Second Edition

Clinical Pain Management

A Practical Guide

Edited by
Mary E. Lynch
Kenneth D. Craig
Philip H. Peng

WILEY Blackwell

Clinical Pain Management

Clinical Pain Management: A Practical Guide

Second Edition

EDITED BY

Mary E. Lynch, MD, FRCPC
Founder (Pain Medicine)
Professor
Department of Anesthesia, Pain Management and Perioperative Medicine
Department of Psychiatry
Department of Pharmacology
Dalhousie University
Halifax, Nova Scotia, Canada

Kenneth D. Craig, OC, PhD, FCAHS
Professor Emeritus
Department of Psychology
University of British Columbia
Vancouver, Canada

Philip W. Peng, MBBS, FRCPC
Founder (Pain Medicine)
Professor
Department of Anesthesiology and Pain Medicine
University Health Network and Sinai Health System
University of Toronto
Toronto, Canada

WILEY Blackwell

This second edition first published 2022
© 2022 John Wiley & Sons Ltd

Edition History
John Wiley & Sons Ltd (1e, 2011)

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by law. Advice on how to obtain permission to reuse material from this title is available at http://www.wiley.com/go/permissions.

The right of Mary E. Lynch, Kenneth D. Craig, and Philip W. Peng to be identified as the authors of the editorial material in this work has been asserted in accordance with law.

Registered Offices
John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Office
9600 Garsington Road, Oxford, OX4 2DQ, UK

For details of our global editorial offices, customer services, and more information about Wiley products visit us at www.wiley.com.

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Limit of Liability/Disclaimer of Warranty
The contents of this work are intended to further general scientific research, understanding, and discussion only and are not intended and should not be relied upon as recommending or promoting scientific method, diagnosis, or treatment by physicians for any particular patient. In view of ongoing research, equipment modifications, changes in governmental regulations, and the constant flow of information relating to the use of medicines, equipment, and devices, the reader is urged to review and evaluate the information provided in the package insert or instructions for each medicine, equipment, or device for, among other things, any changes in the instructions or indication of usage and for added warnings and precautions. While the publisher and authors have used their best efforts in preparing this work, they make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives, written sales materials or promotional statements for this work. The fact that an organization, website, or product is referred to in this work as a citation and/or potential source of further information does not mean that the publisher and authors endorse the information or services the organization, website, or product may provide or recommendations it may make. This work is sold with the understanding that the publisher is not engaged in rendering professional services. The advice and strategies contained herein may not be suitable for your situation. You should consult with a specialist where appropriate. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

Library of Congress Cataloging-in-Publication Data

Names: Lynch, Mary E., editor. | Craig, Kenneth D., 1937– editor. | Peng, Philip W. H., editor.
Title: Clinical pain management : a practical guide / edited by Mary E. Lynch, Kenneth D. Craig, Philip W. Peng.
Other titles: Clinical pain management (Lynch)
Description: Second edition. | Hoboken, NJ : Wiley-Blackwell, 2022. | Includes bibliographical references and index.
Identifiers: LCCN 2021048524 (print) | LCCN 2021048525 (ebook) | ISBN 9781119701156 (paperback) | ISBN 9781119701187 (adobe pdf) | ISBN 9781119701163 (epub)
Subjects: MESH: Pain Management | Chronic Pain–therapy | Palliative Care–methods
Classification: LCC RB127.5.C48 (print) | LCC RB127.5.C48 (ebook) | NLM WL 704.6 | DDC 616/.0472–dc23/eng/20211015
LC record available at https://lccn.loc.gov/2021048524
LC ebook record available at https://lccn.loc.gov/2021048525

Cover Design: Wiley
Cover Image: © Dan Robitaille: Living with chronic pain has shaped my perception in many ways; positive, negative. Art is something that's allowed me to translate that perception, and use it to create perspective rather than distance.

Set in 8/12pt ITCStoneSerifStd by Straive, Pondicherry, India

This book is dedicated to our patients, their families
and all people suffering with pain.

Contents

Part 1 Basic Understanding of Pain Medicine

Part 2 Assessment of Pain

Part 3 Management

Part 4 Pharmacotherapy

Part 5 Interventional

Part 6 Psychological

Part 7 Complementary Therapies

Part 8 Specific Clinical States

Part 9 Special Populations

List of Contributors

Oli Abate Fulas MD PhD, Department of Anesthesia and Alan Edwards Centre for Research on Pain, McGill University, Montréal, Québec, Canada

Caroline Arbour PhD RN, Associate Professor, Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada; Faculty of Nursing, Université de Montréal, Québec, Canada

Lene Baad-Hansen DDS PhD, Professor, Section for Orofacial Pain and Jaw Function, Aarhus University, Aarhus, Denmark; Scandinavian Center for Orofacial Neurosciences (SCON), Aarhus University, Aarhus, Denmark

Misha Bačkonja MD, Department of Anaesthesiology and Pain Medicine, University of Washington Medical School, Seattle, Washington, USA

Louis de Beaumont PhD Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada; Faculty of Medicine, Université de Montréal, Québec, Canada

Inna Belfer MD, PhD, National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, Maryland, USA

Fabrizio Benedetti MD, Professor of Physiology and Neuroscience, University of Turin Medical School, Neuroscience Department, Turin, Italy; Medicine and Physiology of Hypoxia, Plateau Rosà, Switzerland

Klaus Bielefeldt MD PhD, George E. Wahlen Veterans Administration (VA) Medical Center, Salt Lake City, Utah, USA; Department of Medicine, University of Utah, Salt Lake City, Utah, USA

Kathryn A. Birnie PhD, Postdoctoral Fellow, Department of Anesthesiology, Perioperative, and Pain Medicine, University of Calgary, Calgary, Canada; Alberta Children's Hospital Research Institute, Calgary, Alberta, Canada

Laura Bockus-Thorne RD, BSN, Research Assistant, Department of Applied Human Nutrition, Mount Saint Vincent University, Halifax, Nova Scotia, Canada

Eduardo Bruera MD, Professor and Chair, Department of Palliative Care and Rehabilitation Medicine Unit 1414, University of Texas M.D. Anderson Cancer Center, Houston, Texas, USA

Kim J. Burchiel MD FACS, Professor and Chair, Department of Neurological Surgery, Oregon Health and Science University, Portland, USA

Chantel C. Burkitt PhD, Gillette Children's Specialty Healthcare, St. Paul, Minnesota, USA; Special Education Program, Department of Educational Psychology, University of Minnesota, Minneapolis, Minnesota, USA

Michael Butterfield MSc, MD, FRCPC (Psychiatry and Pain Medicine) Department of Psychiatry, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia, Canada

Malin Carmland Danish Pain Research Center, Aarhus University, Aarhus, Denmark; Department of Neurology, Aarhus University Hospital, Aarhus, Denmark

Eugene J. Carragee MD, Professor and Vice Chairman, Department of Orthopedic Surgery, Stanford University School of Medicine, Redwood City, California, USA

James Chue MD, Fellow in Pain Medicine, Department of Anesthesiology, The Jacobs School of Medicine at the University of Buffalo, Buffalo, New York, USA

Terence J. Coderre PhD, Professor, Department of Anesthesia and Alan Edwards Centre for Research on Pain, McGill University, Montréal, Québec, Canada

Kenneth D. Craig OC, PhD, FCAHS, Department of Psychology, University of British Columbia, Vancouver, Canada

Melissa A. Day PhD, Associate Professor, School of Psychology, The University of Queensland, Brisbane, Australia; Affiliate Associate Professor, Department of Rehabilitation Medicine, University of Washington, Seattle, Washington, USA

Oscar A. de Leon-Casasola MD, Professor of Anesthesiology and Medicine, Senior Vice-Chair, Department of Anesthesiology, The Jacobs School of Medicine at the University at Buffalo, Buffalo, New York, USA; Chief, Division of Pain Medicine, Roswell Park Comprehensive Cancer Institute, Buffalo, New York, USA

Anthony H. Dickenson PhD FmedSci, Professor of Neuropharmacology, Department of Neuroscience, Physiology and Pharmacology, Division of Biosciences, University College, London, United Kingdom

Fernando Exposto DDS PhD, Assistant Professor, Section for Orofacial Pain and Jaw Function, Aarhus University, Aarhus, Denmark; Scandinavian Center for Orofacial Neurosciences (SCON), Aarhus University, Aarhus, Denmark

Cibele Dal Fabbro PhD, Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada

Timothy R. Deer MD, President and CEO, The Spine and Nerve Center of the Virginias, Charleston, West, Virginia, USA

Nanna Brix Finnerup MD PhD, Associate Professor, Danish Pain Research Center, Aarhus University, Aarhus, Denmark; Department of Neurology, Aarhus University Hospital, Aarhus, Denmark

Mary-Ann Fitzcharles MB ChB FRCP(C), Division of Rheumatology, McGill University Health Centre, Montréal, Québec, Canada; Alan Edwards Pain Management Unit, McGill University Health Center, Montréal, Québec, Canada

Elisa Frisaldi PhD, Postdoctoral Fellow, University of Turin Medical School, Neuroscience Department, Turin, Italy

Andrea D. Furlan MD PhD, Associate Professor, KITE, Toronto Rehabilitation Institute, University Health Network, Toronto, Ontario, Canada; Division of Physical Medicine & Rehabilitation, Department of Medicine, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada; Institute for Work & Health, Toronto, Ontario, Canada

Gerald F. Gebhart PhD, Professor Emeritus, Carver College of Medicine, University of Iowa, Iowa City, USA

Ian Gilron PMD MSc FRCPC, Professor, Departments of Anesthesiology & Perioperative Medicine and Biomedical & Molecular Sciences, Queen's University, Kingston, Ontario, Canada

Andrea Glenn PhD candidate, Department of Nutritional Sciences, University of Toronto, Toronto, Ontario, Canada

Douglas L. Gourlay MD, MSC, FRCPC, FASAM, Educational Consultant, Hamilton, Ontario, Canada

Shannan Grant PDt MSc PhD, Assistant Professor, Department of Applied Human Nutrition, Mount Saint Vincent Hospital, Halifax, Nova Scotia, Canada; Departments of Pediatrics and Obstetrics and Gynaecology, IWK Health Centre, Halifax, Nova Scotia, Canada

Katharine N. Gurba MD PhD, Assistant Professor Washington University Pain Center and Department of Anesthesiology, Washington University School of Medicine, St. Louis, Missouri, USA

Thomas Hadjistavropoulos PhD ABPP, Professor, Department of Psychology and Center on Aging and Health, University of Regina, Regina, Saskatchewan, Canada

Jonathan M. Hagedorn MD, Assistant Professor of Anesthesiology, Department of Anesthesiology and Perioperative Medicine, Division of Pain Medicine, Mayo Clinic, Rochester, Minnesota, USA

Simon Haroutounian PhD MSc Pharm, Chief of Division of Clinical and Translational Research, Chief of Clinical Pain Research, Associate Professor Washington University Pain Center and Department of Anesthesiology, Washington University School of Medicine, St. Louis, USA

Winfried Häuser MD, Associate Professor, Department Internal Medicine I and Interdisciplinary Center of Pain Medicine, Klinikum Saarbrücken, Germany; Department of Psychosomatic Medicine and Psychotherapy, Technische Universität München, Germany

Howard A. Heit MD, FACP, FASAM, Private Practice, Reston, Virginia, USA

Alberto Herrero Babiloni DDS, Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada; Division of Experimental Medicine, McGill University, Montréal, Québec, Canada

Marshall T. Holland MD, Assistant Professor, Department of Neurosurgery, Heersink School of Medicine, The University of Alabama at Birmingham, Birmingham, AL

Petra Hroch Tiessen MD, Department of Anesthesiology and Pain Medicine, University of Toronto, Toronto, Ontario, Canada

Robert N. Jamison PhD, Associate Professor, Departments of Anesthesia and Psychiatry, Brigham and Women's Hospital, Harvard Medical School, Chestnut Hill, Massachusetts, USA

David Jenkins MD PhD DSc, Professor, Associate Professor, Department of Nutritional Sciences, University of Toronto, Toronto, Ontario, Canada

Troels Staehelin Jensen MD PhD, Professor, Danish Pain Research Center, Aarhus University, Aarhus, Denmark; Department of Neurology, Aarhus University Hospital, Aarhus, Denmark

Joel Katz PhD, Department of Psychology, York University, Toronto, Canada; Department of Anesthesia and Pain Management, Toronto General Hospital, Toronto, Canada; Department of Anesthesia, University of Toronto, Toronto, Canada

Meaghan Kavanagh PhD candidate, Department of Nutritional Sciences, University of Toronto, Toronto, Ontario, Canada

Beatrice P. de Koninck Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada

Jacqueline Tu Anh Thu Lam, Consultant, Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada; Faculty of Medicine, Université de Montréal, Québec, Canada

Helene Langevin MD, National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, Maryland, USA

Gilles J. Lavigne DMD FRCD PhD, Professor and Dean, Faculty of Dental Medicine, Université de Montréal, Québec, Canada; Center for Advanced Research in Sleep Medicine & Trauma Unit, Research Center, Centre Integre Sante et Services Sociaux du Nord Ile de Montreal (CIUSSS du NIM), Montréal, Québec, Canada

Mary E. Lynch , MD, FRCPC, Founder (Pain Medicine) Department of Anesthesia, Pain Management and Perioperative Medicine, Department of Psychiatry, Department of Pharmacology, Dalhousie University, Halifax, Nova Scotia, Canada

Una E. Makris MD, Associate Professor, University of Texas Southwestern Medical Center, Dallas, Texas, USA

Marc O. Martel Assistant Professor, Division of Experimental Medicine, McGill University, Montréal, Québec, Canada; Faculty of Dentistry & Department of Anesthesia, McGill University, Montréal, Québec, Canada

Anjali Martinez MD, Assistant Professor, Obstetrics and Gynecology, George Washington University, Washington, DC, USA

Benjamin Matson MD, Assistant Professor , Department of Anesthesiology, The Jacobs School of Medicine at the University of Buffalo, Buffalo, New York, USA; Division of Pain Medicine, Roswell Park Comprehensive Cancer Institute, Buffalo, New York

Michael McGillion RN PhD, Assistant Professor, School of Nursing, McMaster University, Hamilton, Ontario, Canada

Lauren McNeill RD MPH, Tasting to Thrive, Toronto, Ontario, Canada

Vesanto Melina RD MS, Nutrispeak, Vancouver, British Columbia, Canada

Ronald Melzack Professor Emeritus, Department of Psychology, McGill University, Montréal, Québec, Canada

Alyssa Merbler MA, Department of Educational Psychology, University of Minnesota, Minneapolis, Minnesota, USA

Sarah E.E. Mills PhD, Academic Clinical Fellow, University of Dundee, Scotland, UK

Amir Minerbi MD PhD, Institute for Pain Medicine, Rambam Health Campus, Haifa, Israel

Laura Murphy PharmD, Assistant Professor, KITE, Toronto Rehabilitation Institute, University Health Network, Toronto, Ontario, Canada; Department of Pharmacy, University Health Network, Toronto, Ontario, Canada; Leslie Dan Faculty of Pharmacy, University of Toronto, Toronto, Ontario, Canada

Abagail Raiter BA, Gillette Children's Specialty Healthcare, Saint Paul, Minnesota, USA

Tim F. Oberlander MD FRCPC, Professor, Department of Pediatrics, School of Population and Public Health, Faculty of Medicine, University of British Columbia, University of British Columbia, Vancouver, British Columbia, Canada; Complex Pain Service, British Columbia Children's Hospital, Vancouver, British Columbia, Canada

M. Gabrielle Pagé PhD, Principal Scientist, Centre de recherche du Centre hospitalier de l'Université de Montréal (CRCHUM), Montréal, Canada; Département d'anesthésiologie et de medicine de la douleur, Faculté de médecine, et Département de Psychologie, Faculté des arts et des sciences, Université de Montréal, Montréal, Canada

Tonya M. Palermo PhD, Associate Professor, Department of Anesthesiology and Pain Medicine, Pediatrics and Psychiatry, University of Washington School of Medicine, Seattle Children's Hospital and Research Institute, Seattle, Washington, USA

Catherine Paré BA, Department of Psychology, McGill University, Montréal, Québec, Canada

Kushang V. Patel PhD, MPH, Research Associate Professor, Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, USA

Philip W. Peng MBBS, FRCPC, Founder (Pain Medicine) Professor, Department of Anesthesiology and Pain Medicine, University Health Network and Sinai Health System, University of Toronto, Toronto, Canada

Tali Sahar Pain Relief Unit, Department of Anesthesia, Hadassah Medical Center, Jerusalem, Israel; Department of Family Medicine, Hebrew University of Jerusaleum, Jerusalem, Israel

Barry J. Sessle Professor, Faculties of Dentistry and Medicine, University of Toronto, Toronto, Ontario, Canada

Aziz Shaibani MD, Clinical Professor, Nerve and Muscle Center of Texas, Baylor College of Medicine, Houston, Texas, USA

Christine Short MD FRCPC, Associate Professor, Dalhousie University, Department of Medicine, Division of Physical Medicine and Rehabilitation; Department of Surgery, Division of Neurosurgery, Queen Elizabeth II Health Sciences Centre, Halifax, Nova Scotia, Canada

Stephen D. Silberstein MD, Jefferson Headache Center, Thomas Jefferson University, Philadelphia, Pennsylvania, United States

Andrew J. Smith MDCM, Interprofessional Pain and Addiction Recovery Clinic, Centre for Addiction and Mental Health, Toronto Academic Pain Medicine Institute, Toronto, Ontario, Canada

Blair H. Smith MD MEd FRCGP FRCP Edin, Clinical Professor, University of Dundee, Scotland, UK

Pam Squire MD CCFP CPE, Assistant Clinical Professor, University of British Columbia, Vancouver, British Columbia, Canada

Michael Stanton-Hicks MBBS DrMed FRCA ABPM FIPP, Pain Management Department, Centre for Neurological Restoration; Children's Hospital CCF Shaker Pediatric Pain Rehabilitation Program, Cleveland Clinic, Cleveland, Ohio, USA

Jennifer N. Stinson RN-EC PhD CPNP, Scientist, Child Health Evaluation Sciences, The Hospital for Sick Children, Toronto, Ontario, Canada; Department of Anesthesia and Pain Medicine, The Hospital for Sick Children, Toronto, Ontario, Canada; Lawrence S. Bloomberg, Faculty of Nursing, University of Toronto, Ontario, Canada

Agnes Stogicza MD FIPP CIPS, Department of Anesthesiology and Pain Medicine, Saint Magdolna Private Hospital, Budapest, Hungary

Michael J.L. Sullivan PhD, Professor, Department of Psychology, McGill University, Montréal, Québec, Canada

Peter Svensson Professor and Chairman, Section for Orofacial Pain and Jaw Function, Aarhus University, Aarhus, Denmark; Scandinavian Center for Orofacial Neurosciences (SCON), Aarhus University, Aarhus, Denmark; Faculty of Odontology, Malmø University, Malmø, Sweden

Frank J. Symons PhD, Distinguished McKnight University Professor, Special Education Program, Department of Educational Psychology, Center for Neurobehavioral Development, University of Minnesota, Minneapolis, Minnesota, USA

David M. Walton PhD, Assistant Professor, School of Physical Therapy, Western University, London, Ontario, Canada

Beverly E. Thorn PhD, Professor Emerita, Department of Psychology, The University of Alabama, Tuscaloosa, Alabama, USA

Rolf-Detlef Treede MD, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany

Dennis C. Turk PhD, Department of Anesthesiology & Pain Medicine, University of Washington, Seattle, USA

Vishal P. Varshney MD FRCPC (Anesthesiology) FRCPC (Pain Medicine), Department of Anesthesia, Providence Healthcare, Vancouver, British Columbia, Canada; Department of Anesthesiology, Pharmacology and Therapeutics, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia, Canada

Judith Versloot PhD, Institute for Health Policy, Management and Evaluation, University of Toronto, Toronto, Canada

Ashwin Viswanathan MD, Professor, Department of Neurosurgery, Baylor College of Medicine, Houston, Texas, USA

Aliza Weinrib PhD, Clinical Psychologist, Department of Anesthesia and Pain Management, Toronto General Hospital, Toronto, Canada

Timothy H. Wideman PhD, Associate Professor, School of Physical and Occupational Therapy, McGill University, Montréal, Canada

Sandra M. LeFort Faculty of Nursing, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada

Karen Webber Faculty of Nursing, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada

Chitra Lalloo Child Health Evaluation Sciences, The Hospital for Sick Children, Toronto, Ontario, Canada

Wen Chen National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, Maryland, USA

Emmeline Edwards National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, Maryland, USA

David Shurtleff National Center for Complementary and Integrative Health (NCCIH), National Institutes of Health (NIH), Bethesda, Maryland, USA

Maija Haanpää Department of Neurosurgery, Helsinki University Hospital, Helsinski, Finland

Amy Swan Department of Palliative Care and Rehabilitation Medicine Unit 1414, University of Texas M.D. Anderson Cancer Center, Houston, Texas, USA

See Wan Tham Department of Anesthesiology and Pain Medicine, University of Washington School of Medicine, Seattle Children's Hospital and Research Institute, Seattle, Washington, USA

Jeffery L. Koh Department of Anesthesiology and Peri-Operative Medicine, Oregon Health and Science University, Portland, Oregon, USA

Muhammad Saad Yousuf, Center for Advanced Pain Studies, School of Behavioral and Brain Sciences, University of Texas at Dallas, Dallas, Texas, USA

Allan I. Basbaum, Department of Anatomy, University of California at San Francisco. San Francisco, California, USA

Theodore J. Price, Center for Advanced Pain Studies, School of Behavioral and Brain Sciences, University of Texas at Dallas, Dallas, Texas, USA

Hance Clarke, Department of Anesthesia and Pain Management, Toronto General Hospital, Toronto, Canada; Department of Anesthesia and Pain Medicine, University of Toronto, Toronto, Canada

Foreword to First Edition

This excellent guide to clinical pain management covers every important facet of the field of pain. It describes recent advances in diagnosing and managing clinical pain states and presents procedures and strategies to combat a wide range of chronic pains. Unfortunately, many people suffer various forms of pain even though we have the knowledge to help them, but our educational systems have failed. This book is a valuable contribution to the field of pain by providing up - to - date knowledge that will stimulate a new generation of health professionals who are dedicated to abolishing pain.

Despite the impressive advances and optimistic outlook, many chronic pains remain intractable. Some people who suffer chronic headaches, backaches, fibromyalgia, pelvic pain and other forms of chronic pain are helped by several therapies that are now available, but most are not. For example, we have excellent new drugs for some kinds of neuropathic pains, but not for all. The continued suffering by millions of people indicates we still have a long way to go.

The field of pain has recently undergone a major revolution. Historically, pain has been simply a sensation produced by injury or disease. We now possess a much broader concept of pain that includes the emotional, cognitive and sensory dimensions of pain experience, as well as an impressive array of new approaches to pain management. Chronic pain is now a major challenge to medicine, psychology, and all the other health sciences and professions. Every aspect of life, from birth to dying, has characteristic pain problems. Genetics, until recently, was rarely considered relevant to understanding pain, yet sophisticated laboratory studies and clinical observations have established genetic predispositions related to pain as an essential component of the field. The study of pain therefore now incorporates research in epidemiology and medical genetics.

Clinical Pain Management: A Practical Guide highlights a mission for all of us: to provide relief of all pain, pain in children and the elderly, and for any kind of severe pain that can be helped by sensible administration of drugs and other pain therapies. We must also teach patients to communicate about their pain, and inform them that they have a right to freedom from pain. If we can pursue these goals together –as members of the full range of scientific and health professions –we can hope to meet the goal we all strive for: to help our fellow human beings who suffer pain.

Ronald Melzack
McGill University Montréal
Québec, Canada
2010

The editors would like to thank Ms. Sara Whynot for considerable assistance with every phase of the manuscript.

Foreword to Second Edition

In his Foreward to the first edition of this book, *Clinical Pain Management: A Practical Guide*, Ron Melzack emphasized that pain has many dimensions and that, despite advances in pain management and understanding, chronic pain in particular continues to be a major health concern. This, unfortunately, is still the case and many challenging problems still exist in managing and understanding chronic pain.

The Introductory chapter of this second edition of the book by its three editors, Drs. Lynch, Craig and Peng, draws attention to the challenges that exist for people living with chronic pain conditions, for the clinician trying to provide effective management of the patient's pain, for the scientist seeking to unravel the mechanisms underlying pain, and for society as a whole. These challenges stem from the complexity and multidimensional nature of chronic pain, the limited understanding of the processes underlying most chronic pain conditions, and the variety of diagnostic and therapeutic approaches advocated for pain management, some of which have little to no solid evidence base to support their use. Furthermore, chronic pain is in epidemic proportions in most countries, with a prevalence of around 20% or even higher, and the problem is compounded by problems with access to care and socioeconomic factors. Additionally, like many other chronic health disorders or diseases, the majority of chronic pain conditions are most common in the elderly. Therefore, unless effective steps are taken soon to address this crisis, their prevalence and associated problems will continue to grow over the coming decades because demographic predictions indicate that the elderly will comprise a growing proportion of the population in most countries.

Chronic pain can indeed be considered a "silent" epidemic because most people, including policymakers, have been unaware of this crisis and its ramifications. As a consequence, chronic pain has remained neglected to a large extent, despite clinical and scientific publications and pain-related societies and organizations pointing out its prevalence, the continuing difficulties and inequities with access to timely and appropriate care for many patients living with pain, and the enormous socioeconomic burden of chronic pain. The societal costs of chronic pain are reflected in patients' suffering and reduced quality of life, increased rates of depression and suicide, disrupted relationships with family and friends, and reduced employment or other responsibilities. The economic burden is also huge, amounting to many billions of dollars each year. Unfortunately, it has taken media attention in recent years to the misuse of drugs used for pain management, most notably opioids, to raise public awareness and to gain the attention of policymakers not only to the drug misuse, but also to the pain crisis itself and the socioeconomic toll of chronic pain in particular. It is hoped that this increased attention will translate into a comprehensive series of approaches targeting the many aspects of the pain crisis and result in a better understanding of pain and improved access and healthcare management for patients suffering from acute or chronic pain.

These approaches to address the pain crises have to include an increased emphasis on enhanced education of healthcare clinicians about pain because it has been well documented that most clinicians have only a limited knowledge base and understanding about pain and its management. This book offers the opportunity for clinicians to improve their knowledge about pain and apply that knowledge for the benefit of their patients. The three editors of this book have ensured that its second edition has built upon the first edition which was distinctive in its integration of the clinical, psychosocial and basic science topics related to the different types of pain and their management. As a result of the up-to-date information outlined in the 44 chapters of its second edition, this book provides a valuable resource about pain from a variety of perspectives. It will be particularly valuable not only for clinicians to help them assist their patients experiencing an acute pain or suffering from chronic pain, but also for scientists who wish to gain more insights into these pain conditions and their underlying processes.

Barry J. Sessle
Faculties of Dentistry and Medicine
University of Toronto
Toronto, Ontario, Canada
2021

Part 1

Basic Understanding of Pain Medicine

Chapter 1

The challenge of pain: a multidimensional phenomenon

Mary E. Lynch[1], **Kenneth D. Craig**[2], **& Philip W. Peng**[3]

[1]Department of Anesthesia, Pain Management and Perioperative Medicine, Department of Psychiatry, Department of Pharmacology, Dalhousie University, Halifax, Nova Scotia, Canada
[2]Department of Psychology, University of British Columbia, Vancouver, Canada
[3]Professor, Department of Anesthesiology and Pain Medicine, University Health Network and Sinai Health System, University of Toronto, Toronto, Canada

Pain is one of the most challenging problems in medicine and biology. It is a challenge to the sufferer who must often learn to live with pain for which no therapy has been found. It is a challenge to the physician or other health professional who seeks every possible means to help the suffering patient. It is a challenge to the scientist who tries to understand the biological mechanisms that can cause such terrible suffering. It is also a challenge to society, which must find the medical, scientific and financial resources to relieve or prevent pain and suffering as much as possible. (Melzack & Wall *The Challenge of Pain*, 1982)

Introduction

Last year, the International Association for the Study of Pain (IASP) introduced a revised definition of pain stating that pain is "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage [1]. Pain is divided into two broad categories: acute pain, which is associated with ongoing tissue damage, and chronic pain, which is generally taken to be pain that has persisted for longer periods of time. Many injuries and diseases are capable of instigating acute pain with sources including mechanical tissue damage, inflammation and tissue ischemia. Similarly, chronic pain can be associated with other chronic diseases, terminal illness, or may persist after illness or injury with uncertain biological mechanisms. The point at which chronic pain can be diagnosed may vary with the injury or condition that initiated it; however, for most conditions, pain persisting beyond 3 months is reasonably described as a chronic pain condition. In some cases, one can identify a persistent pain condition much earlier, for example, in the case of post-herpetic neuralgia subsequent to an attack of shingles, if pain persists beyond rash healing it indicates a persistent or chronic pain condition is present.

Exponential growth in pain research in the past five decades has increased our understanding regarding underlying mechanisms of the causes of chronic pain, now understood to involve a neural response to tissue injury. In other words, peripheral and central events related to disease or injury can trigger long-lasting changes in peripheral nerves, spinal cord and brain such that the system becomes sensitized and capable of spontaneous activity or of

Clinical Pain Management: A Practical Guide, Second Edition. Edited by Mary E. Lynch, Kenneth D. Craig, and Philip W. Peng.

responding to non-noxious stimuli as if painful. By such means, pain can persist beyond the point where normal healing takes place and is often associated with abnormal sensory findings. In consequence, the scientific advances are providing a biological basis for understanding the experience and disabling impact of persistent pain. Table 1.1 presents definitions of pain terms relevant to chronic pain.

Traditionally, clinicians have conceptualized chronic pain as a symptom of disease or injury. Treatment was focused on addressing the underlying cause with the expectation that the pain would then resolve. It was thought that the pain itself could not kill. We now know that the opposite is true. Pain persists beyond injury and there is mounting evidence that “pain can kill.” In addition to contributing to ongoing suffering, disability and diminished life quality, it has been demonstrated that uncontrolled pain compromises immune function, promotes tumor growth and can compromise healing with an increase in morbidity and mortality following surgery [2, 3], as well as a decrease in the quality of recovery [4]. Clinical studies suggest that prolonged untreated pain suffered early in life may have long-lasting effects on the individual patterns of stress hormone responses. These effects may extend to persistent changes in nociceptive processing with implications for pain experienced later in life [5, 6]. Chronic pain is associated with the poorest health-related quality of life when compared with other chronic diseases such as emphysema, heart failure or depression [7] and has been found to double the risk of death by suicide compared to controls [8] and suicide rates remain higher even when controlling for mental illness [9]. Often chronic pain causes more suffering and disability than the injury or illness that caused it in the first place [10]. The condition has major implications not only for those directly suffering, but also family and loved ones become enmeshed in the suffering person’s challenges, the work place suffers through loss of productive employees, the community is deprived of active citizens and the economic costs of caring for those suffering from chronic pain are dramatic.

Table 1.1 Definitions of pain terms.

Allodynia	Pain due to a stimulus that does not normally provoke pain
Anesthesia dolorosa	Pain in a region that is completely numb to touch
Dysesthesia	An unpleasant abnormal sensation, whether spontaneous or evoked
Hyperalgesia	An increased response to a stimulus that is normally painful
Hyperpathia	A painful syndrome characterized by an abnormally painful reaction to a stimulus, especially a repetitive stimulus as well as an increased threshold
Neuropathic	Pain initiated or caused by a primary pain lesion or dysfunction in the nervous system
Nociceptor	A receptor preferentially sensitive to a noxious stimulus or to a stimulus that would become noxious if prolonged
Paresthesia	An abnormal sensation, whether spontaneous or evoked (use dysesthesia when the abnormal sensation is unpleasant)

Source: Based on Merskey H, Bogduk N, eds. (1994) *Classification of Chronic Pain, Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms*, 2nd edn. Task Force on Taxonomy, IASP Press, Seattle.

Chronic pain is an escalating public health problem which remains neglected. Alarming figures demonstrate that more than 50% of patients still suffer severe intolerable pain after surgery and trauma [11–13]. Inadequately treated acute pain puts people at higher risk of developing chronic pain. For example, intensity of acute postoperative pain correlates with the development of persistent postoperative pain, which is now known to be a major and under-recognized health problem [13]. The prevalence of chronic pain subsequent to surgery has been found in 10–50% of patients following many commonly performed surgical procedures and in 2–10% this pain can be severe [12].

The epidemiology of chronic pain has been examined in high-quality surveys of general populations from several countries which have demonstrated that the prevalence of chronic pain is at least 18–20% [14-16]. These rates will increase with the aging of the population. In addition to the human suffering inflicted by pain there is also a large economic toll. Pain accounts for over 20% of doctor visits and 10% of drug sales and costs developed countries $1 trillion each year [17].

Chronic pain has many characteristics of a disease epidemic that is silent yet growing; hence addressing it is imperative. It must be recognized as a multidimensional phenomenon involving biopsychosocial aspects. Daniel Carr, in *IASP Clinical Updates*, expressed it most succinctly: "The remarkable restorative capacity of the body after common injury . . . is turned upside down (and) hyperalgesia, disuse atrophy, contractures, immobility, fear-avoidance, helplessness, depression, anxiety, catastrophizing, social isolation, and stigmatization are the norm" [18].

Such is the experience and challenge of chronic pain and it is up to current and future generations of clinicians to relieve or prevent pain and suffering as much as possible. The challenges must be confronted at biological, psychological and social levels. Not only is a better understanding needed, but reforms of caregiving systems that address medical, psychological and health service delivery must be undertaken.

References

1 Raja SN, Carr DB, Cohen M, *et al*. (2020) The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. *Pain* **161(9)**:1976–82.

2 Liebeskind, JC. 1991 Pain can kill. *Pain* **44**:3–4.

3 Page GG. Acute pain and immune impairment. *IASP Pain Clinical Updates* **XIII** (March 2005):1–4.

4 Wu CL, Rowlingson AJ, Partin AW, *et al*. (2005) Correlation of postoperative pain to quality of recovery in the immediate postoperative period. *Reg Anesth Pain Med*, 2005. **30**:516–22.

5 Finley, GA, Franck LS, Grunau RE *et al*. (2005) *Why children's pain matters. IASP Pain Clinical Updates* **XIII**(**4**):1–6.

6 Beggs S. (2015) Long term consequences of neonatal injury. *Can J Psychiatry* **60**:176–80.

7 Choiniere M, Dion D, Peng P *et al*. (2010) The Canadian STOP-PAIN Project-Part 1: Who are the patients on the waitlists of multidisciplinary pain treatment facilities? *Can J Anesth* **57**:539–48.

8 Tang N and Crane C. (2006) Suicidality in chronic pain: review of the prevalence, risk factors and psychological links. *Psychol Med* **36**: 575–86.

9 Ratcliffe GE, Enns MW, Beluk S-L, Sareen J. (2008) Chronic pain conditions and suicidal ideation and suicide attempts: An epidemiologic perspective. *Clin J Pain* **24(3)**:204–10.

10 Melzack R and Wall, PD. (1988) *The Challenge of Pain*. Penguin Books, London.

11 Bond M, Breivik H, and Niv D. (2004). Global day against pain, new declaration. http://www.painreliefhumanright.com.

12 Kehlet H, Jensen TS, and Woolf CJ. (2006). Persistent postsurgical pain: risk factors and prevention. *Lancet* **367**:1618–25.

13 Haroutiunian S, Nikolajsen L, Finnerup NB, *et al*. (2013) The neuropathic component in persistent postsurgical pain: A systematic literature review. *Pain* **154**:95–102.

14 Lynch ME, Schopflocher D, Taenzer P, Sinclair C et al. (2009) Research funding for pain in Canada. *Pain Res Manage***14**:113–5.

15 Blyth FM, March LM, Brnabic AJM, *et al*. (2001) Chronic pain in Australia: a prevalence study. *Pain* **89**:127–34.

16 Eriksen JE, Jensen MK, Sjøgren P *et al*. (2003) Epidemiology of chronic non-malignant pain in Denmark. *Pain***106**:221–8.

17 Max MB and Stewart WF. (2008) The molecular epidemiology of pain: A new discipline for drug discovery. *Nat Rev Drug Discov* **7**:647–58.

18 Carr DB. (2009) What Does Pain Hurt? *IASP Pain Clinical Updates* **XVII(3)**:1–6.

Chapter 2

Epidemiology and economics of chronic and recurrent pain

Dennis C. Turk & Kushang V. Patel

Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, Washington, USA

Introduction

Pain is prevalent worldwide and is among the most common symptoms leading patients to consult a physician in the United States (US) [1]. Recurrent and chronic non-cancer pain (CNCP) are not a set of single, cohesive disorders. Instead, recurrent and CNCP are generic classifications that include a wide range of disorders.

Individuals with recurrent pain and CNCP comprise disparate groups, with varying underlying pathophysiology, and widely diverse impacts on quality of life, function and demands on the healthcare provider and society. Thus, CNCP and recurrent pain have not only significant health consequences, but also personal, economic and societal implications. These conditions have both direct costs of health care and indirect costs (e.g., lost paid employment, disability compensation). In this chapter we provide a summary of the prevalence of some of the most common CNCP and recurrent pain disorders and describe their economic impact.

Epidemiology is, "The study of the occurrence and distribution of health-related states or events in specified populations, including the study of the determinants influencing such states, and the application of this knowledge to control the health problems" [2]. It is important to clarify the meaning of epidemiology and key concepts of incidence and prevalence.

Incidence is the number of new cases of a disease developing during a particular time period in a population at risk of developing the disease. Prevalence is the proportion of the at-risk population affected by a condition (i.e. total number of cases of disease present in the population at a specified time divided by the total number of persons in the population at that specified time). In this chapter, we will focus on prevalence of chronic pain in general as well as in specific diagnostic groups.

It is important to acknowledge at the outset that a number of factors will influence the prevalence rates of any chronic pain diagnosis as population estimates for the prevalence of chronic pain vary widely. Some of the variability in prevalence estimates reported in the literature result from the case definition used. In addition, ascertainment methods (telephone interview, in person interviews), wording of questions (e.g., any pain, pain that prevent respondent from daily activities, pain severe enough to induce healthcare seeking), timeframe (e.g. recall bias, differential time intervals such as pain over the last month versus last week, retrospective vs. current), sample (e.g., population-based) and time, place and population sampled (internet vs. in-person) will all influence the survey results.

One particularly important problem in establishing the prevalence of different chronic pain conditions is the inherent subjectivity of pain presents a fundamental impediment to increased

Clinical Pain Management: A Practical Guide, Second Edition. Edited by Mary E. Lynch, Kenneth D. Craig, and Philip W. Peng.

understanding of its mechanisms, control, and the epidemiology. The language used by any two individuals attempting to describe a similar injury and their pain experience often varies markedly. Similarly, clinicians and clinical investigators commonly use multiple terms that at times have idiosyncratic meanings. Needless to say, appropriate communication requires a common language and a classification system that is used in a consistent fashion.

In order to identify target groups, conduct research, prescribe treatment, evaluate treatment efficacy, to develop policy and for decision making, it is essential that some consensually validated criteria are used to distinguish groups of individuals who share a common set of relevant attributes. The primary purpose of such a classification is to describe the relationships of constituent members based on their equivalence along a set of basic dimensions that represent the structure of a particular domain. Infinite classification systems are possible, depending on the rationale about common factors and the variables believed to discriminate among individuals. The majority of the current taxonomies of pain are "expert-based" classifications.

Expert-Based Classification of Pain

Classifications of disease are usually based on a preconceived combination of characteristics (e.g., symptoms, signs, results of diagnostic tests), with no single characteristic being both necessary and sufficient for every member of the category, yet the group as a whole possesses a certain unity [3]. Most classification systems used in pain medicine (e.g., ICD [4], classification and diagnostic criteria for headache disorders, cranial neuralgias, and facial pain [5], IASP Classification of Chronic Pain [6], CRPS [7], whiplash-associated disorders [8], Research Diagnostic Criteria [RDC] for Temporomandibular Disorders in dentistry [9,10] and the Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks [ACTTION]-American Pain Society Pain Taxonomy [AAPT] [11] and ACTTION-American Pain Society-American Academy of Pain Medicine [AAPM] Pain Taxonomy [AAAPT][12]) are based on the consensus reached by a group of "experts". In this sense, they reflect the inclusion or elimination of certain diagnostic features depending on agreement.

The original IASP Classification of Chronic Pain included 5 axes [i.e. (1) body region; (2) system whose abnormal functioning that might produce the pain; (3) temporal characteristics of pain and pattern of occurrence; (4) onset and intensity of pain; and (5) presumed etiology] and each diagnosis resulted in a unique code number. Thus, this approach moved beyond the location of symptoms and system involved.

Recently, IASP proposed a classification of chronic pain for inclusion in the ICD-11 [4]. The classification includes seven categories (i.e. "primary", cancer, postsurgical/posttraumatic, neuropathic, headache and orofacial, visceral and musculoskeletal). The primary category is somewhat of a mixed collection of pain disorders that cannot be explained by other chronic pain conditions and includes back pain that is neither identified as musculoskeletal nor neuropathic, chronic widespread pain, fibromyalgia (FM) or irritable bowel syndrome. The primary category is consistent with the lumping of this set of disorders in the category of The American Academy of Pain Medicine's (AAPM's) diagnosis of maldynia and central sensitivity disorders advocated by Clauw [13] and Yunus [14] among others. There may be some concern that this poorly defined category may imply the discredited psychogenic classification; that is, an artificial dichotomy where either the condition has a physical (i.e. somatogenic) basis or the absence is "primary" (i.e. psychogenic).

Recently, a consortium composed of Analgesic Clinical Trials Translations, Innovations, Opportunities, and Networks (ACTTION) (a public-private partnership support by the US Food and Drug Administration) partnered with the American Pain Society to create a chronic pain taxonomy – ACTTION American Pain Society Pain Taxonomy (AAPT) [11] and with the American Academy of Pain Medicine [12] to create an acute pain taxonomy – ACTTION, American Pain Society, and American Academy of Pain Medicine Pain taxonomy (AAAPT). AAPT and AAAPT are evidence-based pain taxonomies in which a multidimensional diagnostic framework has been applied to the most prevalent and important chronic and acute pain conditions. A major impetus for the AAPT/AAAPT initiative derived from observing the transformative impact of evidence-based diagnostic classifications that have been published by different medical specialties.

AAPT categorizes chronic pain conditions by organ system and anatomic structure, distinguishing (1) peripheral and central neuropathic pain, (2) musculoskeletal pain, (3) spine pain, (4) orofacial and head pain and (6) abdominal/pelvic/urogenital pain. Because certain types of chronic pain cannot be included in one of these groups, an additional category for disease-related pain not classified elsewhere includes pain associated with cancer and pain associated with sickle cell disease (pain associated with Lyme disease and with leprosy, among other conditions, would also be included in this group). It is important to emphasize that all types of headache were intentionally excluded from AAPT because the International Classification of Headache Disorders provides systematic, valid and widely used diagnostic criteria for these conditions [5].

The AAPT multidimensional framework comprises five dimensions that can be applied to *all* chronic pain conditions. This can be contrasted with the new IASP taxonomy in which psychosocial factors are "optional specifiers" for each diagnosis beyond the classification of "chronic primary pain"; psychosocial factors are given a prominent role as are interference with activities and participation in social roles (somewhat of a departure from the original IASP taxonomy where psychosocial factors are a significant consideration only for one diagnostic classification; namely, chronic primary pain) (see also [11]). Other than prioritizing core diagnostic criteria, which is the first AAPT dimension, the order of the dimensions does not reflect their importance. Indeed, as noted earlier, it is anticipated that AAPT diagnostic criteria will ultimately be based on the mechanisms of the specific chronic pain conditions, whereas in the current version of the taxonomy, these mechanisms constitute the final dimension.

Like the IASP classification, the AAPT also includes seven but somewhat different categories of chronic pain (i.e. peripheral nervous systems; central nervous system; spine; musculoskeletal; orofacial and head; visceral, pelvic, and urogenital; other [e.g., cancer, sickle cell]). The AAPT classification incorporates five dimensions for each condition within the seven categories (core diagnostic criteria [symptoms, signs, and diagnostic findings required for the diagnosis]; common features [including pain characteristics, non-pain features, lifespan], common medical and psychiatric comorbidities; neurobiological, psychosocial and functional consequences; and putative neurobiological and psychosocial mechanism, risk factors, and protective factors. Although the AAPT integrates important components of the classification of chronic pain conditions, there are no epidemiological data, thus far, that have been reported using this classification.

In this chapter, we will use a hybrid approach to classification, as the available epidemiological data tend to follow classification by body location (e.g., back pain, headache, pelvic pain, temporomandibular disorders (TMDs), irritable bowel syndrome (IBS), wide-spread) and etiology (i.e. osteoarthritis (OA), neuropathic whiplash-associated disorders). In the future, epidemiological research may advance our understanding of the prevalence of the diverse set of chronic pain disorders by using the more comprehensive IASP and AAPT classification.

Epidemiology of Chronic Noncancer Pain and Recurrent Pain

CNCP, typically assessed as pain that persists for longer than six months, remains a significant public health issue affecting millions of people worldwide [15]. Worldwide the prevalence is estimated to be over 20% of all adults, with 10% newly diagnosed each year [16, 17]. In 2015 the global point prevalence of activity-limiting low back pain (LBP) alone was 7.3% (540 million people) affected at any one point in time [18].

Based on data from the National Health Interview Survey (NHIS) conducted in 2012, a representative national population-based survey conducted annually by personal, home-based interviews by the National Center for Health Statistics, 25.3 million American adults report daily pain and 23.4 million reported having "a lot of pain" [19]. In a subsequent NHIS survey [20], 20.4% (50 million) of the adult US population reported chronic pain (defined as having pain on every day or most days over the past 6 months) and 8% (19.6 million) had "high-impact chronic pain" severe enough to interfere with their lives (i.e. limited life or work activities on most days or every day during the past 6 months).

The presence of high-impact chronic pain was strongly associated with an increased risk of disability after controlling for other chronic health conditions, where disability was more likely in those with chronic pain than in those with stroke or kidney failure, among other conditions [20]. In the US, pain (i.e. LBP, neck pain, other musculoskeletal pain, OA, migraine) accounts for 9.7 million years living with disability in comparison with 8.8 million years living with disability for the 12 leading medical conditions [21]. The high-impact chronic pain population reported more severe pain and more mental health and cognitive impairments than persons with CNCP or recurrent pain without disability and was also more likely to report worsening of health, more difficulty with self-care and greater health care use [22].

CNCP is estimated to account for 16.2% of all adult outpatient visits in 2015, having increased from 11.3% in 2000 [23]. CNCP is a highly common condition and accounts or 57% of health care encounters [24]. Interestingly, for some of the most prevalent pain conditions (e.g. LBP, FM, headache, pelvic pain) there is no clear objective evidence of any underlying physical pathology associated with reported pain in the majority of cases (e.g. [25-27]). One survey conducted in Australia, found that 65% of people had no clear medical diagnosis for their chronic pain and 33% identified no clear precipitant [28].

A secondary analysis of data from the 2016-2017 National Survey of Children's Health [29] indicated that CNCP and recurrent pain are not only problems for adults, but also for children. An estimated 8% of national sample (95% confidence interval [CI]: 7.5%-8.6%) of children (6-17) had chronic pain as rated by parents [30]. Chronic pain was defined by response to the question: "During the past 12 months, has this child had frequent or chronic difficulty with repeated or chronic physical pain, including headaches or other back or body pain?" The NSCH is an annual cross-sectional survey, conducted via in-person interviews of randomly sampled households, selected via a multistage process to represent the entire civilian, noninstitutionalized population of the US. Pediatric prevalence rates of chronic pain subtypes range across studies from 8% to 83% for headaches, 4% to 53% for abdominal pain, 14% to 24% for back pain, 4% to 40% for musculoskeletal pain, 4% to 49% for multiple pains and 5% to 88% for other pains. Several studies report that 5% of youth report experiencing severe pain that interferes with daily function [31,32].

Similar to adults, physical causes for reported pain are often difficult to identify. In only one-fifth of the patients are specific causes or medical diagnoses for their pain condition able to be identified, which further underscores chronic pain (and its related disability) as a medical syndrome unto itself [33].

Persistent pain in youth may continue to adulthood. A retrospective review of the onset of pain in adults seeking treatment in a pain clinic [34] found that 80% of adults with chronic pain reported that their current pain was a continuation of chronic pain they had experienced during childhood. It is important to note, however, that this estimate is based on patients from a tertiary pain clinic and therefore likely overestimates the proportion of adults with chronic pain who had also experienced chronic pain in childhood. Indeed, much of the burden of chronic pain occurs in later life [19, 35]. because of age-associated musculoskeletal conditions, such as OA.

Musculoskeletal pain

Musculoskeletal pain is perhaps the most commonly reported set of CNCP conditions. Based on the 2012 NHIS (n = 34,525) more than 50% of US adults (approximately 125 million) experience one or more musculoskeletal pain disorders [36]. In an earlier epidemiological study that differentiated among musculoskeletal conditions, the NHIS of 2007, reported 29,019,000 (12.8%) had neck pain, 57,070,000 (25.4%) had pain in the lower back and 9,062,000 (4%) had pain in the face or jaw in the 3 months preceding the interview [37].

Among musculoskeletal locations, the most commonly afflicted region is the lower back. Low LBP accounts for 34 million office visits annually by family physicians and primary care interests [38]. LBP is amongst the top six costliest health conditions, and one of the top three most disabling health conditions [39]. In fact, LBP is the highest ranked condition contributing to years lived with disability worldwide according to the most recent Global Burden of Disease Study and is associated with significant societal and individual cost [21,40, 41]. LBP is also the most common of chronic pain conditions reported by adolescents, however, the range of prevalence rates across studies is quite large, namely, 8–44% [42]. Some of the features of epidemiological surveys listed above many account for the variability observed.

Epidemiologic surveys in the US report a prevalence rate of 25% for LBP any time during a 3-month period [43]. Other industrialized nations, with prevalence rates for chronic LBP ranging 13–28% [42] with19% prevalence rate for CLBP during a 12-month period and a lifetime prevalence rate of 29.5% [44].

Rheumatological diagnoses

Osteoarthritis (OA) is a chronic debilitating condition typically observed within three specific areas in order of decreasing frequency; the hand, knee and hip. It is the most common rheumatological diagnosis [45]. As of 2020, there are an estimated 32.5 million adults in the US who have OA [46]. Using the 2013-15 data, Barbour et al. [47] concluded that 23.7 million (43.5%) had arthritis-attributable activity limitation (an age-adjusted increase of approximately 20% in the proportion of adults with arthritis activity limitations since 2002 [p-trend <0.001]) [47]. The prevalence of OA is projected to increase by about 40% in the next 25 years [48] with the number of affected individuals expected to rise to 78 million by 2040 [47].

The prevalence increases of OA steadily with age, affecting 29.9% in men aged 18–64 years, 31.2% in women aged 18–64 years, 55.8% in men aged 65 years and older and 68.7% in women aged 65 years and older [49]. Symptomatic knee OA alone affects approximately 12% of those aged 60 years and older. OA is more prevalent in women than in men, with a prevalence ratio varying between 1.5:1 and 4:1 [50]. In addition to age and sex, the prevalence of OA can vary due to several risk factors such as ethnicity, level of obesity, physical activity levels, bone density and trauma, as well as global factors such as geographical location [50, 52]. Barbour and his colleagues [47] tracked NHIS data from 2002-2014 and that by 2014 prevalence of OA was especially high among Blacks (42.3%) and Hispanics (35.8%).

Although OA is one of the most common diagnoses in general practice in the US [52], there are a number of other pain-related rheumatological disorders. Prevalence estimates for rheumatoid arthritis suggest that 1.3 million adults have this diagnosis. In addition, juvenile arthritis is estimated to affect 294,000 children; spondylarthritides affects 0.6-2.4 million adults; systemic lupus erythematosus affects from 161-322,000 adults, systemic sclerosis affects 49,000 adults; and primary Sjogren's syndrome affects from 0.4 million to 3.1 million adults [48].

Headache

Headache, an almost universal human experience, is one of the most common complaints encountered in medicine and, perhaps for this reason, the preponderance of data on the epidemiology of CNCP and recurrent pain disorders are found for headaches. According to the World Health Organization [53], half to three quarters of adults aged 18–65 years in the world have had headache in the last year and, among those individuals, 30% or more have reported migraine. When considering more chronic headache, the WHO estimated that the prevalence of headaches on 15 or more days every month affects 1.7–4% of the world's adult population. The life-long prevalence of headache is estimated to be 96% [54]. The 2011 NHIS [55] results reveal that 16.6% of US adults 18 or older reported having migraine or other severe headaches in the last 3 months.

Migraine and tension-type headaches are the most common primary headache disorders [56]. The main subtypes are migraine (vascular headache) with and without aura. An aura is a fully reversible set of nervous system symptoms, most often visual or sensory symptoms, that typically develops gradually, recedes, and is then followed by headache accompanied by nausea, vomiting, photophobia and phonophobia. Tension-type headache is a dull, bilateral, mild- to moderate-intensity pressure–pain without striking associated features that may be categorized as infrequent, frequent or chronic and is easily distinguished from migraine.

Migraine is more prevalent in females between the ages 18-44, with the overall age-adjusted 3-month prevalence of migraine in females was 19.1% and in males 9.0%, but varied substantially depending on age [56, 57, 58]. Data suggest that 70% to 80% of migraineurs have a family history. In the US, the impact of migraine appears to be greater in those who work part time or are unemployed, those with low socioeconomic status, and the uninsured [58]. The 2010 Global Burden of Disease Survey reported that migraine was the third most prevalent disorder and the seventh-highest cause of disability worldwide [56].

The National Headache Foundation estimated that more than 37 million American experience recurrent migraines [59]. However less than half of those who experience migraines have received a formal diagnosis from a health care provider [61]. Migraine alone affects 18% of women and 6% of men in the US and has an estimated worldwide prevalence of approximately 10% [60]. Pediatric prevalence rates range from 8% to 83%, depending on the sample, with the excessively high estimates based on clinical samples compared to the lower estimates from population samples [33].

After reviewing data from three national surveys (NAMCS, National Ambulatory Medical Care Survey (2010), the National Hospital Ambulatory Medical Care Survey (NHAMC [2010], and the NHIS (2005-2010), Burch et al. [58] concluded that migraine is a highly prevalent medical condition, affecting approximately 1 out of every 7 Americans annually and these estimates have been relatively stable over a period of eight years. The American Migraine Prevalence and Prevention study subdivided the migraine prevalence data into definite migraine and probably migraine. The authors concluded that the overall prevalence of migraine of 11.7% and probable migraine of 4.5%, for a total of 16.2% [61].

In the US, migraine accounted for 0.5% of all visits and other headache presentations for 0.4% of all ambulatory care visits. Overall, 52.8% of all visits for migraine occurred in primary care settings, 23.2% in specialty outpatient settings and 16.7% in emergency department (EDs) [55].

Although typically not as severe as migraine, tension-type headache is far more common, with a lifetime prevalence in the general population of up to 80%. The global active prevalence of tension-type headache is approximately 40% and migraine 10% [56].

Headache or pain in the head was the fourth leading cause of visits to the ED in 2009-2010, accounting for 3.1% of all ED visits. The 3-month prevalence of migraine or severe headache was 26.1% [58].

Neuropathic Pain

Neuropathic pain arises as a direct consequence of a lesion or disease affecting the somatosensory system. It can be peripheral in origin as a result of nerve injury or disease (e.g. lumbar radiculopathy, postherpetic neuralgia, diabetic or HIV-related neuropathy, or postsurgical pain), or central (e.g. poststroke or spinal cord injury). Other diseases known to cause neuropathic pain that are diagnosed during childhood include erythromelalgia, toxic and metabolic neuropathies, mitochondrial disorders, paroxysmal extreme pain disorder and Fabry disease. Moreover, there has been increasing recognition that some classically “nonneuropathic” painful conditions (e.g. OA, FM) can give rise to symptoms more commonly associated with neuropathic pain.

Neuropathic pain is characterized by unpleasant symptoms, such as shooting or burning pain, numbness, allodynia and other sensations that are very difficult to describe. “Definite” neuropathic pain can relatively rarely be confirmed, particularly in nonspecialist settings [63, 64]. Neuropathic pain conditions have proven to be particularly recalcitrant to treatment [63].

Much less is known about the prevalence of neuropathic pain disorders compared with other chronic and recurrent pain disorders (e.g. headache, back pain, arthritis). General population studies have reported prevalences of 8% and 6.9% in the United Kingdom and France, respectively [65, 66]. It is important to note that cases identified in these studies were described as having “pain of predominantly neuropathic origin” or “pain with neuropathic characteristics,” rather than “neuropathic pain” [64]. A systematic review of population-based prevalence studies considered the true prevalence of pain with neuropathic characteristics to be 7% to 10% [67]. Furthermore, neuropathic pain is estimated to be present in 17% of adult patients with other CNCP disorders, with as many as 30% of adults seen in pain clinics are estimated to experience neuropathic pain [66, 68].

Pelvic Pain

Pelvic pain is characterized by intermittent or constant pain in the lower abdomen or pelvis for at least 6 months that may or may not be associated with menstruation. However, the pain should not be exclusively associate with menstruation, sexual intercourse or pregnancy. The most common diagnoses for pelvic pain are endometriosis, pelvic inflammatory disease and interstitial cystitis [bladder pain syndrome]. Pelvic pain is estimated to account for 20% of general practitioners' referrals to gynecologists [69].

CPP has a considerable impact on the well-being of women and is a cause of significant distress and disability. It has been reported to be associated with poor quality of life, fatigue, depression, anxiety and marital and sexual dysfunction [70]. Patients with CPP tend to spend days in bed due to illness and report poorer physical and mental health compared with the general population [71]. A study showed that 58.4% of women with CPP reported that they use analgesics and/or nonsteroidal anti-inflammatory drugs on a weekly or daily basis without medical prescription [72].

The heterogeneity of the definitions used for chronic pelvic pain (CPP) introduced challenges for comparing results across different studies. The American Congress of Obstetricians and Gynecologists defines CPP as noncyclical pain in the pelvis, severe enough to require medical attention, located below the umbilicus in the region of the anterior abdominal wall, lumbosacral back or buttocks lasting for at least 6 months [73].

A number of studies have reported the prevalence of CPP in women, but most of them have used sampling frames such as hospital patients which are unable to provide accurate estimates of the prevalence of CPP in the general population. The relatively few population-based studies have reported prevalence ranging from 6.4% [74] to 25.4% [75]. The studies were conducted using randomly selected women from representative sampling frames.

In a US population-based study conducted by the Gallup Organization, 14.7% of eligible women (773/5263, 1 in 7) reported pelvic pain in the last 3 months, 61% of women with pelvic pain symptoms did not have a clear diagnosis, 15% of employed women with chronic pelvic pain reported that they lost time from pain work and 45% overall reported reduced work productivity due to their pain [70]. Worldwide estimates suggest that 24% of women experience CPP [76]. All the studies on the epidemiology of pelvic pain have been conducted among women of reproductive age. Older women who are believed to be less susceptible to CPP have been traditionally excluded from prevalence studies. More recent population studies have also confirmed significant reporting of CPP among older women. For example, the highest rate reported in one of study was in women aged 18–25 years (17%), whereas women older than 75 years had a rate of 13% [77].

Temporomandibular Disorders

Temporomandibular disorders (TMD) are disorders of the jaw muscles (i.e. muscle of mastication), temporomandibular joints and the nerves associated with chronic facial pain. Any problem that prevents the complex system of muscles, bones and joints from working together in harmony may result in a TMD. The exact cause of a person's TMD is often difficult to determine. Pain may be due to a combination of factors, such as genetics, muscle hyperfunction, arthritis, jaw injury or hormonal influences. Some people who have jaw pain also tend to clench or grind their teeth (bruxism), although many people habitually clench or grind their teeth and never develop TMD.

TMDs are common, in some studies affecting approximately 25% of adults [78]. Further, TMD is associated with substantial morbidity, affecting quality of life and work productivity. As an example, it is estimated that for every 100 million working adults in the United States, TMD contributes to 17.8 million lost work days annually [79].

Over 2 decades of NHIS surveys (1989 to 2009), the prevalence of self-reported TMD symptoms remained stable, affecting 5% of US adults [80]. Based on a national population-based survey, it is estimated that 11.2-12.4 million Americans have symptoms related to TMDs [81].

IASP Primary classification (also referred to as chronic widespread pain and Central Sensitivity Syndromes (CSS))

Clinical practitioners commonly see patients with pain and other somatic symptoms that they cannot adequately explain based on the degree of damage or inflammation noted in peripheral tissue. If no cause is found, these individuals are often given a