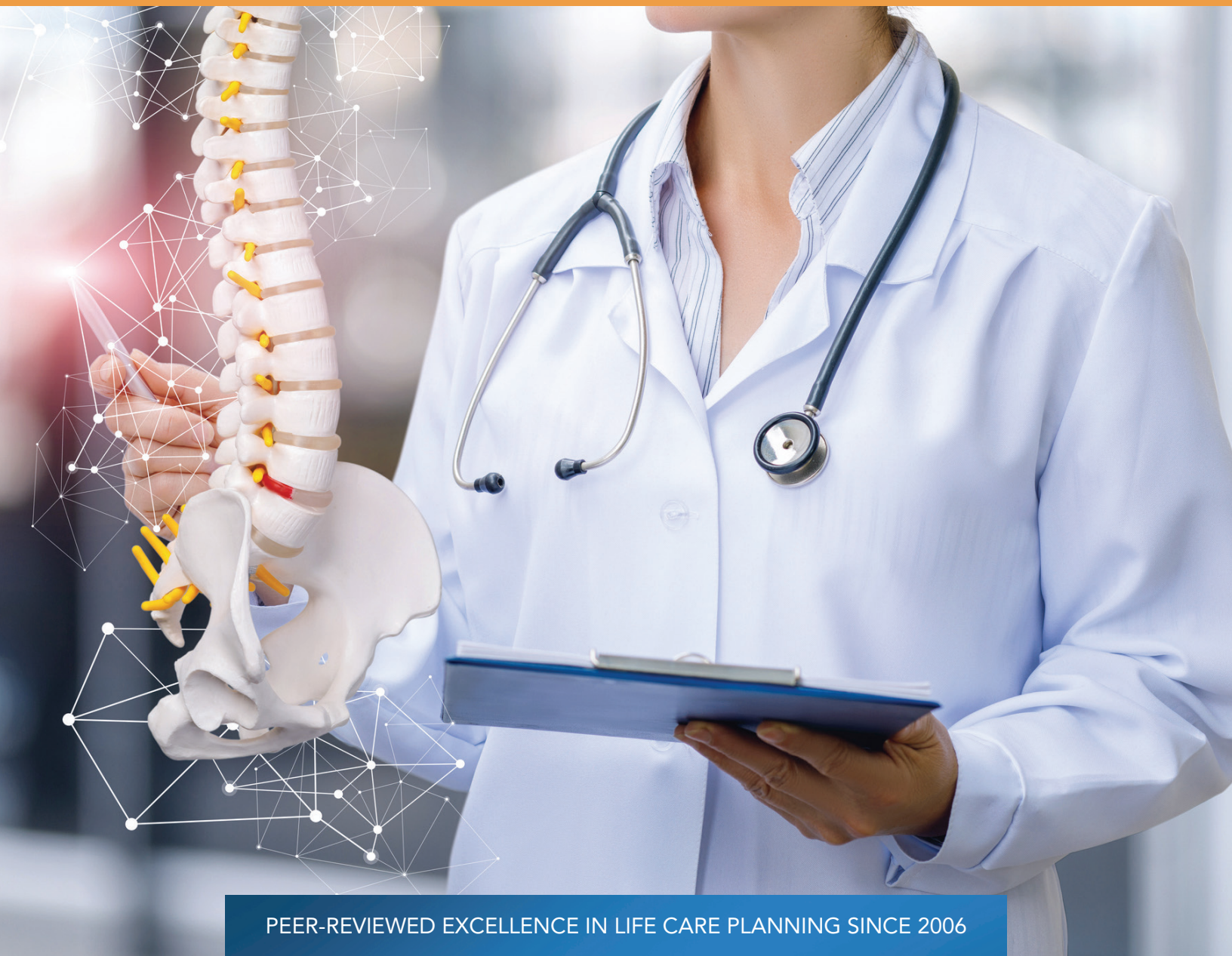
THE AMERICAN ASSOCIATION OF NURSE LIFE CARE PLANNERS

JOURNAL OF NURSE LIFE CARE PLANNING

AANLCP

FALL 2022 vol XXII, no. 3

Orthopedics, Pain, and Research



PEER-REVIEWED EXCELLENCE IN LIFE CARE PLANNING SINCE 2006

FALL 2022

JOURNAL OF NURSE LIFE CARE PLANNING

TABLE OF CONTENTS

DEPARTMENTS

AMERICAN ASSOCIATION OF NURSE LIFE CARE PLANNERS
299 S. Main Street #1300-91732
Salt Lake City, UT 94111
PH & FAX: 801.274.1184
aanlcp.org

From the Editor

"Research is seeing what everybody else has seen and thinking what nobody else has thought."

- Albert Szent-Györgyi

Albert knew what he was talking about when he spoke about research. He was awarded the Nobel Prize in Physiology for Medicine in 1937, in part, because of his research skills and the tangible results they produce.

Authority comes from accomplishments, but it also comes from a capability to speak about the entire landscape of your field.

That is a scary thought, so after many requests for help with this subject, I decided that our community could use a little guidance.

Later in this issue, I created a small supplemental guide to researching more effectively and quickly to help you with your research. I hope that it serves you well.

One thing I wanted to address. Some of our more observant readers may have noticed that our upcoming issues have changed. The Journal Committee will sometimes make changes to our upcoming calendar in line with the timeliness of the subjects and the interest that we see from our submitting authors.

Have a great autumn!

Stephen Axtell
JNLCP Editor | journal@aanlcp.org

Information for Authors

Information for Authors

AANLCP® invites interested nurses and allied professionals to submit article queries or manuscripts that educate and inform the Nurse Life Care Planner about current clinical practice methods, professional development, and the promotion of Nurse Life Care Planning. Submitted material must be original. Manuscripts and queries may be addressed to the Editor. Authors should use the following guidelines for articles to be considered for publication. Please note capitalization of Nurse Life Care Plan, Planning, etc.

Text

- Manuscript length: 1500 – 3000 words
- Use Word© format (.doc, .docx) or Pages (.pages)
- Submit only original manuscript not under consideration by other publications
- Put the title and page number in a header on each page (using the Header feature in Word)
- Place author name, contact information, and article title on a separate title page
- Use APA style (Publication Manual of the American Psychological Assoc. current edition)

Art, Figures, Links

- All photos, figures, and artwork must be in JPG or PDF format (JPG preferred for photos).
- Line art must have a minimum resolution of 1000 dpi, halftone art (photos) a minimum of 300 dpi, and combination art (line/tone) a minimum of 500 dpi.
- Each table, figure, photo, or art must be submitted as a separate file, labeled to match its reference in text, with credits if needed (e.g., Table 1, Common nursing diagnoses in SCI; Figure 3, Time to endpoints by intervention, American Cancer Society, 2019). Graphic elements embedded in a word processing document cannot be used.
- Live links are encouraged. Please include the full URL for each.

Editing and Permissions

- The author must accompany the submission with written release from:
- Any recognizable identified facility for the use of name or image
- Any recognizable person in a photograph, for unrestricted use of the image
- Any copyright holder, for copyrighted materials including illustrations, photographs, tables, etc. Note that images harvested online may be copyrighted.
- All authors must disclose any relationship with facilities, institutions, organizations, or companies mentioned in their work.
- All accepted manuscripts are subject to editing, which may involve only minor changes of grammar, punctuation, paragraphing, etc. However, some editing may involve condensing or restructuring the narrative. Authors will be notified of extensive editing. Authors will approve the final revision for submission. The author, not the Journal, is responsible for the views and conclusions of a published manuscript.
- Submit your article as an email attachment, with document title articlename.doc, e.g., wheelchairs.doc

All manuscripts published become the property of the Journal. Submission indicates that the author accepts these terms. Queries may be addressed to the care of the Editor at: journal@aanlcp.org

Manuscript Review Process

Submitted articles are peer reviewed by Nurse Life Care Planners with diverse backgrounds in life care planning, case management, rehabilitation, and nursing. Acceptance is based on manuscript content, originality, suitability for the intended audience, relevance to Nurse Life Care Planning, and quality of the submitted material. If you would like to review articles for this journal, please contact the Editor.

Journal of Nurse Life Care Planning is the official peer-reviewed publication of the American Association of Nurse Life Care Planners. Articles, statements, and opinions contained herein are those of the author(s) and are not necessarily the official policy of the AANLCP® or the editors, unless expressly stated as such. The Association reserves the right to accept, reject, or alter manuscripts or advertising material submitted for publication. The Journal of Nurse Life Care Planning is published quarterly in spring, summer, fall and winter. Members of AANLCP® receive the Journal subscription electronically as a membership benefit. Back issues are available in electronic (PDF) format on the association website. Journal contents are also indexed at the Cumulative Index of Nursing and Allied Health Literature (CINAHL) at ebscohost.com. Please forward all emailaddress changes to AANLCP® marked "Journal-Notice of Address Update." Contents and format copyright by the American Association of Nurse Life Care Planners. All rights reserved. For permission to reprint articles, graphics, or charts from this journal, please request to AANLCP® headed "Journal-Reprint Permissions" citing the volume number, article title, author and intended reprinting purpose. Neither the Journal nor the Association guarantees, warrants, or endorses any product or service advertised in this publication nor do they guarantee any claims made by any product or service representative. In order to make safe and effective judgments using NANDA-I nursing diagnoses it is essential that nurses refer to the definitions and defining characteristics of the diagnoses listed in this work.

A Message from the President

Dear Members, Colleagues and Fellow Nurse Life Care Planners,

While the colors in Southern California remain mostly green, in other parts of the country leaves have turned to a vibrant orange, yellow, or red, undergoing the transformation that the change of season induces. And while I watch nature change, I'm reminded of how important transformation is. The ability to adapt, and evolve is not a choice we have, but rather a necessity that allows us to move forward in life, bringing new opportunities and experiences. Isn't that what we as life care planners do? Providing guidance for individuals whose life and circumstances have been changed due to an event or illness? The life that is forever changed, the need and ability to adapt as the only available option to improve quality of life and overcome challenges. For the ones we serve the change in their situation isn't a choice.

Embracing change to welcome progress, to create space for new opportunities, to improve ourselves, our work environment, and our industry seems like a choice. It is not. The choice we have is to change before we have to. We are looking at the lifespan of the individual's we are writing our plans for, applying our experience, education, and training in collaboration with others to figure out the future needs to achieve the highest possible outcome. The same applies for our industry and our Association. Change is necessary to succeed and grow, providing the Association the ability to continue its services for life care planners well into the future. It is mine and the executive board members responsibility to make sure this is taking place, handing over an organization that encourages innovation to the next elected officials.

Embracing change isn't always easy. It requires letting go of situations or things we felt comfortable with. It also requires additional hours of work, to assess what changes are needed, to think outside the box and encourage innovation. I am excited to present ideas at upcoming events for members and I look forward to discussing and brainstorm as a group.

I wish each of you the courage to embrace change, to get inspired by nature and turn some of the colors in your lives into a vibrant new painting!

Thank you, members for your continued participation, support, and enthusiasm!

Please reach out to me to share your ideas, suggestions, and comments! If you would like to get more involved with the Association, we would love to welcome you as a member of one of our committees.

With gratitude,

A. Nebel

Andrea Nebel, RN, BSN, CNLCP
President, AANLCP | president@aanlcp.org

"Change is the law of life, and those who look only to the past and present are certain to miss the future" — John F. Kennedy

Methodology Memo

By Ron Luke, JD, PhD

Ipse Dixit

Life care planners frequently review plaintiff life care plans authored by physician life care planners in personal injury litigation. In many of these reviews, there is no discussion of the basis for the recommended goods and services. The basis for these recomendations is not the opinions of treating physicians, as the physician life care planner has never consulted the treating physicians and has recommended medications and procedures never prescribed, performed, or recommended by treating physicians.

A life care planner has an obligation to document a reasonable basis for each recommendation, regardless of what clinical degree or license the life care planner holds. The term "ipse dixit" translates to "because I said so." Courts have repeatedly found expert testimony that is ipse dixit with no supporting basis to be inadmissible. Such testimony is no more acceptable from a physician life care planner, or any physician, than from any other expert.

Physician life care planners can express opinions as physicians and as certified life care planners. Both sorts of expert opinions require a reasonable basis. Any certified life care planner, regardless of academic degree or license, is qualified to criticize the soundness of the work of any other certified life care planner relative to the generally accepted standards for life care planning. It is also proper for any certified life care planner to point out when a physician or other clinician did not provide a reasonable basis for a medical opinion. It is also proper for a non-physician life care planner to note when a physician life care planner is recommending surgeries and other treatments outside his or her medical specialty.

To summarize, any certified life care planner may criticize reports by a physician life care planner where the report violates standards for life care planning; and specifically on the standard to provide a reasonable basis for each recommendation. Where a physician, life care planner or other, has given a basis for a diagnosis or treatment recommendation in a life care plan, a non-physician life care planner should leave any criticism of the medical opinion to a physician in an appropriate specialty.

Contributors to this Issue

Rebecca A. Reier BS RN, CRNA (Ret.), CCS-P

As President of Med-Econ, Inc., a medical practice management company, Rebecca's experience spans a period of 45 years involving billions of dollars in coding and billing for medical charges for groups ranging from single practitioners to 40-member groups in over 22 specialties.

She authored Chapter 28 in the AALNC Textbook on Principles and Practices, Fourth Edition regarding the Medical Record and the concept of Usual, Customary and Reasonable aspects of medical charges

Her educational background includes a summa cum laude BS in Biology and Secondary Education from the University of Charleston and a Certified Coding Specialist (CCS-P) from the American Health Information Management Association.

Christina Lighthill, OTR, OTD, CFWE, CSRS

is an Clinical Coordinator and Occupational Therapist at Rehab Without Walls in Dallas, Texas. She holds a bachelor's degree in Child Development and a doctoral degree in Occupational Therapy from Texas Woman's University. Her passion for stroke rehab and mentoring students led her to becoming a Certified Stroke Rehab Specialist and a Certified Fieldwork Educator early in her career. Since 2012, Chrissy has provided continuing education to other health care professionals on the topic of neuroplasticity, technology for recovery, and evidence-based interventions to enhance traditional therapies and bring about best outcomes for survivors and their families.

Stephen Axtell BA, MA

As editorial and educational director of Kismet Writing and Development, Stephen's editorial experience spans 8 years of doctoral defenses and PHD dissertations for a number of university nursing programs. His Bachelors in Education helps in the creation of development plans for authors seeking publication in both fiction and nonfiction.

As the editor of the Journal of Nurse Life Care Planning, Stephen chairs the Journal Committee and provides writing/research assistance to authors who seek to advance their reputation by contributing to the Journal. He oversees and coordinates peer review for every article that is submitted for publication.

Contributors to this Issue

Dr. Daniel Kang, Chief Medical Officer, KetaMD

is a Los Angeles native and a UC Berkeley grad. Upon graduating, he worked at a non-profit community health center where his data research and collaboration with the state of California helped to increase resources for underserved communities. He attended medical school at Albert Einstein College of Medicine, and completed his residency in Anesthesiology at Brigham and Women's Hospital, an institution of Harvard Medical School. In pursuit of providing anesthetic care across all ages, he continued his training as a pediatric anesthesiology fellow at Children's Hospital of Los Angeles. Dr. Kang is passionate about improving access to quality care and creating efficiencies through the use of technology. As such, he has various publications on optimization of patient experience, automation of preoperative triage, and identifying risk factors for patient safety. As Chief Medical Officer of KetaMD, he is committed to creating the gold standard for at-home ketamine treatment with an emphasis on patient experience and best-in-class integration. His mission is not only to deliver ketamine safely, but to create lasting change and improvement in people's lives by sharing tools and teachings for success.

Dr. Sofia Peeva

is a board-certified anesthesiologist. She has an expertise in airway management, anesthetic administration for a wide range of operations and medication infusion and titration.

Dr. Peeva became interested in ketamine while she was a resident in anesthesia at USC. She has used the medication thousands of times to provide anesthesia in many different settings. After years of experience with ketamine she has recently become interested in how it is being used in the mental health setting. While depression and anxiety rates skyrocket and first line medications are not as effective as intended; Dr. Peeva has emerged as a pioneer who is adapting ketamine to target treatment resistant depression, PTSD, anxiety and chronic pain.

Dr. Peeva co-founded Propel Therapeutics Ketamine Therapy where she provides ketamine therapy in a state-of-the-art immersive environment with the help of Dr. Fischer who is a board-certified psychiatrist. Recently they were identified as best in class (top 20 out fo 350+ clincis) for patient outcomes and engagement by OSMIND which is a national ketamine clinic medical record platform. The duo has been delighted by all the positive results from their patients receiving ketamine infusions and integrative psychotherapy. These encouraging results have motivated her to continue to learn and research so she can fine-tune this important and novel therapy.

To learn more about ketamine therapy and our clinic visit us at: www.PropelTherapeutics.com

Education and Experience:
Undergraduate: University of California, Berkeley
Medical School: Medical College of Virginia
Anesthesia Residency: University of Southern California

Costing Those Orthopedic Implants

Why Does the Facility Charge So Much for Those Implants? Is it Just Another $100 Aspirin?

By Rebecca Reier, BS RN, CRNA (Ret.), CCS-P

Keywords: Costing, Orthopedic, Implants

In reviewing orthopedic charges, the implants and/or supplies often appear notoriously excessive. A mark-up over cost may or may not be acceptable – but HOW MUCH of a mark-up is reasonable – none, 200%, 300%, 400%, 1000%?

When comparing the differences in total charges among facilities for the same DRG or outpatient procedure, the implant charges may be the most variable factor found.

This discussion is most easily applicable for evaluation of previous charges but can be used to realistically assess the cost differences among institutions in the same geographic area for DRG total charges or for, increasingly, outpatient procedures.

The actual facility cost (Average Sales Price- ASP) or List Price of most orthopedic implants and materials can be determined from a variety of sources. Once this aspect is included in the review of past charges or the prediction of future charges, total costing for the patient can become more reasonable.

Payers of all types recognize that many items are marked up by facilities – but the basic cost of these products are included in the payor's value of the procedure. Most implants fall into this category. From the facility point of view, the mark-up on implants merely contributes to the overall "Charges." In offering a competitive price on a popular procedure, some may keep the line-item price well within the purchase cost.

Implant Charges

A valuable source of ASP or List Price for shoulder, hip, knee, and spinal implants can be found through the Orthopedic News Network and Curvo Labs. Each year the data is updated for the most common implants. One can also contact the Patient Advocacy Representatives in most major manufactures such as Medtronic, Zimmer, Abbott etc. They can offer ball-park figures as well.

Where can the information regarding what was implanted or will be implanted be ascertained?

For previous surgeries, the line-item invoice from the facility will indicate the implant charges in an assortment of

HCPCS codes. The HCPCS codes are highly non-specific and variation is wide. Beware of charges for screws and plates that come as a part of the "implant set." These should not be billed separately.

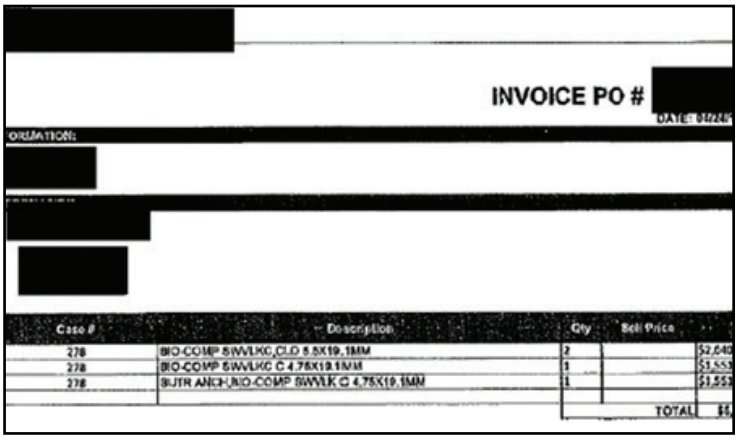
For previous surgery, there is an IMPLANT RECORD that must be filled out in the Operating Room when the implant is inserted into the patient. This Record contains the manufacturer, description, model, and product number and how many were used.

For future surgery, a query of the surgeon will often reveal their preferred manufacturer and type of implant. From that a general description of the implant can often suffice to narrow down the pricing. At that point, a search among references can be found or a contact with the supplier could provide the information. The product manual from many manufacturers is available on line with product numbers, sizes, components, etc.

Implant supplies

Certain procedures such arthroscopic repair of rotator cuff will use (and charge) for anchor sutures or other specific types of sutures materials.

The pricing of these is generally available through an internet search of supply houses. A purchase invoice by the facility may state a quantity of "1" but is usually sold as 5 anchors per box. The anchors generally list cost as $300 each and the invoice simply reflects the box total. So, 4 boxes of anchors represent 20 units individually packaged. The entire contents of the 4 boxes will not be opened for the patient – only those individual packaged anchors that are used. If the typical Rotator Cuff repair may take 4 suture anchors – a charge of 20 units of $6,000 make no sense when the facility used only 4 at $1,200.



In spinal surgeries such as fusions, bone grafts of various materials and sources are used. These prices are also available from Orthopedic News Network.

Examples of egregious implant charges:

Implant Description	Part Number	Charge	ASP	Total ASP	Markup %
Nuvasive cohere cage 7x14x12 mm	1000-00-0714	$37,586	$1,058x2	$2,116	1776%
38 mm Nuvasive ACP Anchor plate	8787238	$9,284	$1,559	$1,559	596%
6 x 15 mm screws	8780215	$12,054	$153 x 6	$918	1313%
Osteocell Pro allograft	unknown amount -large volume	$12,248	$480/ml	$3,165	387%
TOTAL		**$71,172**		**$7,758**	**917%**

Description	Facility Charges	Comment	ASP
Stryker Tornier Ascend Flex Reverse system	$48,239.00	Most expensive Reverse System Comparative Pricing $9,000. Zimmer sells this system as well as Stryker.	$9,000.00

Description	Charges	Source	ASP or List Price	Markup
Prolift Cage	$30,267.00	Ortho News Network Implant prices CURVO	$13,685.00	221%
Rods and screws x 2	$123,447.00	Ortho News Network Implant prices - high range $9,000 x 2	$20,000.00	617%
Bone Matrix	$12,248.00		$1,480.00	828%
TOTAL Implants	**$165,962.00**		**$35,165.00**	472%
Thrombin20000PW x 2	**$4,414.00**	Drugs.com	**$744.00**	593%
	$170,376.00		**$35,909.00**	**474%**

A Rare but Noticeable Occurrence:

Be wary of facilities where the surgeon "buys" and charges for the implant. This is a somewhat rare but a definite "red flag". Physician owned distributorships (PODS) have come under scrutiny with serious fraud charges. Consideration should also be given if the surgeon receives warranties or compensation for the use of certain products.

Caveat

Most orthopedic implants for major surgery are NOT stocked by the facility. The manufacturer's representative is in the Operating Room with their collection of instruments, temporary and permanent implants. The facility incurs the cost after the surgeon has chosen the permanent implant and placed it in the patient.

Therefore, for the facility to claim it has a huge overhead for the implant is not a valid excuse. For the insured patient, these procedures are primarily inclusive of implant costs.

In Summary

Evaluation of the line-item charges for a procedure – inpatient or outpatient – past or future – and assessment of the actual purchase price of a non-inventory implant brings a realistic approach to our opinion of reasonable charges.

Neurological Rehabilitation at Home: Tech-Based Solutions

By Christina Lighthill, OTR, OTD, CFWE, CSRS

Keywords: Assistive Devices, Rehabilitation, Pain management

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2021-2023

1. **Domain 1. Health Promotion. Class 2. Risk for Ineffective Home Maintenance Behaviors**
2. **Domain 4-Activity/rest. Class 2. Activity/exercise**
3. **Domain 4-Activity/rest. Class 5. Self-care**

These days, technology is a constant. Smart devices track our steps, heart rate, and locations. Cell phones are rarely put down, but when they are, the earbuds and smartwatches we wear keep us connected. We expect easy access and digital options for everything, including signing documents, making appointments, and keeping track of health data. Not only does technology empower us in our day-to-day life, but when a major medical event occurs, there is access to information and products at our fingertips that can aid in recovery or manage symptoms without having to rely on a medical professional to prescribe or recommend it.

Background

Around the world, the incidence of neurological injury is on the rise. The growing number of people experiencing and being affected by stroke, traumatic brain injury, spinal cord injury, and other conditions is contributing to a greater incidence of disease and disability (Feigin et al., 2014; James et al., 2019). With the "(population on average growing older in many countries or less dying from communicable diseases) these trends will continue and societies around the globe are well-advised to plan their health-care resources and societal efforts to cope with the increase in neuro-disabilities efficiently" (Platz, 2019, p. 2). Technology is advancing to help meet the need. Researchers and manufacturers are working on innovative products to help those recovering from neurological injuries. The emergence of wearable technology, advancements in robotics, increased government funding for research activities in healthcare, and rising awareness among physicians all contribute to the expected growth of the neurorehabilitation device market (Verified Market Research, 2021).

While the intensity, duration, and time spent on rehabilitative efforts for neurological patients are critical to optimal outcomes (Cooke et al., 2010), insurance benefits may be limited or exhausted when needs continue. Consequences of disability may result in long-term mobility impairments, depression, and the loss of independence in

completing daily activities (Winstein et al., 2016). Individuals may be discharged from therapy or be recommended to continue on a less intensive basis while provided with a home program to supplement. Additionally, the pandemic, which brought quarantines, social distancing, and new standards of hygiene for public places has demonstrated that treatment options outside clinics are increasingly relevant (Libra@ Home, 2020). For survivors and their families, the end of formal clinical rehabilitation should not mean the end of the restorative process (Winstein et al., 2016).

Traditional home exercise plans may bring to mind paper handouts and the use of equipment like weights, resistance bands, or household objects. This type of program requires an individual to track repetitions on their own and find ways to motivate themselves. Sensory stimulation and feedback are likely low, routines are challenging to adhere to, and can get boring quickly (Jurkiewicz et al., 2011). Now, technology has made way for new products to become available, many direct to consumer and designed for home use, to elevate home therapy programs. Interactive games, multi-sensory biofeedback, and artificial intelligence engage users, keep track of progress, and aim to promote adherence.

Chen et al. (2019) identified six types of technologies used within neurological rehabilitation systems meant for home use.

- Games: Offers an engaging and motivating way to get a high amount of repetition.
- Telerehabilitation: Enables remote access to services.
- Robotics: Aims to replace or support manual rehabilitation and address movement of affected limbs to improve range of motion.
- Virtual Reality: Provides a simulated physical environment for task completion to translate into real-life contexts.
- Sensors: Measures movements and physiological responses to provide feedback.
- Tablets: Using mobile devices like tablet computers and iPads.

This article will present several neurorehabilitation devices and tools on the market for survivors of neurological injury to use at home with little to no need for formal training or support. Combining various types of technology to bring home therapy programs to another level to promote engagement, repetition, and–most of all–recovery.

Motus Hand and Motus Foot by Motus Nova

Figure 1: *Motus Nova. (n.d.-e). Motus Hand*

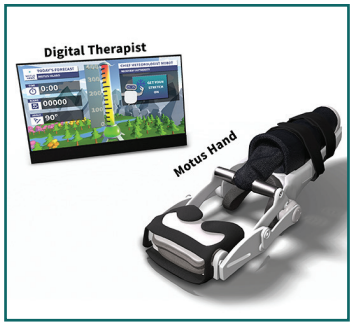


Figure 2: *Motus Nova. (n.d.-c). Motus Hand.*

Figure 3: *Motus Nova. (n.d.-e). Motus Foot*

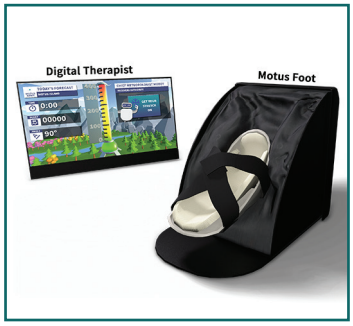


Figure 4: *Motus Nova. (n.d.-d). Motus Foot.*

Motus Nova, founded in 2013 to make healthcare robotics more accessible, is now focused on delivering high-quality neurorehabilitation in the home setting (Motus Nova, n.d.-b). The company offers two devices, the Motus Hand and Motus Foot.

These robotic devices offer mobility exercises for the wrist, hand, and ankle for a stroke survivor and are meant to supplement a home-based or clinical program. Each device has a pneumatic pump and is wirelessly connected to a tablet. Sensors detect when movements occur and when to activate the pump, providing an active range of motion assistance when the user is having trouble finishing a movement. The user engages in game-like training in a virtual environment, with audio and visual feedback. Embedded artificial intelligence tracks and monitors progression and adjusts levels of assistance and resistance while therapy is provided at a high rate of intensity and repetitions, both of which are kept track of for the user (Motus Nova, n.d.-a).

The Motus Hand facilitates basic extension and flexion of the wrist and hand and can advance to more complex exercises and finger strengthening to improve range of motion, motor function, and strength (Motus Nova, n.d.-c). The Motus Foot helps users improve the strength of their foot and ankle to have faster gait speed, more endurance,

and reduced instances of foot drop, leading to a decrease in fall risk (Motus Nova, n.d.-d). In one study, following three months of Motus Hand use, participants increased their levels of independence in daily activities. In another study, following three months of Motus Foot use, participants increased dorsiflexion strength with gains maintained over one month following use. Further, the Motus Foot has been shown to improve gait speed and walking endurance in chronic stroke survivors (Motus Nova, n.d.-e).

The Motus Hand can be leased for $400 a month; the Motus Foot for $700 a month.

FDA Approved.

Insurance information: Insurance does not cover the cost of the devices. Telehealth with the Motus Hand and Foot is covered by insurance. They have various programs that can help cover the cost of the Motus Hand and Foot that can be explored.

FitMi, Music Glove, and Recovery Blog by Flint Rehab

Flint Rehab was founded in 2011 to advance the neurorehabilitation field. The company has produced various tools for recovery including FitMi, Music Glove, and a Neurological Recovery Blog.

The FitMi system facilitates a full-body digital workout for those with neurological conditions, like stroke, traumatic brain injury, spinal cord injury, and cerebral palsy. It consists of two wireless pucks, a docking station, and a therapy program that can be purchased either on a tablet or installed on a personal computer. The pucks contain sensors that detect when they have been hit or moved in certain ways (Flint Rehab, n.d.-a). The user performs a variation of 40 exercises using the pucks and volitional movement while biofeedback is provided by an interactive visual on-screen corresponding to the movement with each puck. These sights and sounds alert the user that their movement has been detected and recorded while encouraging the user to stay engaged.

The FitMi can be used at all levels of impairment, is customizable with 10 levels of difficulty, and can be operated while sitting or standing. It targets mobility and strength in the shoulders, elbows, wrists, hands, core, hip, knee, ankle, and foot, along with providing opportunities for cardiovascular engagement (Flint Rehab, 2016). The program tracks the number of repetitions and levels of endurance for each session and has shown that users performed 12 times more exercise repetitions than in the average conventional therapy session (Flint Rehab, n.d.-b).

FitMi costs between $650- $1250 depending on whether the program is purchased alone, with a tablet, or with a computer monitor.

The Music Glove helps improve hand and finger mobility and function. The glove has sensors at each fingertip and wirelessly connects to a program of interactive musical games with varying levels of challenge. It requires the user to perform repetitive opposition exercises using volitional movement to work on dexterity and fine motor coordination. The user can attain hundreds of repetitions while engaging in hand and finger movements as each musical note floats down the screen while the sensors track accuracy and speed. (Flint Rehab, n.d.-d). After six, 45-minute sessions, participants improved their ability to grip small objects more using the Music Glove compared to conventional hand exercises (Friedman et al., 2014).

The Music Glove program is $360 to purchase.

Flint Rehab's Neurological Recovery Blog is geared toward survivors and their families. It contains eye-catching and engaging articles on neurological recovery organized into categories for stroke, traumatic brain injury, spinal cord injury, cerebral palsy, and general neurological recovery. Articles are thoroughly researched and reference high-quality studies with a team of therapists who review them for accuracy. This expansive blog is regularly updated to keep up with the latest research and ever-changing rehabilitation field and is available in English, Spanish, German, and French. (Flint Rehab, n.d.-c).

Flint Rehab's Blog is free to access and available on their website.

FDA Registered.

Insurance information: These devices are covered by the VA for veterans. Medicare and other medical insurance companies do not cover them.

NeuroBall™ by Neurofenix

Figure 5: *Neurofenix. (2020). NeuroBall™*

Neurofenix, founded in 2016, aims to make a difference in the lives of neurological injury survivors and their families (Neurofenix, n.d.-a).

NeuroBall™ by NeuroFenix is a digital ball-shaped exercise device that is strapped to the user's hand and is wirelessly connected to a tablet. It can help treat upper extremity impairment from musculoskeletal or neurological conditions, including stroke, traumatic brain injury, neuropathy, and spinal cord injury. The program targets the full upper extremities, focusing on the shoulder, elbow, wrist, and fingers. It requires users to employ volitional movement

to perform progressively challenging exercises in a virtual environment while a high level of repetition is achieved with the use of game-like training (Neurofenix, n.d.-b; Neurofenix, n.d.-c).

Advanced sensors can detect even small movements so that users who are more severely impaired may still benefit while the real-time feedback, from sight and sounds in the games, engages, and helps motivate the user. There are also Product Specialists available that can train and support users throughout their journey, making sure they get the most out of the device and review customizable features that can be crafted for an individual (Neurofenix, n.d.-b; Neurofenix, n.d.-c). In one study, users of the NeuroBall were shown to be able to do more frequent and intense upper limb activities, but without an increase in fatigue, spasticity, or pain (Neurofenix, 2020).

NeuroBall can be leased for $200 a month.

FDA Registered.

Insurance information: Not covered by insurance.

Smart Glove, Neomano, and Rehabit by Neofect

Neofect was created in 2010 with a mission to build hope for healthier lives and provide opportunities for rehabilitation through technological innovation. Among their products are the Smart Glove, Neomano, and an app called Rehabit.

Figure 6: *Neofect. (n.d.-d). Smart Glove.*

Figure 7: *Neofect. (n.d.-f). Smart Glove.*

Smart Glove is a lightweight silicone glove, with a built-in accelerometer and sensors that measure movements of the forearm, wrist, and fingers, and is wirelessly connected to a tablet (Neofect, n.d.-b). The user employs volitional movement to engage in games while completing occupation-based hand exercises in a virtual environment. The Smart Glove is compatible with those who have at least slight muscle control of the wrist or hand and are working toward increasing active motor control following a diagnosis of stroke (Neofect, 2021). Smart Glove users demonstrated statistically significant improvements in the Fugl-Meyer Assessment of Motor Recovery After Stroke and Jebsen-Taylor Hand Function Test as compared to controls (Shin et al., 2016).

Smart Glove requires a prescription, comes with a one-time therapy session, and costs $1925.00 to purchase.

Figure 8: *Neofect. (n.d.-e). Neomano.*

Neomano is a soft robotic three-finger glove that fits over the thumb, index, and middle fingers attached to a power supply bank and is Bluetooth connected to a wireless remote controller. The thumb is manually adjustable to position differently depending on the type of object being grasped. The Neomano helps users who have movement in their wrist and arm, but little to no strength in their fingers from a neurological event such as a spinal cord injury. The glove actively assists in closing the index and middle fingers to grasp and hold objects, but it does not assist with finger extension. The index and middle fingers can adjust to a C-shaped grip for larger objects and can also pinch grip for smaller objects. The motor allows the fingers to bend and provides various degrees of gripping strength to perform everyday tasks with greater ease and independence (Neofect. (n.d.-a).

Neomano costs $2,000 to purchase.

The Rehabit App provides the user with easy-to-read and evidence-based education on stroke rehabilitation, behavioral health, lifestyle, nutrition, and mindfulness. It provides a holistic wellness self-management program based on a habit-centered approach. The user can journal, engage in exercises, and create goals while tracking their achievements (Neofect, n.d.-c).

The app and some features can be used for free. There are in-app purchases for VIP membership as follows: Monthly: $20, 3 Months: $50, 6 Months: $70, Yearly: $100.

Smart Glove FDA Registered.

Neomano FDA Registered.

Smart Glove, Neomano Insurance information: Not covered by insurance.

Regrasp by Rehabtronics

Rehabtronics, founded in 2003, is on a mission to improve the lives of people with mobility impairments using neuroscience innovations. They offer several products including the Regrasp.

Figure 9: *Rehabtronics. (n.d.-a). ReGrasp.*

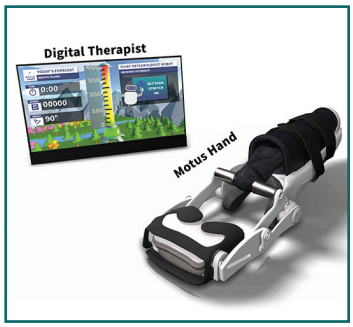


Figure 10: *Rehabtronics. (n.d.-b). ReGrasp.*

Regrasp is a bionic glove used to help regain hand function after a stroke or neurological injury. It deploys functional electrical stimulation (FES) to help the user perform daily tasks using the affected hand, facilitating use and recovery (Rehabtronics, n.d.-b). The wireless glove is strapped to the user's affected forearm and hand, and used in either of two modes. The exercise mode has pre-programmed protocols to exercise muscles, increase range of motion, reduce atrophy, and increase circulation. The FES mode delivers electrical stimulation activated by either a head motion or the tap of a button to generate functional hand movement and perform grasp and release. To trigger stimulation with a head nod, a Bluetooth controller sits securely behind the ear, allowing users to control hand function with their head, freeing up both hands during functional tasks (Rehabtronics, n.d.-a).

Regrasp requires a prescription and costs $3000 to purchase.

Regrasp FDA Cleared.

Regrasp Insurance information: Qualifies for reimbursement from many insurance plans.

Vision Restoration Therapy and NeuroEyeCoach by NovaVision

NovaVision was founded in 2002 with a mission to improve the vision of patients with neurological visual impairments and enhance the quality of life for patients and their families. The company offers two complementary programs, Vision Restoration Therapy and NeuroEyeCoach.

Vision Restoration Therapy is a visual restoration program intended to restore vision loss and enlarge the visual field after neurological injury. Completed on a personal computer, the program has the user focus on a central point displayed on the screen and respond every time a light stimulus appears. The light stimuli are typically presented along the border of the intact and damaged visual fields. Progress is monitored by NovaVision clinicians, while users can access a portal that tracks performance and can be shared with physicians. Therapy is personalized to the type of visual deficit and updated each month; it can be completed on the user's schedule but must occur twice daily, six days a week for six months (NovaVision, n.d.-b). A study with over 300 participants showed improvements in over 70% of users without impact from the length of time since injury (NovaVision, n.d.-b).

A prescription, visual field test results, and eye exam report are required before beginning (NovaVision, n.d.-a).

NeuroEyeCoach is a compensation-based program, to help users to make the most of their remaining vision. It addresses difficulties with eye movements and the ability to integrate visual information with 12 levels of difficulty. The program can be completed in a minimum of 36 sessions, each taking around 15 to 20 minutes. It is designed to be simple to use, with visual and auditory instructions and automatic progression based on the user's performance. Research has shown that this program can lead to more than twice the extent of improvements when compared to normal controls (NovaVision, n.d.-c; Nvcadmin, 2016).

Vision Restoration Therapy and NeuroEyeCoach can be purchased as one package to use for six months for $950. NeuroEyeCoach is available separately for those who have not suffered vision loss but do have problems with eye movement and can be purchased for $450 without an expiration to access.

Vision Restoration Therapy FDA Cleared.

NeuroEyeCoach FDA Registered.

Vision Restoration Therapy and NeuroEyeCoach Insurance Information: This treatment may be covered under major medical insurance plans.

Brightway Events by Brightway Health

Brightway Health was created with a mission to improve access to specialized care so that every person with chronic neurological conditions can get the best possible outcomes. They have several online resource offerings including the Brightway Events App.

The Brightway Events App allows the user to search and join more than 100 live virtual group classes from top brain injury rehabilitation organizations each month. Categories include art, music, support groups, meditation, fitness, yoga, and more. The app is free as are most of the classes, users can also send in classes they are aware of to help expand the app's offerings (Brightway, n.d.).

Conclusion

While most of these companies have clinical specialists to help guide the user into whether a device is right for them, it is prudent to keep the ever-changing nature of clinical knowledge in mind. Equally important, no guideline can substitute for the careful evaluation of the individual patient by an experienced clinician, in which the art and science of medicine intersect. Guidelines that are correct in the aggregate may not represent the best care for any specific individual, and careful individualization is needed at the point of care" (Winstein, 2016, p. 2). It would be ideal that, while still in a clinical setting, an experienced and non-biased clinician would help survivors of neurological injury and their families explore what technologies are available to continue their recovery progress at home, provide individualized education, and help mitigate issues that research and technology can pose.

FAME Framework

This Framework was created to help clinicians make decisions within evidence-based practice. It may be helpful to use when considering the use of a device or tool into the recovery process.

Feasibility: Is this practical within the cultural, physical, and financial context?

Appropriateness: Does it fit within a therapeutic scenario, who can explore the details to see if it's the right fit for the user, is there a clinical person/team or company resource?

Meaningfulness: What are the perceptions, thoughts, and beliefs of the user and possibly their support system?

Effectiveness: Is this likely to achieve the intended effect?

Economic evidence: Who is the payor, what are the available resources, and does the cost support implementation?

(Musselman et al., 2018).

REFERENCES

Brightway. (n.d.). Brightway Events. Retrieved September 2, 2022 from https://www.brightwayhealth.org/

Chen, Y., Abel, K. T., Janecek, J. T., Chen, Y., Zheng, K., & Cramer, S. C. (2019). Home-based technologies for stroke rehabilitation: *A systematic review. International journal of medical informatics*, 123, 11-22. https://doi.org/10.1016/j.ijmedinf.2018.12.001

Cooke, E. V., Mares, K., Clark, A., Tallis, R. C., & Pomeroy, V. M. (2010). The effects of increased dose of exercise-based therapies to enhance motor recovery after stroke: a systematic review and meta-analysis. *BMC medicine*, 8(1), 1-13. https://doi:10.1186/1741-7015-8-60

Feigin, V. L., Forouzanfar, M. H., Krishnamurthi, R., Mensah, G. A., Connor, M., Bennett, D. A., Moran, A. E., Sacco, R. L., Anderson, L., Truelsen, T., O'Donnell, M., Venketasubramanian, N., Barker-Collo, S., Lawes, C. M., Wang, W., Shinohara, Y., Witt, E., Ezzati, M., Naghavi, M., Murray, C. (2014). Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *The Lancet*, 383(9913), 245-255. https://doi.org/10.1016/s0140-6736(13)61953-4

Friedman, N., Chan, V., Reinkensmeyer, A. N., Beroukhim, A., Zambrano, G. J., Bachman, M., & Reinkensmeyer, D. J. (2014). Retraining and assessing hand movement after stroke using the MusicGlove: comparison with conventional hand therapy and isometric grip training. *Journal of neuroengineering and rehabilitation*, 11(1), 1-14. https://doi.org/10.1186/1743-0003-11-76

Flint Rehab. (n.d.-a). *FitMi Home Therapy Program for PC/Mac*. Retrieved August 20, 2022 from https://www.flintrehab.com/product/fitmi/

Flint Rehab. (n.d.-b). *FitMi for the Clinic - An Interactive Full-Body Stroke Rehabilitation System*. Retrieved August 20, 2022 from https://www.flintrehab.com/product/fitmi-clinic/

Flint Rehab. (n.d.-c). *Flint Rehab's Neurological Recovery Blog*. Retrieved August 22, 2022 from https://www.flintrehab.com/learn/

Flint Rehab. (n.d.-d). *MusicGlove Hand Therapy for PC/Mac*. Retrieved August 20, 2022 from https://www.flintrehab.com/product/musicglove-hand-therapy/

Flint Rehab. (2016). *FitMi Motion Interface*. https://cdn.flintrehab.com/uploads/2019/06/FitMi-Brochure.pdf

James, S. L., Theadom, A., Ellenbogen, R. G., Bannick, M. S., Montjoy-Venning, W., Lucchesi, L. R., Nooshin, A., Abdulkader, R., Abraha, H. N., Adsuar, J. C., Afarideh, M., Agrawal, S., Ahmadi, A., Ahmed, M. B., Aichour, A. N., Aichour, I., Aichour, M. T. E., Akinyemi, R. O., Akseer, N....Karch, A. (2019). Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, 18(1), 56-87. https://doi.org/10.1016/S1474-4422(18)30415-0

REFERENCES CONTINUED

Jurkiewicz, M. T., Marzolini, S., & Oh, P. (2011). Adherence to a home-based exercise program for individuals after stroke. *Topics in stroke rehabilitation*, 18(3), 277-284. https://doi.org/10.1310/tsr1803-277

Libra@Home. (2020). *Making Neuro-Rehabilitation a Reality in the Patient's Home*. https://librahome.com/making-neuro-rehabilitation-a-reality-in-the-patients-home/

Motus Nova. (n.d.-a). *How It Works*. Retrieved August 28, 2022 from https://motusnova.com/how-it-works/

Motus Nova. (n.d.-b). *The Motus Nova Story*. Retrieved August 28, 2022 from https://motusnova.com/about-us/

Motus Nova. (n.d.-c). *The Motus Hand*. Retrieved August 28, 2022 from https://motusnova.com/hand/

Motus Nova. (n.d.-d). *The Motus Foot*. Retrieved August 28, 2022 from https://motusnova.com/foot/

Motus Nova. (n.d.-e). *Summary of Clinical Data*. Retrieved August 27, 2022 from https://motusnova.com/scientific-resources/

Musselman, K. E., Shah, M., & Zariffa, J. (2018). Rehabilitation technologies and interventions for individuals with spinal cord injury: translational potential of current trends. *Journal of neuroengineering and rehabilitation*, 15(1), 1-8. https://doi.org/10.1186/s12984-018-0386-7

Neofect. (n.d.-a). *Neofect USA*. Retrieved September 2, 2022 from https://shop.neofect.com/products/neomano

Neofect. (n.d.-b). *Smart Glove Rebuilding Your Life With Your Hands*. Retrieved September 2, 2022 from https://www.neofect.com/us/smart-glove

Neofect. (n.d.-c). *Rehabit*. Retrieved September 2, 2022 from https://www.neofect.com/us/rehabit

Neofect. (2021). *Smart Glove for Home Use*. https://content.neofect.com/resource/pdf/materials/Neofect_Smart%20Glove%20for%20Home%20Use_Slick_.pdf

Neurofenix. (n.d.-a). *About*. Retrieved September 2, 2022 from https://neurofenix.com/about/

Neurofenix. (n.d.-b). *Advanced Arm and Hand Therapy at Your Fingertips*. Retrieved September 2, 2022 from https://neurofenix.com/patients/

Neurofenix. (n.d.-c). *What is NeuroBall*. Retrieved September 2, 2022 from https://neurofenix.com/clinicians/

Neurofenix. (2020). *NeuroBall™ Clinical Evidence Summary*. https://neurofenix.com/wp-content/uploads/Neurofenix-Clinical-Evidence-Summary-v5-US.pdf

NovaVision. (n.d.-a). *Patient Requirements For Vision Restoration Therapy*. Retrieved September 2, 2022 from https://novavision.com/vision-restoration-therapy-vrt/

NovaVision. (n.d.-b). *Vision Restoration Therapy*. Retrieved September 2, 2022 from https://novavision.com/vision-restoration-therapy-vrt/

NovaVision. (n.d.-c). *What Do NovaVision's Therapies Cost?* Retrieved September 2, 2022 https://novavision.com/pricing/

Nvcadmin. (2016, October 5). Clinical Data Supports NeuroEyeCoach As The Gold Standard. *NovaVision*. https://novavision.com/clinical-data-supports-neuroeyecoach-as-the-gold-standard/

Platz, T. (2019). Evidence-based guidelines and clinical pathways in stroke rehabilitation—an international perspective. *Frontiers in Neurology*, 10, 200. https://doi.org/10.3389/fneur.2019.00200

Rehabtronics. (n.d.-a). *ReGrasp Functional Rehabilitation at Your Fingertips*. Retrieved September 2, 2022 from https://rehabtronics.com/products/regrasp-rehabilitation-glove/buy-regrasp/

Rehabtronics. (n.d.-b). *ReGrasp Recover Your Hand Function with the ReGrasp Bionic Glove*. Retrieved September 2, 2022 from https://rehabtronics.com/products/regrasp-rehabilitation-glove/

Sahraie, A., Smania, N., & Zihl, J. (2016). Use of NeuroEyeCoach™ to improve eye movement efficacy in patients with homonymous visual field loss. *BioMed Research International*, 2016. https://doi.org/10.1155/2016/5186461

Shin, J. H., Kim, M. Y., Lee, J. Y., Jeon, Y. J., Kim, S., Lee, S., Seo, B., & Choi, Y. (2016). Effects of virtual reality-based rehabilitation on distal upper extremity function and health-related quality of life: a single-blinded, randomized controlled trial. *Journal of neuroengineering and rehabilitation*, 13(1), 1-10. https://doi.org/10.1186/s12984-016-0125-x

Verified Market Research. (2021). *Neurorehabilitation Devices Market size worth $ 4,933.67 Million, Globally, by 2028 at 16.75% CAGR: Verified Market Research®* https://www.globenewswire.com/en/news-release/2021/11/18/2337576/0/en/Neurorehabilitation-Devices-Market-size-worth-4-933-67-Million-Globally-by-2028-at-16-75-CAGR-Verified-Market-Research.html

REFERENCES CONTINUED

Winstein, C. J., Stein, J., Arena, R., Bates, B., Cherney, L. R., Cramer, S. C., Deruyter, F., Eng, J. J., Fisher, B., Harvey, R. L., Lang, C. E., MacKay-Lyons, M., Ottenbacher, K. J., Pugh, S., Reeves, M. J., Richards, L. G., Stiers, W., Zorowitz, R. D. (2016). Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 47(6), e98-e169. https://doi.org/10.1161/STR.0000000000000098

Media References

Figure 1. Motus Nova. (n.d.-e). *Motus Hand*. [Image]. https://motusnova.com/products/

Figure 2. Motus Nova. (n.d.-c). *Motus Hand*. [Image]. https://motusnova.com/hand/

Figure 3. Motus Nova. (n.d.-e). *Motus Foot*. [Image]. https://motusnova.com/products/

Figure 4. Motus Nova. (n.d.-d). *Motus Foot*. [Image]. https://motusnova.com/foot/

Figure 5. Neurofenix. (2020). *NeuroBall™*. [Image]. https://neurofenix.com/wp-content/uploads/Neurofenix-Clinical-Evidence-Summary-v5-US.pdf

Figure 6. Neofect. (n.d.-d). *Smart Glove*. [Image]. https://www.neofect.com/us/research

Figure 7. Neofect. (n.d.-f). *Smart Glove*. [Image]. https://www.neofect.com/us/blog/tag/neofect-smart-glove

Figure 8. Neofect. (n.d.-e). *Neomano*. [Image]. https://www.neofect.com/us/neomano

Figure 9. Rehabtronics. (n.d.-a). *ReGrasp*. [Image]. https://rehabtronics.com/products/regrasp-rehabilitation-glove/buy-regrasp/

Figure 10. Rehabtronics. (n.d.-b). *ReGrasp*. [Image]. https://rehabtronics.com/products/regrasp-rehabilitation-glove/

Reducing Research Anxiety and Researching Effectively

By Stephen Axtell

Keywords: Publication, research, reliability

"Publishing is the gold standard for developing your reputation," is a refrain that anyone who receives our emails should be familiar with by now. Publishing allows an expert to showcase their understanding and insights in a way that may change the professional conversation. A researcher's name will become synonymous with the facts and analysis they present. But that is part of the anxiety of publication too. If a writer does not research well, they will be tying their reputation to bad information.

This anxiety is a realistic and reasonable one. However, allowing that anxiety to stop a professional only leaves a professional advantage on the table.

To relieve this research anxiety, consider the three largest concerns in effective research: thoroughness, reliability, and research navigation. This article will focus on secondary research. Primary research will benefit from these precepts, but there are other concerns that affect data management and research design that need to be considered separately.

Thoroughness in Research

Every research project, by nature, will be different each time. This makes it difficult to know how to achieve precision in literature review, data collection, and authoritative-perspective consideration. While projects will vary, there are categories of sources that should always be considered in every research project. To be sure that understanding of a

topic is thorough by the time the researcher is ready to write, consider finding a source in each of the following categories. One source may occupy multiple categories.

Clarifying sources: These sources do a particularly good job of clarifying terms and concepts for the target audience. Especially useful early in the research process, as these sources can identify an element of the topic that the researcher may not have considered.

Branching sources: These sources have a wide variety of sources upon which to base their assertions. These sources are an excellent source of additional reading to add to a researcher's breadth of knowledge. These are primarily useful in the early stages of research. However, it is always worthy of note which sources tend to produce this kind of material to help streamline later research.

Rated sources: The source categories that follow should be rated on a document to allow for a researcher to quickly and easily identify weaknesses in their research.

Trending sources: Trends exist in the scientific and medical worlds as much as in any other field. Researchers should consider trends to also present as the contemporary perspective on any one subject. Beyond keeping the researcher abreast of the changing landscape, which will allow the researcher to plan for later work, addressing trending sources and issues will equip the researcher to answer the most common questions their audience will be contemplating as they read the work.

High-Authority Sources: These sources allow for the researcher to add authority to their work by tapping into the authority of another. This category should never be ignored, even if the research in question doesn't seem to call for it.

High-Data Sources: These sources present a great deal of data, preferably in the form of quantitative data. Having access to this data allows the researcher to put proper emphasis on a particular aspect of the topic, or shift the trend of discussion. This is another category that should never be ignored.

Dissenting Sources: Identifying dissent is an uncomfortable but powerful part of any research. It may occur that the only dissent that can be found is unreliable. Identifying the dissent, even if the source isn't used in the final draft of the research, is crucial. If another researcher dissents, it is likely that a reader will too. Being prepared to speak to that concern, even momentarily, will strengthen any publication.

Research Reliability

Cataloging the right kinds of sources is only part of the issue; if the sources that are consulted aren't reliable, those sources will damage the final work instead of improving it. Ergo, the reliability of sources should also be categorized and rated.

Authority

The authority used to substantiate a work creates an upper limit of authority it can speak with.

- Who is the author?
- Who is the author affiliated with?
- Have they written elsewhere on the topic?
- Is there a way to contact the author or association for challenges or clarification?

Currency

Timeliness is critical to staying current and authoritative.

- How recent is this source?
- Have there been any major changes to the industry or field since this source was created?
- Is the site or publication a regularly updated source?

Audience Level/Target

The audience target of a source affects the way in which the data and information is presented. Everything from the mode of speech to the focus and depth will be affected by this consideration.

- Is this a medical, scientific, or industrial source?
- Consider the depth of the publication. Books require, and feature, greater depth and breadth than periodicals.

Accuracy and/or Replicability

Accuracy and replicability is a topic that would take books to cover. However, as an overview:

- How much of the data is quantitative or qualitative?
- Is the author's language free of bias as outlined in the 7th edition of the APA manual?
- Does the association that publishes the material have submission guidelines that can be accessed? Alternatively, an academic/scientific/journalistic standard that can be requested?
- Are the cited sources numerous and broad enough in variety to cover the scholarship on the subject?

Research Navigation

Filtering

The element that will often cost the greatest amount of time and effort is effectively using databases to find sources. Nearly all databases have filters that can be applied to every search. Using every available filter should be standard practice for all researchers. However, this is only part of the toolset available for navigating databases.

Boolean Operators

Boolean operators are a series of mechanisms that are included in nearly every database search engine. These operators can refine a search with more accuracy than filters or well-considered search terminology can alone. Operators actually change how the search engine sorts and understands the results of a query. Each operator, and their function, are detailed below. All of these operators can be mixed in queries to take advantage of multiple effects at once.

And is used between search terms will force the search engine to only provide results that contain all terms that are connected via "and."

For example: searching for ethics and committee and cloning will return only the results that feature all of those terms. Which will likely be ethics boards considering cloning. This is different from the later "" operator in that this method will include both "cloning ethics board" and "ethics board on cloning."

Or is used between terms that may or may not be a part of the results a researcher is seeking.

For example, searching for ethics or committee or cloning could result in "cloning board," "ethics board," and "cloning ethics."

Not will exclude items from a search result.

For example, searching for ethics and board not cloning will exclude items such as: "cloning board," "cloning ethics," and "cloning ethics board."

"" quotation marks enclosing a term will force the engine to return only items that feature that term exactly as entered.

For example, searching for "cloning ethics board" will return items like: "Arizona cloning ethics board." It will not include: "Arizona board of cloning ethics."

* the asterisk is used as a wildcard in searches allowing the search engine to find results with anything in the place of that wildcard.

For example, searching for Arizona * board will return results such as "Arizona municipal water board," "Arizona zoning board," and "ethics board of Arizona."

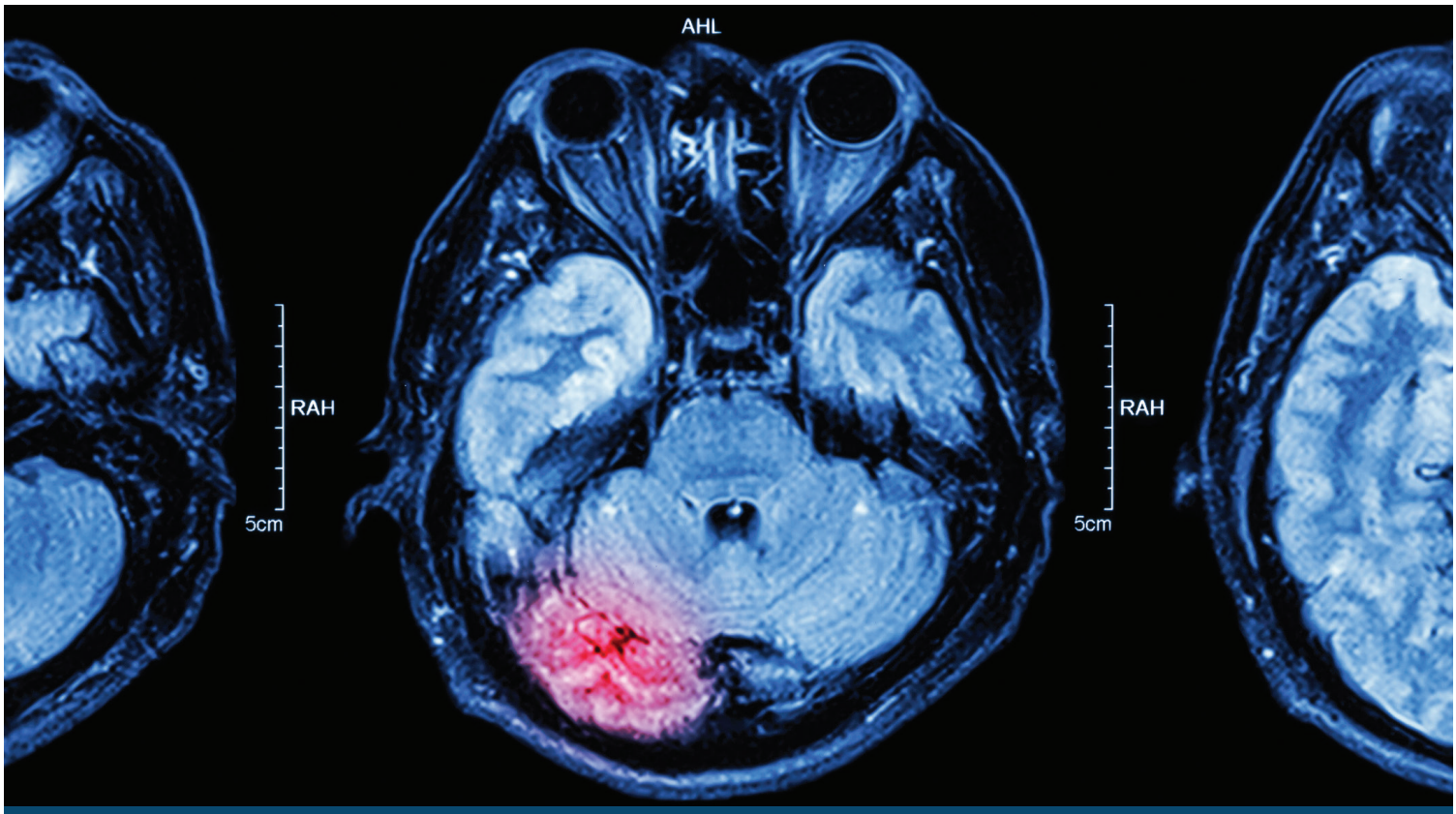
Conclusion

Research anxiety is a natural reaction to the challenges of researching effectively. None of these strategies are complete, these tips should help to address the concerns that cause research anxiety and help in the creation of an effective research strategy.

REFERENCES

American Psychological Association. (2019). *Publication Manual of the American Psychological Association: The Official Guide to APA Style* (American Psychological Association, Ed.). American Psychological Association.

MIT Libraries. (2021, July 30). Boolean operators - *Database Search Tips - LibGuides at MIT Libraries*. Research guides & expert librarians. Retrieved October 1, 2022, from https://libguides.mit.edu/c.php?g=175963&p=115859



Ketamine: A Medicine that Can Help Heal an Injured Brain

By Daniel Kang, MD

Keywords: TBI, Ketamine, Depression

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2021-2023

1. Domain 5. Perception/cognition. Class 4. Cognition
2. Domain 4-Activity/rest. Class 2. Activity/exercise
3. Domain 4-Activity/rest. Class 5. Self-care

Traumatic brain injury (TBI) occurs when a sudden, external, physical assault damages the brain. It is one of the most common causes of disability and death in adults. (1) Ultimately, TBI results in a cascade of events that result in secondary and tertiary injury, and potentially permanent disability, illness, and suffering. One major mechanism hypothesized to play an important role in mediating secondary neuronal injury is excessive stimulation by neurotransmitters leading to intracellular calcium overload and cell death. (2) This phenomenon is called excitotoxicity and it's what happens to the human brain when injured.

Glutamate has been shown to be a primary contributor to excitotoxicity because of its potent effect on increasing intracellular calcium by binding to postsynaptic N-methyl-d-aspartate (NMDA) receptors. In fact, persistently elevated glutamate levels were predictive of higher mortality and worsened 6-month functional outcomes in study of 165 patients who experienced severe TBI. (3) This mechanism of neurodegeneration during excitotoxicity has been described as primary drivers for secondary injury after trauma or stroke for decades. (4,5,6)

Interestingly, ketamine is a NMDA receptor antagonist known to block glutamate's effects through multiple mechanisms. (7,8,9) Not only has ketamine been shown to reverse excitotoxicity, it has been implicated in reducing the spread of depolarizations during acute brain injury. (10,11,12) Preclinical data demonstrates ketamine prevents neuronal and glial apoptosis (cell death) in chronic stress modeling (13) and has potent anti-inflammatory effects (14,15,16,17) which are all implicated in the pathogenesis of neurocognitive deficits following TBI or stroke. Furthermore, ketamine is known to inhibit platelet activation and aggregation (18,19,20) potentially lessening the burden of microthrombosis, another process that contributes

to neuronal injury following TBI or stroke. In fact, in the context of cardiac surgery requiring cardiopulmonary bypass, a process involving a significant degree of cerebral hypoperfusion and neuroinflammation, a single dose of ketamine has shown to decrease postoperative cognitive dysfunction, delirium, and production of cytokines, and other inflammatory markers. (21,22,23,24)

Overall, ketamine seems to exhibit a multifactorial effect on many underlying processes that lead to neuronal death such as excitotoxicity, neuroinflammation, and microthrombosis. Further research is warranted on how to utilize ketamine effectively to harness its potential to heal the injured brain or prevent it from getting worse. (25,26)

Ketamine was first synthesized in 1962 and was characterized as a "dissociative anesthetic" by Dr. Edward Domino, PhD. (27) The first human trials were conducted in 1964 (28) and approved by the FDA for use in humans in 1970. (29) As early as 1975, ketamine was recognized as a potential antidepressant in animal models (30) and was confirmed to be an NMDA receptor antagonist in 1983. (31)

This led to a new wave of research on NMDA receptor antagonism and its applications. Animal studies continued to suggest positive outcomes in depression and chronic stress models. (32,33,34,35,36)

Ultimately, this led to the first randomized, controlled trial in humans utilizing ketamine for depression, which was published in 2000 by Dr. Robert Berman, MD, and colleagues at Yale University. (37) This ground-breaking study included seven patients with major depressive disorder and demonstrated significant improvement in depressive symptoms within 72 hours after ketamine but not placebo infusion. Since then, multiple studies have shown promising results on the use of ketamine for depression, anxiety, suicidality, bipolar disorder, and PTSD. (38,39,40,41,42,43,44,45,46,47,48,49) New use cases for ketamine treatment are constantly being trialed and the evidence continues to grow each day. However, ketamine is currently not FDA approved for mood or neurological disorders and can only be prescribed on an "off-label" basis. The only FDA approved treatment is Spravato (esketamine), an isolated enantiomer of ketamine, which comes in a nasal spray and must be taken in conjunction with an oral antidepressant as well as under the supervision of a health care provider in a certified doctor's office or clinic. (50)

The last two decades have been an incredibly exciting time for ketamine. As more research is being done, we seem to discover more and more use cases for ketamine. A particularly exciting use case is the application of ketamine both acutely and chronically in the setting of TBI. Not only does ketamine seem to have direct neuroprotective effects, it can be utilized to combat some of the comorbidities and suffering in the long term. For example, one study found that up to 53% of patients who suffered mild to severe TBI met criteria for major depressive disorder within the first year. (51) Ketamine can be a powerful adjunct to existing treatments and a viable option for patients who have suffered TBI. Overall, ketamine can decrease suffering, improve quality of life, and help heal an ailing brain.

REFERENCES

1. https://www.hopkinsmedicine.org/health/conditions-and-diseases/traumatic-brain-injury
2. Krishnamurthy K, Laskowitz DT. Cellular and Molecular Mechanisms of Secondary Neuronal Injury following Traumatic Brain Injury. In: Laskowitz D, Grant G, editors. Translational Research in Traumatic Brain Injury. Boca Raton (FL): CRC Press/Taylor and Francis Group; 2016. Chapter 5. Available from: https://www.ncbi.nlm.nih.gov/books/NBK326718/
3. Chamoun R, Suki D, Gopinath SP, Goodman JC, Robertson C. Role of extracellular glutamate measured by cerebral microdialysis in severe traumatic brain injury. J Neurosurg. 2010 Sep;113(3):564-70. doi: 10.3171/2009.12.JNS09689. PMID: 20113156; PMCID: PMC3464461.
4. Arundine M, Tymianski M. Molecular mechanisms of calcium-dependent neurodegeneration in excitotoxicity. Cell Calcium. 2003 Oct-Nov;34(4-5):325-37. doi: 10.1016/s0143-4160(03)00141-6. PMID: 12909079.
5. Szydlowska K, Tymianski M. Calcium, ischemia and excitotoxicity. Cell Calcium. 2010 Feb;47(2):122-9. doi: 10.1016/j.ceca.2010.01.003. Epub 2010 Feb 18. PMID: 20167368. 6. Tymianski M. Cytosolic calcium concentrations and cell death in vitro. Adv Neurol. 1996;71:85-105. PMID: 8790793.
7. Bell, Josh D. MD, PhD. In Vogue: Ketamine for Neuroprotection in Acute Neurologic Injury. Anesthesia & Analgesia: April 2017 - Volume 124 - Issue 4 - p 1237-1243 doi: 10.1213/ANE.0000000000001856
8. Orser BA, Pennefather PS, MacDonald JF. Multiple mechanisms of ketamine blockade of N-methyl-D-aspartate receptors. Anesthesiology. 1997 Apr;86(4):903-17. doi: 10.1097/00000542-199704000-00021. PMID: 9105235.
9. Müller HK, Wegener G, Liebenberg N, Zarate CA Jr, Popoli M, Elfving B. Ketamine regulates the presynaptic release machinery in the hippocampus. J Psychiatr Res. 2013 Jul;47(7):892-9. doi: 10.1016/j.jpsychires.2013.03.008. Epub 2013 Mar 30. PMID: 23548331; PMCID: PMC3678963.

REFERENCES CONTINUED

10. Hertle DN, Dreier JP, Woitzik J, Hartings JA, Bullock R, Okonkwo DO, Shutter LA, Vidgeon S, Strong AJ, Kowoll C, Dohmen C, Diedler J, Veltkamp R, Bruckner T, Unterberg AW, Sakowitz OW; Cooperative Study of Brain Injury Depolarizations (COSBID). Effect of analgesics and sedatives on the occurrence of spreading depolarizations accompanying acute brain injury. Brain. 2012 Aug;135(Pt 8):2390-8. doi: 10.1093/brain/aws152. Epub 2012 Jun 19. PMID: 22719001.
11. Stevens, R.D.; Koehler, R.C. Pathophysiological Insights into Spreading Depolarization in Severe Traumatic Brain Injury. Neurocrit Care 2019, 30, 569–571.
12. Carlson AP, Abbas M, Alunday RL, Qeadan F, Shuttleworth CW. Spreading depolarization in acute brain injury inhibited by ketamine: a prospective, randomized, multiple crossover trial. J Neurosurg. 2018 May 25:1-7. doi: 10.3171/2017.12.JNS171665. Epub ahead of print. PMID: 29799344; PMCID: PMC6279620.
13. Liu WX, Wang J, Xie ZM, Xu N, Zhang GF, Jia M, Zhou ZQ, Hashimoto K, Yang JJ. Regulation of glutamate transporter 1 via BDNF-TrkB signaling plays a role in the anti-apoptotic and antidepressant effects of ketamine in chronic unpredictable stress model of depression. Psychopharmacology (Berl). 2016 Feb;233(3):405-15. doi: 10.1007/s00213-015-4128-2. Epub 2015 Oct 29. PMID: 26514555.
14. Shibakawa YS, Sasaki Y, Goshima Y, Echigo N, Kamiya Y, Kurahashi K, Yamada Y, Andoh T. Effects of ketamine and propofol on inflammatory responses of primary glial cell cultures stimulated with lipopolysaccharide. Br J Anaesth. 2005 Dec;95(6):803-10. doi: 10.1093/bja/aei256. Epub 2005 Oct 14. PMID: 16227338.
15. Chang Y, Chen TL, Sheu JR, Chen RM. Suppressive effects of ketamine on macrophage functions. Toxicol Appl Pharmacol. 2005 Apr 1;204(1):27-35. doi:10.1016/j.taap.2004.08.011. PMID: 15781291.
16. Shaked G, Czeiger D, Dukhno O, Levy I, Artru AA, Shapira Y, Douvdevani A. Ketamine improves survival and suppresses IL-6 and TNFalpha production in a model of Gram-negative bacterial sepsis in rats. Resuscitation. 2004 Aug;62(2):237-42. doi: 10.1016/j.resuscitation.2004.02.015. PMID: 15294410.
17. Loix S, De Kock M, Henin P. The anti-inflammatory effects of ketamine: state of the art. Acta Anaesthesiol Belg. 2011;62(1):47-58. PMID: 21612145.
18. Chang Y, Chen TL, Wu GJ, Hsiao G, Shen MY, Lin KH, Chou DS, Lin CH, Sheu JR. Mechanisms involved in the antiplatelet activity of ketamine in human platelets. J Biomed Sci. 2004 Nov-Dec;11(6):764-72. doi: 10.1007/BF02254361. PMID: 15591773.
19. Nakagawa T, Hirakata H, Sato M, Nakamura K, Hatano Y, Nakamura T, Fukuda K. Ketamine suppresses platelet aggregation possibly by suppressed inositol triphosphate formation and subsequent suppression of cytosolic calcium increase. Anesthesiology. 2002 May;96(5):1147-52. doi: 10.1097/00000542-200205000-00018. PMID: 11981155.
20. Undar A, Eichstaedt HC, Clubb FJ Jr, Lu M, Bigley JE, Deady BA, Porter A, Vaughn WK, Fung M. Anesthetic induction with ketamine inhibits platelet activation before, during, and after cardiopulmonary bypass in baboons. Artif Organs. 2004 Oct;28(10):959-62. doi: 10.1111/j.1525-1594.2004.07377.x. PMID: 15385005.
21. Hudetz JA, Iqbal Z, Gandhi SD, Patterson KM, Byrne AJ, Hudetz AG, Pagel PS, Warltier DC. Ketamine attenuates post-operative cognitive dysfunction after cardiac surgery. Acta Anaesthesiol Scand. 2009 Aug;53(7):864-72. doi: 10.1111/j.1399-6576.2009.01978.x. Epub 2009 Apr 28. PMID: 19422355.
22. Hudetz JA, Patterson KM, Iqbal Z, Gandhi SD, Byrne AJ, Hudetz AG, Warltier DC, Pagel PS. Ketamine attenuates delirium after cardiac surgery with cardiopulmonary bypass. J Cardiothorac Vasc Anesth. 2009 Oct;23(5):651-7. doi: 10.1053/j.jvca.2008.12.021. Epub 2009 Feb 23. PMID: 19231245.
23. Zilberstein G, Levy R, Rachinsky M, Fisher A, Greemberg L, Shapira Y, Appelbaum A, Roytblat L. Ketamine attenuates neutrophil activation after cardiopulmonary bypass. Anesth Analg. 2002 Sep;95(3):531-6, table of contents. doi: 10.1097/00000539-200209000-00005. PMID: 12198030.
24. Roytblat L, Talmor D, Rachinsky M, Greemberg L, Pekar A, Appelbaum A, Gurman GM, Shapira Y, Duvdenani A. Ketamine attenuates the interleukin-6 response after cardiopulmonary bypass. Anesth Analg. 1998 Aug;87(2):266-71. doi: 10.1097/00000539-199808000-00006. PMID: 9706914.
25. Godoy, D.A., Badenes, R., Pelosi, P. et al. Ketamine in acute phase of severe traumatic brain injury "an old drug for new uses?". Crit Care 25, 19 (2021). https://doi.org/10.1186/s13054-020-03452-x
26. Gregers MCT, Mikkelsen S, Lindvig KP, Brøchner AC. Ketamine as an Anesthetic for Patients with Acute Brain Injury: A Systematic Review. Neurocrit Care. 2020 Aug;33(1):273-282. doi: 10.1007/s12028-020-00975-7. PMID: 32328972; PMCID: PMC7223585.

REFERENCES CONTINUED

27. Edward F. Domino, David S. Warner; Taming the Ketamine Tiger. Anesthesiology 2010; 113:678–684 doi: https://doi.org/10.1097/ALN.0b013e3181ed09a2
28. Domino, Edward F., Peter Chodoff, and Guenter Corssen. "Pharmacologic effects of CI-581, a new dissociative anesthetic, in man." Clinical Pharmacology & Therapeutics 6.3 (1965): 279-291.
29. Ketamine hydrochloride (Ketalar). Clin Pharmacol Ther. 1970 Sep-Oct;11(5):777-80. doi: 10.1002/cpt1970115777. PMID: 4989499.
30. Sofia RD, Harakal JJ. Evaluation of ketamine HCl for anti-depressant activity. Arch Int Pharmacodyn Ther. 1975 Mar;214(1):68-74. PMID: 1156026.
31. Anis NA, Berry SC, Burton NR, Lodge D. The dissociative anaesthetics, ketamine and phencyclidine, selectively reduce excitation of central mammalian neurones by N-methyl-aspartate. Br J Pharmacol. 1983 Jun;79(2):565-75. doi: 10.1111/j.1476-5381.1983.tb11031.x. PMID: 6317114; PMCID: PMC2044888.
32. Chaturvedi HK, Chandra D, Bapna JS. Interaction between N-methyl-D-aspartate receptor antagonists and imipramine in shock-induced depression. Indian J Exp Biol. 1999 Oct;37(10):952-8. PMID: 10783752.
33. Trullas R, Skolnick P. Functional antagonists at the NMDA receptor complex exhibit antidepressant actions. Eur J Pharmacol. 1990 Aug 21;185(1):1-10. doi: 10.1016/0014-2999(90)90204-j. PMID: 2171955.
34. Autry AE, Adachi M, Nosyreva E, Na ES, Los MF, Cheng PF, Kavalali ET, Monteggia LM. NMDA receptor blockade at rest triggers rapid behavioural antidepressant responses. Nature. 2011 Jun 15;475(7354):91-5. doi: 10.1038/nature10130. PMID: 21677641; PMCID: PMC3172695.
35. Koike H, Iijima M, Chaki S. Involvement of AMPA receptor in both the rapid and sustained antidepressant-like effects of ketamine in animal models of depression. Behav Brain Res. 2011 Oct 10;224(1):107-11. doi: 10.1016/j.bbr.2011.05.035. Epub 2011 Jun 6. PMID: 21669235.
36. Hashimoto K. Rapid-acting antidepressant ketamine, its metabolites and other candidates: A historical overview and future perspective. Psychiatry Clin Neurosci. 2019 Oct;73(10):613-627. doi: 10.1111/pcn.12902. Epub 2019 Jul 11. PMID: 31215725; PMCID: PMC6851782.
37. Berman RM, Cappiello A, Anand A et al Antidepressant effects of ketamine in depressed patients. Biol. Psychiatry 2000; 47: 351–354.
38. Zarate CA Jr, Singh JB, Carlson PJ, Brutsche NE, Ameli R, Luckenbaugh DA, Charney DS, Manji HK. A randomized trial of an N-methyl-D-aspartate antagonist in treatment-resistant major depression. Arch Gen Psychiatry. 2006 Aug;63(8):856-64. doi: 10.1001/archpsyc.63.8.856. PMID: 16894061.
39. Bobo WV, Vande Voort JL, Croarkin PE, Leung JG, Tye SJ, Frye MA. KETAMINE FOR TREATMENT-RESISTANT UNIPOLAR AND BIPOLAR MAJOR DEPRESSION: CRITICAL REVIEW AND IMPLICATIONS FOR CLINICAL PRACTICE. Depress Anxiety. 2016 Aug;33(8):698-710. doi: 10.1002/da.22505. Epub 2016 Apr 6. PMID: 27062450.
40. Grunebaum MF, Galfalvy HC, Choo TH, Keilp JG, Moitra VK, Parris MS, Marver JE, Burke AK, Milak MS, Sublette ME, Oquendo MA, Mann JJ. Ketamine for Rapid Reduction of Suicidal Thoughts in Major Depression: A Midazolam-Controlled Randomized Clinical Trial. Am J Psychiatry. 2018 Apr 1;175(4):327-335. doi: 10.1176/appi.ajp.2017.17060647. Epub 2017 Dec 5. PMID: 29202655; PMCID: PMC5880701.
41. Singh JB, Fedgchin M, Daly EJ, De Boer P, Cooper K, Lim P, Pinter C, Murrough JW, Sanacora G, Shelton RC, Kurian B, Winokur A, Fava M, Manji H, Drevets WC, Van Nueten L. A Double-Blind, Randomized, Placebo-Controlled, Dose-Frequency Study of Intravenous Ketamine in Patients With Treatment-Resistant Depression. Am J Psychiatry. 2016 Aug 1;173(8):816-26. doi: 10.1176/appi.ajp.2016.16010037. Epub 2016 Apr 8. PMID: 27056608.
42. Whittaker E, Dadabayev AR, Joshi SA, Glue P. Systematic review and meta-analysis of randomized controlled trials of ketamine in the treatment of refractory anxiety spectrum disorders. Ther Adv Psychopharmacol. 2021 Dec 15;11:20451253211056743. doi: 10.1177/20451253211056743. PMID: 34925757; PMCID: PMC8679040.
43. Taylor JH, Landeros-Weisenberger A, Coughlin C, Mulqueen J, Johnson JA, Gabriel D, Reed MO, Jakubovski E, Bloch MH. Ketamine for Social Anxiety Disorder: A Randomized, Placebo-Controlled Crossover Trial. Neuropsychopharmacology. 2018 Jan;43(2):325-333. doi: 10.1038/npp.2017.194. Epub 2017 Aug 29. PMID: 28849779; PMCID: PMC5729569.

REFERENCES CONTINUED

44. Diazgranados N, Ibrahim L, Brutsche NE, Newberg A, Kronstein P, Khalife S, Kammerer WA, Quezado Z, Luckenbaugh DA, Salvadore G, Machado-Vieira R, Manji HK, Zarate CA Jr. A randomized add-on trial of an N-methyl-D-aspartate antagonist in treatment-resistant bipolar depression. Arch Gen Psychiatry. 2010 Aug;67(8):793-802. doi: 10.1001/archgenpsychiatry.2010.90. PMID: 20679587; PMCID: PMC3000408.

45. Zarate CA Jr, Brutsche NE, Ibrahim L, Franco-Chaves J, Diazgranados N, Cravchik A, Selter J, Marquardt CA, Liberty V, Luckenbaugh DA. Replication of ketamine's antidepressant efficacy in bipolar depression: a randomized controlled add-on trial. Biol Psychiatry. 2012 Jun 1;71(11):939-46. doi: 10.1016/j.biopsych.2011.12.010. Epub 2012 Jan 31. PMID: 22297150; PMCID: PMC3343177.

46. Fava M, Freeman MP, Flynn M, Judge H, Hoeppner BB, Cusin C, Ionescu DF, Mathew SJ, Chang LC, Iosifescu DV, Murrough J, Debattista C, Schatzberg AF, Trivedi MH, Jha MK, Sanacora G, Wilkinson ST, Papakostas GI. Double-blind, placebo-controlled, dose-ranging trial of intravenous ketamine as adjunctive therapy in treatment-resistant depression (TRD). Mol Psychiatry. 2020 Jul;25(7):1592-1603. doi: 10.1038/s41380-018-0256-5. Epub 2018 Oct 3. Erratum in: Mol Psychiatry. 2019 Jan 7;: PMID: 30283029; PMCID: PMC6447473.

47. Phillips JL, Norris S, Talbot J, Birmingham M, Hatchard T, Ortiz A, Owoeye O, Batten LA, Blier P. Single, Repeated, and Maintenance Ketamine Infusions for Treatment-Resistant Depression: A Randomized Controlled Trial. Am J Psychiatry. 2019 May 1;176(5):401-409. doi: 10.1176/appi.ajp.2018.18070834. Epub 2019 Mar 29. PMID: 30922101.

48. Feder A, Costi S, Rutter SB, Collins AB, Govindarajulu U, Jha MK, Horn SR, Kautz M, Corniquel M, Collins KA, Bevilacqua L, Glasgow AM, Brallier J, Pietrzak RH, Murrough JW, Charney DS. A Randomized Controlled Trial of Repeated Ketamine Administration for Chronic Posttraumatic Stress Disorder. Am J Psychiatry. 2021 Feb 1;178(2):193-202. doi: 10.1176/appi.ajp.2020.20050596. Epub 2021 Jan 5. PMID: 33397139.

49. Jumaili WA, Trivedi C, Chao T, Kubosumi A, Jain S. The safety and efficacy of ketamine NMDA receptor blocker as a therapeutic intervention for PTSD review of a randomized clinical trial. Behav Brain Res. 2022 Apr 29;424:113804. doi: 10.1016/j.bbr.2022.113804. Epub 2022 Feb 16. PMID: 35181391.

50. https://www.fda.gov/news-events/press-announcements/fda-approves-new-nasal-spray medication-treatment-resistant-depression-available-only-certified

51. Bombardier CH, Fann JR, Temkin NR, Esselman PC, Barber J, Dikmen SS. Rates of major depressive disorder and clinical outcomes following traumatic brain injury. JAMA. 2010 May 19;303(19):1938-45. doi: 10.1001/jama.2010.599. PMID: 20483970; PMCID: PMC3090293.

What is Ketamine and Why Does It Help with Mood Disorders, Anxiety, and Chronic Neuropathic Pain?

By Dr. Sofia Peeva

Keywords: TBI, Ketamine, Depression

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2021-2023

1. **Domain 5. Perception/cognition. Class 4. Cognition**
2. **Domain 4-Activity/rest. Class 2. Activity/exercise**
3. **Domain 4-Activity/rest. Class 5. Self-care**

According to the World Health Organization, depression is the leading cause of disability worldwide. Depression affects more than 360 million people every year globally (and counting). Our current modalities to treat depression and anxiety are failing. With just under a 40% response rate with oral antidepressants, many patients are left wondering, "Do I have to live like this forever?"

Until recently, the answer to this question may have been yes. Then ketamine entered the sphere of mental health and showed overwhelmingly positive results.

When compared to oral antidepressant medications, which can sometimes take 4-6 weeks to begin working, ketamine

therapy can improve symptoms rapidly in just a few infusions. Ketamine is quickly becoming the fastest-acting and most efficacious anti-suicidal treatment available to patients.

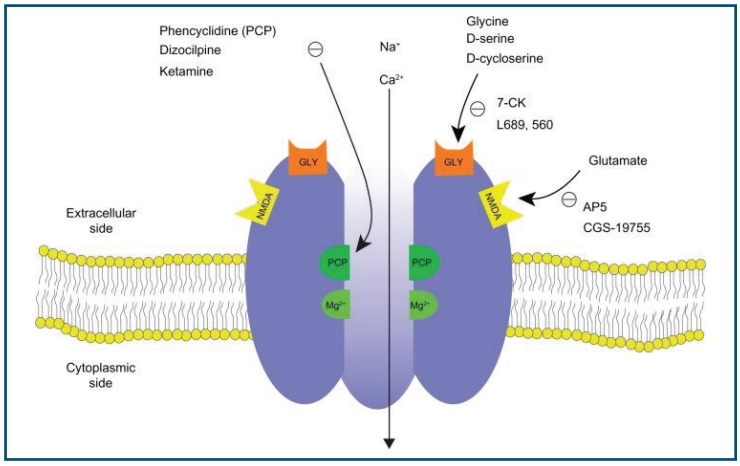
Ketamine began its journey as a synthesized drug in 1962 when Parke Davis and Calvin Stevens combined a ketone with an amine. Ketamine replaced a drug by the name of phencyclidine (PCP) because it had a much better safety profile. Ketamine was initially used in veterinary medicine to sedate horses and dogs. It was first introduced into human clinical use in the mid 1960's and was used extensively in the Vietnam War as a sole anesthetic.

Since its introduction into human use, and in addition to being used in mental health, ketamine is most often used as an adjunct to general anesthetics and in conscious sedation procedures. The population that ketamine is most often used in for procedures is children because of its excellent safety profile and minimal side effects.

Although we do not have a complete understanding of how ketamine works, we do know that one of its main targets is the N- methyl – D – aspartate (NMDA) receptor. The NMDA receptor has been implicated in the mechanism of anesthesia, pain transmission, morphine tolerance, memory and cognitive function, long term potentiation, long term depression, neuronal toxicity, and inflammatory responses. Most recently, animal studies are showing that ketamine can spur neuronal growth prompting research into ketamine and traumatic brain injuries.

By antagonizing the NMDA receptor, ketamine can control the influx of glutamate which is one of the most prevalent excitatory neurotransmitters. It is believed that the slower the rate of release of glutamate, the less sensitized the nervous system becomes which in turn helps decrease nervous system signal transmission. To put this in context, an excited nervous system can lead to organ damage and dysfunction and is one component that is believed to be the cause of chronic neuropathic pain syndromes.

NMDA RECEPTOR:



Ketamine can also bind to a variety of other receptors and exert its effects. In addition to binding to the NMDA receptor, ketamine can interact with certain opioid receptors, muscarinic receptors, adenosine receptors, voltage gated calcium channels, and it also has local anesthetic properties. Due to this unique ability to be non-selective in its receptor binding, ketamine has the capability to treat a wide range of pain and mood disorders such as Chronic Regional Pain Syndrome (CRPS), fibromyalgia, depression, anxiety, PTSD, and as well as other conditions.

Is Ketamine a Psychedelic?

Although ketamine is commonly described as a psychedelic and placed in the same category as MDMA (ecstasy) and psilocybin, technically ketamine is not a psychedelic and is best classified as a dissociative anesthetic. However, ketamine does possess some psychedelic properties as it can induce visual hallucinations and "out of body" sensations during its administration. Often patients will describe their ketamine journeys as profound experiences. These journeys may involve different physical sensations, colors, sounds, thoughts, emotions, and insights. These insights can help guide patients and stimulate a shift in perspective, break negative thinking patterns, and help patients overcome mental roadblocks to their recovery and healing.

How is Ketamine Administered?

Ketamine comes in many formulations and its routes of administration include intravenous, oral, intramuscular, intranasal and rectal.

Of these routes of administration, the intravenous route is considered the gold standard because of its predictability and consistency which can be attributed to its 100% bioavailability. The bioavailability can be used to explain a lot about why certain routes of administration are superior. For example, a popular way to administer ketamine is intranasally however its bioavailability is low and also variable. The same is true for orally administered ketamine. This means that administrations of the medications are unpredictable and variable from session to session. A disadvantage with the intranasal ketamine route of administration also stems from the availability of dry nasal passage membranes because the ketamine cannot penetrate through membranes covered in mucus. Therefore, when prescribing or administering ketamine, bioavailability should be an important consideration in the decision-making process.

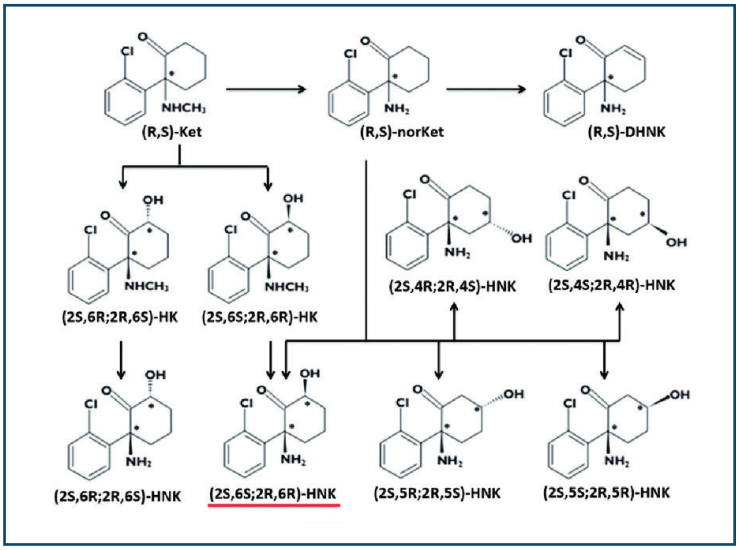
Ketamine, when given intravenously, has a rapid onset due to its high lipid solubility. Its low protein binding allows the ketamine molecule to easily and rapidly diffuse into cell membranes and exert its effect. It can be more precisely dosed because 100% of the medication goes systemically unlike the oral/intranasal versions. Ketamine administered

as an infusion also allows for a steady amount of ketamine to constantly enter the blood stream. This permits the experience to be more fluid and for the patient to spend the maximum amount of time in the therapeutic zone. Most infusions last between 40 to 60 minutes. The immediate effects of intravenous ketamine are terminated similarly to other intravenous medications via redistribution to other less vascular organs. Although the immediate effects of ketamine can wear off in minutes to hours, ketamine does have metabolites of which many are believed also to be active.

KETAMINE BIOAVAILABILITY:

ROUTES	BIOAVAILABILITY
IV	100%
IM	93%
INTRANASAL	25-50%
SUBLINGUAL	25-50%
ORAL	17-24%
RECTAL	25-50%

METABOLITES OF KETAMINE:



How Does Ketamine Help with Pain and Pain Syndromes?

Ketamine is believed to alleviate pain through several pathways. Ketamine can produce analgesia by the action of dissociation. In this sense ketamine has commonly been employed in the emergency room for minor procedures and during short periods of extreme pain, for example, when setting broken bones or noses.

The chronic pain syndromes that ketamine is believed to be particularly effective in fall in the category of neuropathic pain syndromes. We believe that ketamine helps these pain syndromes via the modulation of the glutamate neurotransmitter. By decreasing the release and circulation of glutamate, an excitatory neurotransmitter, we achieve a decrease in the excitation of the nervous system.

The currently suggested protocols from the A merican Society of Anesthesia to treat chronic pain syndromes involve a series of 6 infusions to be completed two to three times per week. Each session lasts 3-4 hours and involves high doses of ketamine. Current research is showing that ketamine therapy for chronic pain likely has benefits however much more research is needed to identify the optimal protocols to render long lasting pain control.

The suggested protocols for mood disorders require intravenous infusions over 45-60 mins once or twice per week for six total infusions. Many of the studies that are coming out with administration protocols are showing that to achieve long lasting effects ketamine should be given in pulses or infusion clusters. Studies indicate that most individuals will respond to ketamine between infusion 4 and 8 and for this reason you see many clinics offering 6 session infusion packages.

The protocols for intranasal, intravenous, and oral ketamine can vary between clinics and the guidelines will likely evolve with time as more data becomes available through on-going studies.

Furthermore, there is research looking into the effects of ketamine when coupled with intention setting and integration therapy. The results are showing that ketamine when coupled with the right type of therapy and in the correct setting can achieve longer lasting effects.

How Effective is Ketamine for Mood/Anxiety Disorders?

A large peer-reviewed retrospective analysis of intravenous ketamine therapy in real-world setting ORKA – 1 (Osmind Real-world Ketamine Analyses) looked at thousands of patient data points and concluded that symptom improvement occurs in 70% of patients. This is consistent with the outcomes that we see at our ketamine clinic, Propel Therapeutics.

Who is a candidate for ketamine therapy for mood and anxiety disorders?

Most patients that present for ketamine therapy can be treated safely if they meet the indications. Indications for ketamine therapy include mood disorders, anxiety disorders, and PTSD that has not responded to other forms of treatment. Patients should receive a thorough psychiatric

evaluation to determine if they are an appropriate treatment candidate. Psychiatric contraindications include mania and active psychosis. Patients should also be motivated and prepared to come in for at least four ketamine therapy sessions.

While ketamine is very safe, there are a few medical contraindications to its use. Since the initial action on the cardiovascular system is due to amine reuptake inhibition (ex: epinephrine, dopamine, serotonin), ketamine can cause an increase in heart rate and blood pressure. It is not advised to administer ketamine to individuals with uncontrolled hypertension and some arrythmias. A pregnant patient should never be given ketamine as there is insufficient evidence at this time to assess its safety to an unborn fetus. Therefore, clinics should screen for pregnancy in women of childbearing age and give proper consent to patients who decline an in-office pregnancy test. Ketamine, like many other medications, is metabolized by the liver and excreted by the kidneys consequently patients with cirrhosis and end-stage-kidney disease are not considered suitable candidates for this therapy.

Is Ketamine Addictive?

Ketamine has a very low addiction potential. The classic definition of highly addictive substances require they create a sense of euphoria that leads to withdrawal once the drug is withheld. Ketamine doesn't fit into these criteria. In fact, recent research has shown to be favorable toward ketamine being used to treat addiction such as alcoholism. Generally, if someone is abusing other drugs, and/or alcohol, they would want to have a period of 30 day of sobriety before considering ketamine therapy as a form of treatment to maintain sobriety. These studies are all in their infancy and so more data is needed to accurately access the role of ketamine in addiction medicine.

Overall, ketamine is a highly effective treatment for mood disorders, anxiety, PTSD, and chronic pain. These are conditions that often do not respond to first line treatment options and leave patients with chronic disabilities and significant impairment in functioning. Ketamine is a novel modality that has dramatically changed the landscape of mental health treatments available to these patients, giving new hope to these conditions.

REFERENCES

1. Eric S Schwenk, Eugene R Viscusi, Asokumar Buvanendran[1] , Robert W Hurley[2] , Ajay D Wasan[3] , Samer Narouze[4], Anuj Bhatia[5], Fred N Davis[6], William M Hooten[7], & Steven P Cohen. (2018) Consensus Guidelines on the Use of Intravenous Ketamine Infusions for Acute Pain Management From the American Society of Regional Anesthesia and Pain Medicine, the American Academy of Pain Medicine, and the American Society of Anesthesiologist; https://pubmed.ncbi.nlm.nih.gov/29870457/

2. Alan F Schatzberg. (2021) Mechanisms of Action of Ketamine and Esketamine. https://ajp.psychiatryonline.org/doi/abs/10.1176/appi.ajp.2021.21060653

3. Jianli Zhao[1 2], Yajing Wang[1] , Dajie Wang[3] (2018) The Effect of Ketamine Infusion in the Treatment of Complex Regional Pain Syndrome: a Systemic Review and Meta-analysis. https://pubmed.ncbi.nlm.nih.gov/29404715/

4. José Eduardo Guimarães Pereira[1 2], Lucas Ferreira Gomes Pereira[3] , Rafael Mercante Linhares[4] , Carlos Darcy Alves Bersot[5] , Theodoros Aslanidis[6], Hazem Adel Ashmawi. (2022)i. [1]Efficacy and Safety of Ketamine in the Treatment of Neuropathic Pain: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. 2022 Apr 9;15:1011-1037. doi: 10.2147/JPR.S358070. eCollection 2022.

5. Low Dose Ketamine Infusions for Comorbid PTSD and Chronic Pain: A randomized Double-Blind Clinical Trial; Alisher R Dadabayev, Sonalee A Joshi, Mariam H. Reda, Tamar Lake, Mark S. Hausman, Edward Domino, Israel Liberzon; Chronic Stress 2020 Jan-dec4; 2470547020981670; DOI 10.1177/2470547020981670

6. Lange; Butterworth; Mackey; Wasnick. Clinical Anesthesiology; 5th edition.

Image References

NMDA receptor: Schematic diagram of NMDA receptor complex. The NMDA receptor is an... | Download Scientific Diagram (researchgate.net)

Metabolites of ketamine Image: Ketamine metabolism. Ket: ketamine; NK: norketamine; DHNK:... | Download Scientific Diagram (researchgate.nett)

Reviewers

The editor wants to thank the following people for their Peer Reviews. Without these hardworking people, the journal would be far less authoritative. The following comments are in addition to the expectations of peer review.

- Misty, your resources and perspective were invaluable.
- Chris, your detailed feedback in-text helped the editor reconsider some clarity issues. Not something expected from Peer Review, but something always appreciated.
- Patti, your rapid and considerate review allowed the editor to have productive conversations with some of the authors before any other reviews came back.
- Dawn, your calls for additional material enriched our offerings.
- Melinda, your perspective is different than most of our reviewers and brought a powerful lens to the materials.

Thank you all!


CRASH CART
TOOLS TO REVIVE YOUR PRACTICE
AANLCP
Crash Cart
now
hosted
&
maintained
by
FIG®
FIGeducation.com

NURSE LIFE CARE PLANNING CERTIFICATION

CERTIFICATION BY EXAM

Candidates must meet the following eligibility criteria per the application deadline as indicated in the CNLCP® Handbook for Candidates and on the Website:
http://cnlcp.org/certification-by-examination/

CNLCP® HANDBOOK FOR CANDIDATES & APPLICATION

Application:
http://ptcny.com/pdf/cnlcp.pdf

CNLCP® Handbook for Candidates:
http://www.ptcny.com/PDF/CNLCP.pdf

AANLCP® Member Discounts

FOR MORE INFORMATION PLEASE VISIT

WWW.CNLCP.ORG

OR CONTACT:

Jan Roughan, Chairperson

Phone: 626-351-0991 Ext. 216

janr@linc.biz

Value of CNLCP® Certification

As healthcare has become more complex, it is increasingly vital to assure the public that healthcare professionals are competent. Individual State Registered Nurse (RN) licensure measures entry-level competence only; and, in so doing, provides the legal authority for an individual to practice nursing. It is the minimum professional practice standard.

Certification, on the other hand, is a formal recognition that validates knowledge, experience, skills and clinical judgment within a specific nursing specialty; and, as such, is reflective of a more stringent professional practice standard. It affirms achievement of proficiency beyond basic licensure.

The Certified Nurse Life Care Planner (CNLCP®) Certification Board is a separately incorporated entity that facilitates consumer health and safety through credentialing/certification of nurse life care planners. It ensures that their practice is consistent with established standards of excellence in the development and defense of the life care planning document.

Similar to consumers knowing to seek out certification status within other professions (e.g., dentists, pharmacists), certification within the field of nurse life care planning has become an important indicator that a certified nurse not only holds state licensure to practice nursing, but is qualified, competent and has met rigorous requirements in the achievement of the CNLCP® credential.

The policies and procedures used by the CNLCP® Certification Board to construct and review items and examination forms for the CNLCP® examination are consistent with guidelines recommended by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (AERA, APA, NCME; 2014) as well as other industry standards such as: Standards for the Accreditation of Certification Programs (National Commission for Certifying Agencies, 2014) and Conformity assessment — General requirements for bodies operating certification of persons (ISO/IEC 17024).

AANLCP® supports certification through the CNLCP® Certification Board.

CNLCP® is a registered trademark of the CNLCP® Certification Board.

LOOKING AHEAD

2023

Winter:	Pediatrics
Spring:	Business of Life Care Planning
Summer:	Interacting with other Disciplines
Fall:	Assistive and Durable Medical Equipment

Index of Past Issues

all past issues from 2009-present area available as PDFs for free download at **www.aanlcp.org**

2014

XIV.1 Technology Updates
XIV.2 LCP Across All Ages
XIV.3 Psych topics in LCP
XIV.4 LCP and the ACA

2015

XV.1 Topics in Translation
XV.2 Updates in Spinal Cord Injury
XV.3 Burns
XV.4 Perinatal / Childhood

2016

XVI.1 Pain
XVI.2 GI Issues
XVI.3 International LCP
XVI.4 Home Care

2017

XVII.1 Brain Injury
XVII.2 The Business of Life Care Planning
XVII.3 Back and Spine
XVII.4 Mobility and Extemity Function

2018

XVIII.1 Costing and Coding

2019

XIX.1 Presidents Issue
XIX.2 Licensure I Qualifications I Certifications
XIX.3 New Directions in Pain Management
XIX.4 Technology Updates

2020

XX.1 Spinal Cord Injury Updates
XX.2 Advances in Amputation
XX.3 Evidence Based Practice
XX.4 Durable Medical Equipment and NLCP

2021

XXI.1 Therapeutic Modalities
XXI.2 The Business of NLCP
XXI.3 Ages and Stages in Life Care Planning

2022

XXII.1 Expert Witnessing and Testimony
XXII.2 Pain Management Revisited