

QUALITY FUNCTION DEPLOYMENT AND **Lean Six Sigma Applications** in Public Health

**Grace L. Duffy
John W. Moran
and William J. Riley**

Quality Function Deployment and Lean-Six Sigma Applications in Public Health

Also available from ASQ Quality Press:

The Public Health Quality Improvement Handbook

Ron Bialek, John W. Moran, and Grace L. Duffy

Lean Doctors: A Bold and Practical Guide to Using Lean Principles to Transform Healthcare Systems, One Doctor at a Time

Aneesh Suneja with Carolyn Suneja

Root Cause Analysis and Improvement in the Healthcare Sector: A Step-by-Step Guide

Bjørn Andersen, Tom Fagerhaug, and Marti Beltz

Solutions to the Healthcare Quality Crisis: Cases and Examples of Lean Six Sigma in Healthcare

Soren Bisgaard, editor

On Becoming Exceptional: SSM Health Care's Journey to Baldrige and Beyond

Sister Mary Jean Ryan, FSM

Journey to Excellence: Baldrige Health Care Leaders Speak Out

Kathleen Goonan, editor

A Lean Guide to Transforming Healthcare: How to Implement Lean Principles in Hospitals, Medical Offices, Clinics, and Other Healthcare Organizations

Thomas G. Zidel

Benchmarking for Hospitals: Achieving Best-in-Class Performance without Having to Reinvent the Wheel

Victor Sower, Jo Ann Duffy, and Gerald Kohers

Lean-Six Sigma for Healthcare, Second Edition: A Senior Leader Guide to Improving Cost and Throughput

Greg Butler, Chip Caldwell, and Nancy Poston

Lean Six Sigma for the Healthcare Practice: A Pocket Guide

Roderick A. Munro

5S for Service Organizations and Offices: A Lean Look at Improvements

Debashis Sarkar

To request a complimentary catalog of ASQ Quality Press publications, call 800-248-1946, or visit our Web site at <http://www.asq.org/quality-press>.

Quality Function Deployment and Lean-Six Sigma Applications in Public Health

Grace L. Duffy

John W. Moran

William Riley

ASQ Quality Press
Milwaukee, Wisconsin

American Society for Quality, Quality Press, Milwaukee 53203

© 2010 American Society for Quality

All rights reserved. Published 2010

Printed in the United States of America

14 13 12 11 10 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Duffy, Grace L.

Quality function deployment and lean-six sigma applications in public health / Grace L. Duffy, John W. Moran, William Riley.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-87389-787-7 (casebound : alk. paper)

1. Public health—Quality control. 2. Medical care—Quality control. 3. Six sigma (Quality control standard) I. Moran, John W. II. Riley, William. III. Title.

RA399.A3D84 2006

362.1068—dc22

2010005632

ISBN-13: 978-0-87389-787-7

No part of this book may be reproduced in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

Publisher: William A. Tony

Acquisitions Editor: Matt Meinholz

Project Editor: Paul O'Mara

Production Administrator: Randall Benson

ASQ Mission: The American Society for Quality advances individual, organizational, and community excellence worldwide through learning, quality improvement, and knowledge exchange.

Attention Bookstores, Wholesalers, Schools, and Corporations: ASQ Quality Press books, videotapes, audiotapes, and software are available at quantity discounts with bulk purchases for business, educational, or instructional use. For information, please contact ASQ Quality Press at 800-248-1946, or write to ASQ Quality Press, P.O. Box 3005, Milwaukee, WI 53201-3005.



Quality Press
600 N. Plankinton Avenue
Milwaukee, Wisconsin 53203
Call toll free 800-248-1946
Fax 414-272-1734
www.asq.org
<http://www.asq.org/quality-press>
<http://standardsgroup.asq.org>
E-mail: authors@asq.org

To place orders or to request a free copy of the ASQ Quality Press Publications Catalog, including ASQ membership information, call 800-248-1946. Visit our Web site at www.asq.org or <http://www.asq.org/quality-press>.



Printed on acid-free paper

Contents

<i>Preface</i>	<i>xiii</i>
<i>Acknowledgments</i>	<i>xv</i>
Chapter 1: The Continuum of Quality Improvement in Public Health	1
Introduction	1
Process Improvement in a Public Health Department	3
Little “qi”	3
Big “QI”	5
Large-Scale Public Health System Quality Improvement	6
Big “QI,” Little “qi,” and Individual “qi”	13
Conclusion	15
Endnotes	17
Chapter 2: Introduction to Quality Function Deployment and Lean-Six Sigma	19
Introduction to Quality Function Deployment	19
Introduction to Lean-Six Sigma	22
Summary	25
Endnotes	26
Chapter 3: An Integrated QI Approach:	
QFD and LSS Support Macro, Meso, Micro	27
Introduction	27
Integrated Processes Create a System	29
The Human Interaction with Macro, Meso, and Micro Levels: Individual QI	33
Endnotes	36
Chapter 4: Customer Focus: Revitalizing Your Organization	
to Become Customer Centric	37
Summary	47
Endnotes	47
Chapter 5: Process Analysis and Waste Reduction	49
Introduction	49
1. Understanding How a Process Is Structured	50
2. How to Analyze a Process	50
<i>Creating a Process Map</i>	<i>51</i>
3. Identifying Inefficiencies in a Process Map	54

Process Features	54
Two Types of Process Maps	55
<i>Opportunity Map</i>	56
<i>Value Stream Mapping Definitions</i>	57
<i>Visualizing Patient Flow</i>	57
<i>Current State Value Map</i>	59
<i>Future State Value Map</i>	60
Spaghetti Diagram	61
Value-Added Versus Time Chart.	62
The Eight Types of Waste	64
Summary.	64
Endnotes	66
Chapter 6: Using the Language of Senior Management: The Bottom Line.	67
Introduction: Show Me the Money.	67
The Externally Versus Internally Focused Organization	69
Identify the Bottom Line	70
Cost of Quality Overview.	77
Contributions of Cost of Quality	78
Selling COQ to Leadership.	80
The Bottom Line Feeds Back to the Top Line: Use QFD to Validate VOC	80
Endnotes	81
Chapter 7: Milestones and Measures: Interim and Final Reporting	83
Introduction.	83
Measurement Characteristics	84
Improving Performance Is About Using Data	89
Definitions in Support of Performance Management	90
Examples of the Four Components.	91
Does Your Agency Have a Performance Management System?.	94
Performance Measures	95
Reporting of Progress	95
The Performance Management Cycle	96
Process Measures in Meso to Micro Level Department Activities.	98
Endnotes	99
Chapter 8: Lean-Six Sigma: “Faster, Better, Smarter”	101
Rapid Cycle Change and Project Management	104
<i>Faster</i>	104
<i>Better</i>	106
<i>Smarter</i>	107
Combining Lean and Six Sigma Methods and Benefits.	109
The DMAIC Methodology	110
Summary.	116
Endnotes	117
Chapter 9: The House of Lean-Six Sigma Tools and Techniques	119
Building Blocks of House of Lean	123
Steps into the House of Lean	129
The Foundation in the House of Lean	129

The Roof for House of Lean	130
Summary	130
Endnotes	130
Chapter 10: Incremental Versus Redesign Strategies	131
<i>Phase 1—Focus</i>	135
<i>Phase 2—Assessment</i>	135
<i>Phase 3—Negotiation</i>	136
<i>Phase 4—Redesign</i>	137
<i>Phase 5—Implementation</i>	138
Summary	139
<i>Laws of Core Process Redesign</i>	140
Endnotes	140
Chapter 11: Developing the QFD Team	143
Types of Teams	144
The Value of Teams to QFD	147
Preparing Individuals to Be Effective Team Members	149
Develop Individuals into an Effective Team	150
Team Decision Making	153
The Decision-Making Process	153
Attributes of a Good Decision	155
Influence and Control Issues for Team Effectiveness	156
<i>The Problem Statement as a Vehicle for Norming</i>	158
Develop Measures to Maintain Process Improvement	159
Set the Time Frame for Implementation	160
<i>Establish a Communication Plan</i>	161
Summary	163
Endnotes	164
Chapter 12: Conducting a QFD Study	165
Chapter 13: Navigating the QFD Matrices	173
Endnotes	182
Appendix A: The Matrix of Matrices	183
Appendix B: QFD Software	185
Appendix C: List of QFD Reference Books	187
About the Authors	189
Index	191

Figures and Tables

Figure 1.1	Continuous quality improvement system in public health.	2
Figure 1.2	MPHCQI model for improvement.	3
Figure 1.3	Chart for lobby wait time, Dakota County Health Department WIC program	5
Figure 1.4	General approach to use the basic tools of quality improvement	9
Figure 1.5	General approach to use the advanced tools of quality improvement	10
Figure 1.6	Carver County local alert confirmation test flowchart.	11
Figure 1.7	Carver County local alert confirmation test cause and effect	12
Figure 1.8	Future state flowchart of optimized HAN test notification	14
Figure 1.9	Continuous quality improvement system in public health.	15
Figure 2.1	Process flow comparisons of predecessor methodologies	24
Figure 3.1	The QFD/VOC integrated fulfillment approach	28
Figure 3.2	General model of process-based health department performance	29
Figure 3.3	The integration of technology, infrastructure, and personnel	34
Figure 3.4	The mechanics of an integrated approach to QI	35
Figure 4.1	Client relationship model.	38
Figure 4.2	Which process steps impact customer needs?	40
Figure 4.3	Cause and effect diagram of poor customer service	41
Figure 4.4	Factors to obtain the VOC	43
Figure 4.5	Kano model	44
Figure 4.6	Understanding/interpreting the voice of the customer.	45
Figure 4.7	Understand the overlapping, conflicting, and distinct needs of each customer group.	46
Figure 5.1	Basic symbols for a process map.	52
Figure 5.2	Basic process map for childhood immunization clinic	53

Figure 5.3	Opportunity flowchart for childhood immunization clinic	56
Figure 5.4	Flowchart symbols for value stream mapping	58
Figure 5.5	Current state value stream map for childhood immunization clinic	60
Figure 5.6	Future state value stream map for childhood immunization clinic	61
Figure 5.7	Spaghetti diagram for a patient at childhood immunization clinic	62
Figure 5.8	Spaghetti diagram for a provider at childhood immunization clinic	63
Figure 5.9	Value-added versus time chart	63
Figure 6.1	Initial projection of annual operating budget expenses	68
Figure 6.2	Externally versus internally focused costing approaches	70
Figure 6.3	Soaring Eagle Clinic 2010 operating statement.	71
Figure 6.4	Orange County Health Department immunization map	73
Figure 6.5	OCHD child immunization process costing summary worksheet	76
Figure 6.6	OCHD immunization flowchart process costing with COQ estimates	79
Figure 7.1	Client requirements to design requirements	84
Figure 7.2	Florida Department of Children and Families QFD customer requirements to design requirements (partial)	86
Figure 7.3	Control plan for DCF customer to design requirements QFD matrix	87
Figure 7.4	Performance management framework and components	90
Figure 7.5	Orange County Health Department current state process map	92
Figure 7.6	Flowchart summary form for septic system permitting QI project	93
Figure 7.7	Introduction to the Pennsylvania Department of Health Intranet site for data driven management.	96
Figure 7.8	Conceptual framework of the public health system as a basis for measuring public health systems performance.	98
Figure 8.1	Evolution of Lean-Six Sigma methodologies	103
Figure 8.2	Relationship of QFD and LSS approaches for quality improvement	108
Figure 8.3	The DMAIC methodology	111
Figure 8.4	Percent nondefective under a normal curve using Six Sigma concept	114
Figure 8.5	Performance metrics developed from customer requirements.	115
Figure 9.1	The PDCA continuous improvement cycle	120
Figure 9.2	General approach using the basic tools of quality improvement.	120
Figure 9.3	General approach to using the advanced tools of quality improvement	121
Figure 9.4	LSS DMAIC management system.	122

Figure 9.5	The house of lean	123
Figure 9.6	Spaghetti diagram showing health department administrative office flow	126
Figure 9.7	Current state value stream map environmental data	128
Figure 10.1	Types of improvement	132
Figure 10.2	Six areas critical for successful business outcomes	133
Figure 10.3	The CPR pathway	135
Figure 10.4	Transitional time line	139
Figure 11.1	The four houses of quality	150
Figure 11.2	Voice of the customer to voice of the process	152
Figure 11.3	Teams make decisions for continuous improvement	154
Figure 11.4	Layers of team control and influence	156
Figure 11.5	Components of the issue	157
Figure 11.6	Internal versus external focus	158
Figure 11.7	Operational versus strategic issue	159
Figure 11.8	Process, capacity, outcomes measurement	160
Figure 11.9	Measurement examples for performance	161
Figure 11.10	Gantt chart for implementation time line	162
Figure 11.11	Sample communication plan	163
Figure 12.1	L-shaped matrix	166
Figure 12.2	$M \times N$ matrix	166
Figure 12.3	Tree diagram	167
Figure 12.4	The system-level QFD approach	168
Figure 12.5	Four houses of quality	168
Figure 12.6	House of quality	169
Figure 12.7	Translating the “who” to the “how”	170
Figure 13.1	Chart A-1: The house of quality	174
Figure 13.2	VOC tree diagram	175
Figure 13.3	Solution and effect diagram	177
Figure 13.4	Technical characteristics tree diagram	178
Figure 13.5	Four houses of quality	180
Table 1.1	Dakota County Public Health Department WIC program process improvement project overview	4

Table 1.2	Macro, Meso, Micro, and Individual mapped to Big, Little, and Individual QI.	7
Table 1.3	PDSA—Carver County HAN alert system tests of change.	13
Table 5.1	Eight types of waste.	65
Table 8.1	Lean-Six Sigma roles and responsibilities.	112
Table 9.1	Categories and descriptions of 5S for septic permit program	124
Table 13.1	A-1 Matrix for weighted customer importance	176
Table 13.2	Component D: House of quality weighting of whats and hows	179
Table 13.3	Matrix to calculate measurement targets for product or service outcomes	181

Preface

Ron Bialek, President, Public Health Foundation

Public Health has recognized the value of continuous improvement. Quality improvement (QI) teams are engaged across the country in identifying root causes of the issues that prevent us from providing the best Public Health services to communities and individuals. We are seeing tremendous excitement throughout the country around the use of QI tools and techniques. Public Health agencies and systems are learning these techniques, exploring and experimenting with them, and developing new and even better approaches to Public Health QI. And yes, we are seeing results: improved processes, efficiencies, and community health status.

The release of *The Quality Improvement Handbook for Public Health* in 2009 signaled a coming together of the best minds in the industry around the current and future state of Public Health performance excellence. Health departments across the nation are using the basic quality tools to assess the needs of their communities, identify priority areas for improvement, and implement processes and measures to meet those needs in a reliable manner.

These foundation efforts are making a difference. Public Health professionals form cross-functional teams with other agencies and not-for-profit organizations to balance resources and share skills to meet the broader needs of the total community. Public Health support organizations such as the Public Health Foundation publish success stories and papers forming the basis of new research in QI methods for community health services.

There is still much more to be done. Comparing the health of the United States with the rest of the world and the health of most every community, we know that we can do better. The public and policy makers are demanding better health outcomes and more efficient use of scarce resources.

The tools of quality, when used effectively, will truly make a difference in the public's health. The basic tools of quality, anchored by the Plan-Do-Check/Study-Act cycle, are helping Public Health departments improve processes at the local level. It is time to take a more advanced approach for cross functional and

long-term improvements that will achieve the systems level results we desire and the public deserves.

Central to the mission of the Public Health Foundation is helping Public Health agencies and systems achieve measurable improvement and better results. This text, introducing quality function deployment (QFD) and Lean-Six Sigma (LSS), is a valuable next step for the integration of improved community health outcomes. We know from years of experience working with Public Health agencies and systems that there are common requirements for Public Health services across the nation. There also are unique needs of individual communities.

The matrixed approach of QFD acknowledges specific priorities of a unique audience. Traditional inputs to health and environmental needs, such as community assessments, regional trend analysis or projections of future growth, feed directly into the voice of the customer process that is the gateway for QFD.

LSS offers a broader range of techniques beyond the seven basic tools of QI now in frequent use among Public Health and community service organizations. The authors provide the next level of quality for both strategic leadership and operational QI teams ready to move beyond the entry level of performance and measurement techniques. This book is written by professionals who are actively using the advanced tools of quality and coaching leading-edge teams for maximum results.

The methods in this text are the next step for us to harness the energy, enthusiasm, hard work, and dedication of our Public Health workforce to make a lasting difference. By effectively expanding our use of QI tools and techniques, we can and will improve our nation's health and the health of the many communities we serve.

Acknowledgments

The application of process-based improvement in Public Health is an exciting new field. The authors are privileged to work with a number of Public Health professionals as we push the envelope for using the quality tools to support community needs. The following professionals and their related Health Departments have been critical in the application of quality function deployment and Lean-Six Sigma in Public Health situations. The authors are grateful for their involvement in this significant project.

Orange County Health Department, Orlando, Florida

Strategic planning manager:

James E. Pate

Quality manager:

Vicente Alberto Araujo

Lean-Six Sigma project managers:

Shelly Persaud

Anne Marie Strickland

Susannah Mena

Melissa Hulse

Data Analyst:

Andrew Burns

Minnesota Department of Health

Kim McCoy, MS, MPH: principal planning specialist

University of Minnesota, School of Public Health

Mac McCullough, BS, research assistant and MPH student, University of Minnesota School of Public Health.

Ben Smalley, research assistant and MHA/MBA student, University of Minnesota School of Public Health and Carlson School of Business

Finally, the authors are eternally grateful to our ASQ Quality Press editors, Matt Meinholz and Paul O'Mara, for believing in us when we approached them with the value of quality improvement in Public Health. The future of health is in prevention, not just clinical treatment of existing conditions. Healthy processes support healthy behaviors. May our readers benefit from the connection.

Introduction

The purpose of this book is to introduce the concepts embedded in quality function deployment (QFD) and Lean-Six Sigma to help Public Health professionals implement quality improvement within their agencies. The tools and techniques of QFD and Lean-Six Sigma are designed to augment a robust PDCA or PDSA problem-solving process, not replace it.

The tools and techniques of QFD and Lean-Six Sigma can help problem-solving teams by providing insight into customer needs and wants, design and development of customer-centric processes, and mapping value streams. Both QFD and Lean-Six Sigma focus on doing the most with the resources we have. Each of these megatools supports efforts to expand our community support programs and to increase the effectiveness of internal capacities. This dual external/internal focus offers an excellent partnership of quality improvement tools for Public Health.

The tools and techniques of QFD and Lean-Six Sigma can help a problem-solving team make breakthrough improvements by building in customer requirements early in the problem-solving process as well as setting the stage for future improvements. You will find that the QFD process ensures that the voice of the customer (VOC) drives all activities associated with designing or redesigning a product or service for internal or external customers. Lean-Six Sigma uses the same VOC inputs to align every activity within the Public Health department (PHD) directly with stated needs of the community and its stakeholders. These two methodologies will help improve quality, costs, and timeliness of products and services, which in for-profit businesses translates into increased profitability. In Public Health, having lower costs can mean more can be done with existing budget dollars.

The objectives of QFD and Lean-Six Sigma are as follows:

- Provide higher-quality products and services to customers.
- Achieve customer-driven design of these products and services by converting user needs into design parameters

- Provide documentation and tracking system for future design endeavors
- Develop delivery processes that are efficient and effective
- Involve suppliers early in the process
- Require data-driven decision making and incorporate a comprehensive set of quality tools under a powerful framework for effective problem-solving
- Provide tools for analyzing process flow and delay times at each activity in a process

The early results of the use of QFD in the United States included a reduction in the cycle time for design work, a defining of quality early in the design stage, a decrease in quality problems during manufacturing, a way to objectively benchmark against the competition on improvements, reduced warranty claims, and an improvement in cross-functional team work.

In this book we will modify the QFD process and Lean-Six Sigma methodology so they are aligned with the needs and differences in Public Health design and delivery of products and services. When we make modifications we will point this out so readers will understand the change from what might be seen in an industrial or healthcare application of the same concepts.

1

The Continuum of Quality Improvement in Public Health

INTRODUCTION

As the Public Health community expands its use of quality improvement (QI), there is often confusion about how all the tools, techniques, methodologies, models, and approaches fit together.¹ Available techniques include basic and advanced tools of quality improvement as well as several QI models including quality function deployment, Lean-Six Sigma, daily management, mobilizing for action through planning and partnerships (MAPP),² turning point,³ Baldrige,⁴ and state quality award models. At times, these models are introduced as competing techniques and processes. The models are not tied together into a system by which they complement one another. This chapter provides an overview showing how various QI techniques and improvement models are related to one another and can be used in compatible ways. The Public Health community would benefit from an overall approach that completely integrates QI into its management practices. Continuous improvement is one component of an integrated system of performance management by which an organization meets and exceeds the needs and expectations of its multiple customer, client, and stakeholder communities.

Some of the ways in which performance management can positively influence a Public Health agency are:

- Better return on dollars invested in health
- Greater accountability for funding and increases in the public's trust
- Reduced duplication of efforts
- Better understanding of Public Health accomplishments and priorities among employees, partners, and the public
- Increased sense of cooperation and teamwork

- Increased emphasis on quality, rather than quantity
- Improved problem solving⁵

More on performance management as an approach to improved community support is provided in Chapter 7.

The Accreditation Coalition Quality Improvement Subgroup⁶ reached a consensus on March 26, 2009, that defined quality improvement in Public Health and that was approved by the Accreditation Coalition in June 2009:

Quality improvement in public health is the use of a deliberate and defined improvement process, such as plan-do-check-act, which is focused on activities that are responsive to community needs and improving population health.

It refers to a continuous and ongoing effort to achieve measurable improvements in the efficiency, effectiveness, performance, accountability, outcomes, and other indicators of quality in services or processes which achieve equity and improve the health of the community

As shown in Figure 1.1, QI in Public Health is a never-ending process that pervades the organization when fully implemented. Top organizational leaders address the quality of the system at a Macro level (Big “QI”). In the middle, professional staff attacks problems in programs or service areas by improving particular processes (Little “qi”). At the individual level, staff seeks ways of improving their own behaviors and environments (Individual “qi”).

When starting their quality journey, Public Health organizations tend to embrace Little “qi,” which means striving for quality in a limited or specific improvement project or area. This is accomplished by using an integrated set of QI methods and techniques that create a value map, identify the key quality characteristics, analyze process performance, reengineer the process if needed, and lock in improve-

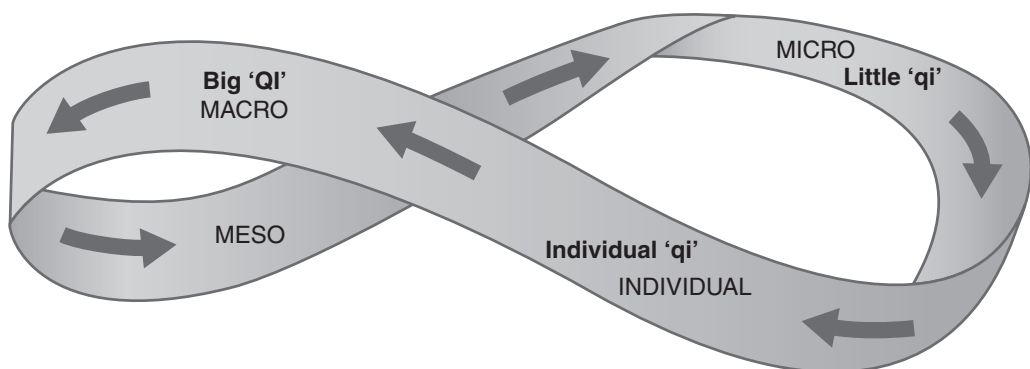


Figure 1.1 Continuous quality improvement system in public health.

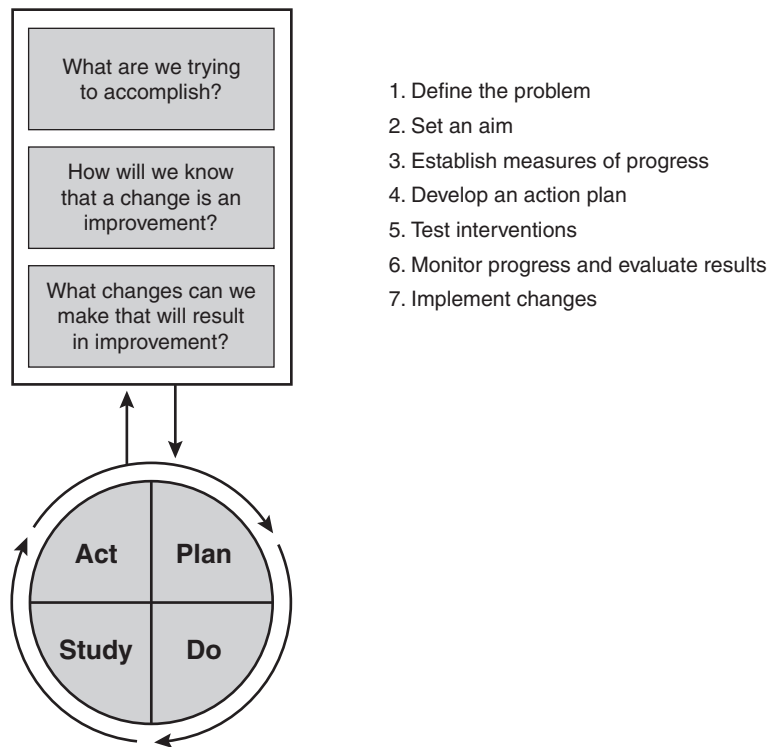
ments. Little “qi” can be viewed as a tactical or systems approach to implementing quality and beginning to generate a culture of QI within the organization.⁷

PROCESS IMPROVEMENT IN A
PUBLIC HEALTH DEPARTMENT

The model for improvement⁸ is one of several approaches that can be used in Public Health departments. As shown in Figure 1.2, the model for improvement consists of several components, including: setting an aim statement, developing measures, implementing tests of change, and using the plan-do-study-act (PDSA) cycle.

LITTLE “qi”

Thingstad-Boe, Riley, and Parsons⁹ recently reported an example of using the model for improvement to demonstrate the application of Little “qi” in a Women,



Source: IHI, 1998.

Figure 1.2 MPHQCQI model for improvement.

Infants, and Children (WIC) program of a county Public Health department in Minnesota. The WIC program is an important nutrition program created in 1966 by the federal government to address concerns about the impact of inadequate nutrition during critical periods of fetal infant and child growth and development.¹⁰ The QI project was conducted in the state's third largest county, which has an annual WIC caseload of more than 70,000 clients.

The study was carried out using the model for improvement. Table 1.1 shows how the four components were used: setting the aim in specific terms, establishing measures to indicate whether a change actually would lead to program improvements, developing general ideas for change that could stimulate specific changes leading to improvements, and applying a plan-do-study-act cycle to test and implement changes. After approval from top leadership, a QI team was established, and it collected initial data regarding the clinic's baseline process performance and client satisfaction. The team then created a value stream map to illustrate the current process and used a control chart to analyze current process performance levels. Upon determining that the process was stable but not capable of meeting client's expectations, the team applied statistical process control analysis to re-engineer the process. Follow-up data demonstrated that the reengineered process led to improved performance, so the team locked in the new process based on these data.

The absence of special cause (a specific factor that causes variation in process performance) in lobby wait time in the process analysis phase of the study led the improvement team to focus on process reengineering rather than process improvement (*process improvement* is removing the special cause, while *process reengineering* involves a complete overhaul of a process). The intervention consisted of creating revised floor travel patterns, redeploying personnel, and conducting staff training to achieve client goals. The results of the Little "qi" project are shown in the X-bar chart in Figure 1.3 (the moving range chart is not shown). The control chart shows the initial process performance for 10 consecutive clinic days at the beginning of the study and 14 consecutive days after the process was

Table 1.1 Dakota County Public Health Department WIC program process improvement project overview.

Aim statement	Improve client satisfaction in county health department WIC Program in six months
Measures of change	Decrease lobby wait time by 20%; increase client satisfaction scale by 25%
Change concept	Reengineer the WIC service process
PDSA cycle	Analyze process, create value stream map, eliminate non-value-added steps, pilot new process, document process shift, and lock in change