin use	9 months
1995	(73)	Newborn nursery	Elimination of MRSA, when combined with multiple other infection-control measures	3.5 years
2000	(75)	MICU/NICU	85% relative reduction of VRE rate in the intervention hospital; 44% relative reduction in control hospital; no change in MRSA	8 months
2000	(74)	Hospitalwide	Substantial reduction in the annual overall prevalence of health-care–associated infections and MRSA cross-transmission rates. Active surveillance cultures and contact precautions were implemented during same period	5 years

Note: ICU = intensive care unit, NICU = neonatal ICU, MRSA = methicillin-resistant *Staphylococcus aureus*, MICU = medical ICU, and N.S. = not stated.

hand antiseptic (1% triclosan); all other infection-control measures remained in place, including the practice of conducting weekly active surveillance by obtaining cultures (72). Another study reported an MRSA outbreak involving 22 infants in a neonatal unit (73). Despite intensive efforts, the outbreak could not be controlled until a new antiseptic was added (i.e., 0.3% triclosan); all previously used control measures remained in place, including gloves and gowns, cohorting, and obtaining cultures for active surveillance.

The effectiveness of a longstanding, hospitalwide program to promote hand hygiene at the University of Geneva hospitals was recently reported (74). Overall adherence to hand-hygiene guidelines during routine patient care was monitored during hospitalwide observational surveys. These surveys were conducted biannually during December 1994–December 1997, before and during implementation of a hand-hygiene campaign that specifically emphasized the practice of bedside, alcohol-based hand disinfection. Individual-sized bottles of hand-rub solution were distributed to all wards, and custom-made holders were mounted on all beds to facilitate access to hand disinfection. HCWs were also encouraged to carry bottles in their pockets, and in 1996, a newly designed flat (instead of round) bottle was made available to further facilitate pocket carriage. The promotional strategy was multimodal and involved a multidisciplinary team of HCWs, the use of wall posters, the promotion of antiseptic hand rubs located at bed-sides throughout the institution, and regular performance feedback to all HCWs (see <http://www.hopisafe.ch> for further

details on methodology). Health-care–associated infection rates, attack rates of MRSA cross-transmission, and consumption of hand-rub disinfectant were measured. Adherence to recommended hand-hygiene practices improved progressively from 48% in 1994 to 66% in 1997 ($p < 0.001$). Whereas recourse to handwashing with soap and water remained stable, frequency of hand disinfection markedly increased during the study period ($p < 0.001$), and the consumption of alcohol-based hand-rub solution increased from 3.5 to 15.4 liters per 1,000 patient-days during 1993–1998 ($p < 0.001$). The increased frequency of hand disinfection was unchanged after adjustment for known risk factors of poor adherence. During the same period, both overall health-care–associated infection and MRSA transmission rates decreased (both $p < 0.05$). The observed reduction in MRSA transmission may have been affected by both improved hand-hygiene adherence and the simultaneous implementation of active surveillance cultures for detecting and isolating patients colonized with MRSA (332). The experience from the University of Geneva hospitals constitutes the first report of a hand-hygiene campaign with a sustained improvement over several years. An additional multimodal program also yielded sustained improvements in hand-hygiene practices over an extended period (75); the majority of studies have been limited to a 6- to 9-month observation period.

Although these studies were not designed to assess the independent contribution of hand hygiene on the prevention of health-care–associated infections, the results indicate that

improved hand-hygiene practices reduce the risk of transmission of pathogenic microorganisms. The beneficial effects of hand-hygiene promotion on the risk of cross-transmission also have been reported in surveys conducted in schools and day care centers (333–338), as well as in a community setting (339–341).

Other Policies Related to Hand Hygiene

Fingernails and Artificial Nails

Studies have documented that subungual areas of the hand harbor high concentrations of bacteria, most frequently coagulase-negative staphylococci, gram-negative rods (including *Pseudomonas* spp.), *Corynebacteria*, and yeasts (14,342,343). Freshly applied nail polish does not increase the number of bacteria recovered from periungual skin, but chipped nail polish may support the growth of larger numbers of organisms on fingernails (344,345). Even after careful handwashing or the use of surgical scrubs, personnel often harbor substantial numbers of potential pathogens in the subungual spaces (346–348).

Whether artificial nails contribute to transmission of health-care-associated infections is unknown. However, HCWs who wear artificial nails are more likely to harbor gram-negative pathogens on their fingertips than are those who have natural nails, both before and after handwashing (347–349). Whether the length of natural or artificial nails is a substantial risk factor is unknown, because the majority of bacterial growth occurs along the proximal 1 mm of the nail adjacent to subungual skin (345,347,348). Recently, an outbreak of *P. aeruginosa* in a neonatal intensive care unit was attributed to two nurses (one with long natural nails and one with long artificial nails) who carried the implicated strains of *Pseudomonas* spp. on their hands (350). Patients were substantially more likely than controls to have been cared for by the two nurses during the exposure period, indicating that colonization of long or artificial nails with *Pseudomonas* spp. may have contributed to causing the outbreak. Personnel wearing artificial nails also have been epidemiologically implicated in several other outbreaks of infection caused by gram-negative bacilli and yeast (351–353). Although these studies provide evidence that wearing artificial nails poses an infection hazard, additional studies are warranted.

Gloving Policies

CDC has recommended that HCWs wear gloves to 1) reduce the risk of personnel acquiring infections from patients, 2) prevent health-care worker flora from being transmitted to patients, and 3) reduce transient contamination of the hands

of personnel by flora that can be transmitted from one patient to another (354). Before the emergence of the acquired immunodeficiency syndrome (AIDS) epidemic, gloves were worn primarily by personnel caring for patients colonized or infected with certain pathogens or by personnel exposed to patients with a high risk of hepatitis B. Since 1987, a dramatic increase in glove use has occurred in an effort to prevent transmission of HIV and other bloodborne pathogens from patients to HCWs (355). The Occupational Safety and Health Administration (OSHA) mandates that gloves be worn during all patient-care activities that may involve exposure to blood or body fluids that may be contaminated with blood (356).

The effectiveness of gloves in preventing contamination of HCWs' hands has been confirmed in several clinical studies (45,51,58). One study found that HCWs who wore gloves during patient contact contaminated their hands with an average of only 3 CFUs per minute of patient care, compared with 16 CFUs per minute for those not wearing gloves (51). Two other studies, involving personnel caring for patients with *C. difficile* or VRE, revealed that wearing gloves prevented hand contamination among the majority of personnel having direct contact with patients (45,58). Wearing gloves also prevented personnel from acquiring VRE on their hands when touching contaminated environmental surfaces (58). Preventing heavy contamination of the hands is considered important, because handwashing or hand antisepsis may not remove all potential pathogens when hands are heavily contaminated (25,111).

Several studies provide evidence that wearing gloves can help reduce transmission of pathogens in health-care settings. In a prospective controlled trial that required personnel to routinely wear vinyl gloves when handling any body substances, the incidence of *C. difficile* diarrhea among patients decreased from 7.7 cases/1,000 patient discharges before the intervention to 1.5 cases/1,000 discharges during the intervention (226). The prevalence of asymptomatic *C. difficile* carriage also decreased substantially on "glove" wards, but not on control wards. In intensive-care units where VRE or MRSA have been epidemic, requiring all HCWs to wear gloves to care for all patients in the unit (i.e., universal glove use) likely has helped control outbreaks (357,358).

The influence of glove use on the hand-hygiene habits of personnel is not clear. Several studies found that personnel who wore gloves were less likely to wash their hands upon leaving a patient's room (290,320). In contrast, two other studies found that personnel who wore gloves were substantially more likely to wash their hands after patient care (87,301).

The following caveats regarding use of gloves by HCWs must be considered. Personnel should be informed that gloves

do not provide complete protection against hand contamination. Bacterial flora colonizing patients may be recovered from the hands of $\leq 30\%$ of HCWs who wear gloves during patient contact (50,58). Further, wearing gloves does not provide complete protection against acquisition of infections caused by hepatitis B virus and herpes simplex virus (359,360). In such instances, pathogens presumably gain access to the caregiver's hands via small defects in gloves or by contamination of the hands during glove removal (50,321,359,361).

Gloves used by HCWs are usually made of natural rubber latex and synthetic nonlatex materials (e.g., vinyl, nitrile, and neoprene [polymers and copolymers of chloroprene]). Because of the increasing prevalence of latex sensitivity among HCWs and patients, FDA has approved several powdered and powder-free latex gloves with reduced protein contents, as well as synthetic gloves that can be made available by health-care institutions for use by latex-sensitive employees. In published studies, the barrier integrity of gloves varies on the basis of type and quality of glove material, intensity of use, length of time used, manufacturer, whether gloves were tested before or after use, and method used to detect glove leaks (359,361–366). In published studies, vinyl gloves have had defects more frequently than latex gloves, the difference in defect frequency being greatest after use (359,361,364,367). However, intact vinyl gloves provide protection comparable to that of latex gloves (359). Limited studies indicate that nitrile gloves have leakage rates that approximate those of latex gloves (368–371). Having more than one type of glove available is desirable, because it allows personnel to select the type that best suits their patient-care activities. Although recent studies indicate that improvements have been made in the quality of gloves (366), hands should be decontaminated or washed after removing gloves (8,50,58,321,361). Gloves should not be washed or reused (321,361). Use of petroleum-based hand lotions or creams may adversely affect the integrity of latex gloves (372). After use of powdered gloves, certain alcohol hand rubs may interact with residual powder on the hands of personnel, resulting in a gritty feeling on the hands. In facilities where powdered gloves are commonly used, various alcohol-based hand rubs should be tested after removal of powdered gloves to avoid selecting a product that causes this undesirable reaction. Personnel should be reminded that failure to remove gloves between patients may contribute to transmission of organisms (358,373).

Jewelry

Several studies have demonstrated that skin underneath rings is more heavily colonized than comparable areas of skin on fingers without rings (374–376). One study found that 40% of nurses harbored gram-negative bacilli (e.g., *E. cloacae*, *Klebsiella*, and *Acinetobacter*) on skin under rings and that certain nurses carried the same organism under their rings for several months (375). In a more recent study involving >60 intensive care unit nurses, multivariable analysis revealed that rings were the only substantial risk factor for carriage of gram-negative bacilli and *S. aureus* and that the concentration of organisms recovered correlated with the number of rings worn (377). Whether the wearing of rings results in greater transmission of pathogens is unknown. Two studies determined that mean bacterial colony counts on hands after handwashing were similar among persons wearing rings and those not wearing rings (376,378). Further studies are needed to establish if wearing rings results in greater transmission of pathogens in health-care settings.

Hand-Hygiene Research Agenda

Although the number of published studies concerning hand hygiene has increased considerably in recent years, many questions regarding hand-hygiene products and strategies for improving adherence of personnel to recommended policies remain unanswered. Several concerns must still be addressed by researchers in industry and by clinical investigators (Box 3).

Web-Based Hand-Hygiene Resources

Additional information regarding improving hand hygiene is available at <http://www.hopisafe.ch>

University of Geneva Hospitals, Geneva, Switzerland

<http://www.cdc.gov/ncidod/hip>

CDC, Atlanta, Georgia

<http://www.jr2.ox.ac.uk/bandolier/band88/b88-8.html>

Bandolier journal, United Kingdom

<http://www.med.upenn.edu>

University of Pennsylvania, Philadelphia, Pennsylvania

BOX 3. Hand-hygiene research agenda**Education and promotion**

- Provide health-care workers (HCWs) with better education regarding the types of patient care activities that can result in hand contamination and cross-transmission of microorganisms.
- Develop and implement promotion hand-hygiene programs in pregraduate courses.
- Study the impact of population-based education on hand-hygiene behavior.
- Design and conduct studies to determine if frequent glove use should be encouraged or discouraged.
- Determine evidence-based indications for hand cleansing (considering that it might be unrealistic to expect HCWs to clean their hands after every contact with the patient).
- Assess the key determinants of hand-hygiene behavior and promotion among the different populations of HCWs.
- Develop methods to obtain management support.
- Implement and evaluate the impact of the different components of multimodal programs to promote hand hygiene.

Hand-hygiene agents and hand care

- Determine the most suitable formulations for hand-hygiene products.
- Determine if preparations with persistent antimicrobial activity reduce infection rates more effectively than do preparations whose activity is limited to an immediate effect.
- Study the systematic replacement of conventional handwashing by the use of hand disinfection.
- Develop devices to facilitate the use and optimal application of hand-hygiene agents.
- Develop hand-hygiene agents with low irritancy potential.
- Study the possible advantages and eventual interaction of hand-care lotions, creams, and other barriers to help minimize the potential irritation associated with hand-hygiene agents.

Laboratory-based and epidemiologic research and development

- Develop experimental models for the study of cross-contamination from patient to patient and from environment to patient.
- Develop new protocols for evaluating the in vivo efficacy of agents, considering in particular short application times and volumes that reflect actual use in health-care facilities.
- Monitor hand-hygiene adherence by using new devices or adequate surrogate markers, allowing frequent individual feedback on performance.
- Determine the percentage increase in hand-hygiene adherence required to achieve a predictable risk reduction in infection rates.
- Generate more definitive evidence for the impact on infection rates of improved adherence to recommended hand-hygiene practices.
- Provide cost-effectiveness evaluation of successful and unsuccessful promotion campaigns.

Part II. Recommendations**Categories**

These recommendations are designed to improve hand-hygiene practices of HCWs and to reduce transmission of pathogenic microorganisms to patients and personnel in health-care settings. This guideline and its recommendations are not intended for use in food processing or food-service establishments, and are not meant to replace guidance provided by FDA's Model Food Code.

As in previous CDC/HICPAC guidelines, each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:

Category 1A. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category 1B. Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC. Required for implementation, as mandated by federal or state regulation or standard.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation. Unresolved issue. Practices for which insufficient evidence or no consensus regarding efficacy exist.

Recommendations

1. Indications for handwashing and hand antisepsis
 - A. When hands are visibly dirty or contaminated with proteinaceous material or are visibly soiled with blood or other body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water (IA) (66).
 - B. If hands are not visibly soiled, use an alcohol-based hand rub for routinely decontaminating hands in all other clinical situations described in items 1C–J (IA) (74,93,166,169,283,294,312,398). Alternatively, wash hands with an antimicrobial soap and water in all clinical situations described in items 1C–J (IB) (69–71,74).
 - C. Decontaminate hands before having direct contact with patients (IB) (68,400).
 - D. Decontaminate hands before donning sterile gloves when inserting a central intravascular catheter (IB) (401,402).
 - E. Decontaminate hands before inserting indwelling urinary catheters, peripheral vascular catheters, or other invasive devices that do not require a surgical procedure (IB) (25,403).
 - F. Decontaminate hands after contact with a patient's intact skin (e.g., when taking a pulse or blood pressure, and lifting a patient) (IB) (25,45,48,68).
 - G. Decontaminate hands after contact with body fluids or excretions, mucous membranes, nonintact skin, and wound dressings if hands are not visibly soiled (IA) (400).
 - H. Decontaminate hands if moving from a contaminated-body site to a clean-body site during patient care (II) (25,53).
 - I. Decontaminate hands after contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient (II) (46,53,54).
 - J. Decontaminate hands after removing gloves (IB) (50,58,321).
 - K. Before eating and after using a restroom, wash hands with a non-antimicrobial soap and water or with an antimicrobial soap and water (IB) (404–409).
 - L. Antimicrobial-impregnated wipes (i.e., towelettes) may be considered as an alternative to washing hands with non-antimicrobial soap and water. Because they are not as effective as alcohol-based hand rubs or washing hands with an antimicrobial soap and water for reducing bacterial counts on the hands of HCWs, they are not a substitute for using an alcohol-based hand rub or antimicrobial soap (IB) (160,161).
 - M. Wash hands with non-antimicrobial soap and water or with antimicrobial soap and water if exposure to *Bacillus anthracis* is suspected or proven. The physical action of washing and rinsing hands under such circumstances is recommended because alcohols, chlorhexidine, iodophors, and other antiseptic agents have poor activity against spores (II) (120,172,224,225).
 - N. No recommendation can be made regarding the routine use of nonalcohol-based hand rubs for hand hygiene in health-care settings. Unresolved issue.
2. Hand-hygiene technique
 - A. When decontaminating hands with an alcohol-based hand rub, apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry (IB) (288,410). Follow the manufacturer's recommendations regarding the volume of product to use.
 - B. When washing hands with soap and water, wet hands first with water, apply an amount of product recommended by the manufacturer to hands, and rub hands together vigorously for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water and dry thoroughly with a disposable towel. Use towel to turn off the faucet (IB) (90–92,94,411). Avoid using hot water, because repeated exposure to hot water may increase the risk of dermatitis (IB) (254,255).
 - C. Liquid, bar, leaflet or powdered forms of plain soap are acceptable when washing hands with a non-antimicrobial soap and water. When bar soap is used, soap racks that facilitate drainage and small bars of soap should be used (II) (412–415).
 - D. Multiple-use cloth towels of the hanging or roll type are not recommended for use in health-care settings (II) (137,300).
3. Surgical hand antisepsis
 - A. Remove rings, watches, and bracelets before beginning the surgical hand scrub (II) (375,378,416).
 - B. Remove debris from underneath fingernails using a nail cleaner under running water (II) (14,417).

- C. Surgical hand antisepsis using either an antimicrobial soap or an alcohol-based hand rub with persistent activity is recommended before donning sterile gloves when performing surgical procedures (IB) (115,159,232,234,237,418).
 - D. When performing surgical hand antisepsis using an antimicrobial soap, scrub hands and forearms for the length of time recommended by the manufacturer, usually 2–6 minutes. Long scrub times (e.g., 10 minutes) are not necessary (IB) (117,156,205,207,238–241).
 - E. When using an alcohol-based surgical hand-scrub product with persistent activity, follow the manufacturer's instructions. Before applying the alcohol solution, prewash hands and forearms with a non-antimicrobial soap and dry hands and forearms completely. After application of the alcohol-based product as recommended, allow hands and forearms to dry thoroughly before donning sterile gloves (IB) (159,237).
4. Selection of hand-hygiene agents
- A. Provide personnel with efficacious hand-hygiene products that have low irritancy potential, particularly when these products are used multiple times per shift (IB) (90,92,98,166,249). This recommendation applies to products used for hand antisepsis before and after patient care in clinical areas and to products used for surgical hand antisepsis by surgical personnel.
 - B. To maximize acceptance of hand-hygiene products by HCWs, solicit input from these employees regarding the feel, fragrance, and skin tolerance of any products under consideration. The cost of hand-hygiene products should not be the primary factor influencing product selection (IB) (92,93,166,274,276–278).
 - C. When selecting non-antimicrobial soaps, antimicrobial soaps, or alcohol-based hand rubs, solicit information from manufacturers regarding any known interactions between products used to clean hands, skin care products, and the types of gloves used in the institution (II) (174,372).
 - D. Before making purchasing decisions, evaluate the dispenser systems of various product manufacturers or distributors to ensure that dispensers function adequately and deliver an appropriate volume of product (II) (286).
 - E. Do not add soap to a partially empty soap dispenser. This practice of “topping off” dispensers can lead to bacterial contamination of soap (IA) (187,419).
5. Skin care
- A. Provide HCWs with hand lotions or creams to minimize the occurrence of irritant contact dermatitis associated with hand antisepsis or handwashing (IA) (272,273).
 - B. Solicit information from manufacturers regarding any effects that hand lotions, creams, or alcohol-based hand antiseptics may have on the persistent effects of antimicrobial soaps being used in the institution (IB) (174,420,421).
6. Other Aspects of Hand Hygiene
- A. Do not wear artificial fingernails or extenders when having direct contact with patients at high risk (e.g., those in intensive-care units or operating rooms) (IA) (350–353).
 - B. Keep natural nails tips less than 1/4-inch long (II) (350).
 - C. Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, and nonintact skin could occur (IC) (356).
 - D. Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient, and do not wash gloves between uses with different patients (IB) (50,58,321,373).
 - E. Change gloves during patient care if moving from a contaminated body site to a clean body site (II) (50,51,58).
 - F. No recommendation can be made regarding wearing rings in health-care settings. Unresolved issue.
7. Health-care worker educational and motivational programs
- A. As part of an overall program to improve hand-hygiene practices of HCWs, educate personnel regarding the types of patient-care activities that can result in hand contamination and the advantages and disadvantages of various methods used to clean their hands (II) (74,292,295,299).
 - B. Monitor HCWs' adherence with recommended hand-hygiene practices and provide personnel with information regarding their performance (IA) (74,276,292,295,299,306,310).
 - C. Encourage patients and their families to remind HCWs to decontaminate their hands (II) (394,422).
8. Administrative measures
- A. Make improved hand-hygiene adherence an institutional priority and provide appropriate

- administrative support and financial resources (IB) (74,75).
- B. Implement a multidisciplinary program designed to improve adherence of health personnel to recommended hand-hygiene practices (IB) (74,75).
 - C. As part of a multidisciplinary program to improve hand-hygiene adherence, provide HCWs with a readily accessible alcohol-based hand-rub product (IA) (74,166,283,294,312).
 - D. To improve hand-hygiene adherence among personnel who work in areas in which high workloads and high intensity of patient care are anticipated, make an alcohol-based hand rub available at the entrance to the patient's room or at the bedside, in other convenient locations, and in individual pocket-sized containers to be carried by HCWs (IA) (11,74,166,283,284,312,318,423).
 - E. Store supplies of alcohol-based hand rubs in cabinets or areas approved for flammable materials (IC).

Part III. Performance Indicators

1. The following performance indicators are recommended for measuring improvements in HCWs' hand-hygiene adherence:
 - A. Periodically monitor and record adherence as the number of hand-hygiene episodes performed by personnel/number of hand-hygiene opportunities, by ward or by service. Provide feedback to personnel regarding their performance.
 - B. Monitor the volume of alcohol-based hand rub (or detergent used for handwashing or hand antisepsis) used per 1,000 patient-days.
 - C. Monitor adherence to policies dealing with wearing of artificial nails.
 - D. When outbreaks of infection occur, assess the adequacy of health-care worker hand hygiene.

References

1. Rotter M. Hand washing and hand disinfection [Chapter 87]. In: Mayhall CG, ed. *Hospital epidemiology and infection control*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 1999.
2. Labarraque AG. Instructions and observations regarding the use of the chlorides of soda and lime. Porter J, ed. [French] New Haven, CT: Baldwin and Treadway, 1829.
3. Semmelweis I. Etiology, concept, and prophylaxis of childbed fever. Carter KC, ed. 1st ed. Madison, WI: The University of Wisconsin Press, 1983.
4. Coppage CM. Hand washing in patient care [Motion picture]. Washington, DC: US Public Health Service, 1961.
5. Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. *Ann Intern Med* 1975;83:683–90.
6. Garner JS, Favero MS. CDC guideline for handwashing and hospital environmental control, 1985. *Infect Control* 1986;7:231–43.
7. Larson E. Guideline for use of topical antimicrobial agents. *Am J Infect Control* 1988;16:253–66.
8. Larson EL, APIC Guidelines Committee. APIC guideline for handwashing and hand antisepsis in health care settings. *Am J Infect Control* 1995;23:251–69.
9. Hospital Infection Control Practices Advisory Committee (HICPAC). Recommendations for preventing the spread of vancomycin resistance. *Infect Control Hosp Epidemiol* 1995;16:105–13.
10. Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* 1996;17:53–80.
11. Pittet D, Mourouga P, Perneger TV, Members of the Infection Control Program. Compliance with handwashing in a teaching hospital. *Ann Intern Med* 1999;130:126–30.
12. Boyce JM. It is time for action: improving hand hygiene in hospitals. *Ann Intern Med* 1999;130:153–5.
13. Selwyn S. Microbiology and ecology of human skin. *Practitioner* 1980;224:1059–62.
14. Price PB. Bacteriology of normal skin: a new quantitative test applied to a study of the bacterial flora and the disinfectant action of mechanical cleansing. *J Infect Dis* 1938;63:301–18.
15. Larson E. Effects of handwashing agent, handwashing frequency, and clinical area on hand flora. *Am J Infect Control* 1984;11:76–82.
16. Maki D. Control of colonization and transmission of pathogenic bacteria in the hospital. *Ann Intern Med* 1978;89(Pt 2):777–80.
17. Larson EL, Norton Hughes CA, Pyrak JD, Sparks SM, Cagatay EU, Bartkus JM. Changes in bacterial flora associated with skin damage on hands of health care personnel. *Am J Infect Control* 1998;26:513–21.
18. Sprunt K, Redman W, Leidy G. Antibacterial effectiveness of routine hand washing. *Pediatrics* 1973;52:264–71.
19. Food and Drug Administration. Tentative final monograph for healthcare antiseptic drug products; proposed rule. *Federal Register* 1994;59:31441–52.
20. Lowbury EJJ. Gram-negative bacilli on the skin. *Br J Dermatol* 1969;81(suppl 1):55–61.
21. Noble WC. Distribution of the Micrococcaceae. *Br J Dermatol* 1969;81(suppl 1):27–31.
22. McBride ME, Duncan WC, Bodey GP, McBride CM. Microbial skin flora of selected cancer patients and hospital personnel. *J Clin Microbiol* 1976;3:14–20.
23. Casewell MW. Role of hands in nosocomial gram-negative infection. In: Maibach HI, Aly R, eds. *Skin microbiology: relevance to clinical infection*. New York, NY: Springer-Verlag, 1981.
24. Larson EL, McGinley KJ, Foglia AR, Talbot GH, Leyden JJ. Composition and antimicrobial resistance of skin flora in hospitalized and healthy adults. *J Clin Microbiol* 1986;23:604–8.
25. Ehrenkranz NJ, Alfonso BC. Failure of bland soap handwash to prevent hand transfer of patient bacteria to urethral catheters. *Infect Control Hosp Epidemiol* 1991;12:654–62.
26. Sanderson PJ, Weissler S. Recovery of coliforms from the hands of nurses and patients: activities leading to contamination. *J Hosp Infect* 1992;21:85–93.
27. Coello R, Jiménez J, García M, et al. Prospective study of infection, colonization and carriage of methicillin-resistant *Staphylococcus aureus* in an outbreak affecting 990 patients. *Eur J Clin Microbiol Infect Dis* 1994;13:74–81.

28. Sanford MD, Widmer AF, Bale MJ, Jones RN, Wenzel RP. Efficient detection and long-term persistence of the carriage of methicillin-resistant *Staphylococcus aureus*. Clin Infect Dis 1994;19:1123–8.
29. Bertone SA, Fisher MC, Mortensen JE. Quantitative skin cultures at potential catheter sites in neonates. Infect Control Hosp Epidemiol 1994;15:315–8.
30. Bonten MJM, Hayden MK, Nathan C, VanVoorhis J, et al. Epidemiology of colonisation of patients and environment with vancomycin-resistant enterococci. Lancet 1996;348:1615–9.
31. Larson EL, Cronquist AB, Whittier S, Lai L, Lyle CT, Della Latta P. Differences in skin flora between inpatients and chronically ill patients. Heart Lung 2000;29:298–305.
32. Polakoff S, Richards IDG, Parker MT, Lidwell OM. Nasal and skin carriage of *Staphylococcus aureus* by patients undergoing surgical operation. J Hyg (Lond) 1967;65:559–66.
33. Leyden JJ, McGinley KJ, Nordstrom KM, Webster GF. Skin microflora. J Invest Dermatol 1987;88:65s–72s.
34. Tuazon CU, Perez A, Kishaba T, Sheagren JN. *Staphylococcus aureus* among insulin-injecting diabetic patients. JAMA 1975;231:1272.
35. Kaplowitz LG, Comstock JA, Landwehr DM, Dalton HP, Mayhall CG. Prospective study of microbial colonization of the nose and skin and infection of the vascular access site in hemodialysis patients. J Clin Microbiol 1988;26:1257–62.
36. Aly R, Maibach HI, Shinefield HR. Microbial flora of atopic dermatitis. Arch Dermatol 1977;113:780–2.
37. Kirmani N, Tuazon CU, Murray HW, Parrish AE, Sheagren JN. *Staphylococcus aureus* carriage rate of patients receiving long-term hemodialysis. Arch Intern Med 1978;138:1657–9.
38. Goldblum SE, Ulrich JA, Goldman RS, Reed WP. Nasal and cutaneous flora among hemodialysis patients and personnel: quantitative and qualitative characterization and patterns of staphylococcal carriage. Am J Kidney Dis 1982;11:281–6.
39. Boelaert JR, Van Landuyt HW, Gordts BZ, De Baere YA, Messer SA, Herwaldt LA. Nasal and cutaneous carriage of *Staphylococcus aureus* in hemodialysis patients: the effect of nasal mupirocin. Infect Control Hosp Epidemiol 1996;17:809–11.
40. Zimakoff J, Pedersen FB, Bergen L, et al. *Staphylococcus aureus* carriage and infections among patients in four haemo- and peritoneal-dialysis centres in Denmark. J Hosp Infect 1996;33:289–300.
41. Bibel DJ, Greenbert JH, Cook JL. *Staphylococcus aureus* and the microbial ecology of atopic dermatitis. Can J Microbiol 1997;23:1062–8.
42. Noble WC. Dispersal of skin microorganisms. Br J Dermatol 1975;93:477–85.
43. Walter CW, Kundsins RB, Shilkret MA, Day MM. Spread of staphylococci to the environment. Antibiotics Annual 1959:952–7.
44. Boyce JM, Opal SM, Chow JW, et al. Outbreak of multidrug-resistant *Enterococcus faecium* with transferable *vanB* class vancomycin resistance. J Clin Microbiol 1994;32:1148–53.
45. McFarland LV, Mulligan ME, Kwok RYY, Stamm WE. Nosocomial acquisition of *Clostridium difficile* infection. N Engl J Med 1989;320:204–10.
46. Samore MH, Venkataraman L, DeGirolami PC, Levin E, Arbeit RD, Karchmer AW. Clinical and molecular epidemiology of sporadic and clustered cases of nosocomial *Clostridium difficile* diarrhea. Am J Med 1996;100:32–40.
47. Lidwell OM, Towers AG, Ballard J, Gladstone B. Transfer of microorganisms between nurses and patients in a clean air environment. J Appl Bacteriol 1974;37:649–56.
48. Casewell M, Phillips I. Hands as route of transmission for *Klebsiella* species. Br Med J 1977;2:1315–7.
49. Hall CB, Douglas RG. Modes of transmission of respiratory syncytial virus. J Pediatr 1981;99:100–2.
50. Olsen RJ, Lynch P, Coyle MB, Cummings J, Bokete T, Stamm WE. Examination gloves as barriers to hand contamination in clinical practice. JAMA 1993;270:350–3.
51. Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV. Bacterial contamination of the hands of hospital staff during routine patient care. Arch Intern Med 1999;159:821–6.
52. Fox MK, Langner SB, Wells RW. How good are hand washing practices? Am J Nursing 1974;74:1676–8.
53. Ojajärvi J. Effectiveness of hand washing and disinfection methods in removing transient bacteria after patient nursing. J Hyg (Lond) 1980;85:193–203.
54. Boyce JM, Potter-Bynoe G, Chenevert C, King T. Environmental contamination due to methicillin-resistant *Staphylococcus aureus*: possible infection control implications. Infect Control Hosp Epidemiol 1997;18:622–7.
55. Hayden MK, Blom, DW, Lyle, EA, et al. The risk of hand and glove contamination by healthcare workers (HCWs) after contact with a VRE (+) patient (pt) or the pts environment (env) [Abstract K-1334]. Presented at the 41st Interscience Conference on Antimicrobial Agents and Chemotherapy Chicago: American Society for Microbiology, 2001.
56. Scott E, Bloomfield SF. The survival and transfer of microbial contamination via cloths, hands and utensils. J Appl Bacteriol 1990;68:271–8.
57. Bauer TM, Ofner E, Just HM, Just H, Daschner FD. An epidemiological study assessing the relative importance of airborne and direct contact transmission of microorganisms in a medical intensive care unit. J Hosp Infect 1990;15:301–9.
58. Tenorio AR, Badri SM, Sahgal NB, et al. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant *Enterococcus* species by health care workers after patient care. Clin Infect Dis 2001;32:826–9.
59. Daschner FD. How cost-effective is the present use of antiseptics? J Hosp Infect 1988;11(suppl A):227–35.
60. Knittle MA, Eitzman DV, Baer H. Role of hand contamination of personnel in the epidemiology of gram-negative nosocomial infections. J Pediatr 1975;86:433–7.
61. Ayliffe GAJ, Babb JR, Davies JG, Lilly HA. Hand disinfection: a comparison of various agents in laboratory and ward studies. J Hosp Infect 1988;11:226–43.
62. Strausbaugh IJ, Sewell DL, Ward TT, Pfaller MA, Heitzman T, Tjoelker R. High frequency of yeast carriage on hands of hospital personnel. J Clin Microbiol 1994;32:2299–300.
63. Marples RR, Towers AG. A laboratory model for the investigation of contact transfer of micro-organisms. J Hyg (Lond) 1979;82:237–48.
64. Mackintosh CA, Hoffman PN. An extended model for transfer of micro-organisms via the hands: differences between organisms and the effect of alcohol disinfection. J Hyg (Lond) 1984;92:345–55.
65. Patrick DR, Findon G, Miller TE. Residual moisture determines the level of touch-contact-associated bacterial transfer following hand washing. Epidemiol Infect 1997;119:319–25.
66. Larson E. A causal link between handwashing and risk of infection? Examination of the evidence. Infect Control Hosp Epidemiol 1988;9:28–36.
67. Larson E. Skin hygiene and infection prevention: more of the same or different approaches? Clin Infect Dis 1999;29:1287–94.

68. Mortimer EA Jr, Lipsitz PJ, Wolinsky E, Gonzaga AJ, Rammelkamp CH Jr. Transmission of staphylococci between newborns. *Am J Dis Child* 1962;104:289–95.
69. Maki DG. The use of antiseptics for handwashing by medical personnel. *J Chemother* 1989;1(suppl 1):3–11.
70. Massanari RM, Hierholzer WJ Jr. A crossover comparison of antiseptic soaps on nosocomial infection rates in intensive care units. *Am J Infect Control* 1984;12:247–8.
71. Doebbeling BN, Stanley GL, Sheetz CT, et al. Comparative efficacy of alternative hand-washing agents in reducing nosocomial infections in intensive care units. *N Engl J Med* 1992;327:88–93.
72. Webster J, Faoagali JL, Cartwright D. Elimination of methicillin-resistant *Staphylococcus aureus* from a neonatal intensive care unit after hand washing with triclosan. *J Paediatr Child Health* 1994;30:59–64.
73. Zafar AB, Butler RC, Reese DJ, Gaydos LA, Mennon PA. Use of 0.3% triclosan (Bacti-Stat*) to eradicate an outbreak of methicillin-resistant *Staphylococcus aureus* in a neonatal nursery. *Am J Infect Control* 1995;23:200–8.
74. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet* 2000;356:1307–12.
75. Larson EL, Early E, Cloonan P, Sugrue S, Parides M. An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. *Behav Med* 2000;26:14–22.
76. Fridkin SK, Pear SM, Williamson TH, Galgiani JN, Jarvis WR. The role of understaffing in central venous catheter-associated bloodstream infections. *Infect Control Hosp Epidemiol* 1996;17:150–8.
77. Vicca AF. Nursing staff workload as a determinant of methicillin-resistant *Staphylococcus aureus* spread in an adult intensive therapy unit. *J Hosp Infect* 1999;43:109–13.
78. Harbarth S, Sudre P, Dharan S, Cadenas M, Pittet D. Outbreak of *Enterobacter cloacae* related to understaffing, overcrowding, and poor hygiene practices. *Infect Control Hosp Epidemiol* 1999;20:598–603.
79. European Committee for Standardization. Chemical disinfectants and antiseptics—hygienic handrub—test method and requirements (phase 2/step 2) [European standard EN 1500]. Brussels, Belgium: Central Secretariat; 1997.
80. Kramer A, Rudolph P, Kampf G, Pittet D. Limited efficacy of alcohol-based hand gels. *Lancet* 2002;359:1489–90.
81. Sattar SA, Abebe M, Bueti AJ, Jampani H, Newman J, Hua S. Activity of an alcohol-based hand gel against human adeno-, rhino-, and rotaviruses using the fingerpad method. *Infect Control Hosp Epidemiol* 2000;21:516–9.
82. Wolff MH, Schmitt J, Rahaas M, König A. Hepatitis A virus: a test method for virucidal activity. *J Hosp Infect* 2001;48(suppl A):S18–S22.
83. Steinmann J. Some principles of virucidal testing. *J Hosp Infect* 2001;48(suppl A):S15–S17.
84. Gould D, Ream E. Assessing nurses' hand decontamination performance. *Nursing Times* 1993;89:47–50.
85. Quraishi ZA, McGuckin M, Blais FX. Duration of handwashing in intensive care units: a descriptive study. *Am J Infect Control* 1984;11:83–7.
86. Lund S, Jackson J, Leggett J, Hales L, Dworkin R, Gilbert D. Reality of glove use and handwashing in a community hospital. *Am J Infect Control* 1994;22:352–7.
87. Meengs MR, Giles BK, Chisholm CD, Cordell WH, Nelson DR. Hand washing frequency in an emergency department. *Ann Emerg Med* 1994;23:1307–12.
88. Larson E, McGeer A, Quraishi ZA, et al. Effect of an automated sink on handwashing practices and attitudes in high-risk units. *Infect Control Hosp Epidemiol* 1991;12:422–8.
89. Broughall JM, Marshman C, Jackson B, Bird P. An automatic monitoring system for measuring handwashing frequency. *J Hosp Infect* 1984;5:447–53.
90. Ojajärvi J, Mäkelä P, Rantasalo I. Failure of hand disinfection with frequent hand washing: a need for prolonged field studies. *J Hyg (Lond)* 1977;79:107–19.
91. Larson EL, Eke PI, Wilder MP, Laughon BE. Quantity of soap as a variable in handwashing. *Infect Control* 1987;8:371–5.
92. Larson E, Leyden JJ, McGinley KJ, Grove GL, Talbot GH. Physiologic and microbiologic changes in skin related to frequent handwashing. *Infect Control* 1986;7:59–63.
93. Larson EL, Eke PI, Laughon BE. Efficacy of alcohol-based hand rinses under frequent-use conditions. *Antimicrob Agents Chemother* 1986;30:542–4.
94. Larson EL, Laughon BE. Comparison of four antiseptic products containing chlorhexidine gluconate. *Antimicrob Agents Chemother* 1987;31:1572–4.
95. Meers PD, Yeo GA. Shedding of bacteria and skin squames after handwashing. *J Hyg (Lond)* 1978;81:99–105.
96. Winnefeld M, Richard MA, Drancourt M, Grobb JJ. Skin tolerance and effectiveness of two hand decontamination procedures in everyday hospital use. *Br J Dermatol* 2000;143:546–50.
97. Maki DG, Zilz MA, Alvarado CJ. Evaluation of the antibacterial efficacy of four agents for handwashing. In: Nelson JC, Grassi C, eds. Current chemotherapy and infectious disease proceedings of the 11th International Congress on Chemotherapy and the 19th ICACC. Washington, DC: American Society for Microbiology, 1979.
98. Boyce JM, Kelliher S, Vallande N. Skin irritation and dryness associated with two hand-hygiene regimens: soap-and-water handwashing versus hand antisepsis with an alcoholic hand gel. *Infect Control Hosp Epidemiol* 2000;21:442–8.
99. Sartor C, Jacomo V, Duvivier C, Tissot-Dupont H, Sambuc R, Drancourt M. Nosocomial *Serratia marcescens* infections associated with extrinsic contamination of a liquid nonmedicated soap. *Infect Control Hosp Epidemiol* 2000;21:196–9.
100. Walter CW. Editorial: disinfection of hands. *Am J Surg* 1965;109:691–3.
101. Gravens DL, Butcher HR Jr, Ballinger WF, Dewar NE. Septisol antiseptic foam for hands of operating room personnel: an effective antibacterial agent. *Surgery* 1973;73:360–7.
102. Eitzen HE, Ritter MA, French MLV, Gioe TJ. A microbiological in-use comparison of surgical hand-washing agents. *J Bone Joint Surg Am* 1979;61-A:403–6.
103. Minakuchi K, Yamamoto Y, Matsunaga K, et al. The antiseptic effect of a quick drying rubbing type povidone-iodine alcoholic disinfectant solution. *Postgrad Med J* 1993;69(suppl 3):S23–S26.
104. Babb JR, Davies JG, Ayliffe GAJ. A test procedure for evaluating surgical hand disinfection. *J Hosp Infect* 1991;18(suppl B):41–9.
105. Bellamy K, Alcock R, Babb JR, Davies JG, Ayliffe GA. A test for the assessment of 'hygienic' hand disinfection using rotavirus. *J Hosp Infect* 1993;24:201–10.
106. Ayliffe GAJ, Babb JR, Quraishi AH. A test for 'hygienic' hand disinfection. *J Clin Pathol* 1978;31:923–8.
107. Lilly HA, Lowbury EJJ, Wilkins MD. Detergents compared with each other and with antiseptics as skin 'degerming' agents. *J Hyg (Lond)* 1979;82:89–93.

108. Ulrich JA. Clinical study comparing hibistat (0.5% chlorhexidine gluconate in 70% isopropyl alcohol) and betadine surgical scrub (7.5% povidone-iodine) for efficacy against experimental contamination of human skin. *Curr Ther Res* 1982;31:27–30.
109. Bartzokas CA, Gibson MF, Graham R, Pinder DC. A comparison of triclosan and chlorhexidine preparations with 60 per cent isopropyl alcohol for hygienic hand disinfection. *J Hosp Infect* 1983;4:245–55.
110. Rotter ML, Koller W, Wewalka G, Werner HP, Ayliffe GAJ, Babb JR. Evaluation of procedures for hygienic hand-disinfection: controlled parallel experiments on the Vienna test model. *J Hyg (Lond)* 1986;96:27–37.
111. Kjrlen H, Andersen BM. Handwashing and disinfection of heavily contaminated hands—effective or ineffective? *J Hosp Infect* 1992;21:61–71.
112. Namura S, Nishijima S, Asada Y. An evaluation of the residual activity of antiseptic handrub lotions: an ‘in use’ setting study. *J Dermatol* 1994;21:481–5.
113. Jarvis JD, Wynne CD, Enwright L, Williams JD. Handwashing and antiseptic-containing soaps in hospital. *J Clin Path* 1979;32:732–7.
114. Pereira LJ, Lee GM, Wade KJ. An evaluation of five protocols for surgical handwashing in relation to skin condition and microbial counts. *J Hosp Infect* 1997;36:49–65.
115. Larson EL, Butz AM, Gullette DL, Laughon BA. Alcohol for surgical scrubbing? *Infect Control Hosp Epidemiol* 1990;11:139–43.
116. Aly R, Maibach HI. Comparative study on the antimicrobial effect of 0.5% chlorhexidine gluconate and 70% isopropyl alcohol on the normal flora of hands. *Appl Environ Microbiol* 1979;37:610–3.
117. Galle PC, Homesley HD, Rhyne AL. Reassessment of the surgical scrub. *Surg Gynecol Obstet* 1978;147:215–8.
118. Rosenberg A, Alatary SD, Peterson AF. Safety and efficacy of the antiseptic chlorhexidine gluconate. *Surg Gynecol Obstet* 1976;143:789–92.
119. Ayliffe GAJ, Babb JR, Bridges K, et al. Comparison of two methods for assessing the removal of total organisms and pathogens from the skin. *J Hyg (Lond)* 1975;75:259–74.
120. Larson EL, Morton HE. Alcohols [Chapter 11]. In: Block SS, ed. *Disinfection, sterilization and preservation*. 4th ed. Philadelphia, PA: Lea and Febiger, 1991:642–54.
121. Price PB. Ethyl alcohol as a germicide. *Arch Surg* 1939;38:528–42.
122. Harrington C, Walker H. The germicidal action of alcohol. *Boston Medical and Surgical Journal* 1903;148:548–52.
123. Price PB. New studies in surgical bacteriology and surgical technic. *JAMA* 1938;111:1993–6.
124. Coulthard CE, Sykes G. The germicidal effect of alcohol with special reference to its action on bacterial spores. *Pharmaceutical Journal* 1936;137:79–81.
125. Pohle WD, Stuart LS. The germicidal action of cleaning agents—a study of a modification of Price’s procedure. *J Infect Dis* 1940;67:275–81.
126. Gardner AD. Rapid disinfection of clean unwashed skin: further experiments. *Lancet* 1948;760–3.
127. Sakuragi T, Yanagisawa K, Dan K. Bactericidal activity of skin disinfectants on methicillin-resistant *Staphylococcus aureus*. *Anesth Analg* 1995;81:555–8.
128. Kampf G, Jarosch R, Rüden H. Limited effectiveness of chlorhexidine based hand disinfectants against methicillin-resistant *Staphylococcus aureus* (MRSA). *J Hosp Infect* 1998;38:297–303.
129. Kampf G, Höfer M, Wendt C. Efficacy of hand disinfectants against vancomycin-resistant enterococci in vitro. *J Hosp Infect* 1999;42:143–50.
130. Platt J, Bucknall RA. The disinfection of respiratory syncytial virus by isopropanol and a chlorhexidine-detergent handwash. *J Hosp Infect* 1985;6:89–94.
131. Krilov LR, Harkness SH. Inactivation of respiratory syncytial virus by detergents and disinfectants. *Pediatr Infect Dis* 1993;12:582–4.
132. Sattar SA, Tetro J, Springthorpe VS, Giulivi A. Preventing the spread of hepatitis B and C viruses: where are germicides relevant? *Am J Infect Control* 2001;29:187–97.
133. Woolwine JD, Gerberding JL. Effect of testing method on apparent activities of antiviral disinfectants and antiseptics. *Antimicrob Agents Chemother* 1995;39:921–3.
134. Pillsbury DM, Livingood CS, Nichols AC. Bacterial flora of the normal skin: report on the effect of various ointment and solutions, with comments on the clinical significance of this study. *Arch Dermatol* 1942;45:61–80.
135. Lowbury EJL, Lilly HA, Ayliffe GAJ. Preoperative disinfection of surgeons’ hands: use of alcoholic solutions and effects of gloves on skin flora. *Br Med J* 1974;4:369–72.
136. Lilly HA, Lowbury EJL, Wilkins MD, Zaggy A. Delayed antimicrobial effects of skin disinfection by alcohol. *J Hyg (Lond)* 1979;82:497–500.
137. Ansari SA, Springthorpe VS, Sattar SA, Tostowaryk W, Wells GA. Comparison of cloth, paper, and warm air drying in eliminating viruses and bacteria from washed hands. *Am J Infect Control* 1991;19:243–9.
138. Ansari SA, Sattar SA, Springthorpe VS, Wells GA, Tostowaryk W. In vivo protocol for testing efficacy of hand-washing agents against viruses and bacteria: experiments with rotavirus and *Escherichia coli*. *Appl Environ Microbiol* 1989;55:3113–8.
139. Steinmann J, Nehrkorn R, Meyer A, Becker K. Two in-vivo protocols for testing virucidal efficacy of handwashing and hand disinfection. *Zentralbl Hyg Umweltmed.* 1995;196:425–36.
140. Mbithi JN, Springthorpe VS, Sattar SA. Comparative in vivo efficiencies of hand-washing agents against hepatitis A virus (HM-175) and poliovirus type 1 (Sabin). *Appl Environ Microbiol* 1993;59:3463–9.
141. Schurmann W, Eggers HJ. Antiviral activity of an alcoholic hand disinfectant: comparison of the in vitro suspension test with in vivo experiments on hands, and on individual fingertips. *Antiviral Res* 1983;3:25–41.
142. Larson E, Bobo L. Effective hand degerming in the presence of blood. *J Emerg Med* 1992;10:7–11.
143. Dineen P, Hildick-Smith G. Antiseptic care of the hands [Chapter 21]. In: Maibach HI, Hildick-Smith G, eds. *Skin bacteria and their role in infection*. New York: McGraw-Hill, 1965.
144. Lilly HA, Lowbury EJL. Transient skin flora: their removal by cleansing or disinfection in relation to their mode of deposition. *J Clin Path* 1978;31:919–22.
145. Rotter M, Koller W, Wewalka G. Povidone-iodine and chlorhexidine gluconate-containing detergents for disinfection of hands. *J Hosp Infect* 1980;1:149–58.
146. Rotter ML. Hygienic hand disinfection. *Infect Control* 1984;1: 18–22.
147. Blech MF, Hartemann P, Paquin JL. Activity of non antiseptic soaps and ethanol for hand disinfection. *Zentralbl Bakteriol Hyg [B]* 1985;181:496–512.

148. Leyden JJ, McGinley KJ, Kaminer MS, et al. Computerized image analysis of full-hand touch plates: a method for quantification of surface bacteria on hands and the effect of antimicrobial agents. *J Hosp Infect* 1991;18(suppl B):13–22.
149. Rotter ML, Koller W. Test models for hygienic handrub and hygienic handwash: the effects of two different contamination and sampling techniques. *J Hosp Infect* 1992;20:163–71.
150. Zaragoza M, Sallés M, Gomez J, Bayas JM, Trilla A. Handwashing with soap or alcoholic solutions? A randomized clinical trial of its effectiveness. *Am J Infect Control* 1999;27:258–61.
151. Paulson DS, Fendler EJ, Dolan MJ, Williams RA. A close look at alcohol gel as an antimicrobial sanitizing agent. *Am J Infect Control* 1999;27:332–8.
152. Cardoso CL, Pereira HH, Zequim JC, Guilhermetti M. Effectiveness of hand-cleansing agents for removing *Acinetobacter baumannii* strain from contaminated hands. *Am J Infect Control* 1999;27:327–31.
153. Casewell MW, Law MM, Desai N. A laboratory model for testing agents for hygienic hand disinfection: handwashing and chlorhexidine for the removal of klebsiella. *J Hosp Infect* 1988;12:163–75.
154. Wade JJ, Desai N, Casewell MW. Hygienic hand disinfection for the removal of epidemic vancomycin-resistant *Enterococcus faecium* and gentamicin-resistant *Enterobacter cloacae*. *J Hosp Infect* 1991;18:211–8.
155. Huang Y, Oie S, Kamiya A. Comparative effectiveness of hand-cleansing agents for removing methicillin-resistant *Staphylococcus aureus* from experimentally contaminated fingertips. *Am J Infect Control* 1994;22:224–7.
156. Lowbury EJJ, Lilly HA. Disinfection of the hands of surgeons and nurses. *Br Med J* 1960;1:5184.
157. Berman RE, Knight RA. Evaluation of hand antisepsis. *Arch Environ Health* 1969;18:781–3.
158. Rotter ML, Simpson RA, Koller W. Surgical hand disinfection with alcohols at various concentrations: parallel experiments using the new proposed European standards method. *Infect Control Hosp Epidemiol* 1998;19:778–81.
159. Hobson DW, Woller W, Anderson L, Guthery E. Development and evaluation of a new alcohol-based surgical hand scrub formulation with persistent antimicrobial characteristics and brushless application. *Am J Infect Control* 1998;26:507–12.
160. Jones MV, Rowe GB, Jackson B, Pritchard NJ. The use of alcoholic paper wipes for routine hand cleansing: results of trials in two hospitals. *J Hosp Infect* 1986;8:268–74.
161. Butz AM, Laughon BE, Gullette DL, Larson EL. Alcohol-impregnated wipes as an alternative in hand hygiene. *Am J Infect Control* 1990;18:70–6.
162. Ojajärvi J. Handwashing in Finland. *J Hosp Infect* 1991;18(suppl B):35–40.
163. Newman JL, Seitz JC. Intermittent use of an antimicrobial hand gel for reducing soap-induced irritation of health care personnel. *Am J Infect Control* 1990;18:194–200.
164. Rotter ML, Koller W, Neumann R. The influence of cosmetic additives on the acceptability of alcohol-based hand disinfectants. *J Hosp Infect* 1991;18 (suppl B):57–63.
165. Larson EL, Aiello AE, Heilman JM, et al. Comparison of different regimens for surgical hand preparation. *AORN J* 2001;73:412–20.
166. Larson EL, Aiello AE, Bastyr J, et al. Assessment of two hand hygiene regimens for intensive care unit personnel. *Crit Care Med* 2001;29:944–51.
167. Ophaswongse S, Maibach HI. Alcohol dermatitis: allergic contact dermatitis and contact urticaria syndrome: a review. *Contact Dermatitis* 1994;30:1–6.
168. Rilliet A, Hunziker N, Brun R. Alcohol contact urticaria syndrome (immediate-type hypersensitivity): case report. *Dermatologica* 1980;161:361–4.
169. Widmer AF. Replace hand washing with use of a waterless alcohol hand rub? *Clin Infect Dis* 2000;31:136–43.
170. Bryant KA, Pearce J, Stover B. Flash fire associated with the use of alcohol-based antiseptic agent [Letter]. *Am J Infect Control* 2002;30:256–7.
171. Hsueh PR, Teng LJ, Yang PC, Pan HL, Ho SW, Luh KT. Nosocomial pseudoe epidemic caused by *Bacillus cereus* traced to contaminated ethyl alcohol from a liquor factory. *J Clin Microbiol* 1999;37:2280–4.
172. Denton GW. Chlorhexidine [Chapter 16]. In: Block SS, ed. *Disinfection, sterilization and reservation*. 4th ed. Philadelphia, PA: Lea and Febiger, 1991.
173. Narang HK, Codd AA. Action of commonly used disinfectants against enteroviruses. *J Hosp Infect* 1983;4:209–12.
174. Walsh B, Blakemore PH, Drabu YJ. The effect of handcream on the antibacterial activity of chlorhexidine gluconate. *J Hosp Infect* 1987;9:30–3.
175. Lowbury EJJ, Lilly HA. Use of 4% chlorhexidine detergent solution (Hibiscrub) and other methods of skin disinfection. *Br Med J* 1973;1:510–5.
176. Paulson DS. Comparative evaluation of five surgical hand scrub preparations. *AORN J* 1994;60:246–56.
177. Stingeni L, Lapomarda V, Lisi P. Occupational hand dermatitis in hospital environments. *Contact Dermatitis* 1995;33:172–6.
178. Marrie TJ, Costerton JW. Prolonged survival of *Serratia marcescens* in chlorhexidine. *Appl Environ Microbiol* 1981;42:1093–102.
179. McAllister TA, Lucas CE, Mocan H, et al. *Serratia marcescens* outbreak in a paediatric oncology unit traced to contaminated chlorhexidine. *Scott Med J* 1989;34:525–8.
180. Vigeant P, Loo VG, Bertrand C, et al. An outbreak of *Serratia marcescens* infections related to contaminated chlorhexidine. *Infect Control Hosp Epidemiol* 1998;19:791–4.
181. Vu-Thien H, Darbord JC, Moissenet D, et al. Investigation of an outbreak of wound infections due to *Alcaligenes xylosoxidans* transmitted by chlorhexidine in a burns unit. *Eur J Clin Microbiol* 1998;17:724–6.
182. Larson E, Talbot GH. An approach for selection of health care personnel handwashing agents. *Infect Control* 1986;7:419–24.
183. Davies J, Babb JR, Ayliffe GAJ, Wilkins MD. Disinfection of the skin of the abdomen. *Br J Surg* 1978;65:855–8.
184. Larson E, Mayur K, Laughon BA. Influence of two handwashing frequencies on reduction in colonizing flora with three handwashing products used by health care personnel. *Am J Infect Control* 1988;17:83–8.
185. Soulsby ME, Barnett JB, Maddox S. Brief report: the antiseptic efficacy of chlorxylenol-containing vs. chlorhexidine gluconate-containing surgical scrub preparations. *Infect Control* 1986;7:223–6.
186. Aly R, Maibach HI. Comparative antibacterial efficacy of a 2-minute surgical scrub with chlorhexidine gluconate, povidone-iodine, and chloroxylenol sponge-brushes. *Am J Infect Control* 1988;16:173–7.
187. Archibald LK, Corl A, Shah B, et al. *Serratia marcescens* outbreak associated with extrinsic contamination of 1% chlorxylenol soap. *Infect Control Hosp Epidemiol* 1997;18:704–9.
188. Lowbury EJJ, Lilly HA, Bull JP. Disinfection of hands: removal of resident bacteria. *Br Med J* 1963;1:1251–6.

189. Kundsins RB, Walter CW. The surgical scrub—practical consideration. *Arch Surg* 1973;107:75–7.
190. Lockhart J. How toxic is hexachlorophene? *Pediatrics* 1972;50:229–35.
191. Shuman RM, Leech RW, Alvord EC Jr. Neurotoxicity of hexachlorophene in humans: II. a clinicopathological study of 46 premature infants. *Arch Neurol* 1975;32:320–5.
192. Dixon RE, Kaslow RA, Mallison GF, Bennett JV. Staphylococcal disease outbreaks in hospital nurseries in the United States—December 1971 through March 1972. *Pediatrics* 1973;51:413–6.
193. Kaslow RA, Dixon RE, Martin SM, et al. Staphylococcal disease related to hospital nursery bathing practices—a nationwide epidemiologic investigation. *Pediatrics* 1973;51:418–29.
194. American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for perinatal care. 4th ed. Elk Grove Village, IL: American Academy of Pediatrics; Washington, DC: American Academy of Obstetricians and Gynecologists, 1997.
195. Gottardi W. Iodine and iodine compounds [Chapter 8]. In: Block SS, ed. *Disinfection, sterilization and preservation*. 4th ed. Philadelphia, PA: Lea & Febiger; 1991.
196. Anderson RL. Iodophor antiseptics: intrinsic microbial contamination with resistant bacteria. *Infect Control Hosp Epidemiol* 1989;10:443–6.
197. Goldenheim PD. In vitro efficacy of povidone-iodine solution and cream against methicillin-resistant *Staphylococcus aureus*. *Postgrad Med J* 1993;69(suppl 3):S62–S65.
198. Traoré O, Fayard SF, Laveran H. An in-vitro evaluation of the activity of povidone-iodine against nosocomial bacterial strains. *J Hosp Infect* 1996;34:217–22.
199. McLure AR, Gordon J. In-vitro evaluation of povidone-iodine and chlorhexidine against methicillin-resistant *Staphylococcus aureus*. *J Hosp Infect* 1992;21:291–9.
200. Davies JG, Babb JR, Bradley CR, Ayliffe GAJ. Preliminary study of test methods to assess the virucidal activity of skin disinfectants using poliovirus and bacteriophages. *J Hosp Infect* 1993;25:125–31.
201. Rotter ML. Chapter 79/Hand washing and hand disinfection. In: Mayhall CG, ed. *Hospital Epidemiology and Infection Control*. Baltimore, MD: Williams & Wilkins, 1996.
202. Wade JJ, Casewell MW. The evaluation of residual antimicrobial activity on hands and its clinical relevance. *J Hosp Infect* 1991;18 (suppl B):23–8.
203. Aly R, Maibach HI. Comparative evaluation of chlorhexidine gluconate (Hibiclens®) and povidone-iodine (E-Z Scrub®) sponge/brushes for presurgical hand scrubbing. *Curr Ther Res* 1983;34:740–5.
204. Herruzo-Cabrera R, Vizcaino-Alcaide MJ, Fdez-AciZero MJ. Usefulness of an alcohol solution of N-duopropenide for the surgical antisepsis of the hands compared with handwashing with iodine-povidone and chlorhexidine: clinical essay. *J Surgical Research* 2000;94:6–12.
205. Hingst V, Juditzki I, Heeg P, Sonntag HG. Evaluation of the efficacy of surgical hand disinfection following a reduced application time of 3 instead of 5 min. *J Hosp Infect* 1992;20:79–86.
206. Faoagali J, Fong J, George N, Mahoney P, O'Rourke V. Comparison of the immediate, residual, and cumulative antibacterial effects of Novaderm R, Novascrub R, Betadine Surgical Scrub, Hibiclens, and liquid soap. *Am J Infect Control* 1995;23:337–43.
207. Pereira LJ, Lee GM, Wade KJ. The effect of surgical handwashing routines on the microbial counts of operating room nurses. *Am J Infect Control* 1990;18:354–64.
208. Peterson AF, Rosenberg A. Comparative evaluation of surgical scrub preparations. *Surg Gynecol Obstet* 1978;146:63–5.
209. Berkelman RL, Holland BW, Anderson RL. Increased bactericidal activity of dilute preparations of povidone-iodine solutions. *J Clin Microbiol* 1982;15:635–9.
210. Merianos JJ. Quaternary ammonium antimicrobial compounds [Chapter 13]. In: Block SS, ed. *Disinfection, Sterilization, and Preservation*. 4th ed. Philadelphia, PA: Lea and Febiger; 1991.
211. Dixon RE, Kaslow RA, Mackel DC, Fulkerson CC, Mallison GF. Aqueous quaternary ammonium antiseptics and disinfectants: use and misuse. *JAMA* 1976;236:2415–7.
212. Sautter RL, Mattman LH, Legaspi RC. *Serratia marcescens* meningitis associated with a contaminated benzalkonium chloride solution. *Infect Control* 1984;5:223–5.
213. Oie S, Kamiya A. Microbial contamination of antiseptics and disinfectants. *Am J Infect Control* 1996;24:389–95.
214. Hayes RA, Trick WE, Vernon MO, et al. Comparison of three hand hygiene (HH) methods in a surgical intensive care unit (SICU) [Abstract K-1337]. Presented at the 41st Interscience Conference on Antimicrobial Agents and Chemotherapy Chicago, IL: American Society for Microbiology, 2001.
215. Dyer DL, Gerenraich KB, Wadhams PS. Testing a new alcohol-free hand sanitizer to combat infection. *AORN J* 1998;68:239–51.
216. Jones RD, Jampani HB, Newman JL, Lee AS. Triclosan: a review of effectiveness and safety in health care settings. *Am J Infect Control* 2000;28:184–96.
217. Ward WH, Holdgate GA, Rowsell S, et al. Kinetic and structural characteristics of the inhibition of enoyl (acyl carrier protein) reductase by triclosan. *Biochemistry* 1999;38:12514–25.
218. Heath RJ, Li J, Roland GE. Inhibition of the *Staphylococcus aureus* NADPH-dependent enoyl-acyl carrier protein reductase by triclosan and hexachlorophene. *J Biol Chem* 2000;275:4654–9.
219. Faoagali JL, George N, Fong J, Davy J, Dowser M. Comparison of the antibacterial efficacy of 4% chlorhexidine gluconate and 1% triclosan handwash products in an acute clinical ward. *Am J Infect Control* 1999;27:320–6.
220. Barry MA, Craven DE, Goularte TA, Lichtenberg DA. *Serratia marcescens* contamination of antiseptic soap containing triclosan: implications for nosocomial infection. *Infect Control* 1984;5:427–30.
221. Lowbury EJJ, Lilly HA, Bull JP. Disinfection of hands: removal of transient organisms. *Br Med J* 1964;2:230–3.
222. Rotter ML. Semmelweis' sesquicentennial: a little-noted anniversary of handwashing. *Current Opinion in Infectious Diseases* 1998;11:457–60.
223. Manivannan G, Brady MJ, Cahalan PT, et al. Immediate, persistent and residual antimicrobial efficiency of Surfactive™ hand sanitizer [Abstract]. *Infection Control Hosp Epidemiol* 2000;21:105.
224. Gershenfeld L. Povidone-iodine as a sporicide. *Am J Pharm* 1962;134:79–81.
225. Russell AD. Chemical sporicidal and sporostatic agents [Chapter 22]. In: Block SS, ed. *Disinfection, sterilization and preservation*. 4th ed. Philadelphia, PA: Lea and Febiger, 1991.
226. Johnson S, Gerding DN, Olson MM, et al. Prospective, controlled study of vinyl glove use to interrupt *Clostridium difficile* nosocomial transmission. *Am J Med* 1990;88:137–40.
227. Russell AD. Mechanisms of bacterial insusceptibility to biocides. *Am J Infect Control* 2001;29:259–61.
228. Cookson BD, Bolton MC, Platt JH. Chlorhexidine resistance in methicillin-resistant *Staphylococcus aureus* or just an elevated MIC? An in vitro and in vivo assessment. *Antimicrob Agents Chemother* 1991;35:1997–2002.

229. McMurtry LM, Oethinger M, Levy SB. Overexpression of *marA*, *soxS*, or *acrAB* produces resistance to triclosan in laboratory and clinical strains of *Escherichia coli*. *FEMS Microbiol Lett* 1998;166:305–9.
230. Chuanchuen R, Beinlich K, Hoang TT, et al. Cross-resistance between triclosan and antibiotics in *Pseudomonas aeruginosa* is mediated by multidrug efflux pumps: exposure of a susceptible mutant strain to triclosan selects *rfcB* mutants overexpressing MexCD-OprJ. *Antimicrob Agents Chemother* 2001;45:428–32.
231. Gröschel DHM, Pruett TL. Surgical antisepsis [Chapter 36]. In: Block SS, ed. *Disinfection, sterilization and preservation*. 4th ed. Philadelphia, PA: Lea and Febiger, 1991.
232. Boyce JM, Potter-Bynoe G, Opal SM, Dziobek L, Medeiros AA. A common-source outbreak of *Staphylococcus epidermidis* infections among patients undergoing cardiac surgery. *J Infect Dis* 1990;161:493–9.
233. Dewar NE, Gravens DL. Effectiveness of sepiisol antiseptic foam as a surgical scrub agent. *Appl Microbiol* 1973;26:544–9.
234. Grinbaum RS, de Mendonça JS, Cardo DM. An outbreak of handscrubbing-related surgical site infections in vascular surgical procedures. *Infect Control Hosp Epidemiol* 1995;16:198–202.
235. AORN Recommended Practices Committee. Recommended practices for surgical hand scrubs. In: Fogg D, Parker N, Shevlin D, eds. *Standards, Recommended Practices, and Guidelines*. Denver, CO: AORN, 2001.
236. Larson E, Anderson JK, Baxendale L, Bobo L. Effects of a protective foam on scrubbing and gloving. *Am J Infect Control* 1993;21: 297–301.
237. Mulberry G, Snyder AT, Heilman J, Pyrek J, Stahl J. Evaluation of a waterless, scrubless chlorhexidine gluconate/ethanol surgical scrub for antimicrobial efficacy. *Am J Infect Control* 2001;29:377–82.
238. Dineen P. An evaluation of the duration of the surgical scrub. *Surg Gynecol Obstet* 1969;129:1181–4.
239. O'Farrell DA, Kenny G, O'Sullivan M, Nicholson P, Stephens M, Hone R. Evaluation of the optimal hand-scrub duration prior to total hip arthroplasty. *J Hosp Infect* 1994;26:93–8.
240. O'Shaughnessy M, O'Malley VP, Corbett G, Given HF. Optimum duration of surgical scrub-time [Short note]. *Br J Surg* 1991;78:685–6.
241. Wheelock SM, Lookinland S. Effect of surgical hand scrub time on subsequent bacterial growth. *AORN J* 1997;65:1087–98.
242. Deshmukh N, Kjellberg SI, Kramer JW. A comparison of 5-minute povidone-iodine scrub and 1-minute povidone-iodine scrub followed by alcohol foam. *Military Medicine* 1998;163:145–7.
243. Kikuchi-Numagami K, Saishu T, Fukaya M, Kanazawa E, Tagami H. Irritancy of scrubbing up for surgery with or without a brush. *Acta Derm Venereol* 1999;79:230–2.
244. Dineen P. The use of a polyurethane sponge in surgical scrubbing. *Surg Gynecol Obstet* 1966;123:595–8.
245. Bornside GH, Crowder VH Jr, Cohn I Jr. A bacteriological evaluation of surgical scrubbing with disposable iodophor-soap impregnated polyurethane scrub sponges. *Surgery* 1968;64:743–51.
246. McBride ME, Duncan WC, Knox JM. An evaluation of surgical scrub brushes. *Surg Gynecol Obstet* 1973;137:934–6.
247. Berman RE, Knight RA. Evaluation of hand antisepsis. *Arch Environ Health* 1969;18:781–3.
248. Loeb MB, Wilcox L, Smail F, Walter S, Duff Z. A randomized trial of surgical scrubbing with a brush compared to antiseptic soap alone. *Am J Infect Control* 1997;25:11–5.
249. Larson E, Friedman C, Cohran J, Treston-Aurand J, Green S. Prevalence and correlates of skin damage on the hands of nurses. *Heart Lung* 1997;26:404–12.
250. Tupker RA. Detergents and cleansers [Chapter 7]. In: van der Valk PGM, Maibach HI, eds. *The Irritant Contact Dermatitis Syndrome*. New York, NY: CRC Press, 1996.
251. Wilhelm KP. Prevention of surfactant-induced irritant contact dermatitis. *Curr Probl Dermatol* 1996;25:78–85.
252. de Haan P, Meester HHM, Bruynzeel DP. Irritancy of alcohols [Chapter 6]. In: van der Valk PGM, Maibach HI, eds. *The Irritant Contact Dermatitis Syndrome*. New York, NY: CRC Press, 1996.
253. Lübke J, Ruffieux C, van Melle G, Perrenoud D. Irritancy of the skin disinfectant n-propanol. *Contact Dermatitis* 2001;45:226–31.
254. qhlenschlaeger J, Friberg J, Ramsing D, Agner T. Temperature dependency of skin susceptibility to water and detergents. *Acta Derm Venereol* 1996;76:274–6.
255. Emilson A, Lindberg M, Forslind B. The temperature effect of in vitro penetration of sodium lauryl sulfate and nickel chloride through human skin. *Acta Derm Venereol* 1993;73:203–7.
256. de Groot AC. Contact allergy to cosmetics: causative ingredients. *Contact Dermatitis* 1987;17:26–34.
257. Schnuch A, Uter W, Geier J, Frosch PJ, Rustemeyer T. Contact allergies in healthcare workers—results from the IVDK. *Acta Derm Venereol* 1998;78:358–63.
258. Rastogi SC, Heydorn S, Johansen JD, Basketter DA. Fragrance chemicals in domestic and occupational products. *Contact Dermatitis* 2001;45:221–5.
259. Uter W, Schnuch A, Geier J, Pfahlberg A, Gefeller O. Association between occupation and contact allergy to the fragrance mix: a multifactorial analysis of national surveillance data. *Occup Environ Med* 2001;58:392–8.
260. Perrenoud D, Bircher A, Hunziker T, et al. Frequency of sensitization to 13 common preservatives in Switzerland. *Contact Dermatitis* 1994;30:276–9.
261. Kiec-Swierczynska M, Krecisz B. Occupational skin diseases among the nurses in the region of Lodz. *Int J Occup Med Environ Health* 2000;13:179–84.
262. Garvey LH, Roed-Petersen J, and Husum B. Anaphylactic reactions in anaesthetised patients—four cases of chlorhexidine allergy. *Acta Anaesthesiol Scand* 2001;45:1290–4.
263. Pham, NH, Weiner JM, Reisner GS, and Baldo BA. Anaphylaxis to chlorhexidine. Case report. Implication of immunoglobulin E antibodies and identification of an allergenic determinant. *Clin Exp Allergy* 2000;30:1001–7.
264. Nishioka K, Seguchi T, Yasuno H, Yamamoto T, Tominaga K. The results of ingredient patch testing in contact dermatitis elicited by povidone-iodine preparations. *Contact Dermatitis* 2000;42:90–4.
265. Wong CSM, Beck MH. Allergic contact dermatitis from triclosan in antibacterial handwashes. *Contact Dermatitis* 2001;45:307.
266. Guin JD, Goodman J. Contact urticaria from benzyl alcohol presenting as intolerance to saline soaks. *Contact Dermatitis* 2001;45:182–3.
267. Podda M, Zollner T, Grundmann-Kollmann M, Kaufmann R, Boehncke WF. Allergic contact dermatitis from benzyl alcohol during topical antimycotic treatment. *Contact Dermatitis* 1999;41:302–3.
268. Yesudian PD, King CM. Allergic contact dermatitis from stearyl alcohol in Efudix® cream. *Contact Dermatitis* 2001;45:313–4.

269. Aust LB, Maibach HI. Incidence of human skin sensitization to isostearyl alcohol in two separate groups of panelists. *Contact Dermatitis* 1980;6:269–71.
270. Funk JO, Maibach HI. Propylene glycol dermatitis: re-evaluation of an old problem. *Contact Dermatitis* 1994;31:236–41.
271. Hannuksela M. Moisturizers in the prevention of contact dermatitis. *Curr Probl Dermatol* 1996;25:214–20.
272. Berndt U, Wigger-Alberti W, Gabard B, Elsner P. Efficacy of a barrier cream and its vehicle as protective measures against occupational irritant contact dermatitis. *Contact Dermatitis* 2000;42:77–80.
273. McCormick RD, Buchman TL, Maki DG. Double-blind, randomized trial of scheduled use of a novel barrier cream and an oil-containing lotion for protecting the hands of health care workers. *Am J Infect Control* 2000;28:302–10.
274. Larson E, Killien M. Factors influencing handwashing behavior of patient care personnel. *Am J Infect Control* 1982;10:93–9.
275. Zimakoff J, Kjelsberg AB, Larsen SO, Holstein B. A multicenter questionnaire investigation of attitudes toward hand hygiene, assessed by the staff in fifteen hospitals in Denmark and Norway. *Am J Infect Control* 1992;20:58–64.
276. Mayer JA, Dubbert PM, Miller M, Burkett PA, Chapman SW. Increasing handwashing in an intensive care unit. *Infect Control* 1986;7:259–62.
277. Ojajärvi J. The importance of soap selection for routine hand hygiene in hospital. *J Hyg (Lond)* 1981;86:275–83.
278. Scott D, Barnes A, Lister M, Arkell P. An evaluation of the user acceptability of chlorhexidine handwash formulations. *J Hosp Infect* 1991;18(suppl B):51–5.
279. Taylor LJ. An evaluation of handwashing techniques—2. *Nursing Times* 1978;74:108–10.
280. Preston GA, Larson EL, Stamm WE. The effect of private isolation rooms on patient care practices, colonization and infection in an intensive care unit. *Am J Med* 1981;70:641–5.
281. Kaplan LM, McGuckin M. Increasing handwashing compliance with more accessible sinks. *Infect Control* 1986;7:408–10.
282. Freeman, J. Prevention of nosocomial infections by location of sinks for hand washing adjacent to the bedside [Abstract 60]. In: Program and abstracts of the 33rd Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, DC: American Society for Microbiology, 1993:130.
283. Bischoff WE, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP. Handwashing compliance by health care workers. The impact of introducing an accessible, alcohol-based hand antiseptic. *Arch Intern Med* 2000;160:1017–21.
284. Pittet D. Compliance with hand disinfection and its impact on hospital-acquired infections. *J Hosp Infect* 2001;48(suppl A):S40–S46.
285. Wurtz R, Moye G, Jovanovic B. Handwashing machines, handwashing compliance, and potential for cross-contamination. *Am J Infect Control* 1994;22:228–30.
286. Kohan C, Ligi C, Dumigan DG, Boyce JM. The importance of evaluating product dispensers when selecting alcohol-based handrubs. *Am J Infect Control* 2002 (in press).
287. Boyce JM. Antiseptic technology: access, affordability, and acceptance. *Emerg Infect Diseases* 2001;7:231–3.
288. Taylor LJ. An evaluation of handwashing techniques—1. *Nursing Times* 1978:54–5.
289. Albert RK, Condie F. Hand-washing patterns in medical intensive-care units. *N Engl J Med* 1981;304:1465–6.
290. Larson E. Compliance with isolation technique. *Am J Infect Control* 1983;11:221–5.
291. Donowitz LG. Handwashing technique in a pediatric intensive care unit. *Am J Dis Child* 1987;141:683–5.
292. Conly JM, Hill S, Ross J, Lertzman J, Loule TJ. Handwashing practices in an intensive care unit: the effects of an educational program and its relationship to infection rates. *Am J Infect Control* 1989;17:330–9.
293. DeCarvalho M, Lopes JMA, Pellitteri M. Frequency and duration of handwashing in a neonatal intensive care unit. *Pediatr Infect Dis J* 1989;8:179–80.
294. Graham M. Frequency and duration of handwashing in an intensive care unit. *Am J Infect Control* 1990;18:77–80.
295. Dubbert PM, Dolce J, Richter W, Miller M, Chapman SW. Increasing ICU staff handwashing: effects of education and group feedback. *Infect Control Hosp Epidemiol* 1990;11:191–3.
296. Simmons B, Bryant J, Neiman K, Spencer L, Arheart K. The role of handwashing in prevention of endemic intensive care unit infections. *Infect Control Hosp Epidemiol* 1990;11:589–94.
297. Pettinger A, Nettleman MD. Epidemiology of isolation precautions. *Infect Control Hosp Epidemiol* 1991;12:303–7.
298. Lohr JA, Ingram DL, Dudley SM, Lawton EL, Donowitz LG. Hand washing in pediatric ambulatory settings: an inconsistent practice. *Am J Dis Child* 1991;145:1198–9.
299. Raju TNK, Kobler C. Improving handwashing habits in the newborn nurseries. *Am J Med.Sci* 1991;302:355–8.
300. Larson EL, McGinley KJ, Foglia A, et al. Handwashing practices and resistance and density of bacterial hand flora on two pediatric units in Lima, Peru. *Am J Infect Control* 1992;20:65–72.
301. Zimakoff J, Stormark M, Larsen SO. Use of gloves and handwashing behaviour among health care workers in intensive care units. A multicentre investigation in four hospitals in Denmark and Norway. *J Hosp Infect* 1993;24:63–7.
302. Pelke S, Ching D, Easa D, Melish ME. Gowning does not affect colonization or infection rates in a neonatal intensive care unit. *Arch Pediatr Adolesc Med* 1994;148:1016–20.
303. Gould D. Nurses' hand decontamination practice: results of a local study. *J Hosp Infect* 1994;28:15–30.
304. Shay DK, Maloney SA, Montecalvo M, et al. Epidemiology and mortality risk of vancomycin-resistant enterococcal bloodstream infections. *J Infect Dis* 1995;172:993–1000.
305. Berg DE, Hershov RC, Ramirez CA. Control of nosocomial infections in an intensive care unit in Guatemala City. *Clin Infect Dis* 1995;21:588–93.
306. Tibballs J. Teaching hospital medical staff to handwash. *Med J Aust* 1996;164:395–8.
307. Slaughter S, Hayden MK, Nathan C, et al. A comparison of the effect of universal use of gloves and gowns with that of glove use alone on acquisition of vancomycin-resistant enterococci in a medical intensive care unit. *Ann Intern Med* 1996;125:448–56.
308. Dorsey ST, Cydulka RK, Emerman CL. Is handwashing teachable?: failure to improve handwashing behavior in an urban emergency department. *Acad Emerg Med* 1996;3:360–5.
309. Watanakunakorn C, Wang C, Hazy J. An observational study of hand washing and infection control practices by healthcare workers. *Infect Control Hosp Epidemiol* 1998;19:858–60.

310. Avila-Agüero ML, Umaña MA, Jiménez AL, Faingezicht I, París MM. Handwashing practices in a tertiary-care, pediatric hospital and the effect on an educational program. *Clin Perform Qual Health Care* 1998;6:70–2.
311. Kirkland KB, Weinstein JM. Adverse effects of contact isolation. *Lancet* 1999;354:1177–8.
312. Maury E, Alzieu M, Baudel JL, et al. Availability of an alcohol solution can improve hand disinfection compliance in an intensive care unit. *Am J Respir Crit Care Med* 2000;162:324–7.
313. Muto CA, Sistrom MG, Farr BM. Hand hygiene rates unaffected by installation of dispensers of a rapidly acting hand antiseptic. *Am J Infect Control* 2000;28:273–6.
314. Jarvis WR. Handwashing—the Semmelweis lesson forgotten? *Lancet* 1994;344:1311–2.
315. Larson E, Kretzer EK. Compliance with handwashing and barrier precautions. *J Hosp Infect* 1995;30(suppl):88–106.
316. Sproat LJ, Inglis TJJ. A multicentre survey of hand hygiene practice in intensive care units. *J Hosp Infect* 1994;26:137–48.
317. Kretzer EK, Larson EL. Behavioral interventions to improve infection control practices. *Am J Infect Control* 1998;26:245–53.
318. Voss A, Widmer AF. No time for handwashing!? Handwashing versus alcoholic rub: can we afford 100% compliance? *Infect Control Hosp Epidemiol* 1997;18:205–8.
319. Larson E. Handwashing and skin physiologic and bacteriologic aspects. *Infect Control* 1985;6:14–23.
320. Thompson BL, Dwyer DM, Ussery XT, Denman S, Vacek P, Schwartz B. Handwashing and glove use in a long-term care facility. *Infect Control Hosp Epidemiol* 1997;18:97–103.
321. Doebbeling BN, Pfaller MA, Houston AK, Wenzel RP. Removal of nosocomial pathogens from the contaminated glove. *Ann Intern Med* 1988;109:394–8.
322. McLane C, Chenelly S, Sylvestrak ML, Kirchhoff KT. A nursing practice problem: failure to observe aseptic technique. *Am J Infect Control* 1983;11:178–82.
323. Pittet D. Improving compliance with hand hygiene in hospitals. *Infect Control Hosp Epidemiol* 2000;21:381–6.
324. Teare L, Handwashing Liaison Group. Hand washing: a modest measure—with big effects. *Br Med J* 1999;318:686.
325. Teare EL, Cookson B, French GL, et al. UK handwashing initiative. *J Hosp Infect* 1999;43:1–3.
326. Larson EL, Bryan JL, Adler LM, Blane C. A multifaceted approach to changing handwashing behavior. *Am J Infect Control* 1997;25:3–10.
327. Weeks A. Why I don't wash my hands between each patient contact [Letter]. *Br Med J* 1999;319:518.
328. Webster J. Handwashing in a neonatal intensive care nursery: product acceptability and effectiveness of chlorhexidine gluconate 4% and triclosan 1%. *J Hosp Infect* 1992;21:137–41.
329. Kelen GD, Green GB, Hexter DA, et al. Substantial improvement in compliance with universal precautions in an emergency department following institution of policy. *Arch Intern Med* 1991;151:2051–6.
330. Lundberg GD. Changing physician behavior in ordering diagnostic tests [Editorial]. *JAMA* 1998;280:2036.
331. Phillips DF. “New look” reflects changing style of patient safety enhancement. *JAMA* 1999;281:217–9.
332. Harbarth S, Martin Y, Rohner P, Henry N, Auckenthaler R, Pittet D. Effect of delayed infection control measures on a hospital outbreak of methicillin-resistant *Staphylococcus aureus*. *J Hosp Infect* 2000;46:43–9.
333. Early E, Battle K, Cantwell E, English J, Lavin JE, Larson E. Effect of several interventions on the frequency of handwashing among elementary public school children. *Am J Infect Control* 1998;26:263–9.
334. Butz AM, Larson E, Fosarelli P, Yolken R. Occurrence of infectious symptoms in children in day care homes. *Am J Infect Control* 1990;18:347–53.
335. Kimel LS. Handwashing education can decrease illness absenteeism. *J Sch Nurs* 1996;12:14–6, 18.
336. Master D, Hess Longe S, Dickson H. Scheduled hand washing in an elementary school population. *Fam Med* 1997;29:336–9.
337. Roberts L, Smith W, Jorm L, Patel M, Douglas RM, McGilchrist C. Effect of infection control measures on the frequency of upper respiratory infection in child care: a randomized, controlled trial. *Pediatrics* 2000;105:738–42.
338. Roberts L, Jorm L, Patel M, Smith W, Douglas RM, McGilchrist C. Effect of infection control measures on the frequency of diarrheal episodes in child care: a randomized, controlled trial. *Pediatrics* 2000;105:743–6.
339. Khan MU. Interruption of shigellosis by handwashing. *Trans R Soc Trop Med Hyg* 1982;76:164–8.
340. Shahid NS, Greenough WB, Samadi AR, Huq MI, Rahman N. Hand washing with soap reduces diarrhoea and spread of bacterial pathogens in a Bangladesh village. *J Diarrhoeal Dis Res* 1996;14:85–9.
341. Stanton BF, Clemens JD. An educational intervention for altering water-sanitation behaviors to reduce childhood diarrhea in urban Bangladesh. *Am J Epidemiol* 1987;125:292–301.
342. McGinley KJ, Larson EL, Leyden JJ. Composition and density of microflora in the subungual space of the hand. *J Clin Microbiol* 1988;26:950–3.
343. Hedderwick SA, McNeil SA, Lyons MJ, Kauffman CA. Pathogenic organisms associated with artificial fingernails worn by healthcare workers. *Infect Control Hosp Epidemiol* 2000;21:505–9.
344. Baumgardner CA, Maragos CS, Larson EL. Effects of nail polish on microbial growth of fingernails: dispelling sacred cows. *AORN J* 1993;58:84–8.
345. Wynd CA, Samstag DE, Lapp AM. Bacterial carriage on the fingernails of OR nurses. *AORN J* 1994;60:796–805.
346. Gross A, Cutright DE, D'Allessandro SM. Effect of surgical scrub on microbial population under the fingernails. *Am J Surg* 1979;138:463–7.
347. Pottinger J, Burns S, Manske C. Bacterial carriage by artificial versus natural nails. *Am J Infect Control* 1989;17:340–4.
348. McNeil SA, Foster CL, Hedderwick SA, Kauffman CA. Effect of hand cleansing with antimicrobial soap or alcohol-based gel on microbial colonization of artificial fingernails worn by health care workers. *Clin Infect Dis* 2001;32:367–72.
349. Rubin DM. Prosthetic fingernails in the OR. *AORN J* 1988;47:944–5, 948.
350. Moolenaar RL, Crutcher M, San Joaquin VH, et al. A prolonged outbreak of *Pseudomonas aeruginosa* in a neonatal intensive care unit: did staff fingernails play a role in disease transmission? *Infect Control Hosp Epidemiol* 2000;21:80–5.
351. Passaro DJ, Waring L, Armstrong R, et al. Postoperative *Serratia marcescens* wound infections traced to an out-of-hospital source. *J Infect Dis* 1997;175:992–5.
352. Foca M, Jakob K, Whittier S, et al. Endemic *Pseudomonas aeruginosa* infection in a neonatal intensive care unit. *N Engl J Med* 2000;343:695–700.

353. Parry MF, Grant B, Yukna M, et al. *Candida* osteomyelitis and diskitis after spinal surgery: an outbreak that implicates artificial nail use. *Clin Infect Dis* 2001;32:352–7.
354. Garner JS, Simmons BP. Guideline for isolation precautions in hospitals. *Infect Control* 1983;4(suppl 4):245–325.
355. CDC. Recommendations for prevention of HIV transmission in health-care settings. *MMWR* 1987;36(suppl 2S):3S–18S.
356. Occupational Safety and Health Administration. 29 CFR Part 1910.1030. Occupational exposure to bloodborne pathogens: final rule. *Federal Register* 1991;29CFR Part 1910:1030.
357. Hartstein AI, Denny MA, Morthland VH, LeMonte AM, Pfaller MA. Control of methicillin-resistant *Staphylococcus aureus* in a hospital and an intensive care unit. *Infect Control Hosp Epidemiol* 1995;16:405–11.
358. Maki DG, McCormick RD, Zilz MA, Stolz SM, Alvarado CJ. An MRSA outbreak in a SICU during universal precautions: new epidemiology for nosocomial MRSA: downside for universal precautions [Abstract 473]. In: Program and abstracts of the 30th Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, DC: American Society for Microbiology, 1990.
359. Kotilainen HR, Brinker JP, Avato JL, Gantz NM. Latex and vinyl examination gloves: quality control procedures and implications for health care workers. *Arch Intern Med* 1989;149:2749–53.
360. Reingold AL, Kane MA, Hightower AW. Failure of gloves and other protective devices to prevent transmission of hepatitis B virus to oral surgeons. *JAMA* 1988;259:2558–60.
361. Korniewicz DM, Laughon BE, Butz A, Larson E. Integrity of vinyl and latex procedures gloves. *Nurs Res* 1989;38:144–6.
362. DeGroot-Kosolcharoen J, Jones JM. Permeability of latex and vinyl gloves to water and blood. *Am J Infect Control* 1989;17:196–201.
363. Korniewicz DM, Kirwin M, Cresci K, Markut C, Larson E. In-use comparison of latex gloves in two high-risk units: surgical intensive care and acquired immunodeficiency syndrome. *Heart Lung* 1992;21:81–4.
364. Korniewicz DM, Kirwin M, Cresci K, et al. Barrier protection with examination gloves: double versus single. *Am J Infect Control* 1994;22:12–5.
365. Sistrom MG, Muto CA, Neal J, Strain BA, Farr BM. Glove leakage rates as a function of latex content and brand: caveat emptor [Abstract 24]. In: Program and abstracts of the 10th Annual Meeting of Society of Healthcare Epidemiology of America, Orlando, Florida, 1998.
366. Flanagan H, Farr B. Continued evaluation of glove leakage rates at the University of Virginia. Presented at the 11th Annual Meeting of the Society for Healthcare Epidemiology of America, Toronto, Canada, April 1, 2001.
367. Korniewicz DM, Laughon BE, Cyr WH, Lytle CD, Larson E. Leakage of virus through used vinyl and latex examination gloves. *J Clin Microbiol* 1990;28:787–8.
368. Rego A, Roley L. In-use barrier integrity of gloves: latex and nitrile superior to vinyl. *Am J Infect Control* 1999;27:405–10.
369. Fisher MD, Reddy VR, Williams FM, Lin KY, Thacker JG, Edlich RF. Biomechanical performance of powder-free examination gloves. *J Emerg Med* 1999;17:1011–8.
370. Edlich RF, Suber F, Neal JG, Jackson EM, Williams FM. Integrity of powder-free examination gloves to bacteriophage penetration. *J Biomed Mater Res* 1999;48:755–8.
371. Murray CA, Burke FJT, McHugh S. An assessment of the incidence of punctures in latex and non-latex dental examination gloves in routine clinical practice. *Br Dental Journal* 2001;190:377–80.
372. Jones RD, Jampani H, Mulberry G, Rizer RL. Moisturizing alcohol hand gels for surgical hand preparation. *AORN J* 2000;71:584–99.
373. Patterson JE, Vecchio J, Pantelick EL, et al. Association of contaminated gloves with transmission of *Acinetobacter calcoaceticus* var. *antitratu* in an intensive care unit. *Am J Med* 1991;91:479–83.
374. Lowbury EJJ. Aseptic methods in the operating suite. *Lancet* 1968;1:705–9.
375. Hoffman PN, Cooke EM, McCarville MR, Emmerson AM. Microorganisms isolated from skin under wedding rings worn by hospital staff. *Br Med J* 1985;290:206–7.
376. Jacobson G, Thiele JE, McCune JH, Farrell LD. Handwashing: ring-wearing and number of microorganisms. *Nurs Res* 1985;34:186–8.
377. Hayes RA, Trick WE, Vernon MO, et al. Ring use as a risk factor (RF) for hand colonization in a surgical intensive care unit (SICU) [Abstract K-1333]. In: Program and abstracts of the 41st Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, DC: American Society for Microbiology, 2001.
378. Salisbury DM, Hutfilz P, Treen LM, Bollin GE, Gautam S. The effect of rings on microbial load of health care workers' hands. *Am J Infect Control* 1997;25:24–7.
379. Spire B, Barré-Sinoussi F, Montagnier L, Chermann JC. Inactivation of lymphadenopathy associated virus by chemical disinfectants. *Lancet* 1984;2:899–901.
380. Martin LS, McDougal JS, Loskoski SL. Disinfection and inactivation of the human T lymphotropic virus type III/lymphadenopathy-associated virus. *J Infect Dis* 1985;152:400–3.
381. Resnick L, Veren K, Salahuddin SZ, Tondreau S, Markham PD. Stability and inactivation of HTLV-III/LAV under clinical and laboratory environments. *JAMA* 1986;255:1887–91.
382. van Bueren J, Larkin DP, Simpson RA. Inactivation of human immunodeficiency virus type 1 by alcohols. *J Hosp Infect* 1994;28:137–48.
383. Montefiori DC, Robinson WE Jr, Modliszewski A, Mitchell WM. Effective inactivation of human immunodeficiency virus with chlorhexidine antiseptics containing detergents and alcohol. *J Hosp Infect* 1990;15:279–82.
384. Wood A, Payne D. The action of three antiseptics/disinfectants against enveloped and non-enveloped viruses. *J Hosp Infect* 1998;38:283–95.
385. Harbison MA, Hammer SM. Inactivation of human immunodeficiency virus by Betadine products and chlorhexidine. *J Acquir Immune Defic Syndr* 1989;2:16–20.
386. Lavelle GC, Gubbe SL, Neveaux JL, Bowden BJ. Evaluation of an antimicrobial soap formula for virucidal efficacy in vitro against human immunodeficiency virus in a blood-virus mixture. *Antimicrob Agents Chemother* 1989;33:2034–6.
387. Bond WW, Favero MS, Petersen NJ, Ebert JW. Inactivation of hepatitis B virus by intermediate-to-high level disinfectant chemicals. *J Clin Microbiol* 1983;18:535–8.
388. Kobayashi H, Tsuzuki M, Koshimizu K, et al. Susceptibility of hepatitis B virus to disinfectants or heat. *J Clin Microbiol* 1984;20:214–6.
389. Kurtz JB. Virucidal effect of alcohols against echovirus 11 [Letter]. *Lancet* 1979;1:496–7.
390. Sattar SA, Raphael RA, Lochnan H, Springthorpe VS. Rotavirus inactivation by chemical disinfectants and antiseptics used in hospitals. *Can J Microbiol* 1983;29:1464–9.
391. Larson E, Silberger M, Jakob K, et al. Assessment of alternative hand hygiene regimens to improve skin health among neonatal intensive care unit nurses. *Heart Lung* 2000;29:136–42.

392. Gould D, Chamberlain A. The use of a ward-based educational teaching package to enhance nurses' compliance with infection control procedures. *J Clin Nursing* 1997;6:55–67.
393. Aspöck C, Koller W. A simple hand hygiene exercise. *Am J Infect Control* 1999;27:370–2.
394. McGuckin M, Waterman R, Porten L, et al. Patient education model for increasing handwashing compliance [Practice forum]. *Am J Infect Control* 1999;27:309–14.
395. Khatib M, Jamaledine G, Abdallah A, Ibrahim Y. Hand washing and use of gloves while managing patients receiving mechanical ventilation in the ICU. *Chest* 1999;116:172–5.
396. Haley RW, Bregman DA. The role of understaffing and overcrowding in recurrent outbreaks of staphylococcal infection in a neonatal special-care unit. *J Infect Dis* 1982;145:875–85.
397. Pittet D, Boyce JM. Hand hygiene and patient care: pursuing the Semmelweis legacy. *Lancet Infectious Diseases* 2001;April:9–20.
398. Boyce JM. Scientific basis for handwashing with alcohol and other waterless antiseptic agents. In: Rutala WA, ed. *Disinfection, sterilization and antiseptics: principles and practices in healthcare facilities*. Washington, DC: Association for Professionals in Infection Control and Epidemiology, Inc, 2001.
399. O'Boyle CA, Henly SJ, Duckett LJ. Nurses' motivation to wash their hands: a standardized measurement approach. *Applied Nursing Research* 2001;14:136–45.
400. Semmelweis IP. *Die aetiologie, der begriff und die prophylaxis des kindbettfiebers*. Pest, Wien und Leipzig: CA Hartleben's Verlags-Expedition 1861.
401. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevrolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. *Lancet* 2000;355:1864–8.
402. Bull DA, Neumayer LA, Hunter GC, et al. Improved sterile technique diminishes the incidence of positive line cultures in cardiovascular patients. *J Surgical Research* 1992;52:106–10.
403. Hirschmann H, Fux L, Podusel J, et al. The influence of hand hygiene prior to insertion of peripheral venous catheters on the frequency of complications. *J Hosp Infect* 2001;49:199–203.
404. Drusin LM, Sohmer M, Groshen SL, Spiritos MD, Senterfit LB, Christenson WN. Nosocomial hepatitis A infection in a paediatric intensive care unit. *Arch Dis Child* 1987;62:690–5.
405. Doebbeling BN, Li N, Wenzel RP. An outbreak of hepatitis A among health care workers: risk factors for transmission. *Am J Public Health* 1993;83:1679–84.
406. Standaert SM, Hutcheson RH, Schaffner W. Nosocomial transmission of *Salmonella gastroenteritis* to laundry workers in a nursing home. *Infect Control Hosp Epidemiol* 1994;15:22–6.
407. Rodriguez EM, Parrott C, Rolka H, Monroe SS, Dwyer DM. An outbreak of viral gastroenteritis in a nursing home: importance of excluding ill employees. *Infect Control Hosp Epidemiol* 1996;17:587–92.
408. Schaffner W, Lefkowitz LB Jr, Goodman JS, Koenig MG. Hospital outbreak of infections with group A streptococci traced to an asymptomatic anal carrier. *N Engl J Med* 1969;280:1224–5.
409. Viglionese A, Nottebart VF, Bodman HA, Platt R. Recurrent group A streptococcal carriage in a health care worker associated with widely separated nosocomial outbreaks. *Am J Med* 1991;91(suppl 3B):329S–33S.
410. Ojajärvi J. An evaluation of antiseptics used for hand disinfection in wards. *J Hyg (Lond)* 1976;76:75–82.
411. Mermel LA, Josephson SL, Dempsey J, Parenteau S, Perry C, Magill N. Outbreak of *Shigella sonnei* in a clinical microbiology laboratory. *J Clin Microbiol* 1997;35:3163–5.
412. McBride ME. Microbial flora of in-use soap products. *Appl Environ Microbiol* 1984;48:338–41.
413. Kabara JJ, Brady MB. Contamination of bar soaps under “in use” condition. *J Environ Pathol Toxicol Oncol* 1984;5:1–14.
414. Heinze JE, Yackovich F. Washing with contaminated bar soap is unlikely to transfer bacteria. *Epidem Inf* 1988;101:135–42.
415. Bannan EA, Judge LF. Bacteriological studies relating to handwashing: 1. the inability of soap bars to transmit bacteria. *Am J Public Health* 1965;55:915–21.
416. Field EA, McGowan P, Pearce PK, Martin MV. Rings and watches: should they be removed prior to operative dental procedures? *J Dent* 1996;24:65–9.
417. Lowbury EJJ, Lilly HA. Gloved hand as applicator of antiseptic to operation sites. *Lancet* 1975;2:153–6.
418. AORN Recommended Practices Committee. Recommended practices for surgical hand scrubs. *AORN J* 1999;69:842–50.
419. Grohskopf LA, Roth VR, Feikin DR, et al. *Serratia liquefaciens* bloodstream infections from contamination of epoetin alfa at a hemodialysis center. *N Engl J Med* 2001;344:1491–7.
420. Dharan S, Hugonnet S, Sax H, Pittet D. Evaluation of interference of a hand care cream with alcohol-based hand disinfection. *Occup Environ Dermatol* 2001;49:81–4.
421. Heeg P. Does hand care ruin hand disinfection? *J Hosp Infect* 2001;48(suppl A):S37–S39.
422. McGuckin M, Waterman R, Storr J, et al. Evaluation of a patient-empowering hand hygiene programme in the U.K. *J Hosp Infect* 2001;48:222–7.
423. Girou E, Oppein F. Handwashing compliance in a French university hospital: new perspective with the introduction of hand-rubbing with a waterless alcohol-based solution. *J Hosp Infect* 2001;48(suppl A):S55–S57.

Appendix

Antimicrobial Spectrum and Characteristics of Hand-Hygiene Antiseptic Agents*

Group	Gram-positive bacteria	Gram-negative bacteria	Mycobacteria	Fungi	Viruses	Speed of action	Comments
<i>Alcohols</i>	+++	+++	+++	+++	+++	<i>Fast</i>	<i>Optimum concentration 60%–95%; no persistent activity</i>
<i>Chlorhexidine (2% and 4% aqueous)</i>	+++	++	+	+	+++	<i>Intermediate</i>	<i>Persistent activity; rare allergic reactions</i>
<i>Iodine compounds</i>	+++	+++	+++	++	+++	<i>Intermediate</i>	<i>Causes skin burns; usually too irritating for hand hygiene</i>
<i>Iodophors</i>	+++	+++	+	++	++	<i>Intermediate</i>	<i>Less irritating than iodine; acceptance varies</i>
<i>Phenol derivatives</i>	+++	+	+	+	+	<i>Intermediate</i>	<i>Activity neutralized by nonionic surfactants</i>
<i>Tricolsan</i>	+++	++	+	—	+++	<i>Intermediate</i>	<i>Acceptability on hands varies</i>
<i>Quaternary ammonium compounds</i>	+	++	—	—	+	<i>Slow</i>	<i>Used only in combination with alcohols; ecologic concerns</i>

Note: +++ = excellent; ++ = good, but does not include the entire bacterial spectrum; + = fair; — = no activity or not sufficient.

*Hexachlorophene is not included because it is no longer an accepted ingredient of hand disinfectants.



MMWR™

Morbidity and Mortality Weekly Report

Recommendations and Reports

October 25, 2002 / Vol. 51 / No. RR-16

Continuing Education Activity Sponsored by CDC Guideline for Hand Hygiene in Health-Care Settings

Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force

EXPIRATION — October 25, 2004

You must complete and return the response form electronically or by mail by **October 25, 2004**, to receive continuing education credit. If you answer all of the questions, you will receive an award letter for 1.75 hours Continuing Medical Education (CME) credit; 0.15 Continuing Education Units (CEUs); 1.5 hours Certified Health Education Specialist (CHES) credit; or 1.9 contact

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Goal and Objectives

This *MMWR* provides evidence-based recommendations for hand hygiene in health-care settings. These recommendations were developed by the Healthcare Infection Control Practices Advisory Committee (HICPAC), the Society for Healthcare Epidemiology of America, the Association for Professionals in Infection Control and Epidemiology, and the Infectious Diseases Society of America Hand Hygiene Task Force. The goal of this report is to provide guidance for clinicians and other health-care practitioners regarding strategies to improve hand-hygiene practices and reduce transmission of microorganisms in health-care settings. Upon completion of this educational activity, the reader should be able to 1) describe the indications for hand hygiene in health-care settings; 2) list the advantages of alcohol-based hand rubs; and 3) describe the barriers to hand hygiene in health-care settings.

To receive continuing education credit, please answer all of the following questions.

1. **Hand hygiene refers to . . .**
 - A. handwashing using plain soap and water.
 - B. using an antiseptic hand rub (e.g alcohol, chlorhexidine, iodine).
 - C. handwashing using antimicrobial soap and water.
 - D. all of the above.
2. **Hand hygiene adherence in health-care facilities might be improved by . . .**
 - A. providing personnel with individual containers of alcohol-based hand rubs.
 - B. providing personnel with hand lotions or creams.
 - C. providing personnel with feedback regarding hand-hygiene adherence/performance.
 - D. all of the above.
3. **Alcohol-based hand rubs have good or excellent antimicrobial activity against all of the following except . . .**
 - A. viruses.
 - B. fungi.
 - C. mycobacteria.
 - D. bacterial spores.
 - E. gram-positive and gram-negative bacteria.
4. **Alcohol-based hand rubs are indicated for all of the following clinical situations except . . .**
 - A. when the hands are visibly soiled.
 - B. preoperative cleaning of hands by surgical personnel.
 - C. before inserting urinary catheters, intravascular catheters, or other invasive devices.
 - D. after removing gloves.
5. **Each of the following statements regarding alcohol-based hand rubs is true except . . .**
 - A. alcohol-based hand rubs reduce bacterial counts on the hands of health-care personnel more effectively than plain soaps.
 - B. alcohol-based hand rubs can be made more accessible than sinks or other handwashing facilities.
 - C. alcohol-based hand rubs require less time to use than traditional handwashing.
 - D. alcohol-based hand rubs have been demonstrated to cause less skin irritation and dryness than handwashing using soap and water.
 - E. alcohol-based hand rubs are only effective if they are applied for ≥ 60 seconds.
6. **Which of the following statements regarding preoperative surgical hand antisepsis is true?**
 - A. Antimicrobial counts on hands are reduced as effectively with a 5-minute scrub as with a 10-minute scrub.
 - B. A brush or sponge must be used when applying the antiseptic agent to adequately reduce bacterial counts on hands.
 - C. Alcohol-based hand rubs for preoperative surgical scrub have been associated with increased surgical site infection rates.
 - D. A and B are true.
 - E. A and C are true.
7. **Antimicrobial-impregnated wipes (i.e., towelettes) . . .**
 - A. might be considered as an alternative to handwashing with plain soap and water.
 - B. are as effective as alcohol-based hands rubs.
 - C. are as effective as washing hands with antimicrobial soap and water.
 - D. A and C.
8. **The following statements regarding hand hygiene in health-care settings are true except . . .**
 - A. Overall adherence among health-care personnel is approximately 40%.
 - B. Poor adherence to hand-hygiene practice is a primary contributor to health-care-associated infection and transmission of antimicrobial-resistant pathogens.
 - C. Personnel wearing artificial nails or extenders have been linked to nosocomial outbreaks.
 - D. Hand hygiene is not necessary if gloves are worn.
9. **Indicate your work setting.**
 - A. State/local health department.
 - B. Other public health setting.
 - C. Hospital clinic/private practice.
 - D. Managed care organization.
 - E. Academic institution.
 - F. Other.
10. **Which best describes your professional activities?**
 - A. Patient care — emergency/urgent care department.
 - B. Patient care — inpatient.
 - C. Patient care — primary-care clinic or office.
 - D. Laboratory/pharmacy.
 - E. Public health.
 - F. Other.
11. **I plan to use these recommendations as the basis for . . . (Indicate all that apply.)**
 - A. health education materials.
 - B. insurance reimbursement policies.
 - C. local practice guidelines.
 - D. public policy.
 - E. other.
12. **Each month, approximately how many patients do you examine?**
 - A. None.
 - B. 1–5.
 - C. 6–20.
 - D. 21–50.
 - E. 51–100.
 - F. >100.
13. **How much time did you spend reading this report and completing the exam?**
 - A. 1–1.5 hours.
 - B. More than 1.5 hours but fewer than 2 hours.
 - C. 2–2.5 hours.
 - D. More than 2.5 hours.

14. After reading this report, I am confident I can describe the guidance for clinicians and other health-care practitioners regarding strategies to improve hand-hygiene practices and reduce transmission of microorganisms in health-care settings.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

15. After reading this report, I am confident I can describe the indications for hand hygiene in health-care settings.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

16. After reading this report, I am confident I can list the advantages of alcohol-based hand rubs.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

17. After reading this report, I am confident I can describe the barriers to hand hygiene in health-care settings.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

18. The objectives are relevant to the goal of this report.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

19. The tables and text boxes are useful.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

20. Overall, the presentation of the report enhanced my ability to understand the material.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

MMWR Response Form for Continuing Education Credit October 25, 2002/Vol. 51/No. RR-16

Guideline for Hand Hygiene in Health-Care Settings

Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force

To receive continuing education credit, you must

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 4. sign and date this form or a photocopy;
 5. submit your answer form by October 25, 2004.
- Failure to complete these items can result in a delay or rejection of your application for continuing education credit.

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Fill in the appropriate blocks to indicate your answers. Remember, you must answer all of the questions to receive continuing education credit!

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Page 121

21. These recommendations will affect my practice.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

22. The availability of continuing education credit influenced my decision to read this report.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

23. How did you learn about this continuing education activity?

- A. Internet.
- B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
- C. Coworker/supervisor.
- D. Conference presentation.
- E. *MMWR* subscription.
- F. Other.

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Hand Hygiene Task Force Members

Chair: John M. Boyce, M.D., Hospital of Saint Raphael, New Haven, Connecticut.

Members: Barry M. Farr, M.D., University of Virginia, Charlottesville, Virginia; William R. Jarvis, M.D., CDC, Atlanta, Georgia; Elaine L. Larson, Ph.D., Columbia School of Nursing, New York, New York; Maryanne McGuckin, DrScEd, University of Pennsylvania, Philadelphia, Pennsylvania; Carol O'Boyle, Ph.D., Minnesota Department of Health, Minneapolis, Minnesota; Didier Pittet, M.D., University of Geneva, Geneva, Switzerland; Jane D. Siegel, M.D., University of Texas Southwestern Medical Center, Dallas, Texas; Marjorie A. Underwood, Mt. Diablo Medical Center, Concord, California; Andreas F. Widmer, M.D., University Hospitals, Basel, Switzerland; Jolynn Zeller, Avera St. Lukes Hospital, Aberdeen, South Dakota; and Beth H. Stover, Kosair Children's Hospital, Louisville, Kentucky.

Disclosure of Financial Interests and Relationships

John Boyce: Research and educational grants from Gojo Industries; honorarium from Procter and Gamble; and consultant to Bode Chemical.

Barry Farr: Research support from Gojo Industries.

Elaine Larson: Received products for testing in research studies from Procter and Gamble, 3M Corporation, and Steris.

Carol O'Boyle: Honorarium from 3M Corporation.

All *MMWR* references are available on the Internet at <http://www.cdc.gov/mmwr>. Use the search function to find specific articles.

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How Adil keeps its data safe:

Once Adil has obtained Medical Employee's personal documents they are store in our Warwick RI office. All documents are handled by Lori Mirabella, Branch Mgr. and Maureen Kennedy, Payroll Specialist & Admin.

All documents are kept in file cabinets and a locked office, which only Maureen & Lori have the keys too.

Documents are also scanned to the corporate office where they secure:

Data Protection Procedures:

· Employee Records and Payroll Data Backup:

All employee-related data, including records and payroll information, is backed up regularly. A scheduled backup process runs weekly to ensure the latest data is securely stored. This includes sensitive files such as employment contracts, personal identification details, and financial information.

· Data Upload to Secure Locations:

To minimize risks, backup data is uploaded to multiple secure locations:

1. **Cloud Storage:** Data is encrypted before being uploaded to a secure secondary cloud storage provider.
2. **Physical Storage:** External hard drives are used for additional redundancy.

· Yearly Backup Archiving:

An annual backup copy is archived and stored with a different cloud vendor to ensure long-term data preservation. These backups are organized year-wise for easy retrieval

SECTION 23: BREACH OF CONTRACT POLICY

If Adil Business Systems, Inc., believe you as their employee has breached their contract, the first thing Adil will do is document the breach. Gather all relevant evidence, including emails, attendance records, and witness statements if appropriate. Timely documentation will be crucial if the situation escalates to legal proceedings.

Depending on the severity of the breach, Adil as the employer can take various actions, including:

- Verbal or written warning
- Performance Improvement Plans (PIPs)
- Suspension or termination

Each action should be proportionate to the breach's impact and follow company policies and legal guidelines. In severe cases, legal action may be necessary. Adil can seek legal remedies such as damages, injunctions, or specific performance orders. Consult with an attorney to discuss the best course of action in certain particular situations

Adil Business Systems, Inc

873 Warwick Ave.
Warwick, RI 02888
401-331- 0755

To Whom It May Concern.

In compliance with the Joint Commission an addendum must be added to this contract. The following are support provisions:

1. Adil Business Systems, Incorporated must inform all employees or clients that if the employees or clients have an issue concerning the safety and wellbeing of a patient, the employee or client has the right to make a formal complaint to The Joint Commission by contacting The Joint Commissions' website: www.jointcomission.org.
2. Adil Business Systems, Incorporated, does not use subcontractors.
3. Adil Business Systems, Incorporated is responsible for all competence requirements for assigned staff.
4. Adil Business Systems, Inc. staff may only be reassigned to areas of practice within their clinical competence.
5. All staff members delegated to the contract facilities are employees of Adil Business Systems, Incorporated.
6. Unexpected incidents, errors, and sentinel events that occur that involve Adil Business Systems, Inc.'s staff should be communicated to the staffing firm.
7. Occupational safety hazards and/ or events are to be reported to Adil Business Systems, Incorporated within twenty-four hours of the event with Workers Compensation information.
8. The client is encouraged to orient Adil Business Systems, Inc. staff to its relevant policies and procedures.
9. Adil discourages any conflict of interest as defined by what occurs when and interested person has a financial interest individually as it relates to a family member, which is disclosed as or found to (a) impair the individual's objectivity or (b) create unfair competitive advantage for any person or organization other than Adil conflict of interest means more than individual bias. There must be financial interest that could directly affect the work or service of Personnel to be considered a conflict. Adil reviews and evaluates this on an annual basis.
10. There will be no retaliation for voicing concerns.

Please contact Adil Business Systems, Incorporated with any additional concerns.

If you have a complaint or concern about Adil Business, Inc. services, please contact LoriMirabella via email (lorim@adil.com) or telephone (401 331 0755). If you are not satisfied.

please contact the Joint Commission via www.jointcommission.org.

Lori Mirabella, Business-Manager

EMPLOYEE HANDBOOK ACKNOWLEDGEMENT

(A separate copy of the Employee Handbook Acknowledgement is included in your welcome packet. Please sign, date, and return the document to the Human Resources within seven (7) days of receipt of this Handbook)

This is to acknowledge that I have received a copy of the Adil Business Systems, Inc. Employee Handbook and I understand that it contains information about the employment policies and practices of the Company. I agree to read and comply with this Employee Handbook.

I also understand that the purpose of this Handbook is to inform me of the Company's current policies and procedures, and that it is not a contract of employment. Nothing in this Handbook provides any entitlement to me, nor is it intended to create contractual obligations of any kind for any specific period. I understand that the Company has the right to change any provision of this Handbook at any time and that I will be bound by any such changes. I recognize that this Handbook is intended only as a general reference and is not intended to cover every situation that may arise during my employment at Adil. I understand that no oral statements or representations can change the provisions of this Employee Handbook. I understand that this Employee Handbook supersedes and replaces any and all prior Employee Handbooks and any inconsistent verbal or written policy statements.

I further understand that Adil Business Systems, Inc. is an AT-WILL employer and that either the Company or I can terminate the relationship at any time, for any reason, with or without cause or notice.

I understand that the information I come into contact with during my employment is proprietary to the Company and accordingly, I agree to keep it confidential, which means I will not use it other than in the performance of my duties, or disclose it to any person or entity outside the company. I understand that I must comply with all of the provisions of the Handbook to have access to and use of company resources. I also understand that if I do not comply with all provisions of the Handbook, my access to company resources may be revoked, and I may be subject to disciplinary action up to and including discharge.

I expressly agree to the provision "Arbitration and Choice of Law", of the Handbook, in which I have agreed to use alternative dispute resolution, in lieu of litigation, as the sole means of resolving any dispute that may arise between the Company and me, subject to the Company's right to seek injunctive relief. I agree to first seek to mediate any dispute with the Company with a mediator from the American Arbitration Association or similar organization trained and experienced in employment disputes. If mediation is not successful, I agree to submit the dispute to arbitration. I understand that by agreeing to arbitration I waive any right I may have to sue or seek a jury trial. The decision of the arbitrator will be final and binding.

I further understand that I am obligated to familiarize myself with the company's safety, health, and emergency procedures as outlined in this Handbook or in other documents.

Employee Name: _____

Date: _____ **Signature:** _____