2nd NATIONAL SYMPOSIUM ON COMPLEMENTARY AND ALTERNATIVE GERIATRIC HEALTH CARE

PROMOTING BALANCE AND FALL PREVENTION

AND THE 23rd ANNUAL GERIATRIC RESEARCH, EDUCATION & CLINICAL CENTER SYMPOSIUM

WELCOME TO
LOGAN COLLEGE OF CHIROPRACTIC

2nd NATIONAL SYMPOSIUM ON COMPLEMENTARY AND ALTERNATIVE GERIATRIC HEALTH CARE PROMOTING BALANCE AND FALL PREVENTION AND THE 23rd ANNUAL GERIATRIC RESEARCH, EDUCATION & CLINICAL CENTER SYMPOSIUM

September 20-21, 2008

Acknowledgements:

This educational activity is sponsored by the following:

Logan College of Chiropractic
Saint Louis University School of Medicine
Gateway Geriatric Education Center OF Missouri & Illinois
Veteran Integrated Service Network 15 GRECC

Conference Overview & Objectives:

Provide a unique multidisciplinary educational conference that advances the clinician's skill and understanding of balance and the prevention of falls in the community and hospital setting. CAM techniques and conventional approaches to fall prevention will be emphasized. Lectures with illustrative case study presentations, and a discussion panel will help facilitate the delivery of these objectives.

- Review the anatomical and neurophysiological principles underlying balance and equilibrium
- Identify the impact of aging on balance and equilibrium
- Present the intrinsic and extrinsic risk factors underlying falls
- Review the optimal history and physical examination of the patient with a fall history
- Discuss the testing strategy (labs, imaging, EKG) for the fall patient
- Present the range of complications associated with falls
- Identify the range of clinical techniques (Tai Chi, nutrition, manual therapy, rehabilitation, pharmacologic, hip protectors) for improving balance and reducing fall risk in community and hospital settings

Planning Committee:

Norman W. Kettner, D.C., Chair, Department of Radiology, Logan College of Chiropractic

Nina Tumosa, Ph.D., GRECC Health Educational Specialist, St. Louis Veterans Affairs
Medical Center

Cynthia Bardenheier, Administrative Assistant to Nina Tumosa, PhD, St. Louis, VAMC– Jefferson Barracks

Elizabeth Goodman, D.C., Ph.D., Interim Dean of Admissions, Logan College of Chiropractic

Carl Saubert, Ph.D., Associate Vice President, Logan College of Chiropractic

Glenn Bub, D.C., Chief of Staff, Logan College of Chiropractic

Fawn Knoll, Public Relations**,** Logan College of Chiropractic

Erica Collier, Administrative Assistant, Department of Radiology, Logan College of Chiropractic

Continuing Education Credits:

ACCREDITATION/APPROVAL

American Nurses Credentialing Center (ANCC)

Saint Louis University School of Nursing is an approved provider of continuing nursing education by the Missouri Nurses Association, an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation. Missouri Nurses Association provider # 109-VII. California State Board Provider #13123.

American Medical Association (ACCME)

Saint Louis University School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The Saint Louis University maintains responsibility for the program. A certificate of attendance will be awarded to participants and accreditation records will be on file at the Saint Louis University CME office. In order to receive a certificate, participants must sign in at the beginning of this activity, complete an evaluation, attend 100% of the program, and pick up their own certificate at the conclusion of the program (certificates will not be mailed). Saint Louis University cannot issue certificates for less than 100% participation as required by accrediting body regulations.

CONTINUING EDUCATION CREDITS:

American Nurses Credentialing Center (ANCC)

Saint Louis University School of Nursing designates this educational activity for 12.25 contact hours in continuing nursing education

American Medical Association (ACCME)

Saint Louis University School of Medicine designates this activity for a maximum of 12.25 AMA PRA Category I Credit(s)™. Physicians should only claim credit commensurate with the extent of their participation in the activity. Continuing Education Certificates will be mailed only to those participants who have requested and paid for them. The certificates will be mailed to the participants by November 1. Should you need verification of your attendance before this date, please see the attendant at the registration booth prior to your departure from the conference. In order to receive continuing education credit, participants must complete and evaluation. Contact St. Louis University representative for ACCME, Nina Tumosa at tumosan@slu.edu for questions related to ACCME credit.

Missouri Board of Nursing Home Administrators

The Division of Geriatrics at Saint Louis University is approved as a Training Agency (TA-064-408) by the Missouri Board of Nursing Home Administrators. This program is being reviewed for a maximum of 12.25 clock hours including a maximum of 10.25 hours that could be patient care hours. For your convenience, each presentation has been assigned the number of proposed patient care and/or administrative hours being reviewed by the Missouri Board of Nursing Home administrators. Continuing Education Certificates will be available at the registration booth prior to your departure from the conference. Copies of the sign-in/sign-out sheets will be forwarded to the Missouri Board of Nursing Home Administrators indicating those people who have paid for continuing education credits. This information will be sent within 30 days of the conclusion of the conference. In order to receive continuing education credit, participants must complete an evaluation for all sessions attended. Contact St. Louis University representative for NHA, Nina Tumosa at tumosan@slu.edu for questions related to NHA credit.

Doctors of Chiropractic (DC)

12 general hours of CEUs have been approved for Missouri, Illinois, Kansas, Arkansas, Kentucky, and Iowa.

AMERICANS WITH DISABILITIES ACT POLICY:

In compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please contact Erica Collier at (636) 227-2100 extension 1830. Notification 48 hours prior to the meeting will enable Logan to make reasonable arrangements to ensure accessibility to this meeting. {28 CFR 35.102-35.104 ADA Title II}

Disclosure Policies

It is the policy of Saint Louis University School of Medicine to insure balance, independence, objectivity, and scientific rigor in its continuing medical education program. Faculty and planning committee members participating in these activities are required to disclose to the audiences prior to the activity the following:

1. The existence of any significant financial or other relationship with the manufacturer of any commercial product or provider of any commercial service discussed.
2. Their intention to discuss a product that is not labeled for the use under discussion.
3. Their intention to discuss preliminary research data.

Saint Louis University School of Medicine will review this activity's disclosures and resolve all identified conflicts of interest, if applicable.

FACULTY DISCLOSURE POLICY

It is the policy of Saint Louis University School of Medicine to insure balance, independence, objectivity and scientific rigor in all its educational programs. All faculty participating in these activities are expected to disclose to the program audiences (1) any real or apparent conflicts of interest related to the content of their presentations, and (2) if their presentation will include any information regarding unapproved uses of pharmaceuticals or (3) ongoing research (preliminary data).

FACULTY DISCLOSURES

All faculty have indicated no disclosures.

SAINT LOUIS UNIVERSITY SCHOOL OF MEDICINE
POLICY FOR RELATIONSHIPS WITH COMMERCIAL ENTITIES

The purpose of continuing medical education (CME) is to enhance the Physician's ability to care for patients. It is the responsibility of the accredited sponsor of a CME activity to assure that the activity is designed primarily for that purpose.

Accredited sponsors often receive financial and other support from non-accredited commercial organizations. Such support can contribute significantly to the quality of CME activities. The purpose of these guidelines is to describe appropriate behavior of accredited sponsors in planning, designing, implementing, and evaluating certified CME activities for which commercial support is received.

-Preamble: ACCME Standards for Commercial Support of CME

COMMERCIAL SUPPORT MAY BE ACCEPTED FOR AN EDUCATIONAL ACTIVITY UNDER THE FOLLOWING CONDITIONS

("Accredited sponsor" refers to Saint Louis University School of Medicine CME):

Statement of Purpose: The program must be for scientific and educational purposes only and will not promote the commercial entity's products, directly or indirectly.

Letter of Agreement: The accredited sponsor and the commercial entity must agree in writing (see Letter of Agreement) to abide by the ACCME Standards for Commercial Support of Continuing Medical Education and the FDA guidelines regarding same.

Design of Activity: In designing educational activities, the accredited sponsor (CME) must assure that the activities have the following characteristics: They must be free of commercial bias for or against any product; If the activities are concerned with commercial products, they must present objective information about those products, based on scientific methods generally accepted in the medical community. Full disclosure of potential conflicts of interest with industry must be made by all participating faculty members (see SLU Policy on Conflict of Interest and Disclosure form), and must be disclosed to the audience of the program through the publicity, in course syllabi, and/or in the introductions of presenters.

Independence of Accredited Sponsors: The design and production of educational activities shall be the ultimate responsibility of the accredited sponsor. Commercial supporters of such activities shall not control the planning, content or execution of the activity. To assure compliance with this standards, the following requirements must be adhered to.

Assistance with Preparation of Educational Materials: The content of slides and reference materials must remain the ultimate responsibility of the faculty selected by the accredited sponsor. A commercial supporter may be asked to help with the preparation of conference related educational materials, but these materials shall not, by their content or format, advance the specific proprietary interests of the commercial supporter.

Assistance with Educational Planning: An accredited sponsor may obtain information that will assist in planning and producing an educational activity from any outside source whether commercial or not. However, acceptance by an accredited sponsor of advice or services concerning speakers, invitees or other educational matters, including content, shall not be among the conditions of providing support by a commercial organization.

Marketing of CME Activities: Only the accredited sponsor may authorize a commercial supporter to disseminate information about a CME activity to the medical community. However, the content of such information is the responsibility of the accredited sponsor, and any such information must identify the educational activity as produced by the accredited sponsor.

Activities Repeated Many Times: If commercially supported educational activities are offered that repeat essentially the same information each time they are given, then it must be demonstrated that every iteration of that activity meets all of the Essentials and Standards of the ACCME.

Educational Activities or Materials Prepared by Proprietary Entities: When educational activities consisting of concepts or materials are prepared by proprietary entities, such activities must adhere to the Essentials and Standards in all respects, especially with regard to the provisions concerning the independence of the accredited sponsor in planning, designing, delivering and evaluating such activities.

Policy for Relationships With Commercial Entities

Enduring Materials: The accredited sponsor is responsible for the quality, content, and use of enduring materials for purposes of CME credit. (For the definition, see AC-CME "Standards for Enduring Materials.")

Identifying Products, Reporting on Research, and Discussing Unlabeled Uses of Products

a. Generic and Trade Names: Presentations must give a balanced view of therapeutic options. Faculty use of generic names will contribute to this impartiality. If trade names are used, those of several companies should be used rather than only that of a single supporting company.

b. Reporting Scientific Research: Objective, rigorous, scientific research conducted by commercial companies is an essential part of the process of developing new pharmaceutical or other medical products or devices. It is desirable that direct reports of such research be communicated to the medical community. An offer by a commercial entity to provide a presentation reporting the results of scientific research shall be accompanied by a detailed outline of the presentation which shall be used by the accredited sponsor to confirm the scientific objectivity of the presentation. Such information must conform to the generally accepted standards of experimental design, data collection and analysis.

c. Unlabeled Uses of Products: When an unlabeled use of a commercial product, or an investigational use not yet approved for the purpose is discussed during an educational activity, the accredited sponsor shall require the speaker to disclose that the product is not labeled for the use under discussion or that the product is still investigational.

Exhibits and Other Commercial Activities:

Exhibits: When commercial exhibits are part of the overall program, arrangements for these should not influence planning nor interfere with the presentation of CME activities. Exhibit placement should not be a condition of support for a CME activity. If exhibits are included as a part of an activity, exhibitors should represent a diversity of companies/products rather than those of a single company.

Representatives from the exhibiting companies may not act in a manner which could be interpreted as interfering with the educational activity (e.g., actively pursing the participants for the purpose of promoting a product).

Continuing medical education activities are not trade shows and must not give the appearance that the primary intent is marketing of product.

Commercial Activities During Educational Activities: No commercial promotional materials shall be displayed or distributed in the same room immediately before, during, or immediately after an educational activity certified for credit.

Commercial Supporters at Educational Activities: Representatives of commercial supporters may attend an educational activity, but may not engage in sales activities while in the room where the activity takes place.

Management of Funds from Commercial Sources:

Independence of the Accredited Sponsor in the Use of Contributed Funds: The ultimate decision regarding funding arrangements for CME activities must be the responsibility of the accredited sponsor. Funds from a commercial source should be in the form of **an educational grant made payable to the accredited sponsor** for the support of programming (see also Saint Louis University School of Medicine Guidelines for Continuing Medical Education Activities). The terms, conditions and purposes of such grants must be documented by a signed agreement between the commercial supporter and the accredited sponsor. All support associated with a CME activity, whether in the form of an educational grant or not, must be given with the full knowledge and approval of the accredited sponsor. No other funds from a commercial source shall be paid to the director of the activity, faculty, or others involved with the supported activity.

Payments to Faculty: Payment of reasonable honoraria and reimbursement of out-of-pocket expenses for faculty is customary and proper. **Payments to the faculty must be from the accredited sponsor, NOT the commercial supporter. As outlined above, "funds from a commercial source should be in the form of an educational grant made payable to the accredited sponsor…" Under no circumstances should a commercial supporter pay a faculty member directly.**

Policy for Relationships With Commercial Entities

Acknowledgement of Commercial Support: Commercial support must be acknowledged in printed announcements and brochures, however, reference must not be made to specific products.

Accountability for Commercial Support: Following the CME activity, upon request, the accredited sponsor should be prepared to report to each commercial supporter and other relevant parties, and each commercial supporter to the accredited sponsor, information concerning the expenditures of funds each has provided. Likewise, each commercial supporter should report to the accredited sponsor information concerning their expenditures in support of the activity.

Commercially Supported Social Events: Commercially supported social events at CME activities should not compete with, nor take precedence over, the educational events.

Policy on Disclosure of Faculty and Sponsor Relationships:

a. Disclosure Policy for All CME Activities: An accredited sponsor shall have a policy requiring disclosure of the existence of any significant financial interest or other relationship a faculty member or the sponsor has with the manufacturer's) of any commercial product's) discussed in an educational presentation. All certified CME activities shall conform to this policy (see Saint Louis University Faculty Disclosure Policy).

b. Disclosure in Conference Materials: CME faculty or sponsor relationships with commercial supporters shall be disclosed to participants prior to educational activities in brief statements in conference materials such as brochures, syllabi, exhibits, poster sessions, and also in post-meeting publications.

c. Disclosure for Regularly Scheduled Activities: In the case of regularly scheduled events, such as grand rounds, disclosure shall be made by the moderator of the activity after consultation with the faculty member or a representative of the supporter. Written documentation that disclosure information was given to participants shall be entered in the file for that activity.

Financial Support for Participants in Educational Activities:

a. Use of funds: In connection with an educational activity offered by an accredited sponsor, the sponsor may not use funds originating from a commercial source to pay travel, lodging, registration fees, honoraria, or personal expenses for non-faculty attendees. Subsidies for hospitality should not be provided outside of modest meals or social events that are held as part of the activity.

b. Scholarships for Medical Students, Residents and Fellows: Scholarship or other special funding to permit medical students, residents, or fellows to attend selected educational conferences may be provided, as long as the selection of students, residents or fellows who will receive the funds is made either by the academic or training institution or by the accredited sponsor with the full concurrence of the academic or training institution.

   Funding for medical students, residents or fellows is acceptable, however, the selection of those individuals must be unrestricted and should be the choice of the accredited sponsor and not the commercial organization, with the full concurrence of the academic or training institution.

2008 GERIATRIC SYMPOSIUM

Schedule of Events:

Saturday, September 20, 2008

8:00am	**Registration**
8:30am	**Welcome** **Dr. George A. Goodman** **President, Logan College of Chiropractic**
8:40am	**Introductions** **Dr. Norman W. Kettner**
8:45am—10:15am	**Managing and Treating the Geriatric Patient with Complementary and Alternative Medicine** **Dr. John E. Morley**
10:15am	**Break**
10:30am—11:30am	**Using Anatomical and Neurophysiological Principles to Manage and Treat Balance and Equilibrium Deficits in Elderly Patients** **Dr. William F. Huber**
11:30am—12:15pm	**Preclinical Signs of Decreasing Strength and Function that can Identify Elderly Patients at Risk for Falling** **Dr. Margaret Herning**
12:15pm	**Lunch**
1:00pm—1:45pm	**Assessment of Intrinsic and Extrinsic Risk Factors Underlying Fall in the Elderly Patient** **Dr. Helen W. Lach**
1:45pm—2:45pm	**How to Optimize the medical History and Physical Examination of an Elderly Patient with a History of Falls** **Dr. Glenn Bub**
2:45pm	**Break**
3:00pm—4:15pm	**Identifying and Managing the Complications of Falls in Older Adults** **Dr. Paul Dougherty**
4:15pm	**Evaluation**
4:30pm	**Adjournment/Closing Remarks** **Dr. Norman W. Kettner**

Sunday, September 21, 2008

8:15am	**Registration**
8:45am—9:45am	**Managing Fall Prevention by Incorporating Chiropractic Approaches Into Practice** **Dr. Cheryl Hawk**
9:45am—10:45am	**Managing and Treating Poor Balance with Exercise Regimens Designed for the Geriatric Patient** **Dr. Yuhua Li**
10:45am	**Break**
11:00am—12:00pm	**Promoting Patient Safety by Manipulating the Environment** **Dr. Karen Frank Barney**
12:00pm	**Lunch**
12:45pm—1:45pm	**Management of Polypharmacy in Order to Reduce Fall Risk in the Elderly Patient** **Dr. Hedva Barenholtz Levy**
1:45pm—2:45pm	**Using the Interdisciplinary Team to Manage Fall Risk in Elderly Patients** **Dr. Joseph Flaherty**
2:45pm	**Break**
3:00pm—4:15pm	**Panel Discussion: Assessing and Managing the Elderly Patient with a History of Falls** **Panelists: Dr. Cheryl Hawk, Dr. Yuhua Li, Dr. Hedva Barenholtz Levy, Dr. Joseph Flaherty**
4:15pm	**Evaluation**
4:30pm	**Adjournment/Closing Remarks** **Dr. Norman W. Kettner**

Lecture Handouts

Managing and Treating the Geriatric Patient with Complementary and Alternative Medicine

John E. Morley, MB, BCh

ART AND AGING

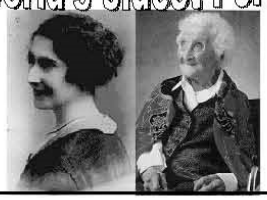
John E Morley
Division of Geriatrics
Saint Louis University
GRECC
St Louis VAMC

Lifespan is Increasing

Jeanne Calment

Mariam Nash

The World's oldest Person

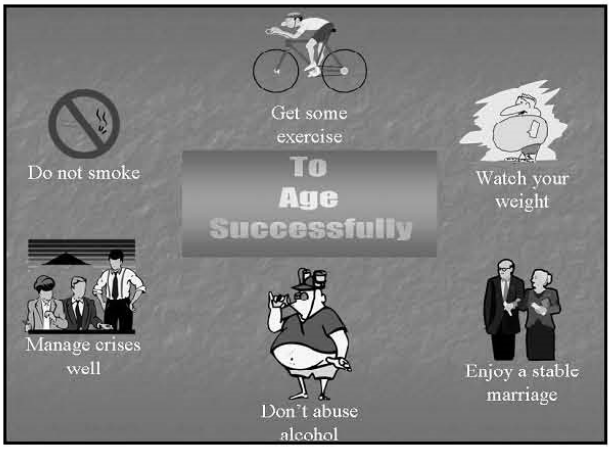


Roger Bacon

(c.1214-1294)

- Controlled diet
- Proper rest
- Exercise
- Moderation life style
- Good hygiene
- Inhaling the breath of a young virgin

Roger Bacon (1214-1294)



Health Behaviors and Aging Successfully
EPIC-Norfolk Study

Khaw et al, PLOS Medicine 2008;5:e2

- Non-smoking
- Not physically inactive
- Moderate alcohol intake (1 – 14/week)
- Fruit and Vegetable 5 servings/daily (vitamin C >50 mmol)

Age 42

Estimated 14 year improvement in physiological age

FRANS HALS

Age 63

Euphronios
(520 – 470 BC)

OLD AGE STYLE
(Altersstil)

"I believe that when one is young, it is the object, the outside world, that fills one with enthusiasm – one is carried away. Later it comes from inside: the need to express his feelings urges the painter to choose some particular starting point, some particular form."
- Bonnard (age 66)

Michelangelo and the Pietas

1500
Age 25

1550 – 1555
Completed at 80

Altersstill Defined

A.E.Brinkman, Spatwerke Grosser Meister, 1925

- A dramatic change compared to earlier works
- "differ in their diversity of forms, colors and subjects."
- dynamic and mutable.....involve newer and less comprehensible forms.....unpredictable, freer, more expressive.....Fragmentary, without form, sketchy and more intense" – Ganter 1965
- "a sense of isolation, a feeling of holy rage...transcendental pessimism....a retreat from realism....a craving for a complete unity of treatment as if the picture were an organism..."Sir Kenneth Clark, 1972
- "..increased sense of drama and a more profound interpretation of human nature...a tendency to a more instinctual less studied approach. .clearly defined contours giving way to a looser, freer brushwork or in sculpture.. more amorphous, less corporeal forms ."- Frances Feldman, 1992

Titian
(1488 – 1576)

1562

1520

The Rape of Europa
1560


1628


1638


1657


1669

Frans Hals

The Laughing Cavalier
1624 (age 42)

Willem Coymans,
1645 (age 63)

Pablo Casals (1876-1973)

"For the past eight years I started each day in the same manner .It is not a mechanical routine but something essential to my daily life. I go to the piano and play two preludes and fugues of Bach. I cannot think of doing otherwise…….It fills me with the wonder of life, and the feeling of an incredible marvel of being a human being."

- Pablo Casals,

Joys and Sorrows

(age 93)

Monet

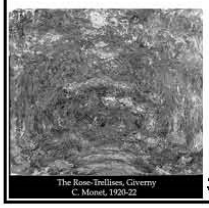

1899


1900


1923

Monet Refuses The Operation
Liesel Mueller

Doctor, you say there are no haloes
Around the streetlights in Paris
And what I see is an aberration
Caused by old age, an affliction.


The Rose-Trellises, Giverny
C. Monet, 1920-22

I tell you it has taken all my life
To arrive at the vision
of gaslamps as angels
To soften and blur the finally banish
The edges you regret I don't see,
To learn the line I call the horizon
Does not exist and sky and water,
So long apart ,are the same state of being.

Fifty-four years before I could see
Rouen cathedral is built
Of parallel shafts of sun,
And now you want to restore
my youthful errors: fixed notions
Of top and bottom,
The illusion of three-dimensional space,
Wisteria separate
From the bridge it covers.

What can I say to convince you
The Houses of Parliament dissolves
Night after night to become
The fluid dream of the Thames?

I will not return to a universe
Of objects that don't know each other
as if islands were not the lost children
Of one great continent. The world
Is flux,
and light becomes what it touches,
Becomes water, lillies on water,
Above and below water,
Becomes lilac and mauve and yellow
And white and cerulean lamps,
Small fists passing sunlight
So quickly to one another
That it would take long, streaming hair
Inside my brush to catch it.
To paint the speed of light!

Our weighted shapes, these verticals
Burn to mix with air
And change our bones, skin and clothes
To gasses. Doctor
If only you could see
How heaven pulls earth into its arms
And how infinitely the heart expands
To claim this world, blue vapor without end.

CASSATT
(1844 – 1926)

Lydia Crocheting in the Garden at Marley
M. Cassatt, 1880

Spring: Margot Standing in a Garden
M. Cassatt, 1902

Joseph Mallard William Turner
(1775 – 1851)

1840

1825

1840 slave ship

Georgia O'Keefe
(1887 - 1986)

1965

"When you get so you can't see
you come to it gradually"

1972

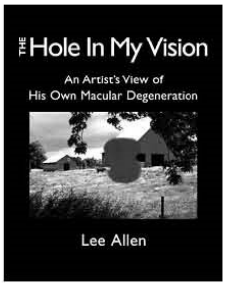
Cezanne

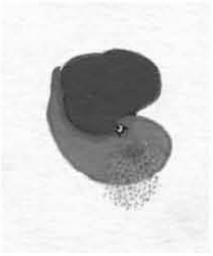
Jas de Buffan: The Pool
1876

Chateau Noir
1904-1906

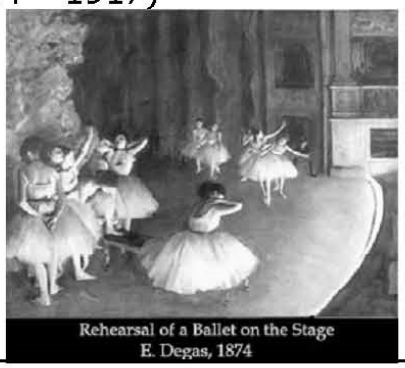
" an upsurge of color...
The sky in turn bursts into a dance of colors,
an explosion of clouds of blue and green, tremendous volumes of sonorous color
which form a tempestuous halo of pure tones....
It is an irrepressible lyric fulfillment
which reminds one of Beethoven's music."
– Meyer Schapiro, 1942

Lee Allen





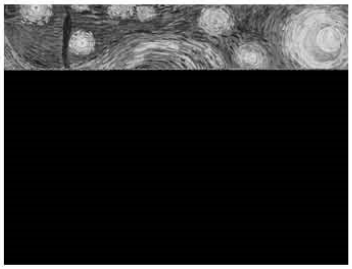
Edgar Degas
(1834 – 1917)



Rehearsal of a Ballet on the Stage
E. Degas, 1874

Vincent Van Gogh

Dr. Gachet



Starry Night

Edvard Munch
1863-1944

The Scream,
1893
Age 30

Self Portrait Between Clock and Bed
1942
Age 79

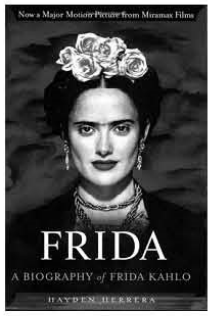
Francisco Goya
(1746 – 1828)

Two Old Men Eating Their Soup
Age 73

Saturn Devouring His Son
Age 76

Art through Pain

The Broken Column, 1944



1907 - 1954

Verdi
(1813-1901)

THE LAST IS BEST

Hurray for Old Wine
Szwojnicki

"Our nature here is not unlike wine;
Some sorts when old continue brisk and fine."
Sir John Denham, Of Old Age

Gypsy with a Mandolin, 1874

Corot , 1873
Age 77

"If Providence gives me another two years,
I believe I shall still be able to paint something beautiful."

Giovani Bellini

1460 Christ Blessing
Age 30

1513 Feast of the Gods
Age 83

Luca Signorelli
(1441 or 1450 – 1523)

Deeds of the Antichrist
1501

The Virgin and Child with Saints
1515

El Greco
(Domenikos Theottokopoulos)

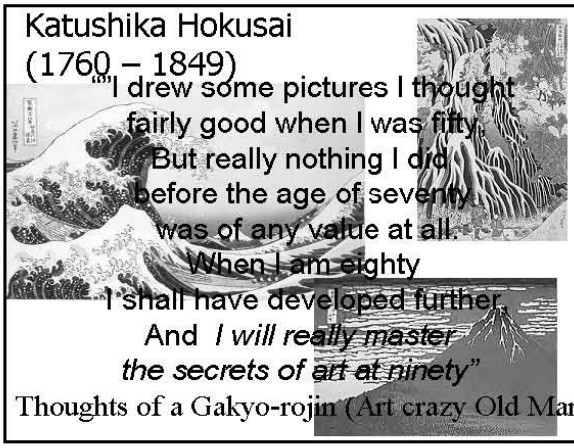
Opening The Fifth Seal
69 to 73 years

JH Fussli (Fuseli)
(1741 – 1825)

Lady MacBeth
Age 43

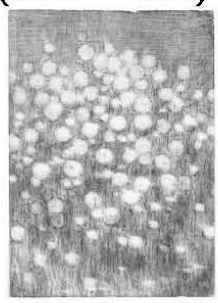
Solitude at Dawn
Age 79

Katushika Hokusai
(1760 – 1849)



"I drew some pictures I thought
fairly good when I was fifty.
But really nothing I did
before the age of seventy
was of any value at all.
When I am eighty
I shall have developed further.
And *I will really master*
the secrets of art at ninety"
Thoughts of a Gakyo-rojin (Art crazy Old Man)

Christian Rohlfs
(1849 – 1938)



Pustenblumen
1936

Yucca painted in his eighties

Aristide Maillol
(1861 – 1944)

- The River
- 1943

Completed at age 82

Frank Lloyd Wright
(1867 – 1959)

The Robie House
1910 (age 43)

Guggenheim Museum,
1959
Age 92

Oscar Niemeyer

Age 100

Niterói, Rio de Janeiro, Brazil

The Niterói Contemporary Art Museum Museu de Arte Contemporânea de Niterói — MAC Designed

Starting Late

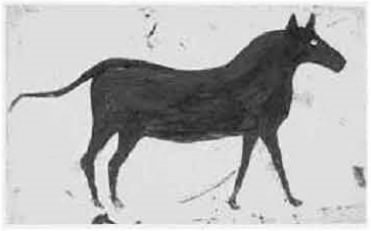
Louis Vivin
(1861 – 1936)

Wedding Feast
1925

Sister Gertrude Morgan
(1900 – 1980)

Bill Traylor
(1854 – 1949)

Started painting at 83



William Edmonson
(1880 – 1951)

"I knowed it was God telling me what to do
I just cut away at some stones

Grandma Moses produced her last painting at age 103.

Renoir, 1915
Blonde a la rosa

Mudel.
DeeDee

Peter Paul Reubens

1628

Henri Matisse
(1869 – 1954)

Raoul Dufy
1877 - 1953

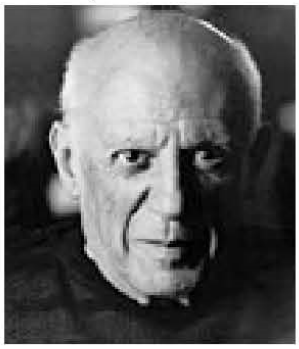
Regatta

Paul Klee and Scleroderma

Richard Wagner
(1813 – 1883)

Completed 1882; Age 70

Piccasso
(1881 – 1973)



Piccasso

Harlequin with Violin
1918, Age 37

Embrace ,
1971, Age 90

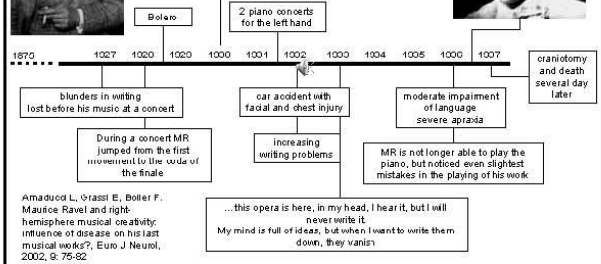
Piccasso

- Self portrait 1972
- Age 91

"The content of the late Picasso Is for the most part thin and self-preoccupied, the manner is garulous"
-John Russell
-The New York Times

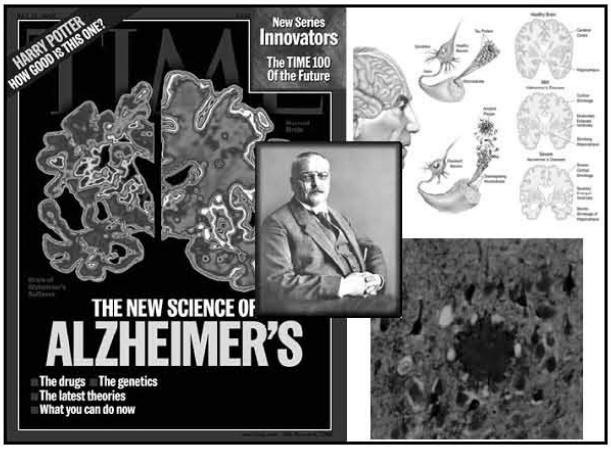
Maurice Ravel

Easy melodic construction
2 themes repeated 3 times



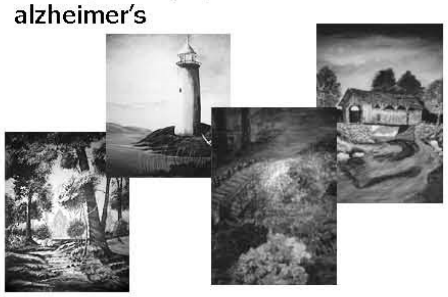
Amaducci L, Grassi E, Boller F. Maurice Ravel and right-hemisphere musical creativity: influence of disease on his last musical works?. Euro J Neurol, 2002, 9: 75-82

Fronto-temporal dementia or Primary Progressive Aphasia



Vivian Hanby

- Began Painting at 63
- these paintings painted when she had alzheimer's



Preserved painting creativity
Danae Chambers

Fornazzari LR. Preserved painting creativity in an artist with Alzheimer's disease. Eur J Neurol, 2005, 12: 419-24

Willem de Kooning

Willem de Kooning
UNTITLED II 1986
oil on canvas
88 x 77 in.

Carolus Horn

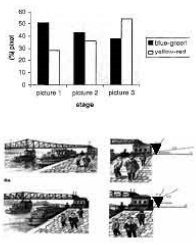
(1921 – 1992)

- famous German painter and graphic artist
  - advertising agency: Opel, Coca Cola, Esso
  - known for very realistic painting
  - repeated several motives before and during his dementia
- progression of AD over 12 years
- no post mortem confirmation, clinical symptoms

How clouds are transformed into fried eggs

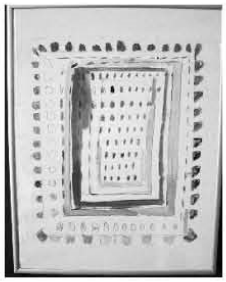
Maurer K, Froehlich L. How clouds are transformed into fried eggs. Alzheimer Insights, 2000, 6: 4-7

C. Horn: Eiserner Steg Frankfurt a.M.

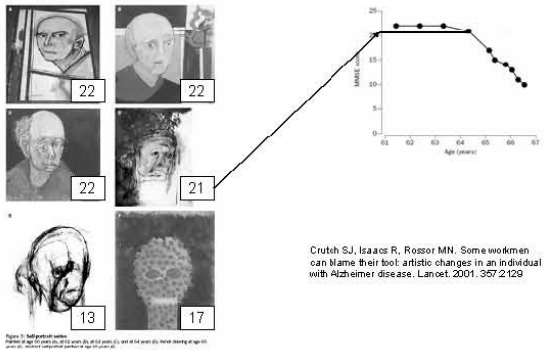


Maurer K, Prvulovic D. Paintings of an artist with Alzheimer's disease: visuoconstructual deficits during dementia. J Neural Transm, 2004, 111: 235-45

C. Horn: last paintings

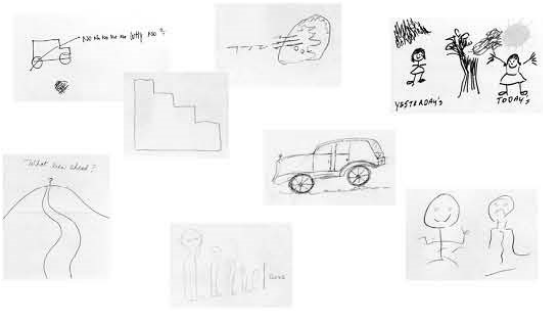


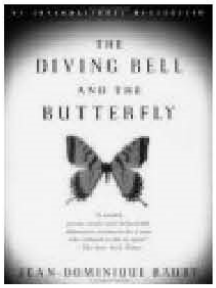
William Untermohlen - self-portraits

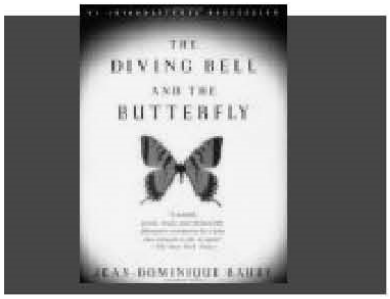


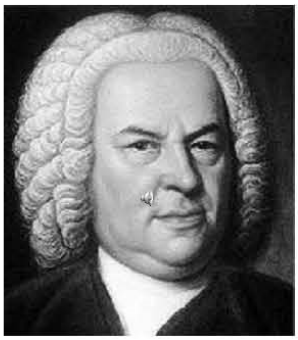
Crutch SJ, Isaacs R, Rossor MN. Some workmen can blame their tool: artistic changes in an individual with Alzheimer disease. Lancet. 2001; 357:2129

Art as Therapy









Johannes Sebastian Bach

1685-1750

Using Anatomical and Neurophysical Principles to Manage and Treat Balance and Equilibrium Deficits in the Elderly Patient

William F. Huber, DC, DACAN, DCBCN, MS(R)

National Symposium on Complementary & Alternative Geriatric Healthcare – Promoting Balance and Fall Prevention

Neurophysiology of Balance and Equilibrium: CAM Models for Treatment

Logan University and College of Chiropractic

Fall Prevention

- Falls have been listed as the leading cause of injury related death or hospitalization in older populations
- It has been stated that 30-50% of the elderly (65 yoa and older) fall each year – of these 20% require medical care following the fall, and 6% of the falls result in fracture.

- Tang and Woolacott (1998) demonstrated that the "combination of slower onset and smaller magnitude of postural responses to slips in older adults resulted in an inefficient balance strategy."
- They also noted that "older adults needed secondary compensatory adjustments, including a lengthened response duration and the use of arms to fully regain balance and prevent a fall."
- This indicates that the system is, as expected, slower to respond to a potential fall, and less effective in that response.

Equilibrium

- Balance in the human is an intricate coordination of continue neurologic input designed to maintain erect posture in a gravitational field.
- Humans rely on many proprioceptive, labyrinthine and visual inputs for this process.
- Once the process of a fall has begun, regardless of direction, the muscle spindles and other stretch receptors immediately increase their activity and initiate reflex arcs become activated to restore a state of balance.

- Given this information, the following must be addressed:
  - If a perturbation to balance occurs, the receptors and pathways utilized must be functional and rapidly integrated
  - This integration must allow for a coordinated response of motor nature to occur
  - This response must be able to not only counteract gravitational forces, but do so in a rapid fashion that will allow for stabilization, but also for a motor program to become to return the individual to the upright posture
  - While this will initially utilize reflex arcs, motor programs must be established to the expected perturbation to allow for more rapid and complete responses to prevent and correct future perturbative experiences.

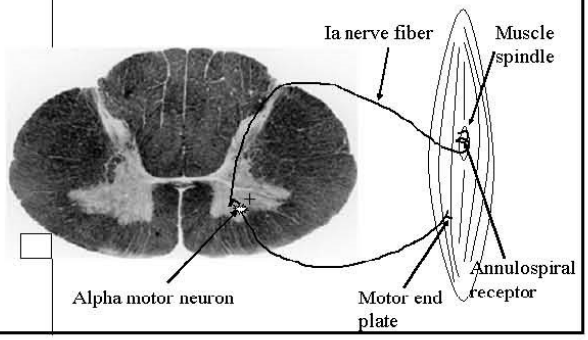
Review of Equilibrium Pathways

- Visual input is require in a horizon oriented fashion, to compare current position with a level horizon
- Vestibular inputs result in reflexes of posture, as well as cerebellar activation of motor pathways
- Spindle receptive afferents of an unconscious proprioceptive fashion drive cerebellar pathways, again that are associated with descending motor control pathways to alpha motor neurons
- Motor programs in cerebellar and basal ganglionic regions are required for initiation, and coordination of these motor responses

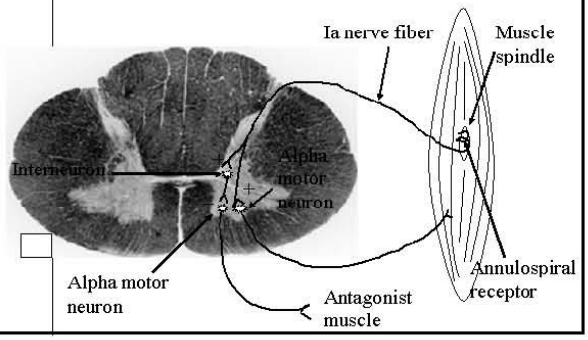
Reflex Pathways for Unconscious Proprioceptive Mechanisms

- Muscle spindles – where found and how stimulated? – greatest density?
- Joint Afferent receptors – joint receptors are organized in the anatomy of synovial articualtions such that the greatest response to dynamic stimuli occurs toward end ranges of normal motion – prior to dislocative events
- What joints maintain the greatest density/population of joint receptors?

MYOTATIC (DEEP TENDON) REFLEX

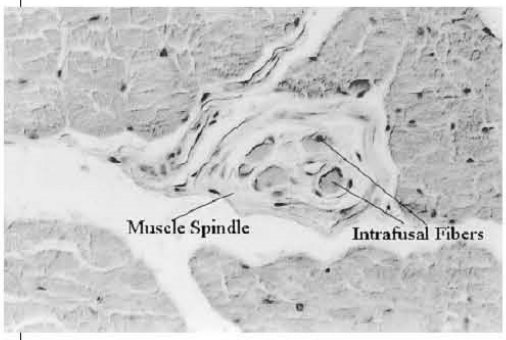


MYOTATIC REFLEX AND RECIPROCAL INHIBITION



MUSCLE SPINDLE

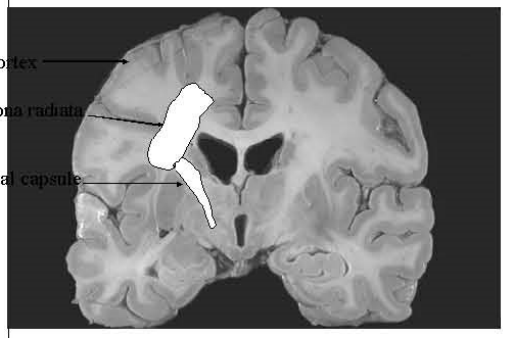
MUSCLE SPINDLES



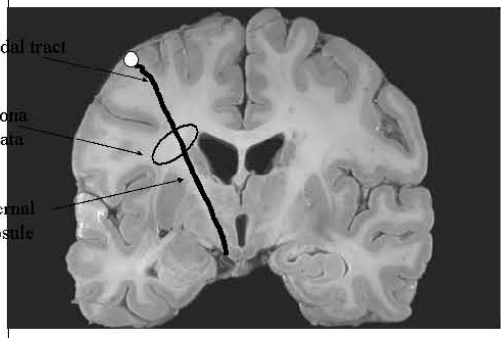
Pyramidal System

- The system, although well known, must be able to respond to stimuli that arise from failure to combat gravitational forces

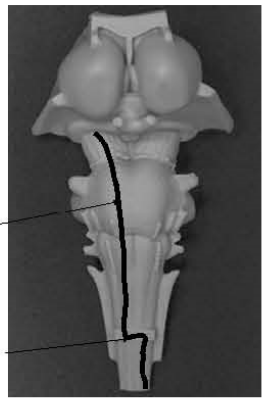
PYRAMIDAL SYSTEM



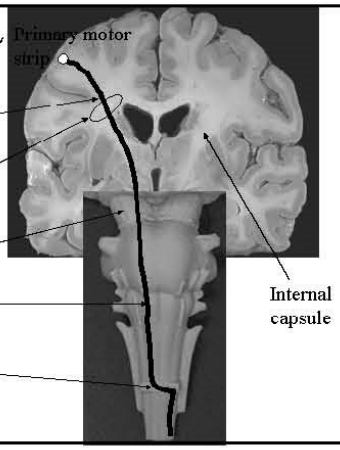
PYRAMIDAL SYSTEM



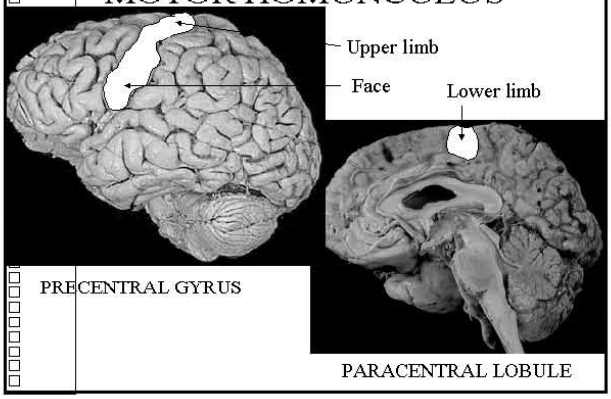
PYRAMIDAL SYSTEM



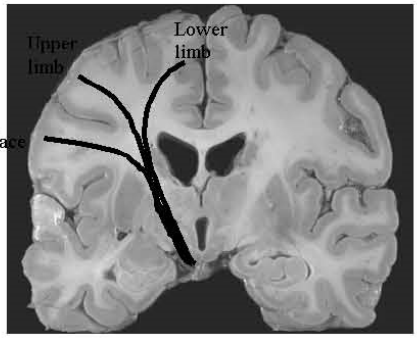
PYRAMIDAL SYSTEM

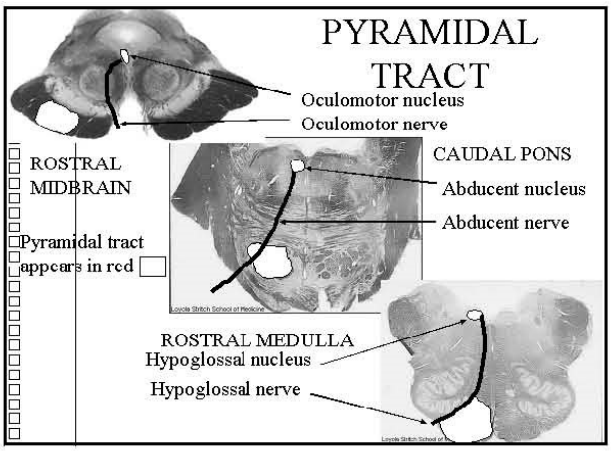


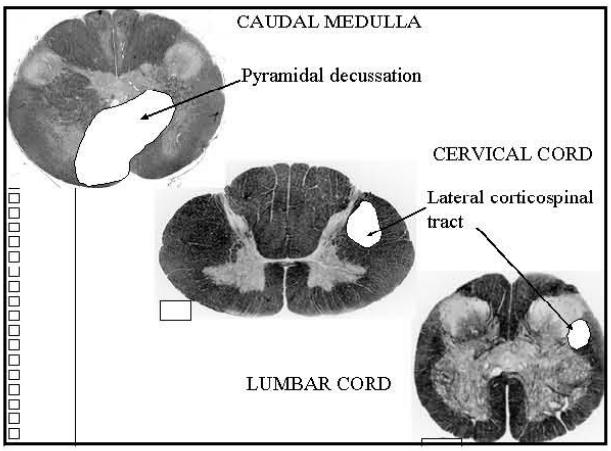
MOTOR HOMUNCULUS



MOTOR HOMUNCULUS

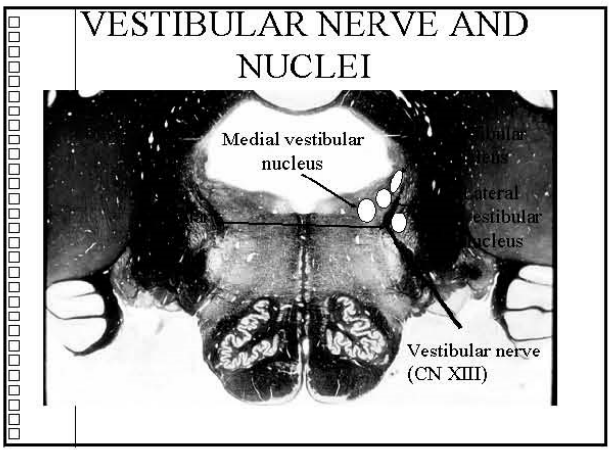


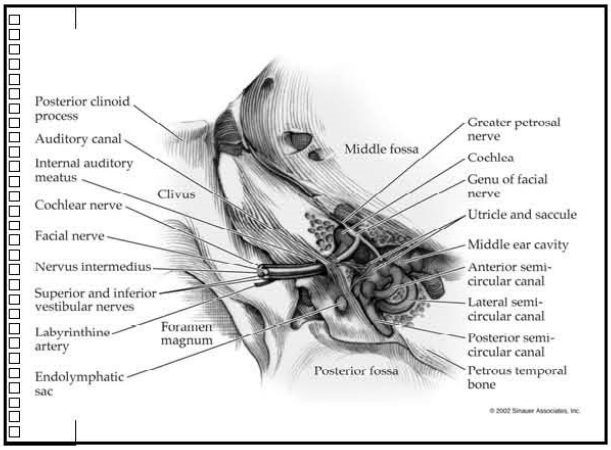


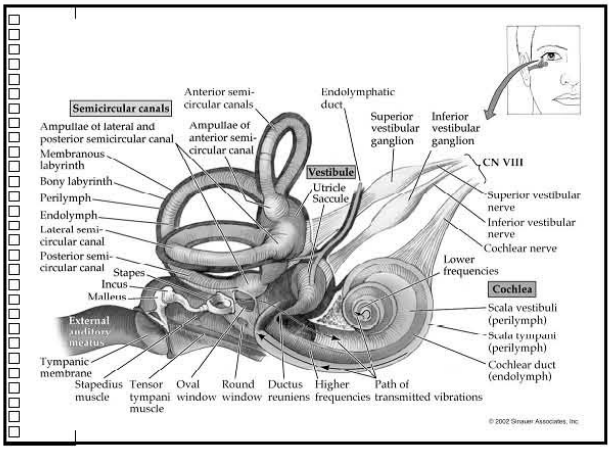


Brainstem Motor Systems

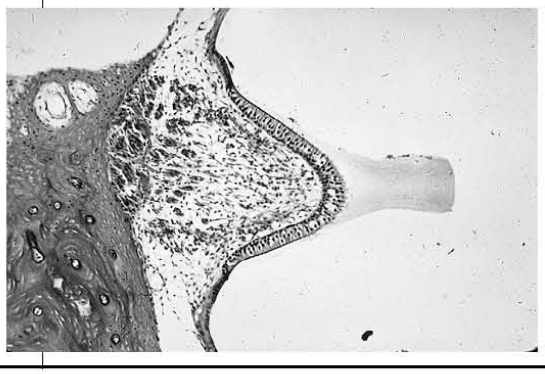
- The brainstem houses motor centers that may responde to rapid changes in position that are unintended, as a consequence of falling
- These centers should be reviewed to identify their causal/effect relationship to balance.



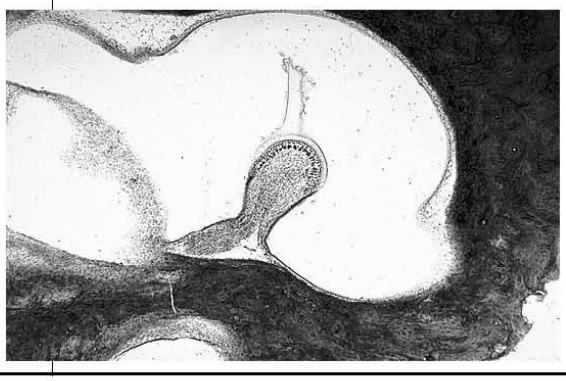




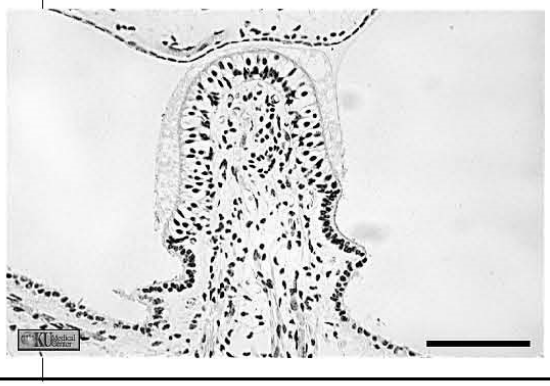
CRISTA AMPULLARIS



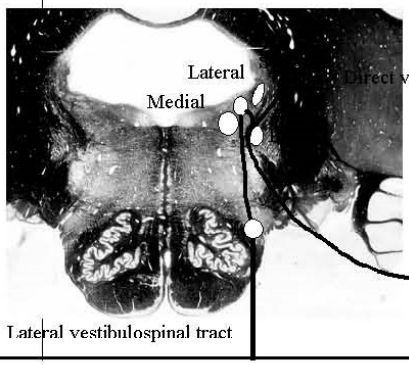
CRISTA AMPULLARIS



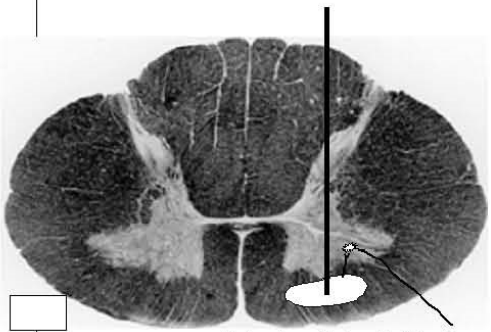
CUPOLA



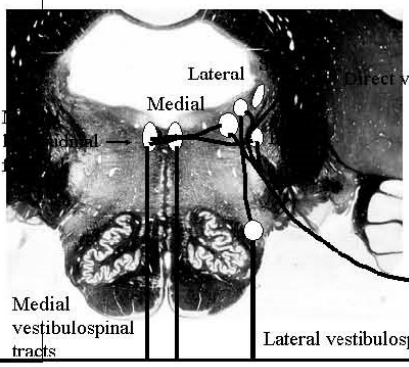
VESTIBULAR NERVE AND NUCLEI



VESTIBULOSPINAL TRACTS



VESTIBULAR NERVE AND NUCLEI



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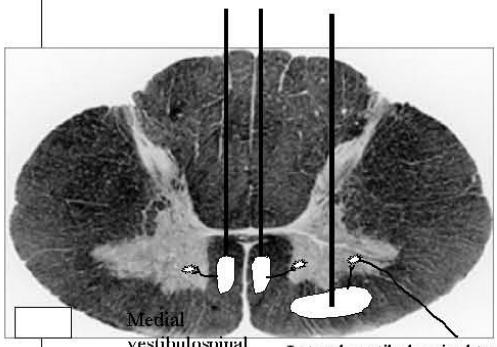

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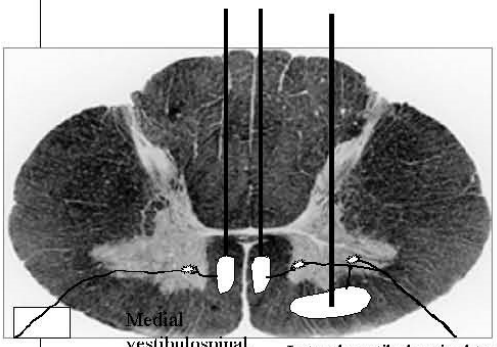
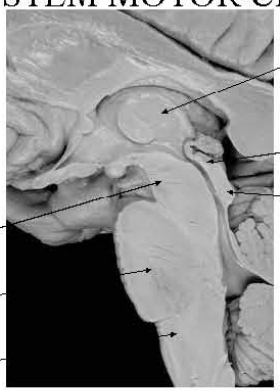
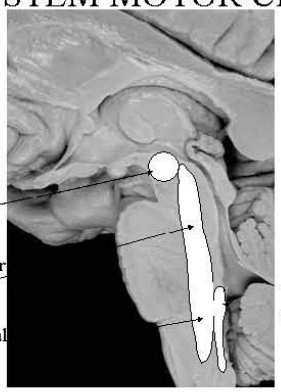


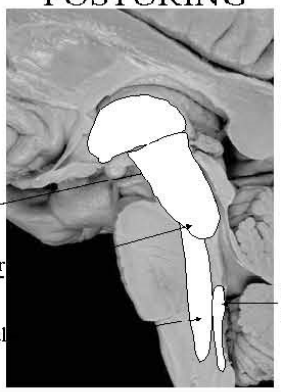
BRAINSTEM MOTOR CENTERS



BRAINSTEM MOTOR CENTERS



POSTURING



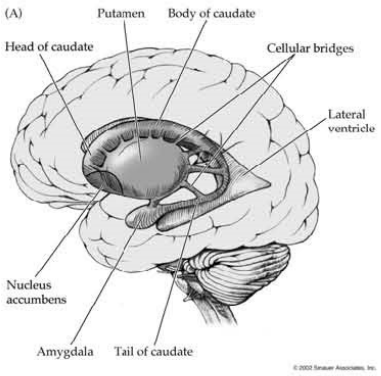
POSTURING:

- Decorticate
- Decerebrate

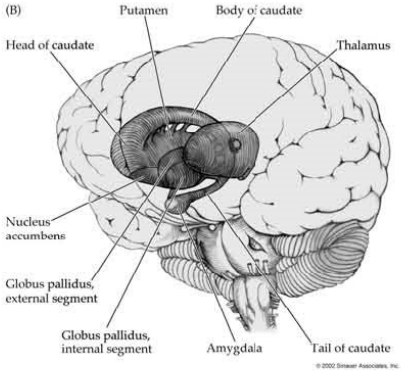
Basal Ganglia

- This system stores motor programs that are allowed to be activated in refence to postural adjustments and their initiation, given an expected somatic position
- Should this position change, a program designed to combat this unexpected change must be activated.
- This program also must be continually updated to maintain it's integrity and adequacy in response to the gravitational and positional failure

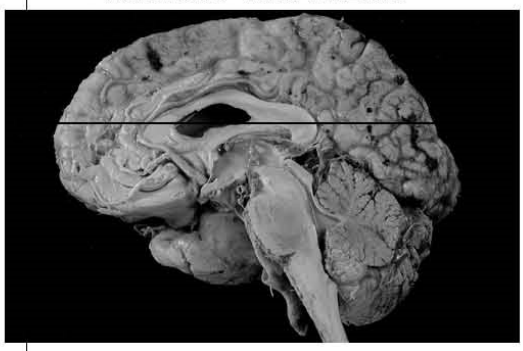
BASAL GANGLIA



BASAL GANGLIA



BASAL GANGLIA



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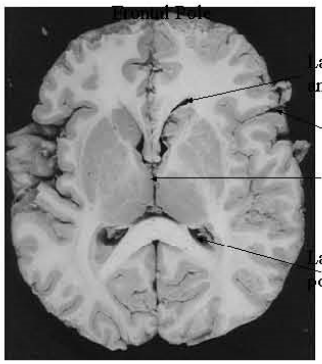
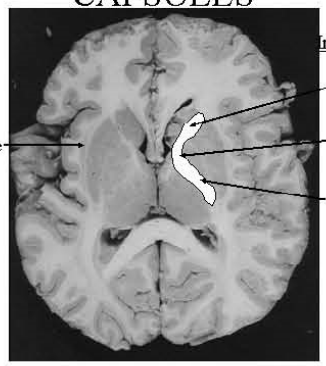


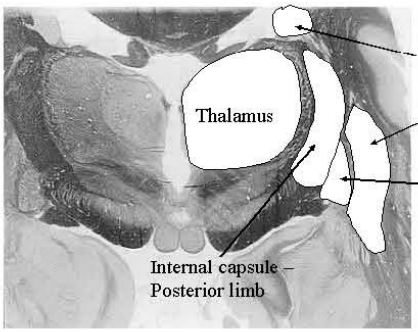
INTERNAL AND EXTERNAL CAPSULES



BASAL GANGLIA

BASAL GANGLIA

BASAL GANGLIA



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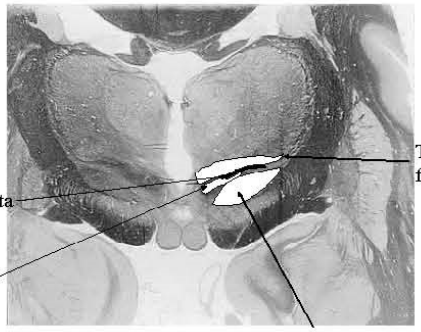
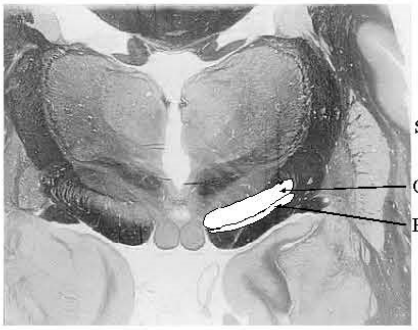
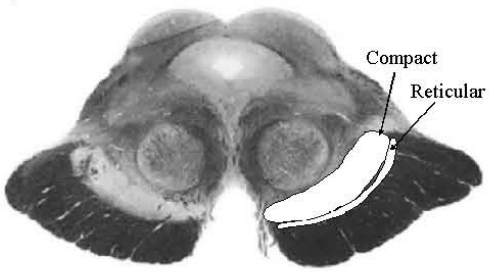


SUBSTANTIA NIGRA



SUBSTANTIA NIGRA



BASAL GANGLIA

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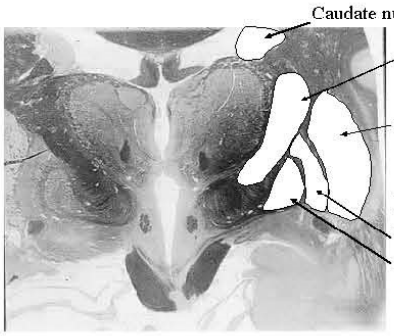

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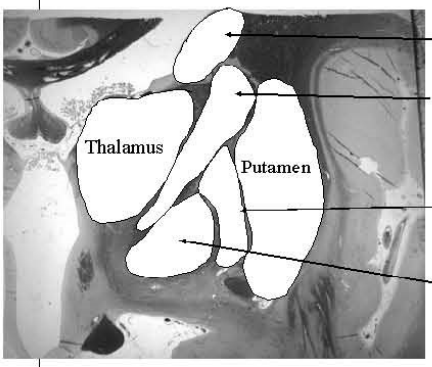
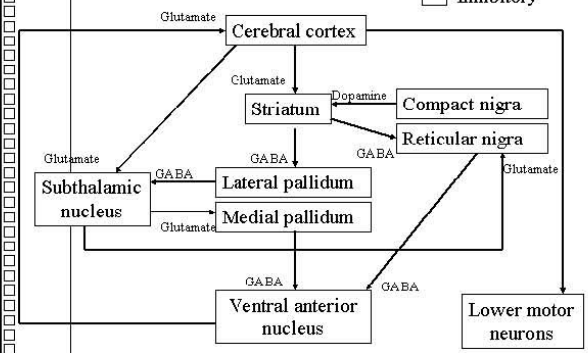
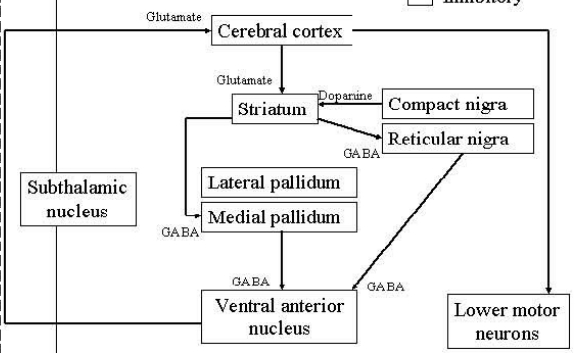


INDIRECT PATHWAY



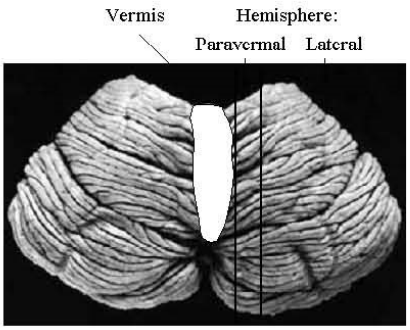
DIRECT PATHWAY



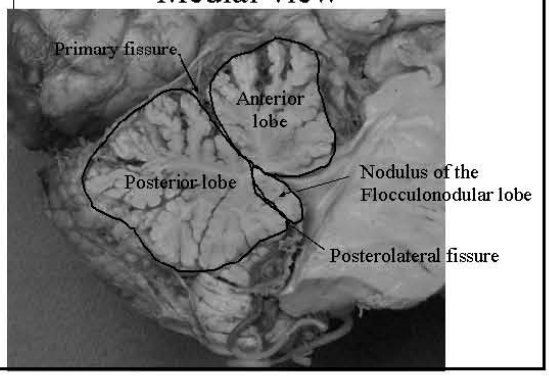
Cerebellar System

- This system is integral in reference to falls.
- Motor programs for the coordination and strength of muscular contraction in reference to posture (unconscious) reside in these fields.
- These programs are updated on a second to second basis, and compared to descending pyramidal signals as well as ascending joint afferents
- This allows for a comparative mechanism to occur between visual receptors, labyrinthine receptors, joint afferents as well descending motor pathways
- Obviously these centers must be updated and activated in a very rapid fashion to prevent deceleration trauma

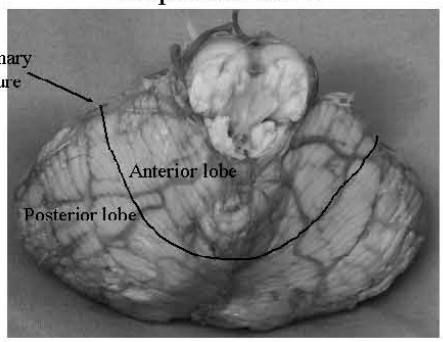
CEREBELLUM



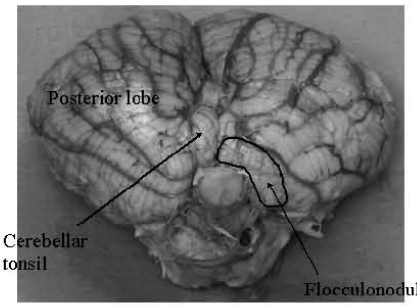
CEREBELLUM
Medial view



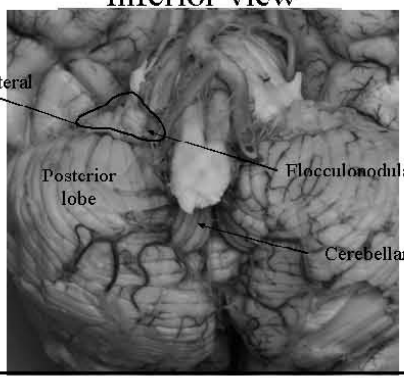
CEREBELLUM
Superior view



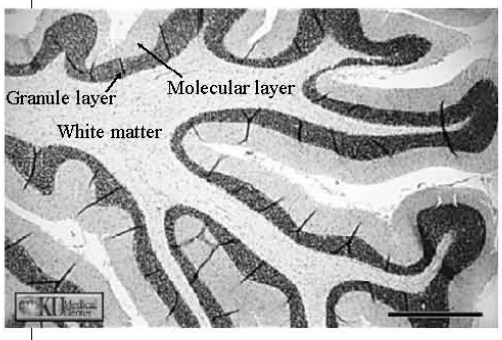
CEREBELLUM
Inferior view



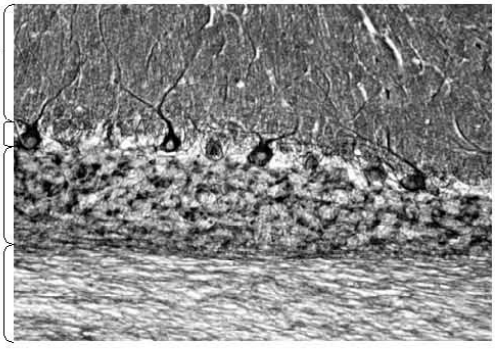
CEREBELLUM
Inferior view



CEREBELLAR LAYERS

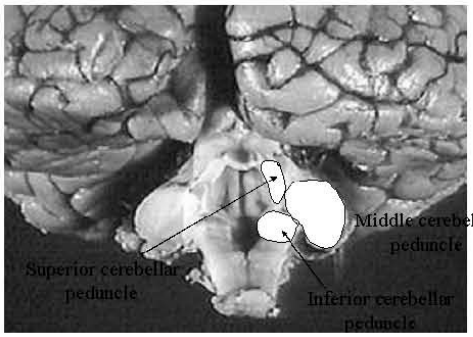


CEREBELLAR LAYERS



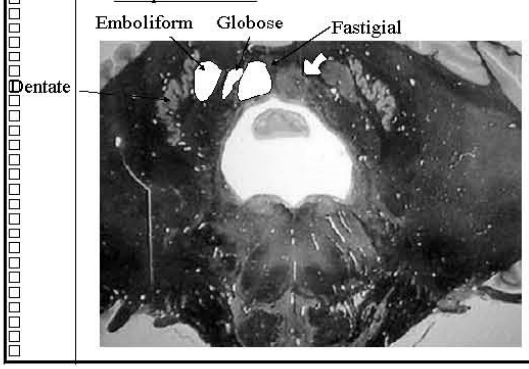
PURKINJE CELL

CEREBELLAR PEDUNCLES

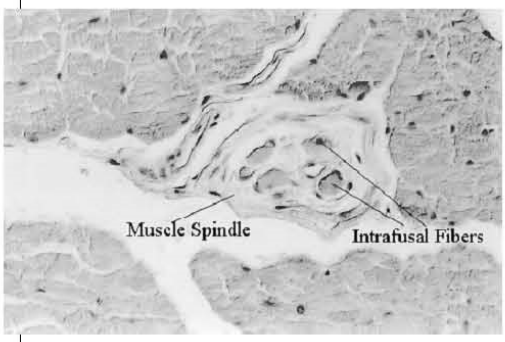


CEREBELLAR NUCLEI

Interposed Nuclei:

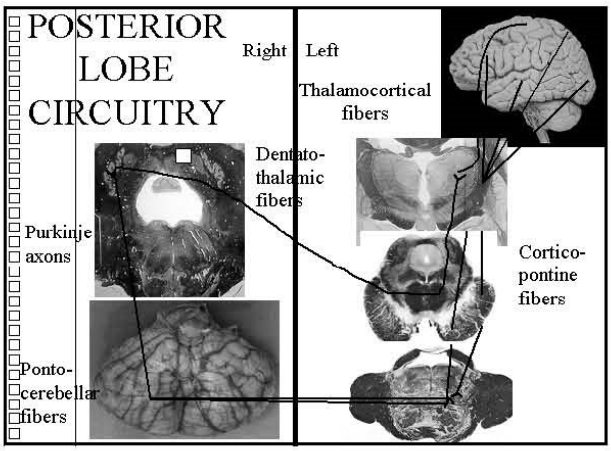


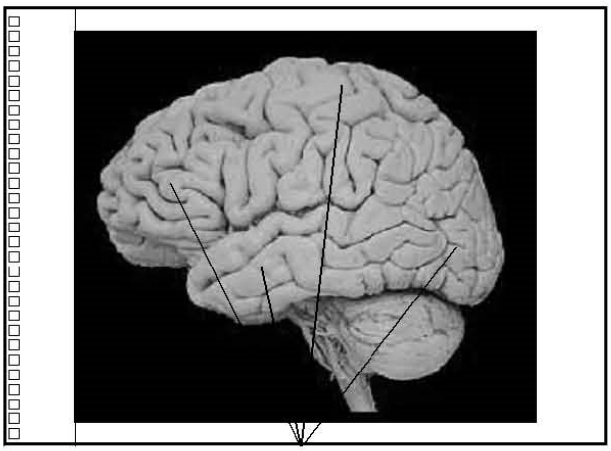
MUSCLE SPINDLES

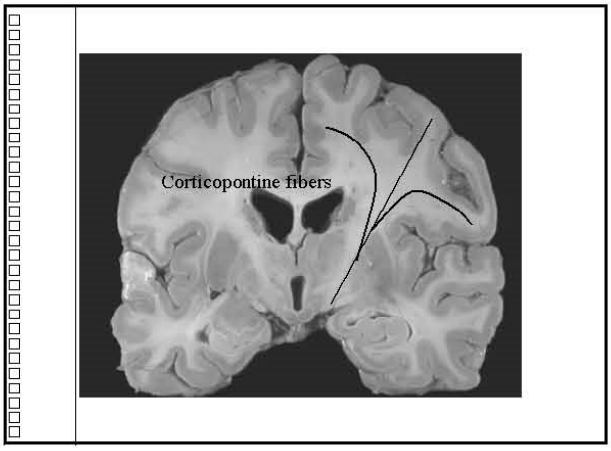


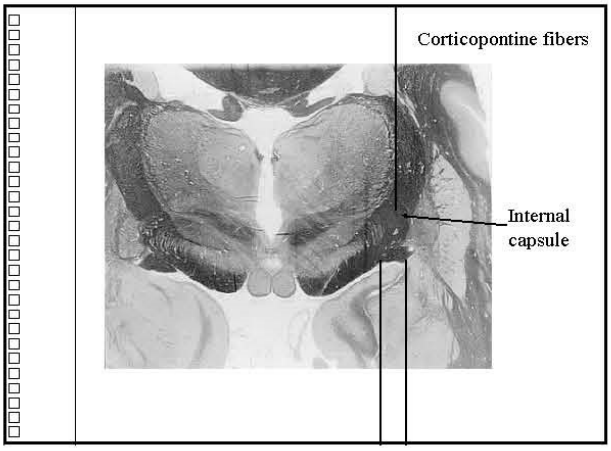
MUSCLE SPINDLE

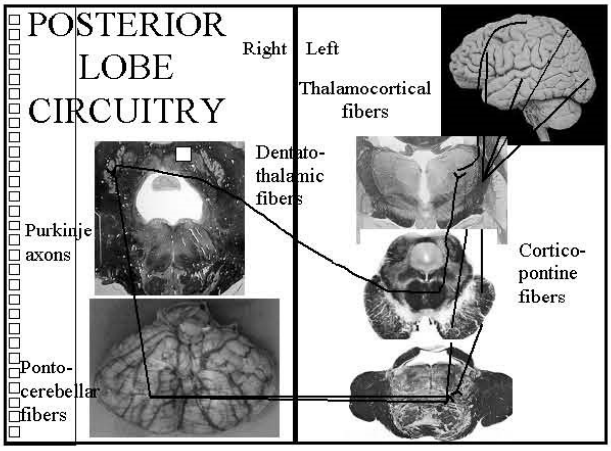
POSTERIOR LOBE CIRCUITRY

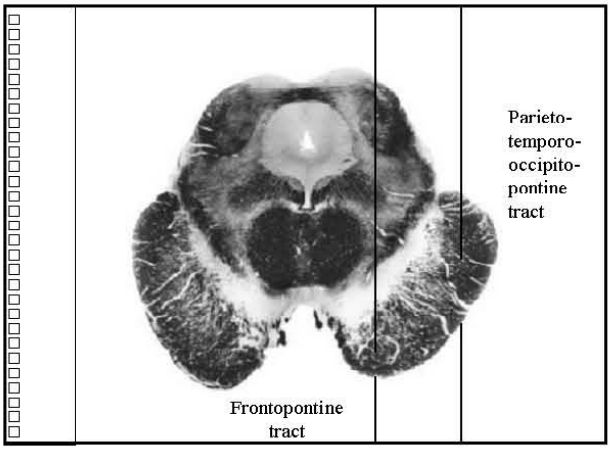

POSTERIOR
LOBE
CIRCUITRY
Right
Left
Thalamocortical
fibers
Dentato-
thalamic
fibers
Purkinje
axons
Cortico-
pontine
fibers
Ponto-
cerebellar
fibers

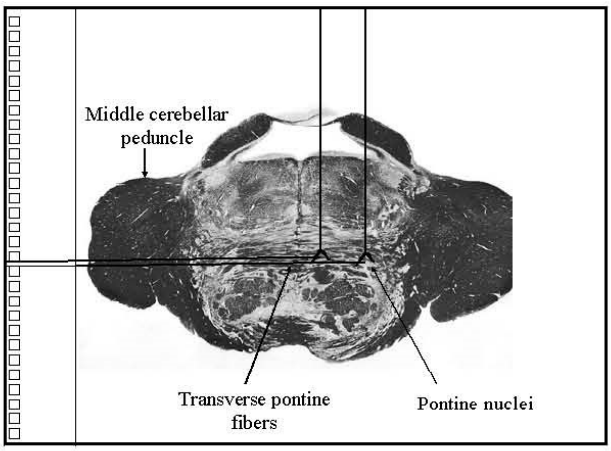


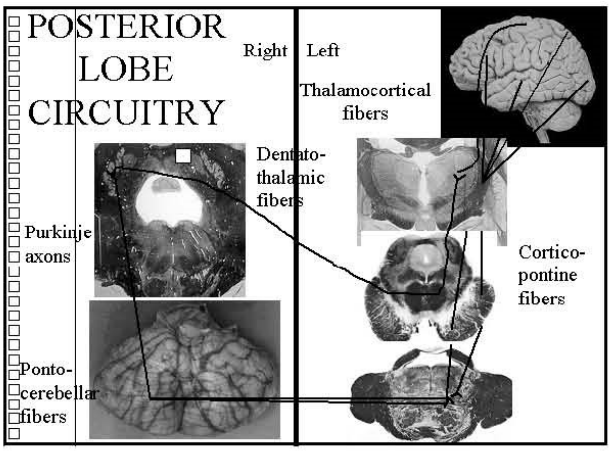

Corticopontine fibers

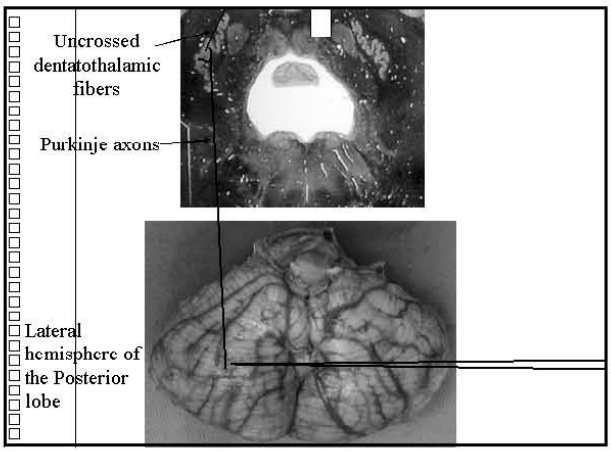

Corticopontine fibers
Internal
capsule

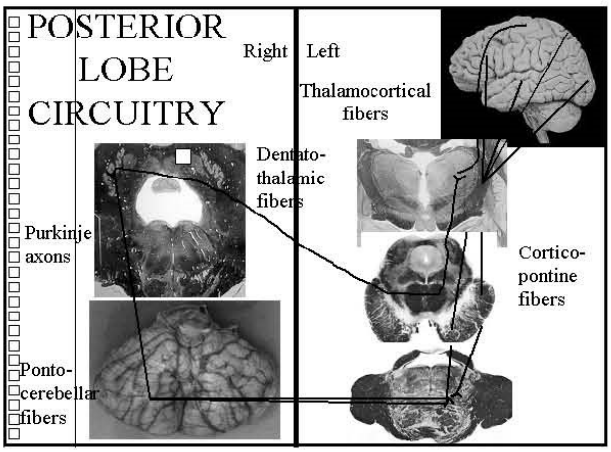

POSTERIOR
LOBE
CIRCUITRY
Right
Left
Thalamocortical
fibers
Dentato-
thalamic
fibers
Purkinje
axons
Cortico-
pontine
fibers
Ponto-
cerebellar
fibers

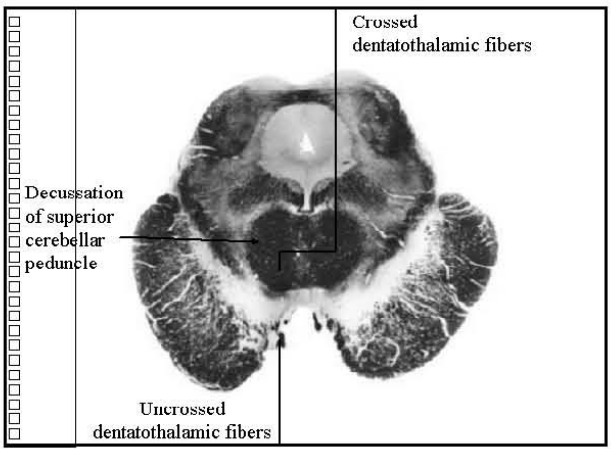

Parieto-
temporo-
occipito-
pontine
tract
Frontopontine
tract

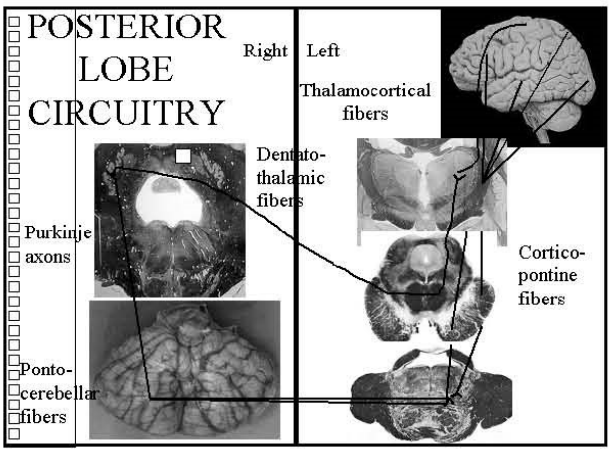

Middle cerebellar peduncle
Transverse pontine fibers
Pontine nuclei

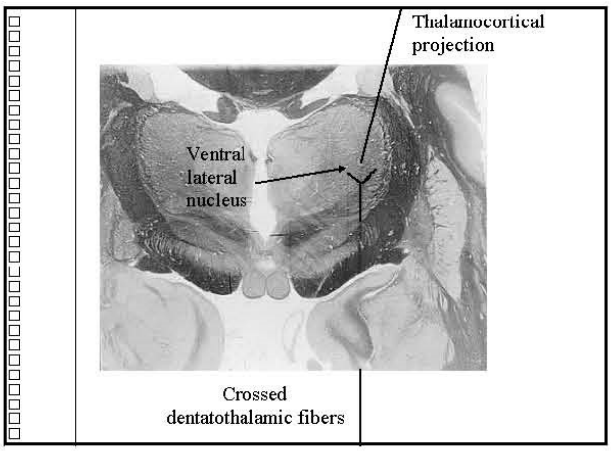

POSTERIOR LOBE CIRCUITRY
Right
Left
Thalamocortical fibers
Dentato-thalamic fibers
Purkinje axons
Cortico-pontine fibers
Ponto-cerebellar fibers

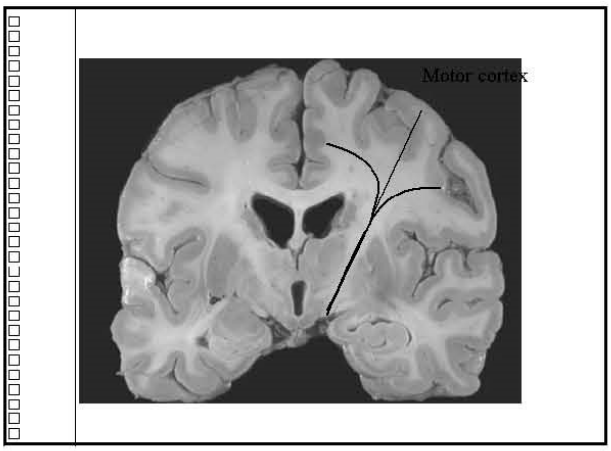

Uncrossed dentatothalamic fibers
Purkinje axons
Lateral hemisphere of the Posterior lobe

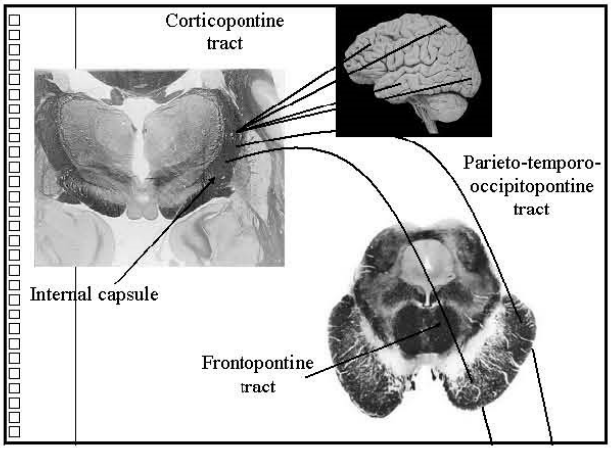

POSTERIOR LOBE CIRCUITRY
Right
Left
Thalamocortical fibers
Dentato-thalamic fibers
Purkinje axons
Cortico-pontine fibers
Ponto-cerebellar fibers

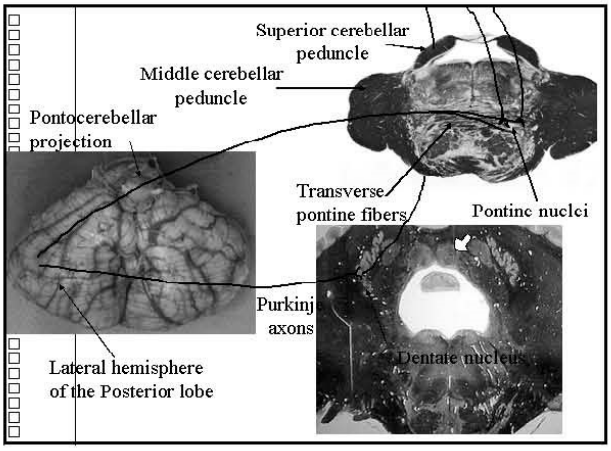

Crossed dentatothalamic fibers
Decussation of superior cerebellar peduncle
Uncrossed dentatothalamic fibers

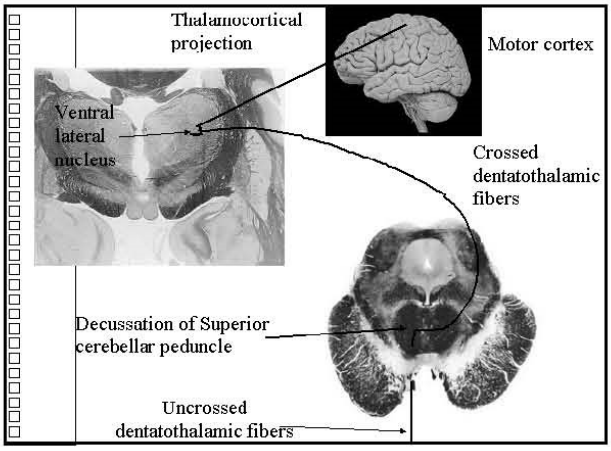

POSTERIOR LOBE CIRCUITRY
Right
Left
Thalamocortical fibers
Dentato-thalamic fibers
Purkinje axons
Cortico-pontine fibers
Ponto-cerebellar fibers



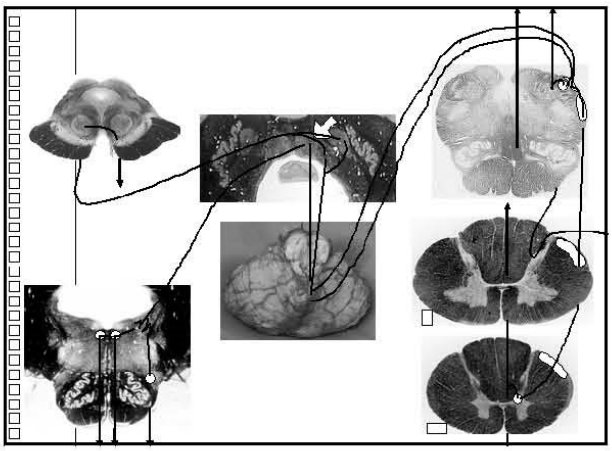


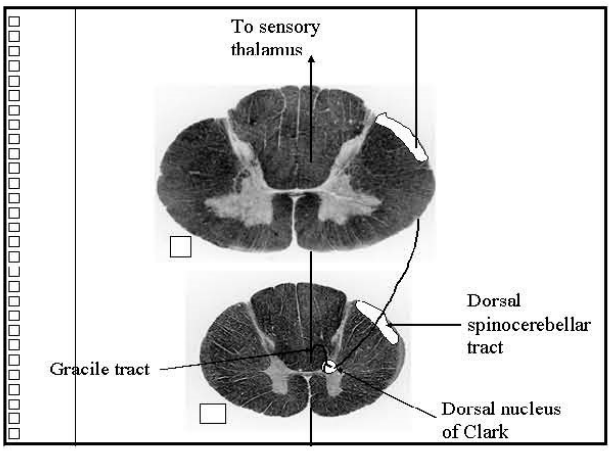


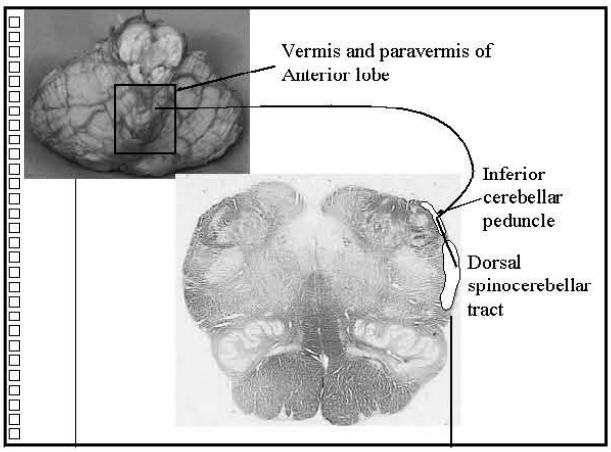


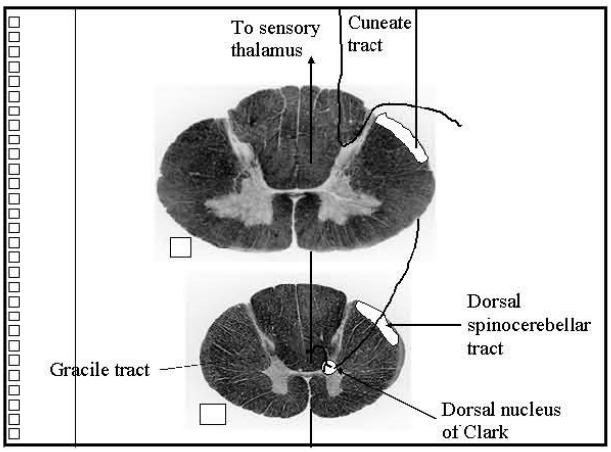


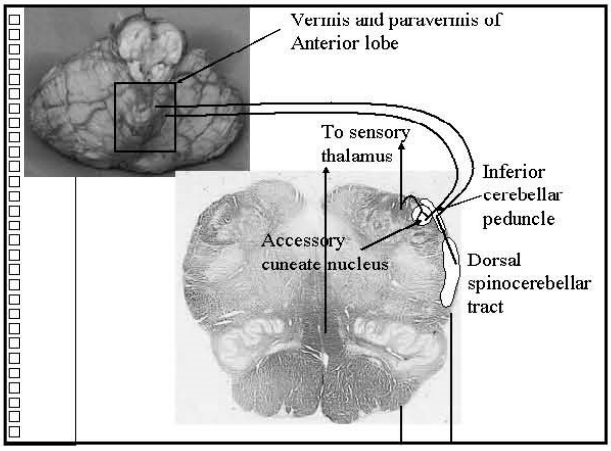
ANTERIOR LOBE CIRCUITRY

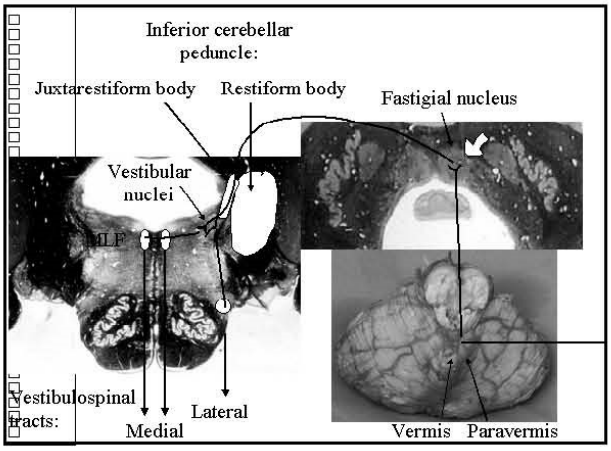


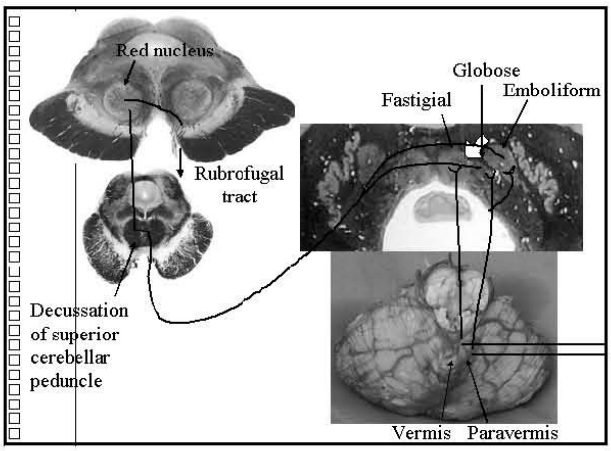

To sensory
thalamus
Dorsal
spinocerebellar
tract
Gracile tract
Dorsal nucleus
of Clark


Vermis and paravermis of
Anterior lobe
Inferior
cerebellar
peduncle
Dorsal
spinocerebellar
tract

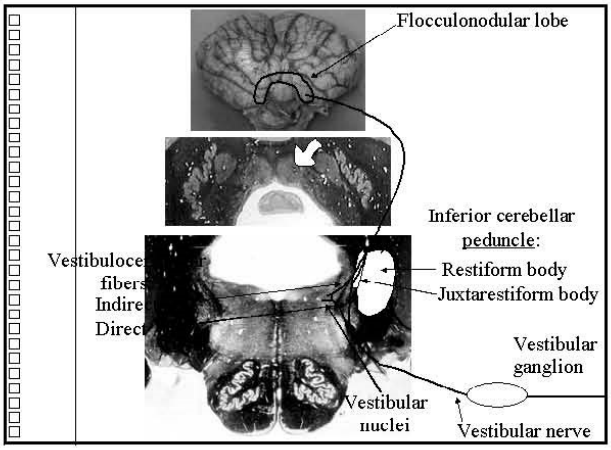

To sensory
thalamus
Cuneate
tract
Dorsal
spinocerebellar
tract
Gracile tract
Dorsal nucleus
of Clark

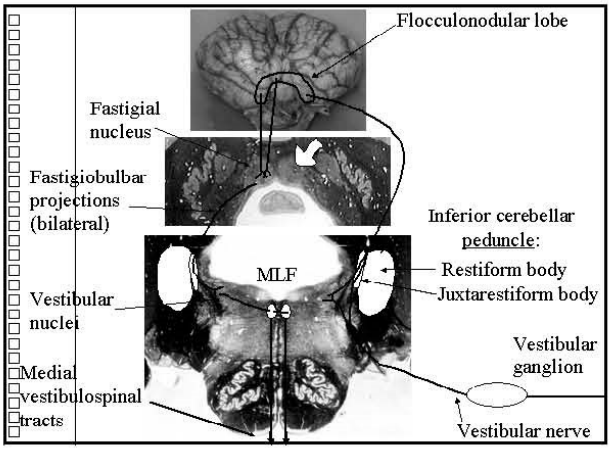

Vermis and paravermis of
Anterior lobe
To sensory
thalamus
Inferior
cerebellar
peduncle
Accessory
cuneate nucleus
Dorsal
spinocerebellar
tract


Inferior cerebellar
peduncle:
Juxtarestiform body
Restiform body
Fastigial nucleus
Vestibular
nuclei
MLF
Vestibulospinal
tracts:
Medial
Lateral
Vermis
Paravermis



FLOCCULONODULAR LOBE CIRCUITRY





CNS

- An essential function of the CNS is to allow the human frame to continually be successful in remaining upright in a gravitational field.
- This is accomplished by the establishment of motor programs that consist of established internal processes that have been developed due to practice, training and experience.
- This equates to synaptogenesis and speed of coordination of neuronal pools for static and dynamic control of the human frame in a multitude of configurations.

- The human nervous system appears to establish known limits of stability, and defines these limits based upon continual afferent input, and makes motor adjustments to maintain the center of body mass (COM) within these limits.
- Loss of the balance occurs when there is a change in the motion state of the human frame, based upon input regarding positioning and velocity, which exceeds the already established COM limits.
- The CNS then is believed to make a subconscious estimate of the likelihood of falling, due to prior experience and memory.
- It is essential that the nervous system be able to determine when a response is required, as at what speed a response is required.
- This response appears to be based on the nervous systems perceived "feesable stability region" in reference to the COM
- This stability region must be applied to each different position, and can obviously be altered via motor activity

- The CNS integrates afferent inputs of multiple origins, and updates the current COM state – this is then compared to the "internal representation of stability limits"
- To refine this internal representation in the face of occurring or anticipating perturbation is required to prevent balance loss – this refinement can allow the CNS to select an appropriate response to counter the perturbation – this is an example of a "feedforward mechanism."
- Obviously the CNS has to rely on prior experience and memory

- The CNS has to be able to determine the likelihood of a loss of balance, and this requires the "mapping" or determination of stability limits.
- This means that for any given COM, the CNS must determine what the stabilility limits are for that BOS – this would require an obvious memory, and continual updating of the actual position to allow for the internal representation of the COM, BOS and therefore stability limits
- Feedforward mechanisms have been shown to prevent falls by improving balance at the onset of a slip by altering motor activity
- When exposed to repeated slipping, the elderly population has been shown to decrease in the incidence of falls, and this decrease was associated with "anticipatory adjustments to the COM state." (Pavol 2002).
- Pavol also stated that this "internal representation of stability limits" can be rapidly refined
- This rapid refinement is essential for the updating or "learning" of the internal representation of stability limits.

- It appears that this internal representation model is used by young and older adults
- This is based on continuously updated internal models, and the source of these updates has been seen
- It is suggested that the effective size of the feasible stability region decreases with older age, and also the feedforward controls decrease with age
- The good news is that the adaptation of these controls is seen to be from a steady state of adaptation that can occur within two trials or less on experiments. (Pai 2003)
- Again, this response is first seen in a more reactionary fashion, with further refinement and information is processed and refined by the CNS

Good News!

- Pavol, Runtz and Edwards (2002) compared the response of young and older adults to "slips" in their environment
- While more of the older adults fell with the initial perturbation, with repeated testing, both groups underwent exponential decreases in falls
- Therefore, after "learning" how to avoid falling, both groups were able to reduce their chance of falling in a similar mathematic fashion.
- Therefore, the older adults have the ability to learn how to respond to perturbations in their environment, and not fall.

Young Vs. Old

- Tsang, Wong, et. Al. (2004) investigated the long term effects of Tai Chi on balance control when subjects were confronted with reduced or conflicting somatosensory, visual and vestibular conditions - obvious application
- There results indicated that Tai Chi practioners not only ipmrovced balance control in the elderly, but also that the elderly practictionarers attaine dthe same level of balance control as did young healthy subjects
- The brain remains plastic

- Pavol (2002) also noted that after introducing a perturbation, the CNS made "feedforward adaptations" that allowed for an "optimal" movement strategy to occur.
- This reduced the chance of falling, as well as reducing the dependence on reactive responses to maintain balance, and instead more heavily relied on anticipation of the event.
- This moves the nervous system out of a reflexive integrative response, and into a coordinated and planned motor response that can be initiated

Responses

- It has been shown with that as little as one event, the CNS shows an adaptive change to balance perturbations
- These changes result in what is known as a "feed forward" mechanism of movement stability
- It has also been seen that these mechanisms result in motor programs for rectification of expected falls based on memory – the establishment of feed forward motor programs that are anticipatory in nature.

- These mechanisms are assumed to be proactive adaptations to movement stability and are the initial line of defense against falling in a known direction. This indicates that the establishment of a primary mechanism of returning the COM within the established parameters relies on accurate establishment of feed forward motor programs that may be activated rapidly prior or in the presence of expected perturbation
- However, any other directional changes require the activation of a secondary reactive response. These responses are based on the rapid acquisition of information from the velocity and position of the human frame instantaneously, and compare this to the already established based of support limits in the human.
- What we are left with is the following: A system that has two component parts
  - One that has the ability to anticipate changes in position based on experience and memory, and then alter motor responses to restore the upright posture. This depends on the ability to be informed as to what is the normal COM and base of support (BOS) and also to establish the limits of these supports prior to necessitating adjustments to the above parameters.
  - A secondary system that relies on the instantaneous feedback of the receptors in the visual, proprioceptive and vestibular systems. This system must integrate the information and establish a reflexive response from a motor standpoint that has the ability to effectively return the human frame within the parameters of the stability, given any perturbation, position and velocity.
  - With these factors involved, it appears that the prevention of falls must integrate the secondary system and it's speed and accuracy as this is the origin of the accurate representation of the primary system.

FALLS

- It appears that due to an initial "slip", the neurologic system responds within one perturbation.
- The system establishes memory for motor programs that provide a rectifying mechanism for the initial slip.
- This is seen by the rapid acquisition of programs to rectify changes in posture following
- It appears that the rapid acquisition of a memory program to prevent the initial perturbation occurs rapidly, but is only for the management of the initial direction of slip
- Continued training is required to allow for synaptogenesis and increased speed of afferent pathways to more fully allow the system to respond to environment changes in position

Tai Chi

- Traditional Chinese exercise practiced for many centuries
- Consist of series of movements that are performed in a slow, flowing fashion
- Principles:
  - Relaxed and extended body
  - Alert and calm mind
  - Well coordinated sequencing of body segments

Video Example

- Studies have show up to a 47.5% reduction in falls following the practice of Tai Chi in the elderly population
- Patients suffering from Parkinson's disease who praticed Tai Chi after the diagnosis had a number one reported effect of improved balance
- Other studies (Devahit, Oteghen 2007) reveal that static balance improved with participating in Tai Chi after a 6 month period, as well as at 12 months from a 1 hour/week Tai Chi sessions
- Gregor, Waddell, et al., 2004 demonstrated that Tai Chi improved the mechanism by which momentum is th eforward direction was generated, and also improved coordination during gait initiation in the elderly population – these findings suggest that postural control, as well as all of it's component control systems, improved. This indicates a central form of improved noticification/activation of postural mechanisms in the elderly population following these exercises
- Gatts and Woolacott (2007) utilized elderly participants following surgical interventions to the lower extremities or back. These individuals trained for 1.5 hours a day, 5 days/week for 3 weeks. Following this training, the Tai Chi participants were seen to have an increased balance response, and also less tripping, when a slipping perturbation was applied to the lower extremity. This study demonstrated that the CNS was better suited to manage an alteration of body position, due to a more efficacious use of the control systems designed to respond to these changes.
- Gatts and Woolacott (2006) also demonstrated that with Tai Chi training, the speed in which the neuromuscular response to lower extremity perturbations occurred were significantly reduced following Tai Chi training. Balance impaired older adults were evaluated for the speed of response in the gastrocnemius and tibialis anterior muscles following perturbation (forward slipping) of a step plate. The Tai Chi, not control groups, demonstrated a faster neuromuscular contractive response to this perturbation, as well as increased co-contraction of antagonist muscle groups. Both of these findings demonstrate an increased stability occurring at the ankle joint following Tai Chi training. This rapid response to an unexpected perturbation is critical as the body relies on the proprioceptive afferent information and reflexive muscular contraction to effectively counteract a perturbation in balance from the lower extremities.

- Tsang and Hui-Chan (2003) demonstrated that with Tai Chi, there was an improvement in knee proprioceptive acuity, and also were able to more rapidly initiate voluntary weight shifting – this allows them to stay within the anticipated stability limits
- The Tai Chi practitioners also demonstrated enhanced control of "leaning trajectory"
- The results indicate that not only did the Tai Chi practitioners have more proprioceptive acuity, and more rapid responses, but they also were able to expand their limits of stability during weight shifting in stance
- What are the implications here?

- Fong and NG (2006) demonstrated that after 1 year of Tai Chi experience, the practitioners had a more rapid gastrocnemius and hamstring reflex reaction as well as a longer balance time on a tilt board.
- Logn and short term practitioners also had less knee joint angle-repositioning errors
- This increase in knee joint position sense was seen after 3 months of Tai Chi practice
- Mak and Ng (2003) report a better postural control in Tai Chi practitioners – this included improved gait speed, stride length and sway parameters when in a single leg stance
- Think of the effects of this with a potential fall
- Remember, wider base breeds better balance

- Tsang dn Hui-Chan (2004)
  - Increased knee proprioception in Tai Chi pratitioners as well as increased limits of stability
  - LIMITS of stability – ie., better knowledge of stability limits as defined neurologically

- Tai Chi has also been reported to improve muscular strength and endurance, as well as balance and flexibilty in the elderly – Taylor-Pillae, Haskell et al. (2006)

Tai Chi Benefits

- Based on knowledge of the human nervous system to potential falling, again there appear to be two distinct responses:
  - An initial response to the first episode of falling that relies heavily on proprioceptive input, and requires an integrative response that involves, at the least, cord level motor reflex pathways – this could almost be considered an "alarm" type reaction, as the body makes rapid adjustments to increase muscular force to counteract the stimulus

    This initial response includes upper extremity movement

  - The secondary response is to the same type of falling stimulus – this is a learned response that we have seen that can occur with only one episode of a slip – this secondary response is of a much more controlled fashion – it is a faster response, but the magnitude of response is lessened and refined to the required changes to combat the falling stimulus – this is not an "alarm" response, but a learned motor response
  - As an example, the upper extremity does not move during these secondary responses. This indicates that the motor response has been refined, and is of a less global nature

- Therefore, it is postulated that Tai Chi, as a method of exercise, may allow the human nervous system the following benefits:
  - 1. Due to the slow manner of motor activity, the nervous system is allowed time to anticipate changes in the COM and BOS, and update the anticipated stability limits
  - 2. Due to potentially slowed neurologic transmission, integration, and lack of neuronal plasticity, the motor programs for planning, coordinating, and achieving motor activity can be anticipated, as well as a continual feedback of actual movement parameters evaluated
  - 3. The feedback from proprioceptive afferents can be integrated allowing for synaptogenesis and coordination of motor segments
  - 4. Slowed movement allows the nervous system to update the positioning, without responding in an initial "alarm mechanism" which tends to result in an overcompensatory motor response

- 5. Through continual activity, motor unit tone increases, as does gamma motor neuronal activity, heightening spindle activation
- 6. New COM and BOS stability limits are established for a wide variation of positions
- 7. Cerebellar deep nuclei and cortical neurons receive increased input, and are then allowed to increase in their metabolic capabilities. This allows for integration between vestibular, visual and proprioceptive input.
- 8. Due to the unpotentiated vestibular input into the system, an increased activity of cerebellar nuclei further help to effectively identify movement parameters and make the appropriate motor adjustments in a compensatory fashion

- 9. Increased speed of neurologic transmission
- 10. Increased motor strength – this includes that balance changes that occur as the upper and lower extremities are extended, flexed, or even used as the sole means of support (lower extremity)
- 11. Increased flexibility, therefore allowing greater degrees of motion to further depolarize joint afferents designed to signal the limits of normal range of motion

How Fast?

- Tsang and Hui-Chan (2004) – demonstrated that with only 4 weeks of "intensive" Tai Chi, an improvement in balance and postural control occurred in elderly subjects
- This included improved vestibular responses, directional control of leaning trajectory
- These improvements were maintained even at 4 week follow up, and after 4 weeks of training, the improvement was comparable to improvements seen in experienced Tai Chi practitioners

Management?

- Chiropractic's role in balance mechanisms
  - Receptors, location, type and stimulus
  - HVLA or other mechanisms –
  - Directional forces and their application to synaptogenesis
  - Is the neurologic system still demonstrating plasticity in the elderly population?
  - Integrative strategies for the systems utilized centrally for the identification of balance parameters
  - Purely orthopedic joint mobility?

Zygopophyseal Capsule

- Posterolateral border of joint
  - outer layer is fibroelastic connective tissue
  - central layer is vascular and composed of loose connective tissue
  - inner layer consists of a synovial membrane

Zygopophyseal Capsule

- Anterior and medial aspects are covered by the ligamentum flavum
- Synovial membrane lines the inner aspect of the capsule, ligamentum flava and synovial recesses
- No synovium covers the articular cartilage within the joint

Zygopophyseal Capsule

- The capsules throughout the column are thin and loose
- Attached to margins of opposing superior and inferior articular facets of the adjacent vertebrae

Zygopophyseal Capsule

- The capsule is richly innervated by sensory endings
- Innervated by medial branch of posterior primary division at the level and from one level above and below

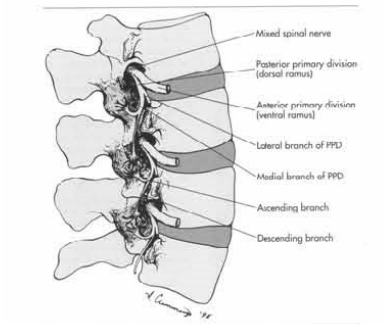


FIG. 2-5 Innervation of the Z joints. Each mixed spinal nerve divides into a medial and lateral branch. The medial branch has an ascending division, which supplies the Z joint at the same level, and a descending division, which supplies the Z joint immediately below.

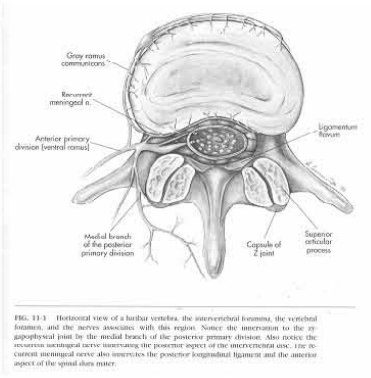


FIG. 11-3 Horizontal view of a lumbar vertebra, the intervertebral foramina, the vertebral foramen, and the nerves associates with this region. Notice the innervation to the zygapophyseal joint by the medial branch of the posterior primary division. Also notice the recurrent meningeal nerve innervating the posterior aspect of the intervertebral disc. The recurrent meningeal nerve also innervates the posterior longitudinal ligament and the anterior aspect of the spinal dura mater.

- Muscular strength and stability
- Upper and lower extremity positioning, strength
- Neurologic motor programs designed to initial postural changes with feedforward anticipation of movements
- Speed of transmission and synaptogenesis
- Activation of central cortical regions secondary to stimulation
- Vascular supply of cortical regions prior to the initiation of activity

- Journal of Electromyography and Kinesiology – Volume 12, Issue 3 June 2003
- This study demonstrated the following
  - The capsule, disk, ligaments were all innervated with abundant afferents that were capable of monitoring proprioceptive and kinesthetic information
  - Mechanical stimulation of more than one of these viscoelastic tissues results in more excitation of local musculature
  - Overall, it seems that spinal structures are well suited to monitor sensory information as well as control spinal muscles and probably also provide kinesthetic perception to the sensory cortex

- Lesions and inflammation in the avascular supporting structures of the spine and SI joints will disturb the proprioception function of the different receptors and result in increased and prolongeed muscle activation that may cause pain
- Stimulation of the disc annulus fibrosus induced responses in the multifidus on multiple levels and on the contralateral side, whereas stimulation of the z joint capsule induced reactions predominantly on the same side and segmental level as the stimulation – thus disc injuries may cause bilateral decreases in motion, where facet inflammation may cause ipsilateral reduced motion
- The mechanically induced stretch reflex of the Z joint resulted in reduced motor activity

- Thus the z joints are seen to have a regulatory function, controlling the intricate neuromuscular balance of the motion segment
- Normal locomotion and posture require multiple levels of neural control
- Descending signals from the brainstem activate complex reflex systems in the spinal cord where the myotatic units with their receptors and polysynaptic circuits are the building blocks
- Afferent information is essential in the modification of muscle activation to make it well coordinated and functional
- Mechanoreceptive responses to normal loading and movements probably have a primary effect on modulatioin and modification of descending signals
- ie. That means that the mechanoreceptors drive higher brain function.

- Injury, certain mechanical loading patterns, degenerative processes and or inflammation may cause perturbation in the proprioceptive function of different receptors and result in increased or prolonged muscle activation by triggering reflex activation of the involved muscle groups, which over time can cause pain.
- Spinal ligaments are associated with complex proprioceptive sensory inputs from nearby discs and capsules
- Compared to other joints, the spinal motion segment has more innervation and is more complex, consisting of an intervertebral disc and two z joints

- Normal locomotion requires multiple levels of neural control. To support the body against gravity, maintain posture and to propel it forward, the nervous system must be able to coordinate muscle contractions at many joints. At the same time, the nervous system must exert active control to maintain balance of the moving body, and it must adapt the locomotion pattern to the environment and to the overall behavioral goals. The spinal circuits activated by descending signals from higher centers accomplish this. Neural circuits in the cord play an essential role in motor coordination. Spinal reflexes where the myotatic units are the building blocks, provide the nervous system with a set of elementary patterns of coordinaton that can be activated, either by sensory stimuli or descending signal from the brain stem and cerebral cortex.

Muscle spindles and GTOs provide proprioceptive information essential for controlling muscle tone , thereby joint stablity.

- the neurological feedback from passive viscoelastic structures provide sensory information needed to regulate muscle tension and hence the stability in the spine

The functioning of the motor system is intimately related to that of the sensory system

The proper moment to moment functioning of the motor system depends on a continuous inflow of sensory information

- Sensory information influences motor output in many ways and at all levels of the motor system
- Motor reflex responses and programmed voluntary respones are dependent upon spinal cord sensory input
- The nerve endings in the outer annulus of the disc, the capsule of z joints and in the ligaments are most likely part of a proprioceptive system responsible for optimal recruitment of the paraspinal muscles

- Mechanoreceptors are thought to play an important role in the function of monitoring position and movements of joints by regulating and modifying muscle tension
- Descending signals that initiate muscle action are modified by the sensory input from the proprioceptive nerve endings
- Overload foces on specific parts can be detected by proper functioning joint sensory receptors and inhibit the involved muscles and thereby prevent injury

- Damage done to ligaments and perhaps other passive structures does not necessarily have to result in a lot of pain, but it can still result in inappropriate muscle activation
- Stimulation of the outer annulus of disc, z joint, cause activation of paraspinal musculature, on the same level as well as different levels
- This interaction stabilizes the segments to each other and helps mainain posture

- A lesion in one location may cause alteratioins in muscle activation in other than the actual segment and also on the contralateral side
- The afferent input from sacroilliac joint receptors, as well as mechanoreceptors in the disc and z joint will contribute to different degrees of the muscle activation and may constitute an integral regulatory system

- Change in length and loading of the ligmaents may result in altered firing patterns and changes in the coordination pattern of the muscles
- Decreased interdiscal space from DJD causes less efficient adaptation of the surround nerve endings causing less optimal neuromuscular reflexes

Sensory Function of Ligaments – Journal of electromyograpohy and Kinesiology Volume 12, Issue3, June 2002

- The ligaments of every joint provide such a complex sensory feedback mechanism further fortifying the fact that feedback from ligaments is an integral part of joint motion
- The coordination of muscle function around joints and joint movement is influenced by many factors these include:

- Afferents from ligaments, muscles, tendons, skin, vision, etc.
- All of these inputs are mixed with earlier experience stored in the cortex and cerebellum, and these inputs are used to update or change the pre-programmed motor functions which secure an optimal coordination of muscle function in relation to the desired motor activity
- The effects of the sensory system inputs are modified, dependent on ongoing activity in all parts of the system

Spine 1997, Jan1;22(1):17-25

- Stretching a single spinal ligament produces a barrage of sensory feedback from several levels of the cord, on both sides
- This was seen in the dorsal root ganglia, the intermediate gray matter of the cord at the level of stimulation as well as levls above and below the site of stimulation
- This was greater ipsi than contra, but also seen in the sympathetic ganglia at these sites
- Activation was seen also in the dorsal column nuclei, as well as in the vestibular nuclei and thalamus
- It appears that this information was relayed via the dorsal column system and the spinocerebellar system

- ACTA Biol Hung 2002;53(1-2:229-244
  - SNS regulates cytokine production
  - All lymphoid organs primary and secondary and other tissues are involved in immune responses and are heaviliy infuenced by NA derived from varicose axon terminals of the SN
  - Circulating catecholamins are also able to influence immune responses, the production of anti-inflammatory and pro inflammatory cytokines by different immune cells
  - These are mainly governed by the hypothalamic/pituitary axis

- Under stressful situations the NA released from sympathtetic terminals was able to inhibit the production of proinflammatory ctokines, and increase antiinflammatory cytokines
- Annals of internal medicine, volume 136, No. 10, pages 713-722
  - This study demonstrates effectiveness of 6 weeks of treatment for nonspecific neck pain
  - Results demonstrated that there was a 68% resolution for manual therapy group, compared with 51% for PT patients and 36% for continued physican care patients (manipulation was 1X/week, PT 2X/week

- 1988 American Journal of Anatomy
  - Mechanoreceptors in articular tissues
    - Most of the receptors in ligaments are found in it's distal portion
    - Concentration of mechanoreceptors appears greater in areas related to the extremes of movement and probably represents the first line of defense in sensing these extremes
    - Discharges from these, spindles, and joint mechanoreceptors are thought to function in alerting the CNS of impending injury, and thus averteing this type of injury

- Journal of Elec. And Kinesiology –June 2002
  - Theoretical and experimental evidence indicated that ligament afferents, with afferents ffrom muscles and skin provide CNS with info on movment and posture through ensemblecoding mechanisms, rather than via modality specific pathways. These are triggered when the ligament is threatened by potentially harmful loads has been questioned, and is seems more likely that these sensory inputs participate in continuous control of muscle activity via feed forward mechanisms, and therefore are important in joint stability, reflex regulation, and muscle function by contributing to muscle stiffness through reflex modulation of the gamma muscle spindle system.

- Anesthesiology –1994, Feb. Lanter, et. Al
  - "The cerebral and systemic effects of movement…
    - This study demonstrated cerebral activation as well as vasodilation in response to muscle spindle afferent activation. These animals demonstrated increased EEG activity subsequent to muscle spindle activation, as well as cerebral vasodilation that was in excess to the metabolic demands of the requirements of the brain.

- Brain 1991 – March – "Cerebral Potentials…"
  - This study demonstrated that muscle spindle and other afferents from movement can be demonstrated by scalp electrodes in the brain.

- Spine – 1994, March McLain, RF
  - This study demonstrated the distribution of mechanoreceptors in synovial joints, and lists the types of receptor identified. The density seen in the cervical spine was seen to be the greatest of spinal regions, and dense at C5/6 and upper C spine, as well as indicating that these were responsible for informing the CNS of activity in these areas proprioceptively.

- Spine 1995 – Nov. (Pickar JG)
  - This study demonstrated that mjority of endings found in facet joints were graded responses. Additionally that this graded response increased relative to the direction of force applied. Thus the mechanosensitive ending in the spinal joints shou direction specificity to facet manipulation. This indicates the benefit of specific adjusting, not global movements.

- Neuroimaging – 2004, August Volume 22 – Issue 4 pages 1722-1731
  - This study demonstrated that posture and gait (motor phenomenon) are involved with peripheral, spinal, and supraspinal structures. Separate and distinct activation and deactivations were seen in patterns with BRAIN IMAGERY. Standing imagery activated the thalamus, BG and cerebellar vermis, walking activated the parahippocampal and fusiform gyrus, occipital visual area and cerebellum and running imagery predominantly activated the cerebellum in vermis and adjacent hemisphere. Deactivations were seen in walking and running in the vestibular region. Automated locomotion like running is seen to be based on spinal generators of sensation whose pace is driven by the cerebellar locomotor region.

Final Thoughts

- Obviously, the improvement of the CNS is critical in fall prevention
- Also important are the ability to increase the strength of muscles and the mobility of the joints.
- Chiropractic can play a key role as one of the most powerful activators of proprioceptive of centrally located joints with large densities of proprioceptors, as well as peripheral joints
- Planned motor activity and continual updating of motor programs in the CNS allow for rapid alterations in the BOS and COM to return the body within the stability limits to prevent falls

	• To maximize effectiveness, the joint afferents should be activated via Chiropractic, and the volitional organization of the motor components of the nervous system continually updated and refined through planned motor activity that allows adaptation of the nervous system, not reactionary activity.

Preclinical Signs of Decreasing Strength and Function that can Identify Elderly Patients at Risk for Falling

Margaret Herning, PT, PhD

Falls in Older Adults from a Physical Therapist Perspective

Margaret Herning PT, PhD
September 2008

A fall is "an event which resulted in a person coming to rest unintentionally on the ground or other lower level…" (Nevitt, et al 1989)

Objectives

Participants will be able to:

- Describe causes for falls in older adults related to strength, sensation, range, and balance.
- Identify impact of pre-clinical disability on falls.
- Identify falls risks with strength, sensation, and range.
- Describe specific tests of balance and cut off scores for fall risks.
- Identify fall interventions used in physical therapy

Incidence and Causes of Falls in Noninstitutionalized Older Adults

(CDC Report 2007 based on data from the National Health Interview Survey 2001-2003)

- Annually 1/3 population over 65 yrs experience a fall
- More common in women than men
- Increase incidence with age and living alone
- Nearly 60% who fall visit the ER (fx most common)
- Nearly 1/3 who fall will need help with ADLs
- Fall injury may trigger fear of falling and institutionalization so they restrict usual activities

National Health Interview Survey

(32,000 Older Adults)

- Fall rates higher in those who found it difficult to walk ¼ mile, stand for 2 hours, stoop, or climb 10 steps.
- Half of falls due to slipping, tripping, or stumbling. Then came falls due to dizziness, fainting, or seizures
- Majority of falls occurred at home

Causes of Falls

Decrease in:

- Vision
- Cognition
- Blood Pressure
- Balance
- Muscle Strength
- Muscle Mass
- Fat Mass
- Bone Strength
- Function

Other Factors:

- Incontinence
- Pain
- Polypharmacy
- Mechanics of the Fall
- 3 or more co-existing dx
- Environmental
- Prior hs of falls

Pre-Clinical Disability and Falls

- A critical issue in preventing falls and eventual frailty is early detection of functional limitation and disability.
- Patients seek help only when there is a marked, acute change or when they can no longer tolerate a functional decrement.

Pre-clinical Disability cont.

- Nagi (1969) first proposed an intermediate state of functional limitations.
- Nagi (1976) showed that those with difficulty lifting 10 lbs, walking up 10 steps, walking ¼ mile, and stooping, crouching, or kneeling had a twofold increased risk of declines in physical functioning 2 yrs later.

Pre-clinical Disability cont.

So we actually have a high proportion of independent OAs who aren't disabled but are at risk for functional loss and disability. They may test "normal" on our Physical Performance Measures but if further observed they are having difficulties. Watch what they report. They may not have "difficulty" because spouse if doing it for them!

- Does your patient MODIFY the method of task performance?
- Does your patient modify the frequency of task performance?

Some Warning Signs

- Can get out and about but avoids walking on uneven surfaces and inclines
- Looks down when walking
- Walks close to walls
- Can only wear tennis shoes to feel secure
- Uses shopping cart always for support
- Homebound in inclement weather then progresses to not walking outside in any

Warning Signs cont..

- Can't change overhead light so leaves room dark
- Stops carrying groceries
- Uses furniture for support in transfers
- First stops heavy housework then light housework
- Sits for all standing tasks
- Sits to put on slacks and socks
- Won't drive at night or in unfamiliar places and ultimately stops driving. Using a different method to get in/out of a car or bus
- Cannot MULTITASK

Warning signs cont.

- Avoids escalator
- Holds railing for stairs and can't carry anything with opposite arm when on stairs
- Does not go down to basement at all
- Can't carry any luggage when traveling
- When stands up has to wait to "get bearings"
- Can't cut toenails (can't see or can't reach)

Pre-Clinical Disability

Linda Fried MD, MPH et al Jr Aging and Health 1991

- Hypothesized an identifiable stage of pre-clinical disability that will predict future disability and a focus for prevention.
- Often people don't perceive difficulty.
- But these individuals use compensatory strategies that minimize functional restrictions.
- May keep functional decline at a preclinical level.
- May report "doing less" than they used to.

Fried cont

- Difficulty may progress along a spectrum.
- Need to address the underlying impairment to prevent a transition to clinical disability.
- Compensatory strategies can be conscious or unconscious. The individual may do a task in an alternative manner (compensate) or adjust the expectation and do the task more slowly or less frequently…or even redefine his role so that the task is no longer considered necessary…keeping the functional impact below a threshold.

Fried cont on Compensatory Strategies

- Physical-change method of performing the task
- Environmental-alter this to decrease obstacles
- Psychosocial-alter role expectations so don't have to do difficult task
- Physiological-may use one system to compensate for another. For example, 5-10% can't use vestibular cues so they rely more on visual and proprioceptive cues to maintain their balance

Compensatory Strategies Should We Change Them?

Take away the compensation and you might precipitate onset of disability if there is no change in the primary impairment. May be important to teach people how to use compensatory strategies!

Further Evidence for the Importance of Subclinical Functional Limitation and Subclinical Disability Assessment in Gerontology and Geriatrics Wolinsky et al 2005

- Study through the Dept of Geriatric Medicine at SLU: Douglas K. Miller MD.
- 998 African Americans 49-65 yrs
- 12 tasks (5 phy function, 3 ADLS, 4 IADLS)
- At baseline more than ¼ had difficulty walking ½ mile, climbing steps, lifting 10 lbs, and doing heavy housework. Almost 40% had difficulty stooping, crouching, kneeling.
- Found a clinically relevant assoc between subclinical status at baseline and onset of difficulty 1-2 yrs later.

Effect of Subclinical Status in Functional Limitation and Disability on Adverse Health Outcomes 3 Years Later (Wolinsky et all 2007)

- 853 from previous study of 49-65 yr old African Americans were re-evaluated 3 yrs later.
- Found that subclinical status for functional limitation and disability independently predicted several adverse health outcomes.

Falls from a Physical Therapy Perspective

The *Guide to Physical Therapist Practice* lists "Primary Prevention/Risk Reduction for Loss of Balance and Falling" as a preferred practice pattern.

Some physical therapists are using "Disuse Equilibrium" as a PT Dx

Since falls are multifactorial assess first underlying factors

Recall Some Muscle Changes in Old Age

- Sarcopenia (muscle mass loss of fibers, especially Type IIB)
- Latency, contraction, and relaxation phases are prolonged
- Loss of strength and power
- Increase in fat/connective tissue

Muscle Changes in Old Age, cont.

- Changes are accelerated by hypokinetics
- Important to normalize muscle strength to body weight
- Threshold level (% max vol contraction) increases with a functional activity

Falling to the Side

- Weak abductors of hip and asymmetry in lateral stepping velocity causes tendency to fall to the side
- Falling to the side increases the fracture rate

Operational Definitions of Impairments

Duncan, 1993 *Arch Phys Med Rehabil* study with men > 69yrs…helpful to identify fall risks.

STRENGTH (tested Cybex at 60 and 90 degrees)

- Ankle DF < 10ft-lbs
- Ankle PF < 10ft-lbs
- Knee ext < 35ft-lbs
- Knee flx < 20ft-lbs
- Hip abd < 40ft-lbs (isometric with HHD)

Impairments Duncan, 1993

CENTRAL PROCESSING

Tibialis Anterior latency >160mscs

SOMATOSENSORY

Proprioception	can't detect 2-3° big toe
Vibration	can't identify at ankle
Vestibular	any nystagmus

Impairments (Duncan, 1993)

RANGE OF MOTION

Ankle DF	$<0^0$
Ankle PF	$<20^0$
Knee ext (lacks)	$>10^0$
Knee flx	$<90^0$
Hip flx	$<90^0$
Hip ext (lacks)	$>20^0$

Baseline Characteristics of Subjects Who Did Not Fall, Who Fell Without Injury, and Who Fell With Injury (N = 1103) (adapted from Tinetti et al, 1995)

	Prevalence N (%) or mean (SD)*	Did Not Fall† (n = 557)	Fell without Injury† (n = 423)	Fell with Injury† (n = 123)
Decreased leg strength	518 (47%)	41%	52%	56%‡
Unable to heel stand	175 (16%)	12%	18%	24%‡
Balance/gait score <12/22	425 (41%)	31%	48%	63% ‡§
Gait speed (m/sec)	.53 (.18)	.56 (.17)	.51 (.19)	.46 (.20) †§
3 chair stands (sec)	9.4 (6.5)	8.7 (6.1)	9.9 (6.7)	11.4 (7.6) ‡§
10 foot taps (sec)	6.7 (5.4)	6.3 (5.1)	6.9 (5.5)	7.9 (5.9) ‡
Dependent in any ADL or IADL	670 (61)	55%	65%	76% ‡§
≥ 3 blocks walked per day	505 (49%)	55%	41%	49% ‡
Any walking aid	125 (12%)	8%	15%	18% ‡§

Selected Clinical Balance Tests

- Static (Quiet Standing)
- Rhomberg
- One Leg Stance
- Automatic Perturbations
- Sensory Organization
- Forward Reach
- Multi-directional reach
- Dynamic Gait
- Four Square Step Test
- Balance Beam
- Get Up and Go
- Berg Balance
- Tinetti Performance
- Physical Performance
- Walk with Eyes Closed
- Walk on Toes; Heels

- Romberg measures difference in sway when standing with eyes open and then with eyes closed.
- Timed Up and GO: Stand up from chair, walk 10 ft, turn, walk back and sit down.
- Dynamic Gait Index: Walk and modify balance based on specific demands.
- Berg Balance Scale: Assess balance sitting, sit/stand, standing/turning, etc.
- Four Squares Test: Assess side, forward, and back stepping.
- Walk While Talk Test: time walking 20 feet and back, then repeat while say alphabet; then repeat saying every other letter of alphabet

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Fall Risk for Specific BalanceTests

Functional Reach (Duncan, 1992)	< 6in
Berg Balance Scale (Shumway-Cook, 1997)	≤49/56
Gait Speed (Tinetti, 1995)	<0.42m/s
3 Chair Stands (Tinetti, 1995)	>10s
Dynamic Gait Index (Shumway-Cook, 1997)	≤19/24
Four Squares Test (Dite 2002)	>15s
Timed Up & Go (Bohannon 2006)	>10s
Single Leg Stance (Bohannon 1984)	<5s (eyes open)

Physical Therapy Interventions

- Strength

Sit-to-stand-espec descend slowly
Standing DF/PF
Short squats
Theraband reisistance for lower extremties-espec gluteus medius

- Range of Motion

Hamstrings
Ankle circles
Quad stretches
Pelvic tilts
Hip extension

Intervention cont.

- Balance

Eyes open/closed:
Stand erect and turn
Single leg stance
Tandem stance and move arms/trunk
Baps Board
4 Squares

- Function

Dual tasks activities
Fast walking changing pace and direction
Obstacle walking

Reccommend:No-slip ice treads for ice and snow

Assessment of Intrinsic and Extrinsic Risk Factors for Falling

Helen Lach, PhD

Intrinsic and Extrinsic Risk Factors Underlying Falls in Older Adults

Helen W. Lach, PhD, RN, GCNS-BC
Saint Louis University School of Nursing

Objectives

Participants will be able to:

1. Discuss the problem of falls for older adults
2. Describe intrinsic and extrinsic risk factors for falls
3. Explain evidence-base for approaches to fall prevention for older adults

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Disclosure

- Dr. Lach has no disclosures regarding this lecture.

Significance of Falls

- Leading cause of injury, death and emergency visits
- Leading cause of injury & hospitalization from trauma
  - Morbidity 10-15% serious injury
  - Fractures hip fractures 20% mortality within year
  - Soft tissue injuries, subdural hematomas, accidental hypothermia

Significance of Falls

- Fatality 49% higher for men
- Fracture rates twice as high in women
- Deaths and serious injury more likely in those over 85
- Fatal fall rates about equal in Whites, Blacks,
- Fractures more common in Whites than Blacks, fatal falls more common in Whites than Hispanics

Significance of Falls

- Affects Quality of Life
  - Fear of falling 43-70%
  - Contributing factor in NH admission
- Cost
  - In 2000: $179 million for fatal falls and $19 billion for nonfatal fall injuries
  - In 2008???

Significance of Falls

Community Older Adults

30% per year

Acute Care

2.2 – 7 falls per 1000 bed days

Rehabilitation Hospitals

8.9 – 19.8 per 1000 bed days

Long Term Care

50% per year

Normal Balance and Mobility (Why we don't fall)

- Sensory System
- Vestibular System
- Somatosensory System

Normal Balance and Mobility

- Perception and Cognition
  - Perception of abilities
  - Fear of falling
  - Central processing
  - Attention
  - Reaction time

Normal Balance and Mobility

- Motor system
  - Muscle strength and endurance
  - Flexibility
  - Gait and walking
  - Use of walking aid

Aging Impact on Falls

- Aging Changes
  - Decreased efficiency of all the sensory systems
  - Vision – lens yellows, decrease in peripheral vision, decreased accommodation
  - Decreased reaction time - processing

Aging Impact on Falls

- Gait Changes
  - Muscle strength and muscle mass decreases 30-50% by the age of 80
  - Feet not picked up as high
  - Slowing (1%/yr, shorter steps)
  - Decreased proprioception – more sway

Aging and Biomechanics of Falls

- Compensatory mechanisms for preventing forward fall
  - Step forward
  - Hands out
- Sideways fall
  - Crossover step

Assessing Risk: Types of Falls

- **Types of falls (Morse 2002)**
  - Accidental Falls (Extrinsic)
  - Unanticipated physiologic falls (Intrinsic)
  - Anticipated physiologic falls (Intrinsic)

Falls

- Multifactorial

Falls as Multifactorial

- Risk of falling increases with number of risk factors
- Tinetti, et al. (1988)
  - 27% with no risk factors
  - 78% of those with 4 or more risk factors
- Not all risk factors are modifiable, but they can compound total risk

Risk Factors for Falls

- 16 studies

Factor	Risk
Weakness	4.4
Prior fall	30
Balance deficit	2.9
Gait deficit	2.6
Assistive device	2.6

Risk Factors for Falls

Factor	Risk
Vision deficit	2.5
Arthritis	2.4
ADL deficit	2.3
Depression	2.2
Cognitive deficit	1.8
Age > 80	1.7
Diabetes	1.4

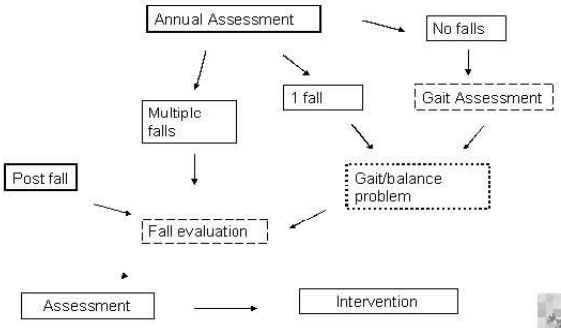
Risk Factors for Falls

- Medications
- Psychotropics 1.73
  - Neuroleptics 1.50
  - Sedatives/hypnotics 1.54
  - Antidepressants 1.66
  - Benzodiazepines 1.48
- Diuretics 1.08
- Anti-arrhythmics 1.59
- Digoxin 1.22

Risks in the Environment - Home

- Rugs/carpets
- Lack of handrails
- Poor lighting
- Low toilets or furniture
- Unstable furniture
- Objects on floor
- Pets

Algorithm for Clinical Assessment and Management of Falls



Adapted from American Geriatrics Society

Fall Prevention for Community Older Adults

CDC Recommendations:

- Physical Activity/ Exercise
- Review medication
- Vision check
- Home safety modifications

Translation of Fall Prevention Works

- Dissemination of fall prevention measures to clinicians
  - 9% reduction in serious fall-related injuries
  - 11% reduction in fall-related edical

Physical Activity/ Exercise

- Evidence remains limited (RR .86/.84)
- Components of routine exercise program may be helpful - muscle strengthening, flexibility, endurance and balance
- Muscle strengthening combined with balance retraining individually prescribed by a trained health professional (3 trials)
- T'ai Chi (1 trail)

Exercise

- Increases function
- Increases quality of life
- Decreases risk factors
- Increases exposure

Home Modification

- Recent evidence (Risk .90/.85)
- Most helpful for those with previous fall
- Caveat - improves all kinds of falls
- Mechanism not clear (i.e. awareness, education)

Medications

- Review medication of those who have fallen
- Reduce/eliminate high risk drugs – psychotropics (withdrawal -1 trail)
- No individual studies but component of multi-factorial studies
- Herbal products

Behavioral and Educational Programs

- Not proven effective at reducing falls
- Have been part of multifactorial studies
- Improved self-efficacy and attitudes in intervention to reduce fear of falling

Education

- Older adults need to take an active role
- Empower older people to learn ore
- Sources for information:
  - www.cdc.gov/injury
  - www.americangeriatrics.org

Hip Protectors

- Fair evidence in nh
- Counity – little study
  - Low supervisio nso poor copliance
  - Low fracture rate so High nubers o fsubjects needed

Multidisciplinary, Multifactorial Interventions

- Community (4 trials)
  - Gait training / assistive devices
  - Medication review
  - Exercise program with balance training
  - Evaluate/treat postural hypotension, cardiovascular disease
  - Reduce environmental hazards
- Residential Care (1 trial)
  - Assessment and intervention

Other Potential Interventions

- Follow up and intervention post fall (RR .82/.63)
- Bone strengthening medications
- Cardiovascular interventions – only proven is cardiac pacing for those with carotid hypersensitiveiy (1 trail)
- Visual inteventions
- Footwear interventions
- Hormone replacement therapy
- Vitamin D (5 trials, meta-analysis, 20% reduction)

Quality Care Indicators for Falls

- All vulnerable elderly should be assessed for fall risks
  1. Asked about recent falls at least annually
  2. Asked/ examined for gait/balance disorders
  3. If they have fallen, then conduct basic fall evaluation
     - Circumstances
     - History and Physical exam – mobility, medications, othostatics, vision, gait, balance, neuro

Adapted from Acove Project

Quality Care Indicators for Falls

4. Gait/balance problems should be evaluated
5. Exercise programs should be offered to those with problems
6. Assistive devised should be offered as appropriate

Helpful Resources

- Guidelines for Prevention of Falls in Older Persons (American Geriatrics Society, British Geriatrics Society, American Acadamy of Orthopedic surgeions Panel on Fall Prevention
- www.patientsafetycenter.com
- VA National Patient Safety Center – www.va.gov/ncsp/index

How to Optimize the Medical History and Physical Examination of an Elderly Patient with a History of Falls.

Glenn Bub, DC

Optimize the History and Physical Examination of the Elderly Patient with a Fall History

Differential Considerations

- Functional vs Accidental
- Is the fall indicative of an underlying disorder?
- If so, what can be done to prevent future falls
  - Most are result of interaction between long or short term predisposing factors and short term precipitating events

Differential Considerations

- The frequency of falls should dictate the level of concern and determine the course of action regarding assessment
- The assessment is not limited to the patient and must include the environment to identify risks

Differential Considerations

- With a history of a single fall within the past year, gait assessment should be performed
- With recurrent falls (2 or more in 6 months), a thorough evaluation should be performed

Differential Considerations

- Fall incidence increases with age and triples from age 70 to 90
- Older adults that tend to fall have more medical diagnoses than those that don't fall
- Patients with very low OR very high mobility are at greatest risk for falling

Differential Considerations

- A fall may be the first sign of an acute illness in the elderly patient
- History of 1 or more falls in prior year, inability to get up after a fall, or a fall occurring indoors is a predictor of future falls

Differential Considerations

- Accidental fall
- Environmental hazard
- Gait disorder
- Balance disorder
- Visual disorder
- Dizziness
- Vertigo
- Hypotension
- Dementia
- Syncopal event

Differential Considerations

- Was there a loss of consciousness that caused the fall?
- Syncope should always be a consideration in older patients with unexplained falls
  - Syncope may be caused by
    - Vasovagal response
    - Carotid sinus hypersensitivity
    - Cardiac arrhythmia
    - Orthostatic or situational hypotension

Risk Factors in Falls

- Falls result from inability to maintain postural stability within the changing demands of the environment
- Factors to consider include
  - Intrinsic risks
  - Extrinsic risks
  - Medications

Intrinsic Risk Factors in Falls

- Age and its related changes
  - Depleted physiologic reserves
- Acute illness
- Chronic illness
- Altered mobility

Intrinsic Risk Factors in Falls

- Age related changes include
  - Visual impairments
  - Decline in muscular strength
  - Loss of joint mobility
  - Proprioceptive sensory decline
  - Vestibular reflex decline
  - Changes in gait

Intrinsic Risk Factors in Falls

Acute Illness

- Pneumonia
- Myocardial infarction
- Infections
- Non-dyspneic pulmonary edema

Intrinsic Risk Factors in Falls

Chronic Illness

- Visual impairments
- NMS declines
- Parkinsonism
- S/P CVA
- COPD
- Vascular disease
- Diabetes
- Depression
- Dementia
- Peripheral neuropathy

Intrinsic Risk Factors in Falls

Altered Mobility

- Lower extremity weakness
  - Independent risk factor for falling
- Lower extremity disability
  - Arthritis of hips/knees
- Abnormal gait or balance
- Foot disorder or deformity
  - Hallux valgus/calluses/digital deformities

Extrinsic Risk Factors in Falls

- Height of bed
- Low toilet seats
- Poor lighting
- Upturned carpets
- Changing positions
- Uneven curb/sidewalk
- Wet or slick floor
- Type of footwear
- Multi-focal eyewear
- High risk activity

Medications

- Polypharmacy
- Meds that induce
  - Sedation, dizziness, hypotension
  - Fluid or electrolyte abnormalities
  - Psychotrophics
  - TCAs/SSRIs
  - Benzodiazapines
  - Hypoglycemic agents

Focused Fall History

- Thorough history is essential to determine
  - Mechanism of falling
  - Specific risk factors
  - Impairments that may contribute
  - Appropriate diagnostic approach
- Must determine if syncope or acute illness is cause for fall

Focused Fall History

- Falls are often associated with
  - C - cognitive impairments
  - A - abnormal mobility
  - D - dizziness
  - D - drugs
  - I - impaired vision
  - E - environmental hazards

Focused Fall History

- Fall specific history should include
  - S – symptoms assoc. with fall
  - P – prior falls
  - L – location of fall
  - A - activity at time of fall
  - T – time of day of fall

Focused Fall History

- Activities at the time of the fall may provide clues to the etiology
  - Arising to stand
    - Orthostatic hypotension
  - When reaching for an object
    - Balance impaired
  - When walking over carpet edge
    - Weakness

Focused Fall History

- Activities at the time of the fall may provide clues to the etiology
  - Associated with neck movements
    - Hypoperfusion of brainstem - VBAI
  - After a meal
    - Postprandial hypotension

Focused Fall History

- A review of all medications including recent dose changes is essential
  - Should include all OTC meds
    - Vitamins/supplements
    - Eye drops
    - Alcohol

Physical Examination

- Should be comprehensive and special focus on
  - Cardiac function
  - Neurologic system
  - Musculoskeletal system
  - Cognition

Physical Examination

- Vital signs provide insight and evidence of
  - Cardiac disease
  - Pulmonary disease
  - Occult infection
  - Hematopoetic disease
- Should be done to evaluate orthostatic events

Physical Examination

- Cardiac examination
  - Focus should be directed towards evaluating for
    - Rhythm
    - Murmurs
    - Bruits

Physical Examination

- Musculoskeletal exam should focus on
  - Arthritic deformity
  - Impaired ranges of motion
  - Feet should be evaluated for presence of
    - Deformity
    - Calluses
    - Contractures

Physical Examination

- Neurologic exam must consider
  - Mental status
  - Absence or presence of 3Ds
  - Cranial nerves with special attention to
    - Vision
    - Hearing/balance
  - Muscular tone
    - Cogwheeling
    - rigidity

Physical Examination

- Evaluation of
  - UE and LE
    - Sensation
    - Strength
  - Cerebellar function
    - Gait
    - Motor control

Physical Examination

- Lab studies to be considered include
  - CBC/UA
  - Glucose
  - Electrolytes
  - Calcium
  - B 12
  - Thyroid function
  - Drug levels, if applicable

Physical Examination

- If acute illness is suspected
  - CXR/EKG
  - Cardiac enzymes
  - 24 hour holter
  - Echocardiogram
  - Tilt table testing

Special Testing

- Evaluation of Balance and Gait
  - One Leg Stand
    - Determine how long patient can stand on one leg without falling
    - Determine how long patient can stand on one leg with eyes closed
    - If closed eyes reduces time by ½ or more, balance training should be considered

Special Testing

- Evaluation of Balance and Gait
  - Walking Speed
    - Determine average walking speed
    - Determine average walking speed while counting backwards by 7 from 100
    - If backwards counting reduces walking speed by ½, consider gait training

Special Testing

- Timed Get up And Go Test
  - Patient arise from a standard armchair
  - Walk a distance of 10 feet
  - Turn around and return to chair
  - Sit back into chair without using their arms
    - 10 sec or less — low risk
    - 11-19 sec — low-moderate risk
    - 20-29 sec — moderate-high risk
    - 30 sec + — high risk/impaired mobility

Special Testing

- Timed Get up And Go Test
  - Repeat test with patient holding full glass of water
  - If dual tasking doubles time, patient should eb considered for
    - Balance training
    - Gait training
    - Strength training

Special Testing

- Sternal Nudge Test
  - Patient stand with both eyes open
  - Feet as close together as possible
  - Place another person behind patient for safety
  - Apply three nudges to patients sternum using fingers with sufficient force to disturb balance
    - Normal response is to reach out with arms and take a step back to maintain balance

Differential Considerations

- Accidental fall
- Environmental hazard
- Gait disorder
- Balance disorder
- Visual disorder
- Dizziness
- Vertigo
- Hypotension
- Dementia
- Syncopal event

Identifying and Managing the Complications of Fall in Older Adults

Paul Dougherty, DC

Complications of falls in Older Adults

Paul Dougherty, DC
Associate Professor, New York Chiropractic College
Adjunct Assistant Professor, University of Rochester School of Medicine and Dentistry

OUTLINE

- Economic impact of falls
- Complications of falls
  - Hip Fracture
  - Vertebral Fracture
  - Wrist Fracture
  - Psychosocial Factors
- Case study

How big is the problem?

- More than one third of adults 65 and older fall each year in the United States (Hornbrook et al. 1994; Hausdorff et al. 2001).
- Among older adults, falls are the leading cause of injury deaths. They are also the most common cause of nonfatal injuries and hospital admissions for trauma (CDC 2005).

How big is the problem?

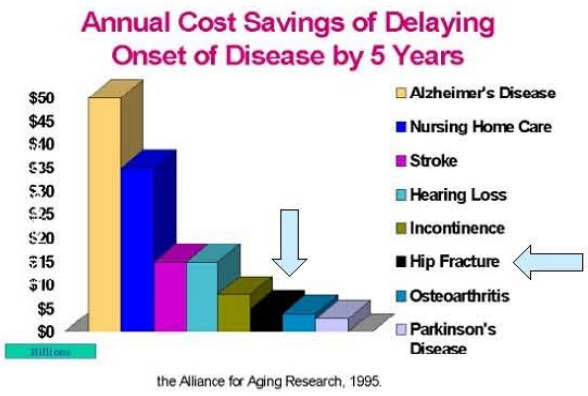
- In 2003, more than 13,700 people 65 and older died from injuries related to falls; about 1.8 million people 65 and older were treated in emergency departments for nonfatal injuries from falls, and about 460,000 of these patients were hospitalized (CDC 2005).
- The rates of fall-related deaths among older adults rose significantly over the past decade (Stevens 2006).

How big is the problem?

- Falls in older adults are associated with high morbidity and mortality and are responsible for **greater than 20 billion dollars a year in healthcare costs in the United States.**
- ***Falls in the community-dwelling older adult: a review for primary-care providers. Clin Interv Aging. 2007;2(4):545-54***

Hip Fractures

- "Hip fractures are probably the most dreaded fall related injury, as approximately half of older adults who sustain hip fracture cannot return home or live independently after the fracture."
- M. King in Principles of Geriatric Medicine and Gerontology



the Alliance for Aging Research, 1995.

Hip Fracture and Mortality

- A study which evaluated the mortality associated with first hip fracture showed:
- cumulative mortality was:
  - 9% at 1 month
  - 15.5% at 3 months
  - 26.5% at 1 year
  - 36.2% at 2 years
  - *Time trends of mortality after first hip fractures. Osteoporos Int. 2007*

Hip Fracture and Morbidity

- Among survivors of hip fracture
  - **20% do not walk again**
  - **30% do not regain their previous level of function.**
  - **As many as 70% will be institutionalized for skilled nursing care following fracture repair**
  - **10% will remain in nursing homes for a year or longer**
  - ***J Bone Joint Surg Am. 2008 Jan;90(1):34-42.***

Factors associated with poor outcome after hip fracture

- steroid use
- disseminated cancer
- impaired sensorium
- congestive heart failure
- Dementia
- diabetes
- Hemiplegia
- severe chronic obstructive pulmonary disease
- a history of stroke
- recent weight loss

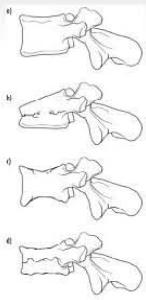
Factors influencing need for Assistive Living

- The following risk factors are associated with increased risk of requiring discharge to an **alternative location**: (1) pre-injury dependence, (2) increasing age, (3) male sex, (4) injury sustained whilst in hospital.
- Injury. 2008 Feb;39(2):213-8. 2007 Dec 11.

Vertebral Compression Fracture

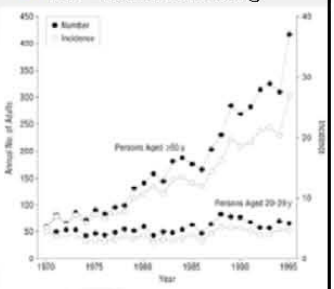
Journal of Bone & Joint Surgery - American Volume. 85-A(10):2010-2022

October 2003



Vertebral Fracture

- A fall-induced vertebral fracture is one of the most severe conditions, especially when the fracture is accompanied by an acute spinal cord injury.
- Arch Intern Med. 2000 Jul 24;160(14):2145-9.
- The incidence is rising



Vertebral Fracture

- Traumatic injury in the elderly is an increasing problem and studies have shown that elderly patients (>/=65 years old) with cervical spine fractures and spinal cord injury (SCI) carry a mortality rate of 21% to 30%.
- *Isolated cervical spine fractures in the elderly: a deadly injury.*
- *J Trauma. 2008 Feb;64(2):311-5.*

These fractures can be missed if we are not vigilant

The complaint of low back pain (LBP) in persons at risk for osteoporotic fractures may require both thoracic and lumbar X-rays.

- LBP patients with a suspect history of an osteoporotic vertebral fracture should also be given an X-ray of the thoracic and lumbar spine.

- *Eur Spine J. 2006 Dec;15(12):1797-800. 2006 Feb 7.*

Wrist Fractures

Wrist Fractures associated with Falls

- Fracture of the distal radius is the most common upper extremity fracture in individuals aged 65 or older.
- The annual incidence in the age group is reported to be 8-10 per 1,000 person years.
- 16% of white women will fracture their distal radius after age 50.

- *JAGS 50:97-103 2002*

Wrist Fractures associated with Falls

- The majority of these fractures will result from a fall sustained while walking.
- Up to 50% of the women who sustain this fracture will have continuing residual impairment and pain after the fracture has been treated and will lose their functional independence.
- J. Amer. Ger. Society 1997 45:905-10

Psychosocial Factors as risk factors for fall

- Several psychosocial factors that are potential risk factors have been suggested.
- Suggested factors include marital status, living arrangements, stress and coping, life satisfaction, emotional status, cognition and social connectedness
- *Age Ageing. 2007 Mar;36(2):145-51. Epub 2007 Jan 27.*

Psychosocial factors after the fall: Depression

- Community based studies that focused on the association of **depression** with physical functioning in general, found a positive relation between both subsyndromal and clinical depressive symptomatology and disability, independent of other relevant factors such as age and comorbidity.
  Age Ageing. 2003 Jan;32(1):88-94.

Psychosocial factors after the fall: Depression

- **Depressive** symptoms 8 weeks after a fall are significantly related to disability at 8 weeks, 5 months and even 12 months after the injury.
- *The role of depressive symptoms in recovery from injuries to the extremities in older persons. A prospective study.*
- *Int J Geriatr Psychiatry. 2003 Jan;18(1):14-22.*

Psychosocial factors after the fall: Fear of falling

- Falling in older people may result in psychological trauma, leading to a self-imposed restriction of activity, even when fractures, soft tissue injuries, or joint dislocations associated with the fall, are not functionally limiting
- *J Gerontol* 1995;50A:M28-34

Psychosocial factors after the fall: Fear of falling

- Reduced confidence may prevent people from performing activities of daily living; therefore, fear of falling could be a cause of or marker for future physical dependence in the elderly.
- *J Gerontol* 1993;48:35-8

Psychosocial factors after the fall: Fear of falling

- Indeed, loss of confidence and a fear of falling is an independent risk factor for functional decline, lower life satisfaction, depressed mood, frailty, and balance deterioration.
- *J Gerontol* 1993;48:35-8

CASE STUDY

- Mrs. Smith is an 85 year old white female, living in an independent living facility.
- She is a smoker, she drinks about three cans of soda per day and she is about 40 lbs overweight.

Past Medical History

- History of:
  - High blood pressure
  - Depression
  - GERD
  - Mild cognitive impairment

Medications

- High blood pressure medicine: Diuretic
- Prilosec: for GERD
- Lexapro: Depression
- OTC Medications:
  - St. Johns Wort
  - Ginko
  - Asprin

History of present illness

- She was at home and had to get up in the night to go to the bathroom.
- She trips over a fold in the rug and falls on her right hip.
- She activates her "lifeline" and is transported to the hospital where she undergoes x-rays which reveal a fractured right femoral neck.

Surgical correction:

Rehabilitation

- She undergoes a successful rehabilitation at a local hospital.
- She has regained the ability to ambulate and then is discharged to go home.

HOME AGAIN

- Mrs Smith does not have any family locally and she has not made very many friends at her local independent living facility.
- She gets out much less because she doesn't have friends and there aren't any activities for her to participate in.
- Her depression worsens and she goes to her doctor who puts her on a new anti-depressant.

HOME AGAIN

- The new medication causes her to be a little drowsy when she is up, she again goes to get up in the night and falls again now fracturing the other hip.

What things could have been done to help Mrs. Smith

- Preventatively?
- After the fall?

REMEMBER

- IF YOU PREVENT A FALL, YOU MAY SAVE A LIFE!!

Connoisseurs of Care? Unannounced Standardized Patients' Ratings of Physicians

Malathi Srinivasan, MD, Peter Franks, MD,* Lisa S. Meredith, PhD,† Kevin Fiscella, MD, MPH,‡ Ronald M. Epstein, MD,‡ and Richard L. Kravitz, MD, MSPH**

Background: Patient satisfaction surveys can be informative, but bias and poor response rates may limit their utility as stable measures of physician performance. Using unannounced standardized patients (SPs) may overcome some of these limitations because their experience and training make them able judges of physician behavior.

Objectives: We sought to understand the reliability of unannounced SPs in rating primary care physicians when covertly presenting as real patients.

Study Design: Data from 2 studies (Patient Centered Communication [PCC]; Social Influences in Practice [SIP]) were included. For the PCC study, 5 SPs made 192 visits to 96 physicians; for the SIP study, 18 SPs made 292 visits to 146 physicians. SPs visits to physicians were randomized, thus avoiding mutual selection bias. Each SP rated 16 to 38 physicians on interpersonal skills (autonomy support: PCC, SIP), technical skills (information gathering: SIP-only), and overall satisfaction (SIP-only). We evaluated SP evaluation consistency (physician vs. total variance ρ), and SPs' overall satisfaction with specific dimensions of physician performance.

Results: Scale reliability varied from 0.71 to 0.92. Physician rhos (95% confidence intervals) for autonomy support were 0.40 (0.22–0.58; PCC) and 0.30 (0.14–0.45; SIP); information gathering rho was 0.46 (0.33–0.59; SIP). Overall SP satisfaction rho was 0.47 (0.34–0.60; SIP). SPs varied significantly in adjusted overall satisfaction levels, but not other dimensions.

Conclusions: These analyses provide some evidence that medical connoisseurship can be learned. When adequately sampled by trained SPs, some physician skills can be reliably measured in community practice settings.

Key Words: unannounced standardized patient, physician performance evaluation, competency assessment, clinical skills and interpersonal skills evaluation, patient satisfaction, autonomy support, primary care

(*Med Care* 2006;44: 1092–1098)

In the modern era of medical accountability,[1] patients routinely are asked to provide ratings of their physicians.[2] These ratings are collected to assess interpersonal quality of care,[3,4] encourage quality improvement, and support pay-for-performance schemes incorporating patient satisfaction.[5] The collection, analysis, and interpretation of such ratings may be flawed, however, by several underlying problems. Ideally, patient ratings of physicians should be used to evaluate factors under the physician's control and tease out those factors that may influence patient ratings but are not under the physician's control. For instance, patient ratings are influence by personal, system, and visit factors that do not relate to the quality of care rendered by the physician.[6,7] Personal patient factors influencing physician evaluations include patient health status,[8] comorbid illnesses, socioeconomic status,[9,10] ethnicity,[11] participation in their own health care,[12,13] prior expectations,[14,15] self-efficacy,[16] and their overall satisfaction with their life.[17,18] System factors include the type of health practitioner seen,[19] type of insurance enrollment, satisfaction with nurse or receptionist,[19] visits from additional health personnel,[20] closed/open physician panels,[21] and wait time. Physician visit factors not under the physician's control may include duration of relationship[22] and number of physician visits per year. Yet, physicians have control over other potential influences on patient satisfaction, such as technical care,[23,24] time spent together,[25–27] and their interactional style during the visit.

In addition to bias introduced by systematic factors, only 30% to 80% of patients return surveys. Those who return surveys may be quite different from those who do not in terms of age, income, and illness severity.[17,28] Fifty to 100 patient surveys are needed to achieve an acceptable level of reliability,[29] and these scores tend to be positively skewed.[19] Finally, dissatisfied patients tend to leave their physicians.[30–32] Those that remain may acclimate to the physician's

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style so that assessments of physicians by current patients produce a biased assessment of physician performance.

The hotel, restaurant, and other service industries have used a second approach to understand service provided by their systems—the "mystery shopper."[33,34] Using this assessment method, an individual is hired to interact with a particular system and then rates performance on multiple dimensions. These trained participant-observers can make detailed comparisons among systems within a particular industry. In medicine, the mystery shopper equivalent is the unannounced standardized patient (SP). Unannounced SPs are actors trained to portray specific patient roles consistently to elicit physician behavior as if the SP were a real patient.[35] They are booked for regular patient visits, with physicians being unaware that the patient is an actor. Unannounced SPs must simultaneously evade physician detection, portray roles consistently, flexibly accommodate unexpected circumstances, and rate physicians consistently. Unannounced SPs have been used to rate physician adherence to national preventive health protocols,[35] history-taking,[36] HIV medications use,[37] nonindicated services,[38] patient centeredness,[39] and response to brand-name medication requests.[40] Because of their extensive experience and training, unannounced SPs may have developed into connoisseurs of physician care and may be able to rate physician behavior more precisely and with fewer measurements per physician than untrained patients.

Unannounced SPs have the potential advantage of being more attuned to physician behavior and less biased by a prior relationship with the physician. However, no studies have reported the reliability of unannounced SPs' observations about physician behavior, technical aspects of care, and SP subjective experience of care. We sought to address the following question: Can unannounced SPs reliably rate of 2 aspects of physician performance (interpersonal and technical skills) and their overall satisfaction? Corresponding to this question, we hypothesized there would be significant agreement between 2 SPs in their assessment of a particular physician's performance (information gathering, interpersonal skills) and in their overall satisfaction with care. We used data from 2 studies[39,40]; in each study, primary care physicians each encountered 2 unannounced SPs.

METHODS

Study Overview

The Patient Centered Communication (PCC)[39] and Social Influences in Practice (SIP)[40] studies have been described in detail elsewhere. Table 1 summarizes key enrollment characteristics. In both studies, SPs presented to practicing primary care physicians for a regularly scheduled visit and covertly audiotaped their interactions. All physicians had provided written informed consent, and both study protocols were approved by the relevant Institutional Review Boards. These unannounced SPs were rigorously trained to portray their roles consistently under a variety of circumstances and physician styles. Physicians and their offices were reimbursed $375 to $400 for participation to offset SP visits costs to their practices. Age and gender distributions of participating physicians were similar to physician practices in each area as a whole. In both studies, to ensure realism, SPs were provided factitious insurance cards obtained from local insurance companies; false identities (including pseudonym, local home and work address), and "mobile phone number" corresponding to the cellular phone number of the study coordinator; and cash to make any applicable copayments. After each encounter, SPs returned to a comfortable environment and rated the physicians using encounter forms while listening to their audiotapes.

In the PCC study (visits conducted in 2000–2001), SPs were trained to portray 2 clinical roles (gastroesophageal reflux disorder [GERD] and multiple nonspecific symptoms including atypical chest pain). They presented to primary care physicians in 1 city, several months apart. SPs for each clinical role were middle aged, nonobese, Caucasian men and women. Physicians were randomized to see patients with both clinical disorders and genders. Order of the SP gender/clinical presentation was assigned randomly. In the PCC study, 100 physicians were enrolled, with 92 providing data on 2 SP encounters. Five SPs each visited 23 to 49 physicians. Physicians were surveyed within 2 days to determine whether they had suspicions that a recent patient was an actor. Detection rates approached 40%, mainly because the

TABLE 1. Physician Enrollment Characteristics

	PCC Study	SIP Study
Enrollment characteristics	Primary care physicians (internal medicine and family medicine) at a major managed care organizations in greater Rochester area: Excellus BlueCross BlueShield, Rochester, NY	Primary care physicians (internal medicine and family medicine) at any of 4 large practice groups: Excellus BlueCross BlueShield, Rochester, NY; UC Davis Primary Care Network, Sacramento, CA; Kaiser-Permanente, Sacramento, CA; Brown & Toland Medical Group, San Francisco, CA
Practice volume restrictions	Physicians with ≥100 patients in their panel	Physicians who see patients at least 2 days a week
Site restrictions	Two physicians per practice site	None
Recruitment processes	Physician recruiters contacted all eligible physicians (n = 295) until 100 physicians had enrolled	Physician recruiters contacted 293 eligible physicians, until they had reached an enrollment of 150 physicians
Physicians enrolled, final n	100	152

physician practices were closed or the staff alerted the physicians that they were suspicious that the SP was an actor.

In the SIP study (visits conducted in 2003–2004), SPs were trained to portray 2 clinical roles (major depression and adjustment disorder with depressed mood) and presented to primary care physicians in 3 cities with 1 of 3 requests (specific request for a specific branded antidepressant, general request for antidepressant, or no request), several months apart. All SPs were middle aged, nonobese, Caucasian women, often with acting experience. Physicians were assigned randomly to receive 2 unannounced SP, in which 1 patient had major depression, and the other adjustment disorder. Order of presentation of request /clinical presentation was randomly assigned. In the SIP study, 152 physicians were enrolled, with 146 providing data on 2 SP encounters. Eighteen SPs each visited 16 to 25 physicians. In this study, the postvisit detection survey was conducted within 2 weeks to 1 month after the SP visit yielding a detection rate of 12.8%.[41]

Study Measures

Interpersonal Skills: Autonomy Support

We examined SIP and PCC data to evaluate SP interpersonal communication because both studies used similar SP training methodology, had 2 SP visits per physician, and used the same evaluation scale for interpersonal communication. In both studies, physician interpersonal skills were assessed via a scale measuring autonomy support. Autonomy support is a construct based on self-determination theory, describing the degree to which an individual feels that their provider creates a positive health care climate that empowers them to become involved in their own care. In primary care, autonomy support is a predictor of behavioral change.[42] The health care climate questionnaire (HCCQ) is a 5-item scale was drawn from a larger 15-item scale that addresses autonomy support.[42] These 5 questions are answered on a 5-point Likert scale (total minimum score of 5 to maximum score of 25). Questions involve SP's judgments about whether the doctor provided them options for their care, conveyed confidence in their ability to change their behavior, and attempted to understand their perspectives. Items also assess whether the SPs felt understood, and were encouraged to ask questions. Low autonomy support scores reflect a style of high provider control. High autonomy support scores reflect a belief that patients can make behavioral changes.

Overall Satisfaction

In the SIP study only, 2 overall satisfaction questions were included. These 2 questions asked the SP to assess their overall satisfaction with care, and if the SP would like this doctor as their personal physician. Each question was rated on a 5-point scale, for a total of 2–10 possible points.

Information Gathering

In the SIP study only, technical care was assessed with 10 questions about critical depression symptoms asked during the history, with input from national experts in depression and primary care. Checklist items were scored dichotomously (0 = no), with minimum possible score of 0, to maximum of 10.

Statistical Analysis

Analyses were performed using STATA (Version 9.2, StataCorp, College Station, TX). Analyses were conducted with each SP-physician encounter as an observation. Random intercept, mixed effects regression analyses evaluated physicians and SPs as crossed random effects and other variables as fixed effects, fitting the models using restricted maximum likelihood. Dependent variables in each analysis were the autonomy support score (PCC and SIP studies), number of depression history-taking questions asked (SIP study), and satisfaction score (SIP study). Each analysis adjusted for case as a dummy variable (GERD vs. atypical chest pain [PCC study], and adjustment disorder vs. major depression, with and without prompting [SIP study]). We derived the rho (an intraclass correlation coefficient) for physicians as the ratio of individual physician variance to total physician variance, plus the residual (error) variance. In turn, the predicted reliability, a function of the number observations, was derived from the intraclass correlation coefficient using the Spearman-Brown prophecy formula

$$\rho_{xx'} = \frac{n * \rho_{xx}}{1 + \rho_{xx}\,(n - 1)}$$

Here, $\rho_{xx'}$ is predicted (or desired) reliability, n is the number of observations, and ρ_{xx} is observed intraclass correlation coefficient (rho) from our study. We derived 95% confidence intervals around predicted reliability (and predicted number of SPs needed to achieve desired levels of reliability) by using the 95% confidence limit values of the obtained values of rho. All analyses adjusted for experimentally controlled variables (case, and request condition). We also conducted the analysis excluding visits in which the physicians probably detected the SP. This analysis yielded substantially similar results and is not reported here.

RESULTS

Encounter Characteristics and Mean Physician Scores

Table 2 shows selected study outcomes. Visits in the PCC study were slightly shorter than those in the SIP study. In the PCC study, the atypical chest pain visit was longer than the GERD visit (5.4 minutes difference, 95% confidence interval [CI] = 3.3–7.6). There were no statistically significant differences in visit length between the 2 encounters in the SIP study.

The mean and standard deviation (SD) in the assessment of interpersonal skills via autonomy support—HCCQ scores—were similar in both studies (17.2 for PCC and 17.9 for SIP study). Although the scores exhibited a broad distribution, they tended to be skewed toward higher autonomy support scores in both studies. In the PCC study, autonomy support scores were significantly and slightly higher in the GERD than atypical chest pain case (difference = 1.6, 95% CI = 0.2–3.0). There were no

TABLE 2. Study Characteristics and Mean Physician Scores

Study	PCC	SIP
Study years	2000–2001	2003–2004
Unannounced SP gender	Female	Female and male
Unannounced SP clinical roles	1. Gastroesophageal reflux disease 2. Atypical chest pain	1. Major depression 2. Adjustment disorder with depressed mood
SP presentation to physician: order of clinical roles, genders	Randomized	Randomized
Physicians with 2 completed SP visits	96	146
Total SP encounters included	192	292
Average visit length in minutes (SD, range)	20.8 (8.0, 7–52)	24.8 (11.2, 5.8–81.5)
Autonomy support mean score (SD, possible range 1–25)	17.2 (4.9, 5–25)	17.9 (4.1, 5–24)
Depression history questions (mean, SD, possible range 0–10)	N/A	6.0 (2.3, 0–10)
Overall satisfaction mean score (SD, possible range 2–10)	N/A	7.1 (2.3, 2–10)

statistically significant differences in autonomy support between the 2 cases in the SIP study.

Information gathering for both SIP roles, for 10 depression-related questions, demonstrated that physicians asked a mean of 6 questions (SD 2.3, range 0–10). The distribution of depression information gathering questions in the SIP study was approximately normal. More depression-related questions were asked in the major depression case than in the adjustment disorder case (difference = 1.5 questions, 95% CI = 1.0–2.0).

The overall satisfaction scores in the SIP study tended to be skewed toward higher satisfaction scores (Table 2). There were no statistically significant differences in satisfaction level between the 2 visits in the SIP study.

Reliability

Scale Internal Consistency Reliability

In the 2 studies, the autonomy support scale showed a reliability (Cronbach's alpha) of 0.92 (PCC) and 0.89 (SIP). In the SIP study, the 10 information gathering questions formed a scale (yes/no responses) with a Cronbach's alpha of 0.71. In the SIP study, the 2 item overall satisfaction scale showed a reliability of 0.90 (Cronbach's alpha).

SP Rating Reliability

Here, we report the proportion of the total scale variance as the result of SP and of the physician, for physician interpersonal skills, technical skills, and SP satisfaction. The greater the proportional variance for a variable, the more that variable influences the final score.

Physician Interpersonal Skills: Autonomy Support (PCC and SIP Studies)

Table 3 shows the key variance components for each regression. The SP variance components were not statistically significant in either the PCC or SIP studies. In the PCC study, the physician rho for autonomy support was 0.40 (95% CI = 0.22–0.58, $P < 0.001$). In the SIP study, the physician rho for autonomy support was 0.30 (95% CI = 0.14–0.45, $P < 0.001$). Using the Spearman-Brown prophecy formula, based on 2 observations per physician, the physician rho translates into a reliability of 0.57 (95% CI = 0.36–0.73) in the PCC study and 0.46 (95% CI = 0.25–0.62) in the SIP study. Using the same formula, in the PCC study, 4 (95% CI = 2–9) SPs would achieve a reliability of 0.7, and 14 SPs (95% CI = 7–32) would achieve a reliability of 0.9. In the SIP study, 6 SPs (95% CI = 3–15) would achieve a reliability of 0.7, and 21 SPs (95% CI = 9–30) would achieve a reliability of 0.9. The relationship between the adjusted autonomy support scores for the 2 visits are shown graphically in Figure 1, which superimposes the findings for both SIP and PCC studies.

TABLE 3. Physician, SP and Residual (Error) Variance Components Observed in Regression Analyses

Study Outcome	Variance Component	Standard Error
PCC: Autonomy support		
Physician	6.95	2.01
Standardized patient	11.38	9.67
Residual	10.54	1.59
SIP: Autonomy support		
Physician	4.82	1.46
Standardized patient	0.91	0.70
Residual	11.38	1.44
SIP: Depression history		
Physician	2.20	0.44
Standardized patient	0.10	0.14
Residual	2.57	0.31
SIP: Satisfaction		
Physician	2.07	0.44
Standardized patient	0.65	0.35
Residual	2.70	0.34

Physician Technical Skills: Information Gathering (SIP Study)

The SP variance component was not statistically significant (Table 3). The physician rho for information gathering was 0.46 (95% CI = 0.33–0.59, $P < 0.001$). This translates into a reliability of 0.63 (95% CI = 0.50–0.74) for the 2 SPs. Three SPs (95% CI = 2–5) would achieve a reliability of 0.70, and 11 SPs (95% CI = 7–19) would achieve a reliability of 0.90.

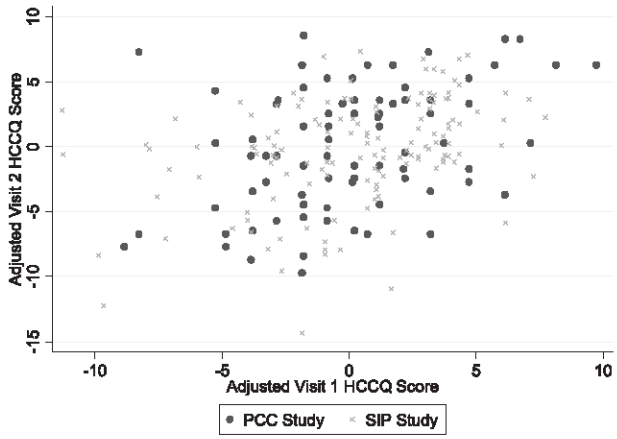

FIGURE 1. Relationships, in both SIP and PCC studies, between adjusted autonomy support (HCCQ) scores for each physician between first and second visits.

Overall Satisfaction (SIP Study)

The SP variance component for overall satisfaction, adjusting for the physician variance component and case, was significant (Table 3, SP rho = 0.19, 95% CI = 0.02–0.37, $P = 0.03$; VC = 0.65, 95% CI = 0.23–1.86). The physician rho for the overall SP satisfaction scale was 0.47 (95% CI = 0.34–0.60, $P < 0.001$). The physician rho for overall satisfaction translates into a reliability of 0.64 (95% CI = 0.51–0.75) for 2 SPs; 3 SPs (95% CI = 2–5) would achieve a reliability of 0.7, and 11 SPs (95% CI = 6–18) would achieve a reliability of 0.90.

DISCUSSION

Our data provide evidence that unannounced SPs can reliably distinguish among individual physician performance in 3 domains: interpersonal skills, information gathering, and satisfaction. In 2 separate studies with 4 different SP roles,[39,40] we found that 2 unannounced SPs portraying somewhat different roles rated autonomy support in a consistent and reliable fashion. One study (SIP) assessed physician's technical competence (information gathering skills) and overall satisfaction, and found reliable SP ratings on these domains as well.

These findings add credence to the growing literature base demonstrating that unannounced SPs can reliably rate evaluate different dimensions of medical performance. SPs have been used extensively in medical education testing since Barrows developed the assessment technique in the 1960s. Among learners, SPs have been reliably shown to assess communication, physical examination, and history-taking skills.[42–46] However, conducting SP evaluation in practice settings is considerably more complicated. In a practice-based setting, the SP does not have control over the setting, the stimuli, cannot end the interaction, or control physician responses as well as during a typical objective structured clinical examination. The unannounced SP literature has previously demonstrated that SPs can reliably rate some aspects of physician behavior, such as physical examination, test ordering, consultations, or physician response to specific patient requests.[35–40,47]

In our study, the variance attributable to SPs as raters for each measure was far less than the variance contributed by physicians themselves, indicating that consistent differences in physician behaviors contribute to the observed total variance, which would be expected if the SPs were astute raters of physician performance.

Depending on the level of desired reliability, only a moderate number of unannounced SPs may be needed to provide feedback about physician performance. For example, our rhos for overall satisfaction suggest that only 3 SP ratings would be necessary to achieve moderate reliability (at 0.7), but up to 11 SP ratings would be needed to provide individual physician feedback with a high degree of reliability (0.9). In an unannounced SP study of Dutch physicians, Gorter[48] found that 14 SP visits were needed (using 8 cases) to achieve a reliability of greater than 0.9, similar to our results. Interestingly, the SP rater reliability seems better for overall satisfaction and technical skills (such as information gathering), than for interpersonal skills (such as autonomy support). The wide confidence intervals around these estimates are consistent with the widely varying reports of the number of patient ratings needed to achieve reliable measures of physician performance. Thus, it is important to sample the physician behavior sufficiently to reach reliabilities of 0.8 to 0.9 before drawing conclusions about individual physician performance. Failure to do so could provide unreliable (higher or lower) estimates of individual performance and also lead to an erroneous system of rewards and incentives.

The data from these 2 studies also provide evidence that physicians exhibit consistent interpersonal behaviors across 2 distinct (albeit related) cases. These relatively consistent scores indicate that physician interpersonal performance, measured by autonomy support, is somewhat stable—at 2 different points in time, with 2 raters, within 2 studies. Previous studies have reported some or little consistency of physician styles, but these studies usually have used real patients or paper cases, possibly with more divergent clinical presentations.[49,50] Real patients undergo a process of mutual selection between physician and patient, which may result in a biased assessment of physician style. Because unannounced SPs were randomly assigned to physicians, we avoid the problem of mutual selection.

Variation in Overall Satisfaction Scores as a Reflection of Both SP and Physician Effects

SP variance components for depression information gathering and autonomy support were not significant, suggesting that when SPs are asked to rate physician behaviors according to specific criteria, they may not introduce systematic bias. This result is in marked contrast to real patients, who bring their preferences, values, and biases with them. However, we did observe a significant SP variance component for overall satisfaction. This variation was independent of the significant physician variance component found for satisfaction. It is perhaps not surprising that when asked to assess overall satisfaction (including selecting the physician as their own doctor), SP judgments vary significantly between physicians. Using multiple observers of multiple physicians allowed us to separate out the unique contributions of

SPs and physicians. In contrast, real patients typically evaluate only their own physician, without necessarily sampling a large range of physician behaviors.

Unannounced SP assessment of autonomy support (HCCQ) is a relatively new construct, which we sought to explore. In both SIP and PCC studies, our SPs interacted with several physicians, in many locations across their region. While our SP HCCQ ratings were somewhat positively skewed, our SPs reported a wide range of scores. In contrast, patient interpersonal ratings of physicians usually are highly positively skewed and more tightly clustered,[19] detracting from their usefulness in providing meaningful physician feedback. Real patients may feel an intrinsic need to like their physician. If not, they may experience cognitive dissonance ("I wouldn't accept suboptimal care; therefore, my doctor can't be bad"), or will switch physicians.[31,32]

The 2 studies used unannounced SPs, with the notion that physician behavior might be different if the physician knew the patient had an evaluative role. Despite careful efforts to conceal the SP's identity, many physicians suspected that they might be seeing an SP. Not surprisingly, this problem was most evident in closed practices and when physicians were asked closer to the SP visit. The literature suggests that physician behavior does not substantially change when SPs are "discovered,"[41] perhaps because physician might not be sure about the SP's identity. It is uncertain, however, how physicians would change their behavior if the SP were truly identified, or if they knew that health systems were using SPs to evaluate care.

Our study has several other potential limitations. First, we cannot determine whether reliability scores would change if our SP population was more heterogeneous (race, ethnicity, social class, and diseases). Theoretically, similar demographic groups may have similar expectations for care that differ from other groups. Second, SP satisfaction may have been influenced by training. Our training focused on ensuring consistency in performance and rating, to assess the physician's reactions to SP requests/problems. Although we did not discuss what we considered a good visit outcome, SP satisfaction may have been excessively focused on areas they were trained to rate. Third, since each study had different desired outcomes per SP role, we could not assess the influence of visit outcomes on overall satisfaction. Fourth, although the participating physician demographics were similar to the local physician population, self-selection bias may limit generalizability. Fifth, we did not adjust for additional physician and system factors in our regressions, since they were not part of our initial randomization schema. In addition, the power to detect a significant SP variance component may be limited by having had only 2 to 6 SPs per study. Finally, although unannounced SPs data may be less biased than real patient data, the cost of employing, training and using unannounced SPs may exceed standard methods of gathering patient experience data via survey.

Gold standards that could help gauge the validity of either patient or SP ratings do not exist for most social constructs, such as communication or satisfaction. Usually evaluators use construct or convergence validity, instead of criterion validity, for gauging validity. Nevertheless, the argument that SPs can function as clinical connoisseur is strong. If SPs were not connoisseurs, it is unlikely that our observed degree of reliability would occur randomly in 2 separate studies, across genders, across roles, in settings across the nation, with SPs presenting so differently to their physician. Here, physician variance contributed much more strongly to score variation than variation based on rater. Each SP sampled the interactional styles of 6 to 49 primary care physicians, exposing them to wide array of physician styles, attitudes, and behaviors. Additionally, SPs had seen excellent physician behaviors modeled during training, as an initial basis of comparison. In comparison, most real patients only see 1 or 2 physicians during the course of a year; even patients who see multiple physicians would rarely meet more than 2 or 3 primary care physicians during that time.

In summary, unannounced SPs provide a reliable, flexible method to evaluate clinical behaviors of physicians – and assess what they do routinely in practice. Use of unannounced SP has advantages over patient surveys, primarily by reducing the positive bias seen in real patient evaluations. This evaluation methodology complements other clinical benchmarking methods that assess quality of care. Using SPs, health systems could evaluate physicians' care in many areas, including chronic disease management, mental illness detection, response to angry patients, behavior change counseling, and participatory consultation styles. Unlike patient surveys, response rate would not be an issue, since SPs would be paid to complete their questionnaires. From a health system perspective, limited numbers of unannounced SPs, traveling to different physician practices, would provide an objective method for assessing physician performance. Additionally, SPs could also provide detailed information about the entire health care system—from interaction with front office staff to the billing department—potentially useful for health system improvement. Our study raises the intriguing possibility that unannounced, well-trained SPs are connoisseurs of clinical care who can be used to reliably assess physicians across a spectrum of performance parameters.

REFERENCES

1. Relman AS. Assessment and accountability: the third revolution in medical care. *N Engl J Med*. 1988;319:1220–1222.
2. Ware JE, Hays RD. Methods for measuring patient satisfaction with specific medical encounters. *Med Care*. 1988;26:393–402.
3. Hargraves JL, Hays RD, Cleary PD. Psychometric Properties of the Consumer Assessment of Health Plans Study (CAHPS) 2.0 Ault Core Survey. *Health Services Res*. 2003;38:1509–1527.
4. http://www.leapfroggroup.org. Accessed January 10, 2006.
5. Morain C. HMOs try to measure (and reward) "doctor quality." *Med Econ*. 1992;69:206–207, 211–215.
6. Kinmouth BM, Woodcock Griffin S, et al. Randomized controlled trial patient centred care of diabetes in general practice: impact on current wellbeing and future disease risk. *Br Med J*. 1998;317:1202–1208.
7. Michie S, Milkes J, Weinman. Patient-centredness in chronic illness: what is it and does it matter? *Patient Education Counsel*. 2003;51:197–206.
8. Davies AR, Shebourne DC, Peterson JR, et al. *Scoring Manual: Adult Health Status and Patient Satisfaction Measures used in RAND's Health Insurance Experiment*. Santa Monica, CA: Publication number N-2190-HHS; 1988.
9. Fiscella K, Franks P. The influence of patients' education on physicians' practice profiles. *Ann Int Med*. 1999;131:745–751.

10. Zaslavsky AM, Hochheimer JN, Schneider ED, et al. Impact of sociodemographic case mix on the HEDIS measures of health plan quality. *Med Care*. 2000;38:981–992.
11. Meredith LS, Siu AL. Variation and quality of self-report health data: Asians and Pacific Islanders compared with other ethnic groups. *Med Care*. 1995;33:1120–1131.
12. Greenfield S, Kaplan SH, Ware JE. Patient's participation in medical care: effects on blood sugar and quality of life in diabetes. *J Gen Intern Med*. 1988;3:448–457.
13. Krupat E, Bell RA, Kravitz RL, et al. When physicians and patients think alike: patient centered beliefs and their impact on satisfaction and trust. *J Family Pract*. 2001;50:1057–1062.
14. Jackson JL, Chamberlin J, Kroenke K. Predictors of Patient Satisfaction. *Soc Sci Med*. 2001;52:609–620.
15. Rao JK, Weinberger M, Kroenke K. Visit specific expectation and patient-centered outcomes: a literature review. *Arch Family Med*. 2000; 9:1148–1155.
16. Zanbelt LC, Smets EMA, Oort FJ, et al. Satisfaction with the outpatient encounter. *J Gen Intern Med*. 2004;19:1088–1095.
17. Flocke SA. Measuring attributes of primary care: development of a new instrument. *J Family Pract*. 1997;45:64–74.
18. Weiss GL. Patient Satisfaction with primary medical care. Evaluation of sociodemographic and predispositional factors. *Med Care*. 1988;26:383–392.
19. Robin DW, Becker ER, Adams KA, et al. Patient satisfaction with primary care: does type of practitioner matter? *Med Care*. 2004;42:579–590.
20. Maisels JM, Kring EA. A simple approach to improving patient satisfaction. *Clin Pediatr*. 2005;44:797–800.
21. Harvey JM, Orav EJ, Bates DW, et al. Patient satisfaction profiling of individual physicians: impact of panel status. *J Eval Clin Pract*. 2004; 10:553–561.
22. Hjortdahl P, Laerum E. Continuity of care in general practice: effect on patient satisfaction. *BMJ*. 1992;304:1287–1290.
23. Meredith LS, Orlando M, Humphrey N, et al. Are better ratings of the patient-provider relationship associated with higher quality of care for depression? *Med Care*. 2001;39:349–360.
24. Orlando M, Meredith LS. Understanding the causal relationship between patient ratings of care and quality of care for depression. *Med Care*. 2002;40:696–704.
25. Lin C, Albertson GA, Schilling LM, et al. Is patients' perception of time spent with the physician a determinant of ambulatory patient satisfaction? *Arch Intern Med*. 2001;161:1437–1442.
26. Dugdale D, Epstein R, Pantilat S. Time and the patient-physician relationship. *J Gen Intern Med*. 1999;14:S34–S40.
27. Gross D, Zyzanski S, Borawski E, et al. Patient satisfaction with time spent with their physician. *J Family Pract*. 1998;46:133–137.
28. Kahn KL, Liu H, Adams JL, et al. Methodologic challenges associated with patient responses to follow-up longitudinal surveys regarding quality of care. *Health Services Res*. 2003;38:1579–1598.
29. Nelson EC, Gentry MA, Mook KH, et al. How many patients are needed to provide reliable evaluation of individual clinicians? *Med Care*. 2004; 42:259–266.
30. Mostashari F, Riley E, Selwyn PA, et al. Acceptance and adherence with antiretroviral therapy among HIV-infected women in a correctional facility. *Journal AIDS*. 1998;18:341–348.
31. Marquis MS, Davies AR, Ware JE. Patient satisfaction and change in medical care provider: a longitudinal study. *Med Care*. 1983;21:821–829.
32. Ware JE, Davies AR. Behavioral consequences of consumer dissatisfaction with medical care. *Evaluation Program Planning*. 1983;6:291–297.
33. Stucker C. *The Mystery Shopper's Manual*. 5th ed. Sugarland, TX: Special Interests Publishing; 2002.
34. Koeppel D. 'Mystery Shoppers' Help Mind the Store. *New York Times*. Sept 1, 2002. Section 14LI, Page 3, Column 1.
35. Glassman PA, Luck J, Peabody JW, et al. Using standardized patients to measure quality: evidence from the literature and prospective study. *Joint Commission J Quality Improve*. 2000;26:644–653.
36. Ramsey PG, Randall CJ, Paauw DS, et al. History-taking and preventive medicine skills among primary care physicians: an assessment using standardized patients. *Am J Med* 1998;104:152–158.
37. Carney PA, Ward DH. Using unannounced standardized patients to assess the HIV preventive practices of family nurse practitioners and family physicians. *Nurse Pract*. 1998;23:56–58, 63, 67–68.
38. Gallagher TH, Bernard L, Chesney M, et al. How do physicians respond to patients' request for costly, un-indicated services? *J Gen Intern Med*. 1997;12:663–668.
39. Epstein RM, Franks P, Chields CG, et al. Patient-centered communication and diagnostic testing. *Ann Family Med*. 2005;3:415–421.
40. Kravitz RL, Epstein RM, Feldman MD, et al. Influence of patient's requests for direct-to-consumer advertised antidepressants: a randomized controlled trial. *JAMA*. 2005;293:1995–2002.
41. Franz C, Epstein RM, Miller K, et al. Caught in the act? Prevalence, predictors, and consequences of physician detection of unannounced standardized patients. *Health Services Res*. In press.
42. Williams GC, Grow VM, Freedman ZR, et al. Motivational predictors of weight loss and weight loss maintainence. *J Person Social Psychol*. 1996;70:115–126.
43. Tamblyn RM. Use of standardized patients in the assessment of medical practice. *Can Med Assoc J*. 1998;158:205–207.
44. Colliver J, Swartz MH. Assessing clinical performance with standardized patients. *JAMA*. 1997;278:790–791.
45. Tamblyn RM, Klass DK, Schanbl GK, et al. Factors associated with the accuracy of standardized patient presentation. *Acad Med*. 1990;65:S55–S56.
46. Cohen DS, Colliver JA, Marcy MS, et al. Psychometric properties of a standardized-patient check list and rating form used to assess interpersonal and communications skills. *Acad Med*. 1995;71:S87–S89.
47. McLeod P, Tambyln RM, Gayton D, et al. Use of standardized patients to assess between-physician variations in resource utilization. *JAMA*. 1997;278:1164–1168.
48. Gorter S, Rethans JJ, van der Heijde D, et al. Reproducibility of clinical performance assessment in practice using incognito standardized patients. *Med Ed*. 2002;36:827–832.
49. Flocke SA, Miller WL, Crabtree BF. Relationships between physician practice style, patient satisfaction, and attributes of primary care. *J Family Pract*. 2002;51:835–840.
50. Landon BE, Reschovsky J, Blumenthal D, et al. Personal, organizational, and market level influences on physicians' practice patterns: results of a national survey of primary care physicians. *Med Care*. 2001;39:889–905.

REVIEW

Defining and Assessing Professional Competence

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Context Current assessment formats for physicians and trainees reliably test core knowledge and basic skills. However, they may underemphasize some important domains of professional medical practice, including interpersonal skills, lifelong learning, professionalism, and integration of core knowledge into clinical practice.

Objectives To propose a definition of professional competence, to review current means for assessing it, and to suggest new approaches to assessment.

Data Sources We searched the MEDLINE database from 1966 to 2001 and reference lists of relevant articles for English-language studies of reliability or validity of measures of competence of physicians, medical students, and residents.

Study Selection We excluded articles of a purely descriptive nature, duplicate reports, reviews, and opinions and position statements, which yielded 195 relevant citations.

Data Extraction Data were abstracted by 1 of us (R.M.E.). Quality criteria for inclusion were broad, given the heterogeneity of interventions, complexity of outcome measures, and paucity of randomized or longitudinal study designs.

Data Synthesis We generated an inclusive definition of competence: the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and the community being served. Aside from protecting the public and limiting access to advanced training, assessments should foster habits of learning and self-reflection and drive institutional change. Subjective, multiple-choice, and standardized patient assessments, although reliable, underemphasize important domains of professional competence: integration of knowledge and skills, context of care, information management, teamwork, health systems, and patient-physician relationships. Few assessments observe trainees in real-life situations, incorporate the perspectives of peers and patients, or use measures that predict clinical outcomes.

Conclusions In addition to assessments of basic skills, new formats that assess clinical reasoning, expert judgment, management of ambiguity, professionalism, time management, learning strategies, and teamwork promise a multidimensional assessment while maintaining adequate reliability and validity. Institutional support, reflection, and mentoring must accompany the development of assessment programs.

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MEDICAL SCHOOLS, POSTgraduate training programs, and licensing bodies conduct assessments to certify the competence of future practitioners, discriminate among candidates for advanced training, provide motivation and direction for learning, and judge the adequacy of training programs. Standards for professional competence delineate key technical, cognitive, and emotional aspects of practice, including those that may not be measurable.[1,2] However, there is no agreed-upon definition of competence that encompasses all important domains of professional medical practice. In response, the Accreditation Council for Graduate Medical Education defined 6 areas of competence and some means of assessing them[3]: patient care (including clinical reasoning), medical knowledge, practice-based learning and improvement (including information management), interpersonal and communication skills, professionalism, and systems-based practice (including health economics and teamwork).[3]

In this article, we will advance a definition of professional competence of physicians and trainees that expands on these 6 areas, perform an evidence-based critique of current methods of assessing these areas of competence, and propose new means for assessing residents and medical students.

For editorial comment see p 243.

DEFINING PROFESSIONAL COMPETENCE

Building on prior definitions,[1-3] we propose that professional competence is *the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served.* Competence builds on a foundation of basic clinical skills, scientific knowledge, and moral development. It includes a cognitive function—acquiring and using knowledge to solve

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real-life problems; an integrative function—using biomedical and psychosocial data in clinical reasoning; a relational function—communicating effectively with patients and colleagues; and an affective/moral function—the willingness, patience, and emotional awareness to use these skills judiciously and humanely (BOX 1). Competence depends on habits of mind, including attentiveness, critical curiosity, self-awareness, and presence. Professional competence is developmental, impermanent, and context-dependent.

Box 1. Dimensions of Professional Competence

Cognitive
Core knowledge
Basic communication skills
Information management
Applying knowledge to real-world situations
Using tacit knowledge and personal experience
Abstract problem-solving
Self-directed acquisition of new knowledge
Recognizing gaps in knowledge
Generating questions
Using resources (eg, published evidence, colleagues)
Learning from experience

Technical
Physical examination skills
Surgical/procedural skills

Integrative
Incorporating scientific, clinical, and humanistic judgment
Using clinical reasoning strategies appropriately (hypothetico-deductive, pattern-recognition, elaborated knowledge)
Linking basic and clinical knowledge across disciplines
Managing uncertainty

Context
Clinical setting
Use of time

Relationship
Communication skills
Handling conflict
Teamwork
Teaching others (eg, patients, students, and colleagues)

Affective/Moral
Tolerance of ambiguity and anxiety
Emotional intelligence
Respect for patients
Responsiveness to patients and society
Caring

Habits of Mind
Observations of one's own thinking, emotions, and techniques
Attentiveness
Critical curiosity
Recognition of and response to cognitive and emotional biases
Willingness to acknowledge and correct errors

Acquisition and Use of Knowledge

Evidence-based medicine is an explicit means for generating an important answerable question, interpreting new knowledge, and judging how to apply that knowledge in a clinical setting.[4] But Polanyi[5] argues that competence is defined by tacit rather than explicit knowledge. Tacit knowledge is that which we know but normally do not explain easily, including the informed use of heuristics (rules of thumb), intuition, and pattern recognition. The assessment of evidence-based medicine skills is difficult because many of the heuristics used by novices are replaced by shortcuts in the hands of experts,[6] as are other clinical skills.[7]

Personal knowledge is usable knowledge gained through experience.[8] Clinicians use personal knowledge when they observe a patient's demeanor (such as a facial expression) and arrive at a provisional diagnosis (such as Parkinson disease) before eliciting the specific information to confirm it. Because experience does not necessarily lead to learning and competence,[9] cognitive and emotional self-awareness is necessary to help physicians question, seek new information, and adjust for their own biases.

Integrative Aspects of Care

Professional competence is more than a demonstration of isolated competencies[10]; "when we see the whole, we see its parts differently than when we see them in isolation."[11] For example, the student who can elicit historical data and physical findings, who can suture well, who knows the anatomy of the gallbladder and the bile ducts, and who can draw the biosynthetic pathway of bilirubin may not accurately diagnose and manage a patient with symptomatic gallstones. A competent clinician possesses the integrative ability to think, feel, and act like a physician.[6,12-15] Schon[16] argues that professional competence is more than factual knowledge and the ability to solve problems with clear-cut solutions: it is defined by the ability to manage *ambiguous* problems, tolerate uncertainty, and make decisions with limited information.

Competence depends on using expert scientific, clinical, and humanistic judgment to engage in clinical reasoning.[14,15,17,18] Although expert clinicians often use pattern recognition for routine problems[19] and hypothetico-deductive reasoning for complex problems outside their areas of expertise, expert clinical reasoning usually involves working interpretations[12] that are elaborated into branching networks of concepts.[20-22] These networks help professionals initiate a process of problem solving from minimal information and use subsequent information to refine their understanding of the problem. Reflection allows practitioners to examine their own clinical reasoning strategies.

Building Therapeutic Relationships

The quality of the patient-physician relationship affects health and the recovery from illness,[23,24] costs,[25] and outcomes of chronic diseases[26-29] by altering patients' understanding of their illnesses and reducing patient anxiety.[26] Key measurable patient-centered[28] (or relationship-centered)[30,31] behaviors include responding to patients' emotions and participatory decision making.[29]

Medical errors are often due to the failure of health systems rather than individual deficiencies.[32-34] Thus, the assessment of teamwork and institutional self-assessment might effectively complement individual assessments.

Affective and Moral Dimensions

Moral and affective domains of practice may be evaluated more accurately by patients and peers than by licensing bodies or superiors.[35] Only recently have validated measures captured some of the intangibles in medicine, such as trust[36,37] and professionalism.[38,39] Recent neurobiological research indicates that the emotions are central to all judgment and decision making,[13] further emphasizing the importance of assessing emotional intelligence and self-awareness in clinical practice.[1,40-42]

Habits of Mind

Competence depends on habits of mind that allow the practitioner to be attentive, curious, self-aware, and willing to recognize and correct errors.[43] Many physicians would consider these habits of mind characteristic of good practice, but they are especially difficult to objectify. A competent physician, for example, should be able to judge his or her level of anxiety when facing an ambiguous clinical presentation and be aware of how the anxiety of uncertainty may be influencing his or her clinical judgment. Errors in medicine, according to this view, may result from overcertainty that one's impressions are beyond doubt.[41,43,44]

Context

Competence is context-dependent. Competence is a statement of relationship between an ability (in the person), a task (in the world),[45] and the ecology of the health systems and clinical contexts in which those tasks occur.[46,47] This view stands in contrast to an abstract set of attributes that the physician possesses—knowledge, skills, and attitudes—that are assumed to serve the physician well in all the situations that he or she encounters. For example, rather than assessing a student's competence in diagnosing and treating heart disease (a disease-specific domain) by dividing it into competencies (physical examination, interpretation of electrocardiogram, and pharmacology of β-blockers), our view is that competence is defined by the interaction of the task (the concrete process of diagnosing and treating Mrs Brown, a 52-year-old business executive who is now in the emergency department because of new-onset chest pain), the clinician's abilities (eliciting information, forming a therapeutic relationship, performing diagnostic maneuvers, and making judgments about treatment), and the health system (good insurance and ready access to care). Caring for Mrs Brown requires different skills than caring for Ms Hall, a 52-year-old uninsured homeless woman who has similar symptoms and receives episodic care at an inner-city clinic.

Development

Competence is developmental. There is debate about which aspects of competence should be acquired at each stage of training. For example, early clinical experiences and problem-based learning formats encourage clinical reasoning skills formerly relegated to the final years of medical school. But students tend to use the same cognitive strategy for solving all problems, whereas experts draw on several strategies,[6] which raises the question of whether assessment of practicing physicians should be qualitatively different from the assessment of a student. Determining how and at what level of training the patient-physician relationship should be assessed is also difficult. For example, participatory decision making correlates with clinical outcomes,[29,29] but it is unclear when trainees should be assessed on this skill. Although a third-year resident might be expected to counsel a fearful diabetic patient about the need to start insulin, a third-year student might be expected only to elicit the patient's preferences, emotions, and expectations. Changes in medical practice and the context of care invite redefinitions of competence; for example, the use of electronic communication media[48] and changes in patient expectations.[49,50]

CURRENT MEANS OF ASSESSMENT

Assessment must take into account what is assessed, how it is assessed, and the assessment's usefulness in fostering future learning. In discussing validity of measures of competence in an era when reliable assessments of core knowledge, abstract problem solving, and basic clinical skills have been developed,[45,51-56] we must now establish that they encompass the qualities that define a good physician: the cognitive, technical, integrative, contextual, relational, reflective, affective, and moral aspects of competence. We distinguish between expert opinion, in-

termediate outcomes, and the few studies that show associations between results of assessments and actual clinical performance.[57-60]

We consider how the process of assessment might foster future learning. Too often, practitioners select educational programs that are unlikely to influence clinical practice.[61] Good assessment is a form of learning and should provide guidance and support to address learning needs. Finally, we address concerns that the medical profession still lacks adequate accountability to the public[62] and has not done enough to reduce medical errors.[32,63]

Within each domain of assessment, there are 4 levels at which a trainee might be assessed (FIGURE).[64] The *knows* level refers to the recall of facts, principles, and theories. The *knows how* level involves the ability to solve problems and describe procedures. The *shows how* level usually involves human (standardized patient), mechanical, or computer simulations that involve demonstration of skills in a controlled setting. The *does* level refers to observations of real practice. For each of these levels, the student can demonstrate the ability to imitate or replicate a protocol, apply principles in a familiar situation, adapt principles to new situations, and associate new knowledge with previously learned principles.[65]

METHODS

Using the MEDLINE database for 1966 to 2001, we searched for articles that studied the reliability or validity of measures of clinical or professional competence of physicians, medical students, and residents. An initial search using the following Medical Subject Headings of the National Library of Medicine yielded 2266 references: *educational measurement*, *patient simulation*, *clinical competence* OR *professional competence* AND *reproducibility of results*, *validity* OR *research*, OR the text word *reliability*. This set was reduced by including any of 20 text words describing assessment techniques; we used words such as *OSCE*, *oral examination*, *peer assessment*, *triple jump*, *essay*, *portfolio*, and *CEX* (clinical evaluation exercise), yielding 430 references. Articles of a purely descriptive nature, reviews that offered no new data, and opinions and position statements were excluded, yielding 101 English-language references. We surveyed the

Figure. A Framework for Assessment

		LEVEL OF ASSESSMENT				CONTEXT OF CARE				
		Knows	Knows how	Shows how	Does	New problem	Chronic illness	Emergency	Preventive	Acute hospital
CLINICAL TASKS	Self-assessment and reflection									
	Information gathering from patients and families									
	Relationship-building and professionalism									
	Sharing information, behavior change, and patient involvement									
	Physical examination									
	Patient procedural skills (suturing, drawing blood)									
	Interpretation of diagnostic tests (electrocardiogram, mental status, imaging)									
	Diagnostic reasoning: Psychosocial issues									
	Diagnostic reasoning: Biomedical issues									
	Diagnostic reasoning: Diagnostic uncertainty									
	Clinical judgment: Planning further diagnostic workup									
	Clinical judgment: Generating therapeutic plan									
	Accessing, interpreting, and applying the medical literature									
	Presenting data to colleagues (referral letter, chart note)									
KNOWLEDGE CONTENT AREAS	Basic mechanisms (anatomy, immunology, microbiology)									
	Pathophysiology of disease (dermatology, renal, gastrointestinal)									
	Social science (epidemiology, psychology, culture/diversity)									
	Special topics (spirituality, ethics, economics)									

The grid is filled out according to the type of assessment conducted, ie, standardized patient or simulation, video, postencounter probe, essay, or computer exercises. Each category can be combined with a number designating a category such as the name of a patient, a type of computer exercise, or a team exercise.

first 200 of the 2165 references excluded and found none that met our search criteria. Quality criteria for inclusion were broad, given the small number of controlled trials of assessment interventions and the complexity of outcome measures. Because we knew that MEDLINE search strategies would not capture all relevant studies, we searched reference lists in the 101 articles, other review articles, and books and did additional literature searches using the key authors of recent reviews; we gathered 94 additional relevant references. Of the 195 references, 124 presented new data on assessment of physicians.

Summary of Studies

The 3 most commonly used assessment methods are subjective assessments by supervising clinicians, multiple-choice examinations to evaluate factual knowledge and abstract problem solving,[66] and standardized patient assessments of physical examination and technical and communication skills.[67-69] Although curricular designs increasingly integrate core knowledge and clinical skills, most assessment methods evaluate these domains in isolation. Few assessments use measures such as participatory decision making[70] that predict clinical outcomes in real practice. Few reliably assess clinical reasoning, systems-based care, technology, and the patient-physician relationship.[5,69] The literature makes important distinctions between criteria for licensing examinations and program-specific assessments with mixed formative and summative goals.

Evaluation of factual knowledge and problem-solving skills by using multiple-choice questions offers excellent reliability[71-75] and assesses some aspects of context and clinical reasoning. Scores on Canadian licensing examinations, which include standardized patient assessment and multiple-choice tests, correlated positively with subsequent appropriate prescribing, mammographic screening, and referrals,[58] and multiple-choice certification examination scores correlated with subsequent faculty[76] and peer[77] ratings. Many have questioned the validity of multiple-choice examinations, though.[78-81] For example, compared with Florida family physicians who are not board-certified, those who are have nearly twice the risk of being sued.[82] Standardized test scores have been inversely correlated with empathy, responsibility, and tolerance.[83] Also, because of lack of expertise and resources, few medical school examinations can claim to achieve the high psychometric standards of the licensing boards.

The Objective Structured Clinical Examination (OSCE) is a timed multistation examination often using standardized patients (SPs) to simulate clinical scenarios. The roles are portrayed accurately[56,84] and simulations are convincing; the detection rate of unannounced SPs in community practice is less than 10%.[57,59,85-89] Communication, physical examination, counseling, and technical skills can be rated reliably if there is a sufficiently large number of SP cases[67,90-100] and if criteria for competence are based on evidence.[101] Although few cases are needed to assess straightforward skills, up to 27 cases may be necessary to assess interpersonal skills reliably in high-stakes examinations.[102,103] Although SPs' ratings usually correlate with those of real patients,[104] differences have been noted.[105-107]

Defining pass/fail criteria for OSCEs has been complex.[94,108-111] There is debate about who should rate student performance in an OSCE.[112] Ratings by the SP are generally accurate[52] but may be hampered by memory failure, whereas external raters, either physicians or other SPs, may be less attuned to affective aspects of the interview and significantly increase the cost of the examination.

Checklist scores completed by physician-examiners in some studies improve with expertise of the examinees[113] and with the reputation of the training program.[90,114] But global rating scales of interpersonal skills may be more valid than behavioral checklists.[7,115,116] The OSCE scores may not correlate with multiple-choice examinations and academic grades,[90,100,117] suggesting that these tools measure different skills. Clinicians may behave differently in examination settings than in real practice,[100,118] and short OSCE stations can risk fragmentation and trivialization of isolated elements of what should be a coherent whole.[119] The OSCE also has low test reliability for measuring clinical ethics.[120]

There are few validated strategies to assess actual clinical practice, or Miller's *does* level. Subjective evaluation by residents and attending physicians is the major form of assessment during residency and the clinical clerkships and often includes the tacit elements of professional competence otherwise overlooked by objective assessment instruments. Faculty ratings of humanism predicted patient satisfaction in one study.[121] However, evaluators often do not observe trainees directly. They often have different standards[122,123] and are subject to halo effects[124] and racial and sex bias.[125,126] Because of interpatient variability and low interrater reliability, each trainee must be subject to multiple assessments for patterns to emerge. Standardized rating forms for direct observation of trainees[127-132] and structured oral examination formats have been developed in response to this criticism.[133,134]

The Royal College of General Practitioners, dissatisfied with the capability of the OSCE to evaluate competence for the final professional licensing examination, developed a format in which candidates for certification present several best-case videotapes of their performance in real clinical settings to a trained examiner who uses specified criteria for evaluation.[135] Although the face validity of such a measure is high and the format is well accepted by physicians,[136] the number of cases that should be presented to achieve adequate reliability is unclear.[137-139]

Profiling by managed-care databases is increasingly used as an evaluation measure of clinical competence. However, data abstraction is complex[140] and defining competence in

terms of cost and value is difficult. The underlying assumptions driving such evaluation systems may not be explicit. For example, cost analyses may favor physicians caring for more highly educated patients.[141]

Peer ratings are accurate and reliable measures of physician performance.[77,142] Peers may be in the best position to evaluate professionalism; people often act differently when not under direct scrutiny.[143] Anonymous medical student peer assessments of professionalism have raised awareness of professional behavior, fostered further reflection, helped students identify specific mutable behaviors, and been well accepted by students.[35] Students should be assessed by at least 8 of their classmates. The composite results should be edited to protect the confidentiality of the raters.

Self-assessments have been used with some success in standardized patient exercises[144] and in programs that offer explicit training in the use of self-assessment instruments.[145] Among trainees who did not have such training, however, self-assessment was neither valid nor accurate. Rather, it was more closely linked to the trainee's psychological sense of self-efficacy and self-confidence than to appropriate criteria, even among bright and motivated individuals.

Box 2. Some Purposes of Assessment

For the Trainee

Provide useful feedback about individual strengths and weaknesses that guides future learning
Foster habits of self-reflection and self-remediation
Promote access to advanced training

For the Curriculum

Respond to lack of demonstrated competence (denial of promotion, mandated remediation)
Certify achievement of curricular goals
Foster course or curricular change
Create curricular coherence
Cross-validate other forms of assessment in the curriculum
Establish standards of competence for trainees at different levels

For the Institution

Guide a process of institutional self-reflection and remediation
Discriminate among candidates for further training or promotion
Express institutional values by determining what is assessed and how assessment is conducted
Develop shared educational values among a diverse community of educators
Promote faculty development
Provide data for educational research

For the Public

Certify competence of graduates

COMMENT

Aside from the need to protect the public by denying graduation to those few trainees who are not expected to overcome their deficiencies, the outcomes of assessment should foster learning, inspire confidence in the learner, enhance the learner's ability to self-monitor, and drive institutional self-assessment and curricular change. Given the difficulty in validating tests of basic skills, it is not surprising that there is scant literature on the assessment of learning, professionalism, teamwork, and systems-based care or on the ability of assessment programs to drive curricular change or reduce medical errors.

Assessment serves personal, institutional, and societal goals (BOX 2). Distinctions between these goals often are blurred in practice. For example, formative feedback is intended to foster individual reflection and remediation[146] but may be perceived as having evaluative consequences. Summative evaluation is a powerful means for driving curricular content and what students learn. Assessment provides information to allow institutions to choose among candidates for advanced training. The public expects greater self-monitoring, communication, and teamwork from health care practitioners.[147] The decline of public trust in medicine may reflect a growing concern that physicians are not achieving these goals.[36]

Assessment is also a statement of institutional values. Devoting valuable curricular time to peer assessment of professionalism, for example, can promote those values that are assessed while encouraging curricular coherence and faculty development, especially if there are corresponding efforts at the institution toward self-assessment and change.

Whereas performance is directly measurable, competence is an inferred quality.[148] Performance on a multiple-choice test may exceed competence, as in the case of a trainee with a photographic memory but poor clinical judgment. Conversely, competence may exceed test performance, as in the case of a trainee with severe test anxiety. Correlation with National Board scores and feedback on graduates' performance can be useful in validating some assessment instruments but should be done with caution. For example, efficiency is highly valued in residents but less so in medical students.

Future Directions

Medical schools in Canada, the United Kingdom, Australia, Spain, the Netherlands, and the United States have made commitments to developing innovative assessments of professional competence, some of which we describe. These assessments are increasingly multimodal and tailored to the goals and context in which they will be

Box 3. Innovations in Assessing Professional Competence

- Multimethod assessment
- Clinical reasoning in situations that involve clinical uncertainty
- Standardized patient exercises linked to postencounter probes of pathophysiology and clinical reasoning
- Exercises to assess use of the medical literature
- Long-station standardized patient exercises
- Simulated continuity
- Teamwork exercises
- Unannounced standardized patients in clinical settings
- Assessments by patients
- Peer assessment of professionalism
- Portfolios of videotapes
- Mentored self-assessment
- Remediation based on a learning plan

used. Large-scale licensure examinations must use computer-gradable formats, but comprehensive examinations using structured direct observation,[107] OSCE stations, real patient cases,[107] case-based questions,[79] peer assessments, and essay-type questions[149] are reliable as well. Proponents of the new formats argue that they provide more useful feedback and are more efficient at the medical school or residency level (Box 1 and Box 3) than traditional formats.[81,150] They target core knowledge and clinical skills in different contexts and at different levels of assessment. Because of their complexity, a matrix (Figure) can be useful to display the domains assessed.

Comprehensive assessments link content across several formats. Postencounter probes immediately after SP exercises using oral, essay, or multiple-choice questions test pathophysiology and clinical reasoning in context.[151,152] Triple-jump exercises[152]—consisting of a case presentation, an independent literature search, and then an oral or written postencounter examination—test the use and application of the medical literature. Validated measures of reflective thinking[153] have been developed that use patient vignettes followed by questions that require clinical judgment. These measures reflect students' capacity to organize and link information; also, they predict clinical reasoning ability 2 years later.[153] Combining formats appears to have added value with no loss in reliability.[150,154] Ongoing educational outcomes research will show whether composite formats help students learn how to learn more effectively, develop habits of mind that characterize exemplary practice,[43] and provide a more multidimensional picture of the examinee than the individual unlinked elements. Two examples of comprehensive assessment formats follow.

Genetics, Evidence-Based Medicine, Screening, and Communication. A student is instructed to perform a literature search about genetic screening test for Alzheimer disease in anticipation of an SP encounter later that day. Assessment instruments include a structured evaluation of the search strategy and a communication rating scale, completed by an SP, that assesses the clarity of the student's presentation and the student's ability to involve the patient in the decision-making process. Next, the student completes an essay about the ethics of genetic screening and the genetics of Alzheimer disease. This exercise assesses the student's communication skills, clinical reasoning, ability to acquire and use new knowledge, and contextualized use of knowledge of genetics, health economics, and medical ethics.

Cognitive and Affective Challenges of Clinical Uncertainty. A rating scale is used to assess a resident on her ability to agree on a plan of action with an SP who portrays an outpatient demanding a computed tomographic scan for headaches without neurological signs. In a postencounter exercise, the resident creates a rank-order differential diagnosis and then answers a series of script concordance[153,155] questions in which the examinee is presented hypothetical additional data (for example, numbness in the left hand) and then asked to judge how her diagnostic hypotheses or therapeutic actions would change. Failure to include a key diagnostic possibility or the overestimation or underestimation of probability are criteria for evaluation. The goal of the exercise is to demonstrate emotional intelligence[40] and self-awareness in the context of conflict and ambiguity. Similar observations might be made with trainees' video portfolios of real clinical encounters.

Well-functioning health systems are characterized by continuity, partnership between physicians and patients, teamwork between health care practitioners, and communication between health care settings.[156,157] The use of time in a continuity relationship can be assessed with a series of SP or real-patient exercises. To assess partnership, patient assessment, currently used to assess physicians in practice,[158] is being tested for students and residents.[159,160] These efforts are guided by data showing that patients' ratings of communication and satisfaction correlate well with biomedical outcomes,[24,29] emotional distress,[161] health care use,[25] and malpractice litigation.[162] Patient ratings also have the potential to validate other measures of competence.[163] Several institutions assess teamwork by using peer assessments. Others use sophisticated mannequins to simulate acute cardiovascular physiological derangements found in intensive care settings[164-169]; trainees are graded on teamwork as well as individual problem solving, and statistical adjustments can account for team composition. Communication between health settings could be assessed at the student level, for example, by grading of their written referral letters.[170]

Although it could be argued that licensing boards do not have the mandate to remediate examinees who perform poorly or modify educational curricula, medical schools and residency programs do. Tests that demonstrate students' strengths or weaknesses may not provide the student with the opportunity to reflect on actual behaviors and patterns of thought that

should be changed. To foster reflection and action, some institutions require a learning plan in which trainees chart their learning needs, the means of achieving them, expected time of completion, and means of verification[146,171] as a required outcome of an assessment.

A strong mentoring system should accompany any comprehensive assessment program. An inadequate system for feedback, mentoring, and remediation will subvert even the most well-conceived and validated examination. Curricular change also can be guided by results of assessments but requires a parallel process of institutional reflection, feedback, and remediation.

These new assessment formats are feasible, and several institutions have invested significant time and resources to develop them. The promise that a more comprehensive assessment of professional competence might improve practice, change medical education, and reduce medical errors should be studied in controlled trials. The public's trust in the medical profession and the ability of medical practitioners to learn from mistakes depends on valid and reliable means of assessment. Medical educators, professional societies, and licensing boards should view professional competence more comprehensively to improve the process of assessment.

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REFERENCES

1. American Board of Internal Medicine. *Guide to Evaluation of Residents in Internal Medicine*. Philadelphia, Pa: American Board of Internal Medicine; 1999.
2. Norman GR. Defining competence: a methodological review. In: Neufeld VR, Norman GR, eds. *Assessing Clinical Competence*. New York, NY: Springer; 1985:15-35.
3. ACGME Outcome Project. Accreditation Council for Graduate Medical Education Web site. Available at: http://www.acgme.org. 2000. Accessed October 1, 2001.
4. Sackett DL. *Evidence-Based Medicine: How to Practice and Teach EBM*. New York, NY: Churchill Livingstone; 1997.
5. Polanyi M. *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago, Ill: University of Chicago Press; 1974.
6. Benner P. *From Novice to Expert*. Menlo Park, Calif: Addison-Wesley; 1984.
7. Hodges B, Regehr G, McNaughton N, Tiberius R, Hanson M. OSCE checklists do not capture increasing levels of expertise. *Acad Med*. 1999;74:1129-1134.
8. Dewey J. *Experience and Nature*. 1932 ed. New York, NY: Dover; 1958.
9. Langer EJ. *The Power of Mindful Learning*. Reading, Mass: Perseus Books; 1997.
10. Eraut M. Learning professional processes: public knowledge and personal experience. In: Eraut M, ed. *Developing Professional Knowledge and Competence*. London, England: Falmer Press; 1994:100-122.
11. Polanyi M. The logic of tacit inference. In: Grene M, ed. *Knowing and Being: Essays*. Chicago, Ill: University of Chicago; 1969:123-158.
12. Gale J, Marsden P. Clinical problem solving: the beginning of the process. *Med Educ*. 1982;16:22-26.
13. Damasio AR. *Descartes' Error: Emotion, Reason, and the Human Brain*. New York, NY: GP Putnam's Sons; 1994.
14. Mandin H, Jones A, Woloschuk W, Harasym P. Helping students learn to think like experts when solving clinical problems. *Acad Med*. 1997;72:173-179.
15. Friedman MH, Connell KJ, Olthoff AJ, Sinacore JM, Bordage G. Medical student errors in making a diagnosis. *Acad Med*. 1998;73(suppl):S19-S21.
16. Schon DA. *The Reflective Practitioner*. New York, NY: Basic Books; 1983.
17. Feinstein AR. "Clinical Judgment" revisited: the distraction of quantitative models. *Ann Intern Med*. 1994;120:799-805.
18. Downie RS, Macnaughton J, Randall R. *Clinical Judgement: Evidence in Practice*. Oxford, England: Oxford University Press; 2000.
19. Dunn MM, Woolliscroft JO. Assessment of a pattern-recognition examination in a clinical clerkship. *Acad Med*. 1994;69:683-684.
20. Schmidt HG, Norman GR, Boshuizen HP. A cognitive perspective on medical expertise: theory and implication [published correction appears in *Acad Med*. 1992;67:287]. *Acad Med*. 1990;65:611-621.
21. Bordage G, Zacks R. The structure of medical knowledge in the memories of medical students and general practitioners: categories and prototypes. *Med Educ*. 1984;18:406-416.
22. Bordage G. Elaborated knowledge: a key to successful diagnostic thinking. *Acad Med*. 1994;69:883-885.
23. Starfield B, Wray C, Hess K, Gross R, Birk PS, D'Lugoff BC. The influence of patient-practitioner agreement on outcome of care. *Am J Public Health*. 1981;71:127-131.
24. The Headache Study Group of the University of Western Ontario. Predictors of outcome in headache patients presenting to family physicians—a one year prospective study. *Headache*. 1986;26:285-294.
25. Stewart M, Brown JB, Donner A, et al. The impact of patient-centered care on outcomes. *J Fam Pract*. 2000;49:796-804.
26. Di Blasi Z, Harkness E, Ernst E, Georgiou A, Kleijnen J. Influence of context effects on health outcomes: a systematic review. *Lancet*. 2001;357:757-762.
27. Stewart M. Effective physician-patient communication and health outcomes: a review. *CMAJ*. 1995;152:1423-1433.
28. Stewart M, Brown JB, Boon H, Galajda J, Meredith L, Sangster M. Evidence on patient-doctor communication. *Cancer Prev Control*. 1999;3:25-30.
29. Kaplan SH, Greenfield S, Ware JE Jr. Assessing the effects of physician-patient interactions on the outcomes of chronic disease [published correction appears in *Med Care*. 1989;27:679]. *Med Care*. 1989;27:S110-S127.
30. Tresolini C, and the Pew-Fetzer Task Force. *Health Professions Education and Relationship-Centered Care: Report of the Pew-Fetzer Task Force on Advancing Psychosocial Health Education*. San Francisco, Calif: Pew Health Professions Commission; 1994.
31. Candib LM. *Medicine and the Family: A Feminist Perspective*. New York, NY: Basic Books; 1995.
32. Ternov S. The human side of medical mistakes. In: Spath PL, ed. *Error Reduction in Healthcare: A Systems Approach to Improving Patient Safety*. San Francisco, Calif: Jossey Bass; 1999:97-138.
33. Chopra V, Bovill JG, Spierdijk J, Koornneef F. Reported significant observations during anaesthesia: a prospective analysis over an 18-month period. *Br J Anaesth*. 1992;68:13-17.
34. Cooper JB, Newbower RS, Long CD, McPeek B. Preventable anesthesia mishaps: a study of human factors. *Anesthesiology*. 1978;49:399-406.
35. Asch E, Saltzberg D, Kaiser S. Reinforcement of self-directed learning and the development of professional attitudes through peer- and self-assessment. *Acad Med* 1998;73:575.
36. Safran DG, Montgomery JE, Chang H, Murphy J, Rogers WH. Switching doctors: predictors of voluntary disenrollment from a primary physician's practice. *J Fam Pract*. 2001;50:130-136.
37. Safran DG, Taira DA, Rogers WH, Kosinski M, Ware JE, Tarlov AR. Linking primary care performance to outcomes of care. *J Fam Pract*. 1998;47:213-220.
38. American Board of Internal Medicine. *Project Professionalism*. Philadelphia, Pa: American Board of Internal Medicine; 1998.
39. Peabody F. The care of the patient. *JAMA*. 1927;88:877-882.
40. Goleman D. *Emotional Intelligence*. New York, NY: Bantam Books; 1995.
41. Novack DH, Suchman AL, Clark W, Epstein RM, Najberg E, Kaplan C. Calibrating the physician: personal awareness and effective patient care. *JAMA*. 1997;278:502-509.
42. Ramsey PG, Wenrich M, Carline JD, Inui TS, Larson EB, LoGerfo JP. Use of peer ratings to evaluate physician performance. *JAMA*. 1993;269:1655-1660.
43. Epstein RM. Mindful practice. *JAMA*. 1999;282:833-839.
44. Novack DH, Epstein RM, Paulsen RH. Toward creating physician-healers: fostering medical students' self-awareness, personal growth, and well-being. *Acad Med*. 1999;74:516-520.
45. Klass D. Reevaluation of clinical competency. *Am J Phys Med Rehabil*. 2000;79:481-486.
46. LaDuca A, Taylor DD, Hill IK. The design of a new physician licensure examination. *Eval Health Prof*. 1984;7:115-140.
47. Kane M. Model-based practice analysis and test specifications. *Appl Meas Educ*. 1997;10:18.
48. Dugdale DC, Epstein R, Pantilat SZ. Time and the patient-physician relationship. *J Gen Intern Med*. 1999;14(suppl 1):S34-S40.
49. Emanuel EJ, Dubler NN. Preserving the physician-patient relationship in the era of managed care. *JAMA*. 1995;273:323-335.
50. Kravitz RL, Cope DW, Bhrany V, Leake B. Internal medicine patients' expectations for care during office visits. *J Gen Intern Med*. 1994;9:75-81.
51. LaDuca A. Validation of professional licensure ex-

aminations: professions theory, test design, and construct validity. *Eval Health Prof*. 1994;17:178-197.
52. De Champlain AF, Margolis MJ, King A, Klass DJ. Standardized patients' accuracy in recording examinees' behaviors using checklists. *Acad Med*. 1997; 72(suppl 1):S85-S87.
53. Kopelow ML, Schnabl GK, Hassard TH, et al. Assessing practicing physicians in two settings using standardized patients. *Acad Med*. 1992;67(suppl):S19-S21.
54. Margolis MJ, De Champlain AF, Klass DJ. Setting examination-level standards for a performance-based assessment of physicians' clinical skills. *Acad Med*. 1998;73(suppl):S114-S116.
55. Ross LP, Clauser BE, Margolis MJ, Orr NA, Klass DJ. An expert-judgment approach to setting standards for a standardized-patient examination. *Acad Med*. 1996;71(suppl):S4-S6.
56. Tamblyn RM, Klass DJ, Schnabl GK, Kopelow ML. The accuracy of standardized patient presentation. *Med Educ*. 1991;25:100-109.
57. McLeod PJ, Tamblyn RM, Gayton D, et al. Use of standardized patients to assess between-physician variations in resource utilization. *JAMA*. 1997;278: 1164-1168.
58. Tamblyn R, Abrahamowicz M, Brailovsky C, et al. Association between licensing examination scores and resource use and quality of care in primary care practice. *JAMA*. 1998;280:989-996.
59. Tamblyn RM. Use of standardized patients in the assessment of medical practice. *CMAJ*. 1998;158: 205-207.
60. Abrahamowicz M, Tamblyn RM, Ramsay JO, Klass DK, Kopelow ML. Detecting and correcting for rater-induced differences in standardized patient tests of clinical competence. *Acad Med*. 1990;65(suppl):S25-S26.
61. Davis D. Does CME work? an analysis of the effect of educational activities on physician performance or health care outcomes. *Int J Psychiatry Med*. 1998;28: 21-39.
62. Kassirer JP. Pseudoaccountability. *Ann Intern Med*. 2001;134:587-590.
63. Kohn LT, Corrigan JM, Donaldson MS. *To Err Is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 2000.
64. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990;65(suppl): S63-S67.
65. Broudy HS, Smith BO, Burnett J. *Democracy and Excellence in American Secondary Education*. Chicago, Ill: Rand McNally; 1964.
66. Newble D, Dawson B, Dauphinee D. Guidelines for assessing clinical competence *Teaching Learning Med*. 1994;6:213-220.
67. Colliver JA, Swartz MH. Assessing clinical performance with standardized patients. *JAMA*. 1997;278: 790-791.
68. Barrows HS. An overview of the uses of standardized patients for teaching and evaluating clinical skills: AAMC. *Acad Med*. 1993;68:443-451.
69. Kassebaum DG, Eaglen RH. Shortcomings in the evaluation of students' clinical skills and behaviors in medical school. *Acad Med*. 1999;74:842-849.
70. Greenfield S, Kaplan S, Ware JE Jr. Expanding patient involvement in care: effects on patient outcomes. *Ann Intern Med*. 1985;102:520-528.
71. Case SM, Becker DF, Swanson DB. Relationship between scores on NBME basic science subject tests and the first administration of the newly designed NBME Part I examination. *Acad Med*. 1992;67(suppl): S13-S15.
72. Norcini JJ, Swanson DB, Grosso LJ, Shea JA, Webster GD. A comparison of knowledge, synthesis, and clinical judgment: multiple-choice questions in the assessment of physician competence. *Eval Health Prof*. 1984;7:485-499.
73. Norcini JJ, Swanson DB, Grosso LJ, Webster GD. Reliability, validity and efficiency of multiple choice question and patient management problem item formats in assessment of clinical competence. *Med Educ*. 1985;19:238-247.
74. Case SM, Ripkey DR, Swanson DB. The relationship between clinical science performance in 20 medical schools and performance on Step 2 of the USMLE licensing examination: 1994-95 Validity Study Group for USMLE Step 1 and 2 Pass/Fail Standards. *Acad Med*. 1996;71(suppl):S31-S33.
75. Case SM, Swanson DB. Validity of NBME Part I and Part II scores for selection of residents in orthopaedic surgery, dermatology, and preventive medicine. *Acad Med*. 1993;68(suppl):S51-S56.
76. Downing SM. The assessment of clinical competence on the emergency medicine specialty certification examination: the validity of clinically relevant multiple-choice items. *Ann Emerg Med*. 1980;9:554-556.
77. Ramsey PG, Wenrich MD, Carline JD, Inui TS, Larson EB, LoGerfo JP. Use of peer ratings to evaluate physician performance. *JAMA*. 1993;269:1655-1660.
78. Holsgrove GJ. Guide to postgraduate exams: multiple-choice questions. *Br J Hosp Med*. 1992;48:757-761.
79. Schuwirth LW, Verheggen MM, van der Vleuten C, Boshuizen HP, Dinant GJ. Do short cases elicit different thinking processes than factual knowledge questions do? *Med Educ*. 2001;35:348-356.
80. Veloski JJ, Rabinowitz HK, Robeson MR, Young PR. Patients don't present with five choices: an alternative to multiple-choice tests in assessing physicians' competence. *Acad Med*. 1999;74:539-546.
81. van der Vleuten C. Validity of final examinations in undergraduate medical training. *BMJ*. 2000;321: 1217-1219.
82. Ely JW, Dawson JD, Young PR, et al. Malpractice claims against family physicians: are the best doctors sued more? *J Fam Pract*. 1999;48:23-30.
83. Tutton PJ. Psychometric test results associated with high achievement in basic science components of a medical curriculum. *Acad Med*. 1996;71:181-186.
84. Tamblyn RM, Klass DK, Schanbl GK, Kopelow ML. Factors associated with the accuracy of standardized patient presentation. *Acad Med*. 1990;65(suppl):S55-S56.
85. Tamblyn R, Berkson L, Dauphinee WD, et al. Unnecessary prescribing of NSAIDs and the management of NSAID-related gastropathy in medical practice. *Ann Intern Med*. 1997;127:429-438.
86. Carney PA, Allen JD, Eliassen MS, Owen M, Badger LW. Recognizing and managing depression in primary care: a standardized patient study. *J Fam Pract*. 1999;48:965-972.
87. Carney PA, Dietrich AJ, Freeman DH Jr, Mott LA. The periodic health examination provided to asymptomatic older women: an assessment using standardized patients. *Ann Intern Med*. 1993;119:129-135.
88. Carney PA, Dietrich AJ, Freeman DH Jr, Mott LA. A standardized-patient assessment of a continuing medical education program to improve physicians' cancer-control clinical skills. *Acad Med*. 1995;70:52-58.
89. Tamblyn RM, Klass DJ, Schnabl GK, Kopelow ML. The accuracy of standardized patient presentation. *Med Educ*. 1991;25:100-109.
90. van der Vleuten C, Sawnson DB. Assessment of clinical skills with standardized patients: state of the art. *Teaching Learning Med*. 1990;2:58-76.
91. Grand'Maison P, Lescop J, Rainsberry P, Brailovsky CA. Large-scale use of an objective, structured clinical examination for licensing family physicians. *CMAJ*. 1992;146:1735-1740.
92. Joorabchi B. Objective structured clinical examination in a pediatric residency program. *AJDC*. 1991; 145:757-762.
93. Latif A. An examination of the examinations: the reliability of the objective structured clinical examination and clinical examination. *Med Teacher*. 1992;14: 179-183.
94. MacRae HM, Cohen R, Regehr G, Reznick R, Burnstein M. A new assessment tool: the patient assessment and management examination. *Surgery*. 1997; 122:335-343.
95. Matsell DG, Wolfish NM, Hsu E. Reliability and validity of the objective structured clinical examination in paediatrics. *Med Educ*. 1991;25:293-299.
96. Vu NV, Barrows HS, Marcy ML, Verhulst SJ, Colliver JA, Travis T. Six years of comprehensive, clinical, performance-based assessment using standardized patients at the Southern Illinois University School of Medicine. *Acad Med*. 1992;67:42-50.
97. Vu NV, Distlehorst LH, Verhulst SJ, Colliver JA. Clinical performance-based test sensitivity and specificity in predicting first-year residency performance. *Acad Med*. 1993;68(suppl):S41-S45.
98. Newble DI, Swanson DB. Psychometric characteristics of the objective structured clinical examination. *Med Educ*. 1988;22:325-334.
99. Petrusa ER, Blackwell TA, Ainsworth MA. Reliability and validity of an objective structured clinical examination for assessing the clinical performance of residents. *Arch Intern Med*. 1990;150:573-577.
100. Gomez JM, Prieto L, Pujol R, et al. Clinical skills assessment with standardized patients. *Med Educ*. 1997;31:94-98.
101. Gorter S, Rethans JJ, Scherpbier A, et al. Developing case-specific checklists for standardized-patient-based assessments in internal medicine: a review of the literature. *Acad Med*. 2000;75:1130-1137.
102. Swartz MH, Colliver JA, Bardes CL, Charon R, Fried ED, Moroff S. Validating the standardized-patient assessment administered to medical students in the New York City Consortium. *Acad Med*. 1997; 72:619-626.
103. Carline JD, Paauw DS, Thiede KW, Ramsey PG. Factors affecting the reliability of ratings of students' clinical skills in a medicine clerkship. *J Gen Intern Med*. 1992;7:506-510.
104. Sanson-Fisher RW, Poole AD. Simulated patients and the assessment of medical students' interpersonal skills. *Med Educ*. 1980;14:249-253.
105. Tamblyn R, Abrahamowicz M, Schnarch B, et al. Can standardized patients predict real-patient satisfaction with the doctor-patient relationship? *Teaching Learning Med*. 1994;6:36-44.
106. Pieters HM, Touw-Otten FW, De Melker RA. Simulated patients in assessing consultation skills of trainees in general practice vocational training: a validity study. *Med Educ*. 1994;28:226-233.
107. Wass V, Jones R, van der Vleuten C. Standardized or real patients to test clinical competence? the long case revisited. *Med Educ*. 2001;35:321-325.
108. Cusimano MD, Rothman A, Keystone J. Defining standards of competent performance on an OSCE. *Acad Med*. 1998;73(suppl):S112-S113.
109. Kaufman DM, Mann KV, Muijtjens AM, van der Vleuten C. A comparison of standard-setting procedures for an OSCE in undergraduate medical education. *Acad Med*. 2000;75:267-271.
110. Travis TA, Colliver JA, Robbs RS, et al. Validity of simple approach to scoring and standard setting for standardized-patient cases in an examination of clinical competence. *Acad Med*. 1996;71(suppl):S84-S86.
111. Norcini JJ, Stillman PL, Sutnick AI, et al. Scoring and standard setting with standardized patients. *Eval Health Prof*. 1993;16:322-332.
112. Martin JA, Reznick RK, Rothman A, Tamblyn RM, Regehr G. Who should rate candidates in an objective structured clinical examination? *Acad Med*. 1996; 71:170-175.
113. Blane CE, Calhoun JG. Objectively evaluating student case presentations. *Invest Radiol*. 1985;20:121-123.
114. Stillman P, Swanson D, Regan MB, et al. Assessment of clinical skills of residents utilizing stan-

dardized patients: a follow-up study and recommendations for application. *Ann Intern Med*. 1991;114:393-401.
115. Cohen R, Rothman AI, Poldre P, Ross J. Validity and generalizability of global ratings in an objective structured clinical examination. *Acad Med*. 1991;66:545-548.
116. Swartz MH, Colliver JA, Bardes CL, Charon R, Fried ED, Moroff S. Global ratings of videotaped performance versus global ratings of actions recorded on checklists: a criterion for performance assessment with standardized patients. *Acad Med*. 1999;74:1028-1032.
117. Mumford E, Schlesinger H, Cuerdon T, Scully J. Ratings of videotaped simulated patient interviews and four other methods of evaluating a psychiatry clerkship. *Am J Psychiatry*. 1987;144:316-322.
118. Tamblyn RM, Abrahamowicz M, Berkson L, et al. First-visit bias in the measurement of clinical competence with standardized patients. *Acad Med*. 1992;67(suppl):S22-S24.
119. Ferrell BG, Thompson BL. Standardized patients: a long-station clinical examination format. *Med Educ*. 1993;27:376-381.
120. Singer PA, Robb A, Cohen R, Norman G, Turnbull J. Performance-based assessment of clinical ethics using an objective structured clinical examination. *Acad Med*. 1996;71:495-498.
121. McLeod PJ, Tamblyn R, Benaroya S, Snell L. Faculty ratings of resident humanism predict patient satisfaction ratings in ambulatory medical clinics. *J Gen Intern Med*. 1994;9:321-326.
122. Irby D. Teaching and learning in ambulatory care settings: a thematic review of the literature. *Acad Med*. 1995;70:898-931.
123. Kalet A, Earp JA, Kowlowitz V. How well do faculty evaluate the interviewing skills of medical students? *J Gen Intern Med*. 1992;7:499-505.
124. Rowland-Morin PA, Burchard KW, Garb JL, Coe NP. Influence of effective communication by surgery students on their oral examination scores. *Acad Med*. 1991;66:169-171.
125. Wang-Cheng RM, Fulkerson PK, Barnas GP, Lawrence SL. Effect of student and preceptor gender on clinical grades in an ambulatory care clerkship. *Acad Med*. 1995;70:324-326.
126. Herbers JE Jr, Noel GL, Cooper GS, Harvey J, Pangaro LN, Weaver MJ. How accurate are faculty evaluations of clinical competence? *J Gen Intern Med*. 1989;4:202-208.
127. Norcini JJ, Blank LL, Arnold GK, Kimball HR. The mini-CEX (clinical evaluation exercise): a preliminary investigation. *Ann Intern Med*. 1995;123:795-799.
128. Dunnington GL, Wright K, Hoffman K. A pilot experience with competency-based clinical skills assessment in a surgical clerkship. *Am J Surg*. 1994;167:604-606.
129. Dunnington G, Reisner L, Witzke D, Fulginiti J. Structured single-observer methods of evaluation for the assessment of ward performance on the surgical clerkship. *Am J Surg*. 1990;159:423-426.
130. Keynan A, Friedman M, Benbassat J. Reliability of global rating scales in the assessment of clinical competence of medical students. *Med Educ*. 1987;21:477-481.
131. Kroboth FJ, Hanusa BH, Parker S, et al. The inter-rater reliability and internal consistency of a clinical evaluation exercise. *J Gen Intern Med*. 1992;7:174-179.
132. McKinley RK, Fraser RC, van der Vleuten C, Hastings AM. Formative assessment of the consultation performance of medical students in the setting of general practice using a modified version of the Leicester Assessment Package. *Med Educ*. 2000;34:573-579.
133. Yang JC, Laube DW. Improvement of reliability of an oral examination by a structured evaluation instrument. *J Med Educ*. 1983;58:864-872.
134. Stillman RM, Lane KM, Beeth S, Jaffe BM. Evaluation of the student: improving validity of the oral examination. *Surgery*. 1983;93:439-442.
135. Lockie C. *The Examination for Membership in the Royal College of General Practitioners*. London, England: Royal College of General Practitioners; 1990. Occasional Paper 46.
136. Ram P, van der Vleuten C, Rethans JJ, Grol R, Aretz K. Assessment of practicing family physicians: comparison of observation in a multiple-station examination using standardized patients with observation of consultations in daily practice. *Acad Med*. 1999;74:62-69.
137. Ram P, van der Vleuten C, Rethans JJ, Schouten B, Hobma S, Grol R. Assessment in general practice: the predictive value of written-knowledge tests and a multiple-station examination for actual medical performance in daily practice. *Med Educ*. 1999;33:197-203.
138. Ram P, Grol R, Rethans JJ, Schouten B, van der Vleuten C, Kester A. Assessment of general practitioners by video observation of communicative and medical performance in daily practice: issues of validity, reliability and feasibility. *Med Educ*. 1999;33:447-454.
139. Tate P, Foulkes J, Neighbour R, Campion P, Field S. Assessing physicians' interpersonal skills via videotaped encounters: a new approach for the Royal College of General Practitioners Membership examination. *J Health Commun*. 1999;4:143-152.
140. Luck J, Peabody JW, Dresselhaus TR, Lee M, Glassman P. How well does chart abstraction measure quality? a prospective comparison of standardized patients with the medical record. *Am J Med*. 2000;108:642-649.
141. Fiscella K, Franks P. Influence of patient education on profiles of physician practices. *Ann Intern Med*. 1999;131:745-751.
142. Tornow W, London M. *Maximizing the Value of 360-Degree Feedback: A Process for Successful Individual and Organizational Development*. San Francisco, Calif: Jossey-Bass Inc; 1998.
143. Hundert EM, Hafferty F, Christakis D. Characteristics of the informal curriculum and trainees' ethical choices. *Acad Med*. 1996;71:624-642.
144. Kaiser S, Bauer JJ. Checklist self-evaluation in a standardized patient exercise. *Am J Surg*. 1995;169:418-420.
145. Gordon MJ. A review of the validity and accuracy of self-assessments in health professions training. *Acad Med*. 1991;66:762-769.
146. Westburg J, Jason H. *Collaborative Clinical Education: The Foundation of Effective Patient Care*. New York, NY: Springer Publishing Co; 1993.
147. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academy Press; 2001.
148. Gonzi A. *The Development of Competence-Based Assessment Strategies for the Professions*. Canberra: Australian Government Publishing Service; 1993. National Office of Everseas Skills Recognition Research Paper # 8.
149. Wass V, McGibbon D, van der Vleuten C. Composite undergraduate clinical examinations: how should the components be combined to maximize reliability? *Med Educ*. 2001;35:326-330.
150. van der Vleuten C CP, Norman GR, De Graaff E. Pitfalls in the pursuit of objectivity: issues of reliability. *Med Educ*. 1991;25:110-118.
151. Hodges B. *Assessment Across Basic Science and Clinical Skills: Using OSCEs With Postencounter Basic Science Probes*. 2001. Manual located at the University of Toronto, Toronto, Ontario.
152. Smith RM. The triple-jump examination as an assessment tool in the problem-based medical curriculum at the University of Hawaii. *Acad Med*. 1993;68:366-372.
153. Brailovsky C, Charlin B, Beausoleil S, Cote S, van der Vleuten C. Measurement of clinical reflective capacity early in training as a predictor of clinical reasoning performance at the end of residency: an experimental study on the script concordance test. *Med Educ*. 2001;35:430-436.
154. Verhoeven BH, Hamers JG, Scherpbier AJ, Hoogenboom RJ, van der Vleuten C. The effect on reliability of adding a separate written assessment component to an objective structured clinical examination. *Med Educ*. 2000;34:525-529.
155. Charlin B, Roy L, Brailovsky C, Goulet F, van der Vleuten C. The Script Concordance test: a tool to assess the reflective clinician. *Teaching Learning Med*. 2000;12:189-195.
156. Risser DT, Simon R, Rice MM, Salisbury ML. A structured teamwork system to reduce clinical errors. In: Spath PL, ed. *Error Reduction in Health Care: A Systems Approach to Improving Patient Safety*. New York, NY: John Wiley & Sons; 1999:235-277.
157. Suchman AL, Botelho RJ, Hinton-Walker P. *Partnerships in Healthcare: Transforming Relational Process*. Rochester, NY: University of Rochester Press; 1998.
158. American Board of Internal Medicine. *Patient and Physician Peer Assessment and the ABIM Program of Continuous Professional Development*. Philadelphia, Pa: American Board of Internal Medicine; 2001.
159. Dauphinee WD. Assessing clinical performance. Where do we stand and what might we expect? *JAMA*. 1995;274:741-743.
160. Violato C, Marini A, Toews J, Lockyer J, Fidler H. Feasibility and psychometric properties of using peers, consulting physicians, co-workers, and patients to assess physicians. *Acad Med*. 1997;72(suppl 1):S82-S84.
161. Roter DL, Hall JA, Kern DE, Barker LR, Cole KA, Roca RP. Improving physicians' interviewing skills and reducing patients' emotional distress—a randomized clinical trial. *Arch Intern Med*. 1995;155:1877-1884.
162. Beckman HB, Markakis KM, Suchman AL, Frankel RM. The doctor-patient relationship and malpractice: lessons from plaintiff depositions. *Arch Intern Med*. 1994;154:1365-1370.
163. Tamblyn R, Benaroya S, Snell L, McLeod P, Schnarch B, Abrahamowicz M. The feasibility and value of using patient satisfaction ratings to evaluate internal medicine residents. *J Gen Intern Med*. 1994;9:146-152.
164. Helmreich RL. On error management: lessons from aviation. *BMJ*. 2000;320:781-785.
165. Helmreich RL, Davies JM. Anaesthetic simulation and lessons to be learned from aviation. *Can J Anaesth*. 1997;44:907-912.
166. Schaefer HG, Helmreich RL. The importance of human factors in the operating room. *Anesthesiology*. 1994;80:479.
167. Davies JM, Helmreich RL. Virtual reality in medical training. *CMAJ*. 1997;157:1352-1353.
168. Helmreich RL, Musson DM. Surgery as team endeavour. *Can J Anaesth*. 2000;47:391-392.
169. Sexton JB, Thomas EJ, Helmreich RL. Error, stress, and teamwork in medicine and aviation: cross sectional surveys. *BMJ*. 2000;320:745-749.
170. Epstein RM. Communication between primary care physicians and consultants. In: Suchman AL, Botelho RJ, Hinton-Walker P, eds. *Partnerships in Health Care: Transforming Relational Process*. Rochester, NY: University of Rochester Press; 1998:171-183.
171. Frankford DM, Konrad TR. Responsive medical professionalism: integrating education, practice, and community in a market-driven era. *Acad Med*. 1998;73:138-145.

Physicians' Responses to Patients' Medically Unexplained Symptoms

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Objective: To understand how physicians communicate may contribute to the mistrust and poor clinical outcomes observed in patients who present with medically unexplained symptoms (MUS). **Methods:** After providing informed consent, 100 primary care physicians in greater Rochester, New York, were visited by two unannounced covert standardized patients (actors, or SPs) portraying two chest pain roles: classic symptoms of gastroesophageal reflux disease (GERD) with nausea and insomnia (the GERD role) and poorly characterized chest pain with fatigue and dizziness (the MUS role). The visits were surreptitiously audiorecorded and analyzed using the Measure of Patient-Centered Communication (MPCC), which scores physicians on their exploration of the patients' experience of illness (component 1) and psychosocial context (component 2), and their attempts to find common ground on diagnosis and treatment (component 3). **Results:** In multivariate analyses, MUS visits yielded significantly lower scores on MPCC component 1 ($p = .01$). Subanalysis of component 1 scores showed that patients' symptoms were not explored as fully and that validation was less likely to be used in response to patient concerns in the MUS than in the GERD visits. Component 2 and component 3 were unchanged. **Conclusion:** Physicians' inquiry into and validation of symptoms in patients with MUS was less common compared with more medically straightforward patient presentations. Further research should study the relationship between communication variables and poor clinical outcomes, misunderstandings, mutual distrust, and inappropriate healthcare utilization in this population, and test interventions to address this problem. **Key words:** somatization, physician–patient relations, patient-centered care, symptoms, communication, standardized patients.

GERD = gastrointestinal reflux disease; **MPCC** = Measure of Patient-Centered Communication; **MUS** = medically unexplained symptoms; **PCC** = patient-centered communication.

INTRODUCTION

Patients come to physicians in search of validation of their symptoms, meaningful causal explanations, and treatment that promises to alleviate their distress. However, when their physicians have difficulty finding a coherent explanation for their distress, patients often feel discounted and misunderstood (1,2). For convenience, these symptoms that elude diagnosis are called "medically unexplained" or "somatoform," even though it is a failure to understand them rather than the symptoms themselves that define them as "unexplained." These patients tend to report lower quality of life, generate higher health care costs as a result of increased use of diagnostic tests, and have longer visits compared with general medical patient populations (3–6). Not surprisingly, patients who present with medically unexplained symptoms (MUS) are often described by physicians as difficult and frustrating (7).

Although psychopathology, patient personality, history of trauma or abuse, and sociocultural factors have been associated with somatoform disorders (8–10) and MUS (3,5,11–24), the physician may also unwittingly reinforce the expression of somatic symptoms (25). Qualitative studies suggest several ways that ineffective communication between physicians and patients may underlie some of these patients' negative experiences. Patients with MUS often provide clues to their psychological concerns, which are rarely acknowledged by the physician (26,27). Physicians tend to attempt to reassure these patients by normalizing their symptoms without providing an adequate explanation for their impressions (28). Cognitive and affective factors may underlie difficulties between physicians and patients with MUS. Dealing with ambiguity, for example, increases the cognitive complexity of the encounter and physician anxiety (29). These, in turn, may conspire to promote premature closure. In an effort to manage their own anxiety, physicians are reported to either reject the patient's symptoms (or ideas about causation) as not legitimate or collude with the patient's proposed explanations and requests in an attempt to please the patient. Physicians may interpret patients' distress as requests for healthcare services of marginal benefit (30,31); physicians may test ostensibly to reassure patients, but may also be motivated by their own anxiety about missing a diagnosis or feelings of inadequacy in the face of unexplained symptoms (32,33). The physician's collusion may limit consideration of a wider range of diagnostic alternatives (1), whereas premature reassurance may paradoxically raise patients' anxieties (34).

Prior reports from this study suggest that physicians use one of two communication styles when confronted with ambiguity: usual care, in which ambiguity is denied and closure sought, and a "partnering" approach in which the patient's experience is understood, ambiguity is acknowledged, and patient input is sought. Partnering is one aspect of a patient-centered communication (PCC) style that emphasizes the need to explore and validate the patient's illness experience, develop an understanding of the patient as a person, and respect each patient's unique needs, wishes, and contexts (16). Other PCC skills include coming to agreement on a name for the illness and a plan for follow-up visits, diagnostic testing, and treatment, recognizing that ambiguity about the nature of some symptoms may persist for months or years.

We previously reported that that MUS visits were longer than visits for unambiguous straightforward symptoms. Normally, longer visits are associated with higher scores on mea-

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sures of PCC (30). However, qualitative findings that physicians tend to discount and misunderstand patients with MUS suggest that visits with patients with MUS would exhibit less PCC. We hypothesized that MUS visits would score lower on measures of PCC even when controlling for important confounders, especially visit time.

We used unannounced covert standardized patients (SPs) to provide physicians with nearly identical stimuli and to avoid three challenges. First are Hawthorne effects—physicians may change their interactional style if they know that they are being observed. Second is case-mix; it is difficult to compare physician behavior with patients who present different symptom clusters. Third is mutual accommodation—patients influence physicians' communication style. Fourth is self-selection; real patients are likely to select and remain with physicians who share their views (38) and whom they trust (39). Thus, by using unannounced SPs, we could study the physician's contribution to communication, in particular, self disclosure.

METHODS

We compared physician responses to two SP roles, one of whom presented symptom clusters that, in pilot testing, generated diagnostic ambiguity and disagreement; the intention was to present concerns that physicians would not easily be able to fit into a clear unifying diagnostic category. The other presented symptoms that were perceived as coherent and generated greater than 90% physician agreement. To measure "patient-centered" physician communication behaviors, we analyzed the audiotaped interactions between physicians and SPs using a scale that specifically rates level of physicians' responsiveness to patients' expressed concerns rather than alternative measures that simply count the number and types of utterances without consideration of their context (35). However, because measures of PCC have not been validated in this population, we consider our analyses exploratory.

This analysis is part of a large study that used three different sources of data to arrive at descriptions of physicians' overall clinical style. We report only on data derived from surreptitious audiorecordings of clinical encounters between unannounced standardized patients and primary care physicians. The methods, physician sample, SP training protocols, and characteristics of real patients who completed surveys (not reported here) have been reported in detail previously (30,36).

Physician Sample

We used personal physician-to-physician recruitment methods, which have demonstrated higher recruitment yields than postal, e-mail, or telephone recruitment (37). In late 1999, 12 physician-recruiters identified primary care physicians in active clinical practice within 45 minutes' drive of Rochester belonging to a large managed care organization (MCO) serving the eight-county Rochester, New York, region (population 1.1 million). To achieve stable measures of costs for another aspect of the study, only physicians who had greater than 100 patients in the MCO were enrolled; thus, enrolled physicians, compared with nonenrolled physicians, had larger practices. We also intentionally oversampled family physicians to allow for future comparisons between family physicians and internists. A maximum of two physicians per practice were recruited to avoid clustering effects and minimize physician detection of SPs. Thus, 297 of the 594 local physicians were eligible for recruitment. They recruited in random order until a total of 100 physicians were recruited. Physicians gave informed consent to participate in a study of "patient care and outcomes." They agreed to have two unannounced covert surreptitiously audiorecorded SP visits without advance notice at any point in the subsequent 12 months during 2000 to 2001. Physicians were reimbursed $100 for each SP visit (slightly less than usual charges for a new patient acute appointment) and $100 for participation in the study; $100 was also provided to the office staff at each site. The study received Institutional Review Board approval. Physician demographic data are summarized in Table 1.

TABLE 1. Physician Demographic Data (n = 100)

Mean age	43
Number (%) female	23 (23%)
Specialty	
Number (%) of family physicians	47 (47%)
Number (%) of general internists	53 (53%)
Solo practitioners	24 (24%)
Rural practice	32 (32%)

Standardized Patient Role Development

Detailed clinical biographies were developed for the two clinical presentations (gastrointestinal reflux disease [GERD] and MUS). Role outlines were prepared by the coinvestigators and were revised iteratively until they were judged by a consensus of investigators and advisors to be clinically credible and manageable within the context of a 15- to 20-minute new-to-doctor acute visit. We then piloted the roles with family physicians and asked them for their most likely diagnosis, seeking 90% agreement on the GERD diagnosis and less than 30% agreement on any single diagnosis for the MUS role. Standardized patients were middle-aged, white, nonobese men and women, some with professional acting experience. Training focused on depicting the historical and emotional features of the roles, including response to physical examination maneuvers and physician recommendations. Each SP was assigned one of the 2 roles for the entire study and was required to portray role details with 95% accuracy.

Standardized Patient Roles

To compare ambiguous with straightforward patient presentations, we created two contrasting roles; both portrayed a mildly ill patient with chest pain of 2 weeks' duration who worried about what the symptoms might represent. We attempted to present patients with the same level of illness severity. The "GERD" role portrayed a 48-year-old patient with symptoms of heartburn: nocturnal chest pain exacerbated by food and partially relieved by antacids, typical of GERD. There were secondary concerns about nausea, insomnia (resulting from pain) and fatigue (resulting from insomnia), which clinicians would normally attribute to the underlying GERD. The "MUS" role portrayed a 48-year-old patient with poorly characterized chest pain. There were secondary concerns of dizziness, fatigue, and "not feeling quite right," which clinicians might normally not connect into a single unifying diagnosis; assuming that the symptoms were chronic, this role would meet criteria for multisomatoform disorder (40). Consistent with observations by Salmon et al. (31) that patients with MUS express worry that then leads to physician test-ordering, both roles incorporated an identical prompt from the patient after several minutes of the history-taking portion of the visit that expressed concern that the symptom represented "something serious" followed by more specific concerns about heart disease and cancer. There were no specific requests for testing or treatment in the role scripts. If the physician suggested that stress or anxiety might be related to the symptoms, the SP would endorse such an explanation but not volunteer psychological causation spontaneously, consistent with Kirmayer's description of "facultative somatization" (41). Recognizing that some patients with GERD share psychological features of patients with MUS (42,43), we constructed the GERD role to exhibit few of these features (e.g., depression, anxiety, history of trauma or abuse, ambiguous or dramatic symptom portrayal, doctor shopping, poor response to treatment). One male and one female were trained to the ambiguous symptoms role; one male and two females were trained to the GERD role when it became apparent that one of the females could not do all of the visits. In pilot testing, the symptom presentations were calibrated so as to communicate patient discomfort and concern but not to prompt referral to an emergency department or administration of medications in the physician's office.

Standardized Patient Visits

Each physician saw two SPs: one male and one female, and one of each illness condition. The first SP visit was randomly assigned stratified by SP illness condition and gender; the second visit was by an SP of the other gender

who portrayed the other illness condition. In that way, each physician could act as his or her own control. Visits occurred at least 2 months from securing consent from participating physicians and were at least 2 months apart.

To ensure realism, SPs were provided factitious insurance cards obtained from local insurance companies; false identities (including pseudonym, local home and work address, and "mobile phone number" corresponding to the cellular phone number of the study coordinator); and cash to make any applicable copayments.

Project staff enlisted practice managers at local clinical sites to help the SPs make medical appointments. Clinic personnel were told that the patient wanted to establish as a "new patient" with the doctor but also had an acute issue ("chest pain for a couple of weeks") that required attention within 1 to 2 weeks.

SPs were monitored throughout training and data collection. Experienced trainers at each site reviewed audiotapes and reporting forms corresponding to each SP's first six visits plus the first two visits after any sustained break in activity (>1 month). Trainers completed a checklist of behaviors and gave feedback to each SP after each visit.

Two days after the visit, a fax was sent to the physician to determine whether, when prompted, the physician could identify the patient as a SP, not a real patient. The fax notified the physician that a SP had visited in the past few days and prompted the physician to describe any patient that they may now suspect was an SP. If the physician identified the SP after prompting, they were asked to indicate how realistic the SP portrayal was and whether detection occurred before, during, or after the visit. These visits were subject to additional scrutiny. Four physicians from outside of Rochester, blinded to the study hypotheses, were recruited to review randomly selected visits in which the physician identified the SP correctly; we provided paired audiotapes of identified and unidentified SP encounters and asked them to guess which were identified (detected) SPs.

Each SP visit was recorded using a digital audio-disk recorder with a high-quality microphone; equipment was completely hidden within a coat pocket, backpack, or handbag. Visit length was calculated (in minutes) excluding waiting time in the examining room before the visit and any period of more than 1 minute during which the physician left the room.

Measures of Patient-Centered Communication

We analyzed the audiorecordings using the Measure of Patient-Centered Communication (MPCC) (44). The MPCC measures physician responsiveness to patient concerns; component 1 has been positively correlated with patient trust (36) and patient perceptions of patient-centeredness (45).

The MPCC includes three components of patient-centered communication. For component 1 ("exploring both the disease and the illness experience"), the coder notes patient statements that fall into one of six mutually exclusive subcomponents: reason for visit (symptoms) (e.g., "I've been having these headaches."), feelings (e.g., "I'm really worried about this."), ideas (e.g., "Could it be because I'm having allergies?"), effect of the symptoms on functioning (e.g., "The headaches wake me up at night"), expectations (e.g., "I just wanted to see if some medication might help."), and prompts (any concern that was repeated to prompt the physician to respond). For each stated patient concern, the rater determines whether it is "cutoff", whether there has been "preliminary exploration" of the concern, "further exploration" (more than one physician question about the concern), or "validation" (physician expression of understanding or empathy). For example, if a patient says, "I have a headache" and the physician completely ignores the concern or immediately changes the topic, it would be coded as a cutoff. If the physician asked for more information, it would be coded as "preliminary exploration," and if the physician asked more than one question exploring the symptom, it would be coded as "further exploration." Saying, "I think I understand" or "This sounds difficult" after having explored the concern would receive the highest number of points—for having "validated" the patient's concern through expression of empathy, legitimation, understanding, or support. Given that each subcomponent may include several concerns, the subcomponent score is the mean physician response to all concerns within the subcomponent. The mean score for each component is the mean of the subcomponent scores. Component 2 ("understanding the whole person") uses a similar method to measure the degree to which the physician explores the patient's family, social network, job, and interests. Component 3 ("finding common ground") uses an analogous method to measure the degree to which the physician explains and involves the patient in discussions about the nature of the problem and the management plan. Developers of the scale report interrater reliabilities of 0.80 to 0.83 for the total MPCC score (45); component score reliabilities and correlations among the components are not published.

Two coders were trained to score the audiorecordings using the MPCC; each coded half of the recordings. The coders and the coding supervisor (CGS) were trained in a 20-hour course offered by the developers of the scale. The first 10% were dual-coded for reliability and then an additional 10% at random. In the present study, intraclass correlation coefficients for the total and three components were 0.79, 0.67, 0.89, and 0.43, respectively. There were weekly coding meetings in which all visits were discussed and coding issues were addressed; the developers of the coding system were available for ongoing consultation. Our mean (0.50) and standard deviation (SD) (0.17) of the total MPCC score were identical to those reported by the developers of the scale (45).

Analyses

At least one SP visit recording was available from each of the 100 physicians included in the investigation. The analysis was based on measures taken during 189 SP visits. The 11 missing visits included seven GERD and four MUS portrayals. Reasons for missing visit data included physician withdrawal as a result of practice changes ($n = 7$) and equipment failure ($n = 4$). Raw MPCC and component scores were transformed to a standard normal distribution (mean 0; SD 1) to facilitate comparison of effects across measures.

To aid interpretation of effects, outcome measures of MPCC and its components were standardized to have a mean of zero and a SD of one for all analyses. Simple associations between measures of MPCC and role (MUS versus GERD) were explored using paired *t*-tests and Pearson correlation coefficients using only the 178 measures obtained from the 89 physicians that saw SPs portraying both roles.

Random-effects multiple regression models were used to adjust the estimates for physician age and gender, whether the physician correctly identified the patient as an SP, and visit length. Both physician age and gender modify some measures of communication (35,46,47). Age was dropped from our analyses, because it did not appear to confound the relationship between SP condition and MPCC scores. Gender did modify those relationships and was kept in the models, although it did not achieve statistical significance. Random-effects models allowed us to adjust for the clustering of measures within physicians and to make use of cases in which only one observation was obtained; random-effects models included 189 observations from all 100 physicians. We conducted separate analyses for each of the subcomponents of PCC separately consistent with prior reports by our group and the authors of the scale. All analyses were conducted using SAS version 8.2 (SAS Corp., Cary, NC).

RESULTS

MPCC measures were available from 89 physicians that saw both a MUS and a GERD case. MUS visits averaged 5.5 minutes longer than the GERD visits (23.6 versus 18.1; paired *t*-test $p < .0001$). Longer visits also had higher MPCC scores ($r = 0.36$, $p = .0002$). Correlations between physician scores with the 2 SPs were modestly correlated; Pearson correlation coefficients between MUS and GERD cases for total MPCC and components 1 to 3 were 0.38 ($p = .0002$), 0.22 ($p = .04$), 0.31 ($p = .003$), and 0.12 ($p = .25$), respectively.

There were 189 MPCC measures from 100 physicians available for multivariate analyses, including 93 GERD and 96 MUS interviews. In multivariate analyses controlling for physician gender, visit length, and SP detection, MUS visits yielded significantly lower scores on MPCC component 1

(p = .005). There was no significant effect of the patient's presentation (MUS or GERD) on total MPCC scores or the other components (Table 2).

Table 3 shows the frequencies of specific physician response codes in component 1 and the scores adjusted for the number of concerns addressed in each category. These analyses demonstrate that, compared with GERD visits, there were more cutoffs and preliminary and further exploration responses in the MUS visits and an equal number of validation responses. However, because more concerns were coded in the MUS visits for any given concern, the MUS role scored about the same for preliminary explorations and cutoffs but lower for further exploration and validation.

Detailed data on retrospective identification of the SP have been presented previously (30). Forty percent of physicians identified the SP when prompted 2 days later. The most common reasons were that the physician had a closed practice (n = 19; 63%) making retrospective identification easier, the physician was notified by the office staff (n = 10, 33%), and poor acting by the SP (n = 1, 3%). Of the detected visits, the average rating of realism was 8.1 on a 10-point scale. Audit of recordings by blinded judges could not distinguish between visits in which the SP was or was not identified. Adjustment for SP identification and realism ratings did not affect the results shown, although for component 1, the association of SP identification with higher MPCC scores approached statistical significance.

Analyses of interaction effects demonstrated no tendency of the scores to converge with longer visits, indicating that differences between the GERD and MUS roles persisted regardless of visit length.

DISCUSSION

We undertook this study to explore whether physicians encountering patients with MUS tend to demonstrate fewer patient-centered communication behaviors compared with when they encounter patients with straightforward symptoms. Although the MUS visits were longer, we did not see the expected increases in any component of our measure of PCC (45). Rather, when controlled for visit time, we found that physicians scored lower on component 1; they did not explore and validate the patient's reason for visit, and their ideas, expectations, feelings, and functioning as thoroughly as in the GERD role. Two observations account for the differences in component 1 scores; they explored patients' concerns less fully and they validated patients' concerns even less often (5% of concerns) than in the GERD role (8%). Similarly, physicians did not explore or validate the patient's psychosocial concerns any more thoroughly in the MUS role compared with the GERD role (MPCC component 2). Although interrater

TABLE 2. Effects of Physician Gender, Visit Length, and Standardized Patient (SP) Role (medically unexplained symptoms [MUS], and Gastroesophageal Reflux) on the Measure of Patient-Centered Communication (MPCC) Scores in 193 Primary Care Office Visits

Effect	B	SE	p	95% CI
MPCC component 1 ("exploring both the disease and the illness experience")				
Intercept	0.07	0.24	0.77	−0.41 to 0.55
Visit length†	0.07	0.05	0.19	−0.03 to 0.17
SP identified	0.28	0.15	0.07	−0.02 to 0.57
Male physician	−0.35	0.18	0.06	−0.71 to 0.01
MUS role	−0.38	0.13	0.005	−0.65 to −0.11
MPCC component 2 ("understanding the whole person")				
Intercept	−0.60	0.25	0.02	−1.09 to −0.11
Visit length†	0.10	0.05	0.04	0.00 to 0.20
SP identified	0.09	0.15	0.54	−0.21 to 0.40
Male physician	0.16	0.19	0.41	−0.22 to 0.53
MUS role	0.03	0.13	0.84	−0.24 to 0.29
MPCC component 3 ("finding common ground")				
Intercept	−0.64	0.24	0.009	−1.11 to −0.16
Visit length†	0.19	0.05	0.0002	0.09 to 0.29
SP identified	−0.16	0.15	0.29	−0.46 to 0.14
Male physician	−0.01	0.18	0.95	−0.36 to 0.34
MUS role	−0.16	0.14	0.25	−0.44 to 0.11
MPCC total				
Intercept	−0.71	0.24	0.004	−1.19 to −0.23
Visit length†	0.19	0.05	0.0002	0.09 to 0.29
SP identified	0.11	0.15	0.46	−0.18 to 0.40
Male physician	−0.03	0.19	0.88	−0.40 to 0.35
MUS role	−0.20	0.12	0.11	−0.44 to 0.05

*All outcome measures transformed to a standard normal distribution (mean = 0, SD = 1).
†Regression beta parameter for visit length in minutes transformed to represent the effect of a 5-minute increase on the standardized mean MPCC measure.
SE indicates standard error; CI = confidence interval.

TABLE 3. Physician Responses to Patient Concerns: Total Number of Occurrences per Visit and Number of Occurrences per Concern Expressed

	GERD Mean (95% CI)	MUS Mean (95% CI)	F
Preliminary exploration	6.75 (6.25–7.26)	10.75 (10.25–11.24)	145.94****
Percent of concerns explored initially	0.88 (0.85–0.91)	0.92 (0.89–0.95)	3.43*
Further exploration	4.45 (4.09–4.82)	6.39 (6.03–6.75)	60.65****
Percent of concerns explored further	0.59 (0.56–0.62)	0.54 (0.52–0.58)	4.78**
Validation	0.61 (0.46–0.77)	0.61 (0.46–0.76)	0.00
Percent of concerns validated	0.08 (0.06–0.10)	0.05 (0.04–0.07)	6.04**
Cutoffs	0.93 (0.65–1.22)	1.33 (1.05–1.62)	4.03**
Percent of concerns cut off	0.12 (0.09–0.16)	0.11 (0.08–0.14)	0.70

*$p \leq .10$; **$p \leq .05$; ***$p < .01$; ****$p < .001$.
GERD indicates gastroesophageal reflux disease; MUS = medically unexplained symptoms; CI = confidence interval.

reliability limits our ability to comment on component 3, we found no evidence that physicians made more attempts to achieve a common understanding with patients about the diagnosis and treatment.

Previous studies have demonstrated differences in communication related to patient demographic factors (race (48), gender (46,49,50), severity of illness (51), and patient activation (49,52). Although we consider our findings preliminary pending further study, our data support qualitative observations that suggest that physicians' interactional style is less patient-centered with patients with MUS and that physicians alter their communication style in response to the nature and expression of symptoms. Given that patient-centered communication is associated with greater trust (36), more appropriate use of health services (53), more socioemotional talk (53), and lower likelihood of malpractice litigation (54), our findings suggest that future research should examine whether lack of PCC mediates the distrust, conflict, and inappropriate utilization of healthcare services noted in encounters between patients with MUS and their physicians.

We can only speculate about the reasons for the changes in communication patterns, or lack thereof, in PCC with patients who presented with ambiguous symptoms, but it is likely that cognitive, time management, and attitudinal issues play a role. First, patients presenting the same number of symptoms may require different levels of cognitive effort on the part of the physician depending on whether the symptoms seem coherent from the physician's perspective. Educational psychologists suggest that complex heuristics or "scripts" are activated by these recognizable and coherent patterns of illness, resulting in efficient diagnostic reasoning (55). However, when the same number of symptoms does not tie together into a familiar pattern of disease, those same "scripts" will either not be helpful or lead the clinician astray; greater cognitive effort is required to resolve the problem, and the physician may experience greater anxiety at not being able to resolve the problem efficiently. Both of these factors conspire toward premature closure.

Second, a greater level of communication skill may be required to explore symptoms that compete for physicians' time and attention during relatively brief office visits (56). Although visit time is partially under physician control, it is also subject to considerations of the health system, other personnel schedules, and lack of additional reimbursement for longer visits in some settings. Although the MUS visits were longer, they may not have been lengthened enough to accommodate the greater complexity of the consultation. Thus, physicians might benefit from training in agenda setting and organizing the visit in addition to training in self-awareness to recognize when they are tending toward premature closure as a result of cognitive overload or anxiety (57,58).

Third, attitudinal factors such as stigmatizing or discounting patients' concerns may have resulted in labeling the patients as "hypochondriacs"; at that point, physicians may have used communication moves to circumscribe, shorten, or terminate the visit. Future research using real (not standardized) patients, data on physician personality and response to ambiguity, and interpersonal process recall to understand physicians' cognitive processes could test the relative contributions of patients, physicians, the health system, and physician reimbursement to these miscommunications.

Prior results from this study showed positive correlations between increased patient-centered communication behaviors (MPCC component 1) observed in SPs and survey measures of patient trust conducted with real patients of the same physician (36). The current analysis suggest further study of whether physician responses, in addition to patient presentation (personality, mental disorders, communication style), contribute to decreased trust between patients with MUS and their physicians (1,27,31,59–61). Diminished trust may play a role in failure of physicians to reach common ground, mutual frustration, and doctor-shopping. Anxious patients who lack trust in their physicians may further amplify their symptoms in an attempt to regain the physician's attention; anxiety can also worsen the quality and severity of symptoms (22,62).

Study Limitations

Challenges in coding patient-centered communication, limitations of SP methodology, and the cross-sectional observational nature of this study all suggest caution in interpreting these results, which should be treated as preliminary, pending further verification.

Patient-centered communication is difficult to measure; our subsequent analyses suggest that it is not a single construct; even components of it may not be adequately operationalized

as a single scale (35). At the time of the study, the MPCC was the only available observational instrument based on a theory of PCC. In this and other analyses from this study (36), only component 1 scores were correlated with meaningful outcomes. Component 3 of the scale had lower interrater reliability and problems with face validity in that it does not explicitly correspond to theories of decision-making developed since the study was initiated (63). The null findings for component 3 of the MPCC may be ascribed to its poor psychometric properties.

The strengths of SP methodology are also its weaknesses. We created one MUS role from a heterogeneous spectrum of possible patient presentations. The choice of the SP roles may have induced or selected for certain specific types of physician behavior. Use of more SP visits would likely have produced higher reliability but would have made physician recruitment and retention very difficult. SPs are new patients; physicians' behavior with a new patient may not predict their subsequent behavior as the relationship develops over time (64). However, to have used audiotaped real patient visits could have introduced Hawthorne effects and suffered from physician–patient self-selection and accommodation to each other's interactional styles.

SP detection did not affect the results we report. In a post hoc analysis limited to only unsuspected visits, associations between MUS and component 1 were significant. Nonetheless, the relationship between MPCC scores and prompted suspicion approached statistical significance. This may reflect physicians who altered their behavior when the suspected that they were being observed, that more interpersonally sensitive physicians were more likely to pick up on elements of the visit that might distinguish an SP from a real patient, or that physicians who are likely to detect SPs tend to have closed practices as a result of their popularity with patients. Also, there is an inverse relationship between timing of the inquiry and the reported detection rate (65). We chose to inform physicians 2 days after the visit as a courtesy. However, the proximity of the prompt to the SP visit allowed the physician to choose from a small pool of recent patients that they might recall (availability bias). Data from the same physician pool from a more recent study in which the fax was sent 10 working days after the SP visit resulted in a meaningful detection rate of 12.8% (66). Other studies that report detection rates as low as 2% simply asked the physicians to contact study personnel if they suspected they had seen an SP and were never prompted (67).

We also could not adequately determine whether it was the number of concerns raised by the patient or the nature of symptoms that prompted differences in physicians' actions; however, the observation that the curves describing the relationship between MPCC and time were parallel for the MUS and GERD conditions provides some comfort that more time would not change underlying physician communication patterns.

The results apply only to those physicians selected into the study sample. Although the patients of enrolled and nonenrolled physicians appear to be similar, the physicians themselves, given their agreement to participate in a relatively intrusive study, are likely to exhibit some important differences from others in the community. Generalization to patients and primary care physicians outside the Rochester area cannot be guaranteed.

CONCLUSIONS

Within-physician variations in patient-centered communication cannot be ascribed solely to immutable physician and patient characteristics. This study adds to the growing literature that PCC also depends on clinical contexts such as patient activation, severity of illness, and specific patient symptom presentations. Physicians, facing lack of time, the anxiety of uncertainty, and frustrated patients, often retreat into physician-centered behavior that is likely to be counterproductive—they do not respond by inquiring further into the patient's experience of illness or validate the patient's distress; rather, they tend to truncate further exploration of the patient's concerns. Physicians, in general, are capable of learning PCC skills (68). Future research should examine whether changes in physician communication behaviors can improve mutual understanding, trust. and satisfaction, and reduce disability and healthcare costs associated with MUS.

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REFERENCES

1. Salmon P, Peters S, Stanley I. Patients' perceptions of medical explanations for somatisation disorders: qualitative analysis. BMJ 1999;318:372–6.
2. McWhinney IR, Epstein RM, Freeman TR. Rethinking somatization. Ann Intern Med 1997;126:747–50.
3. Smith GR Jr, Monson RA, Ray DC. Patients with multiple unexplained symptoms: their characteristics, functional health, and health care utilization. Arch Intern Med 1986;146:69–72.
4. Smith GR Jr. The course of somatization and its effects on utilization of health care resources [published erratum appears in Psychosomatics 1994;35:513]. Psychosomatics 1994;35:263–7.
5. Barsky AJ, Ettner SL, Horsky J, Bates DW. Resource utilization of patients with hypochondriacal health anxiety and somatization. Med Care 2001;39:705–15.
6. Zoccolillo M, Cloninger C. Somatization disorder: psychologic symptoms, social disability and diagnosis. Compr Psychiatry 1986;27:65–73.
7. Hahn SR. Physical symptoms and physician-experienced difficulty in the physician–patient relationship. Ann Intern Med 2001;134:897–904.
8. Bridges K, Goldberg D, Evans B, Sharpe T. Determinants of somatization in primary care. Psychol Med 1991;21:473–83.
9. Kroenke K, Price RK. Symptoms in the community. Prevalence, classification, and psychiatric comorbidity. Arch Intern Med 1993;153:2474–80.
10. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders: DSM-IV, Fourth ed. Washington, DC: American Psychiatric Association; 1994.
11. Barsky AJ, Ahern DK, Bailey ED, Delamater BA. Predictors of persistent palpitations and continued medical utilization. J Fam Pract 1996;42:465–72.

12. Connelly JE, Philbrick JT, Smith GR Jr, Kaiser DL, Wymer A. Health perceptions of primary care patients and the influence on health care utilization. Med Care 1989;27(suppl):S99–109.
13. Csordas TJ. Somatic modes of attention. Cultural Anthropology 1993;8: 135–56.
14. deGruy FV, Dickinson P, Dickinson L, Mullins H, Baker W, Blackmon D. The families of patients with somatization disorder. Fam Med 1989; 21:438–42.
15. Drossman DA, Talley NJ, Lesserman J, Olden KW, Barreiro MA. Sexual and physical abuse and gastrointestinal illness. Review and recommendations. Ann Intern Med 1995;123:782–94.
16. Epstein RM, Quill TE, McWhinney IR. Somatization reconsidered: Incorporating the patient's experience of illness. Arch Intern Med 1999; 159:215–22.
17. Fabrega H Jr. Somatization in cultural and historical perspective. In: Kirmayer LJ, Robbins JM, eds. Current Concepts of Somatization: Research and Clinical Perspectives. Washington, DC: American Psychiatric Press, Inc; 1991:181–99.
18. Gureje O, Simon GE. The natural history of somatization in primary care. Psychol Med 1999;29:669–76.
19. Katon W, Lin E, Von Korff M, Russo J, Lipscomb P, Bush T. Somatization: a spectrum of severity. Am J Psychiatry 1991;148:34–40.
20. Kirmayer LJ, Robbins JM. Three forms of somatization in primary care: prevalence, co-occurrence, and sociodemographic characteristics. J Nerv Ment Dis 1991;179:647–55.
21. Kirmayer LJ, Robbins JM. Patients who somatize in primary care: a longitudinal study of cognitive and social characteristics. Psychol Med 1996;26:937–51.
22. Kirmayer LJ, Young A. Culture and somatization: clinical, epidemiological, and ethnographic perspectives. Psychosom Med 1998;60:420–30.
23. McDaniel SH, Hepworth J, Doherty WJ. Somatizing patients and their families. In: McDaniel SH, Hepworth J, Doherty WJ, eds. Medical Family Therapy. New York: Basic Books; 1992:122–51.
24. Waitzkin H, Magana H. The black box in somatization: unexplained physical symptoms, culture, and narratives of trauma. Soc Sci Med 1997;45:811–25.
25. Elks ML. On the genesis of somatization disorder: the role of the medical profession. Med Hypotheses 1994;43:151–4.
26. Robbins JM, Kirmayer LJ, Cathebras P, Yaffe MJ, Dworkind M. Physician characteristics and the recognition of depression and anxiety in primary care. Med Care 1994;32:795–812.
27. Salmon P, Dowrick CF, Ring A, Humphris GM. Voiced but unheard agendas: qualitative analysis of the psychosocial cues that patients with unexplained symptoms present to general practitioners. Br J Gen Pract 2004;54:171–6.
28. Dowrick CF, Ring A, Humphris GM, Salmon P. Normalisation of unexplained symptoms by general practitioners: a functional typology. Br J Gen Pract 2004;54:165–70.
29. Gerrity M, White K. Physicians' reactions to uncertainty: refining the constructs and scales. Motivation and Emotion 1995;19:175–91.
30. Epstein RM, Franks P, Shields CG, Meldrum SC, Miller KN, Campbell TL, Fiscella K. Patient-centered communication and diagnostic testing. Ann Fam Med 2005;3:415–21.
31. Ring A, Dowrick C, Humphris G, Salmon P. Do patients with unexplained physical symptoms pressurise general practitioners for somatic treatment? A qualitative study. BMJ 2004;328:1057. Epub 2004 Mar 31.
32. Deyo RA. Cascade effects of medical technology. Annu Rev Public Health 2002;23:23–44.
33. Mold JW, Stein HF. The cascade effect in the clinical care of patients. N Engl J Med 1986;314:512–4.
34. Jordan JV. Relational development through mutual empathy. In: Bohart AC, Greenberg LS, eds. Empathy Reconsidered: New Directions in Psychotherapy. Washington, DC: American Psychological Association.; 1995:343–51.
35. Epstein RM, Franks P, Fiscella K, Shields CG, Meldrum SC, Kravitz RL, Duberstein PR. Measuring patient-centered communication in patient–physician consultations: theoretical and practical issues. Soc Sci Med 2005;61:1516–28.
36. Fiscella KM, Meldrum SM, Franks PM, Shields CGP, Duberstein PP, McDaniel SHP, Epstein RMM. Patient trust: is it related to patient-centered behavior of primary care physicians? Med Care 2004;42: 1049–55.
37. Levinson W, Dull VT, Roter DL, Chaumeton N, Frankel RM. Recruiting physicians for office-based research. Med Care 1998;36:934–7.
38. Krupat E, Bell RA, Kravitz RL, Thom D, Azari R. When physicians and patients think alike: patient-centered beliefs and their impact on satisfaction and trust. J Fam Pract 2001;50:1057–62.
39. Safran DG, Montgomery JE, Chang H, Murphy J, Rogers WH. Switching doctors: predictors of voluntary disenrollment from a primary physician's practice. J Fam Pract 2001;50:130–6.
40. Kroenke K, Spitzer RL, deGruy FV, Hahn SR, Linzer M, Williams JB, Brody D, Davies M. Multisomatoform disorder. An alternative to undifferentiated somatoform disorder for the somatizing patient in primary care. Arch Gen Psychiatry 1997;54:352–8.
41. Kirmayer LJ, Robbins JM, Dworkind M, Yaffe MJ. Somatization and the recognition of depression and anxiety in primary care. Am J Psychiatry 1993;150:734–41.
42. Baker LH, Lieberman D, Oehlke M. Psychological distress in patients with gastroesophageal reflux disease. Am J Gastroenterol 1995;90: 1797–803.
43. Hamilton J, Guthrie E, Creed F, Thompson D, Tomenson B, Bennett R, Moriarty K, Stephens W, Liston R. A randomized controlled trial of psychotherapy in patients with chronic functional dyspepsia. Gastroenterology 2000;119:661–9.
44. Brown JB, Stewart MA, Ryan BL. Assessing Communication Between Patients and Physicians: The Measure of Patient-Centered Communication (MPCC). Working Paper Series, Paper #95–2, 2nd ed. London, Ontario, Canada: Thames Valley Family Practice Research Unit and Centre for Studies in Family Medicine; 2001.
45. Stewart M, Brown JB, Donner A, McWhinney IR, Oates J, Weston WW, Jordan J. The impact of patient-centered care on outcomes. J Fam Pract 2000;49:796–804.
46. Hall JA, Irish JT, Roter DL, Ehrlich CM, Miller LH. Gender in medical encounters: an analysis of physician and patient communication in a primary care setting. Health Psychol 1994;13:384–92.
47. Roter DL, Stewart M, Putnam SM, Lipkin M Jr, Stiles W, Inui TS. Communication patterns of primary care physicians. JAMA 1997;277: 350–6.
48. Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR. Patient-centered communication, ratings of care, and concordance of patient and physician race. Ann Intern Med 2003;139:907–15.
49. Street RL Jr, Krupat E, Bell RA, Kravitz RL, Haidet P. Beliefs about control in the physician–patient relationship: effect on communication in medical encounters. J Gen Intern Med 2003;18:609–16.
50. Roter DL, Hall JA, Aoki Y. Physician gender effects in medical communication: a meta-analytic review. JAMA 2002;288:756–64.
51. Hall JA, Roter DL, Milburn MA, Daltroy LH. Patients' health as a predictor of physician and patient behavior in medical visits. A synthesis of four studies. Med Care 1996;34:1205–18.
52. Street RL. Communicative styles and adaptations in physician-parent consultations. Soc Sci Med 1992;34:1155–63.
53. Dugdale DC, Epstein R, Pantilat SZ. Time and the patient–physician relationship. J Gen Intern Med 1999;14(suppl 1):S34–40.
54. Levinson W, Roter DL, Mullooly JP, Dull VT, Frankel RM. Physician–patient communication. The relationship with malpractice claims among primary care physicians and surgeons. JAMA 1997;277:553–9.
55. Schmidt HG, Norman GR, Boshuizen HP. A cognitive perspective on medical expertise: theory and implication [published erratum appears in Acad Med 1992;67:287]. Acad Med 1990;65:611–21.
56. Jaen CR, Stange KC, Nutting PA. Competing demands of primary care: a model for the delivery of clinical preventive services. J Fam Pract 1994;38:166–71.
57. Mauksch LB, Hillenburg L, Robins L. The establishing focus protocol: training for collaborative agenda setting and time management in the medical review. Families, Systems and Health 2001;19:147–57.
58. Borrell-Carrio F, Epstein RM. Preventing errors in clinical practice: a call for self-awareness. Ann Fam Med 2004;2:310–6.
59. Peters S, Stanley I, Rose M, Salmon P. Patients with medically unexplained symptoms: sources of patients' authority and implications for demands on medical care. Soc Sci Med 1998;46:559–65.
60. Echlin D, Garden AS, Salmon P. Listening to patients with unexplained menstrual symptoms: what do they tell the gynaecologist? BJOG 2002; 109:1335–40.
61. Stanley IM, Peters S, Salmon P. A primary care perspective on prevailing assumptions about persistent medically unexplained physical symptoms. Int J Psychiatry Med 2002;32:125–40.
62. Robbins JM, Kirmayer LJ. Cognitive and social factors in somatization.

In: Kirmayer LJ, Robbins JM, eds. Current Concepts of Somatization: Research and Clinical Perspectives. Washington, DC: American Psychiatric Press; 1991.
63. Charles C, Gafni A, Whelan T. Decision-making in the physician–patient encounter: revisiting the shared treatment decision-making model. Soc Sci Med 1999;49:651–61.
64. Tamblyn RM, Abrahamowicz M, Berkson L, Dauphinee WD, Gayton DC, Grad RM, Isaac LM, Marrache M, McLeod PJ, Snell LS. First-visit bias in the measurement of clinical competence with standardized patients. Acad Med 1992;67(suppl):S22–4.
65. Franz CE, Epstein RM, Miller K, Brown A, Song J, Brown AFMD, Franks PK-R, Kravitz R. Prevalence, predictors, and consequences of physician detection of unannounced standardized patients. Health Serv Res. In press.
66. Kravitz RL, Epstein RM, Feldman MD, Franz CE, Azari R, Wilkes MS, Hinton L, Franks P. Influence of patients' requests for direct-to-consumer advertised antidepressants: a randomized controlled trial. JAMA 2005; 293:1995–2002.
67. Beullens J, Rethans JJ, Goedhuys J, Buntinx F. The use of standardized patients in research in general practice. Fam Pract 1997;14:58–62.
68. Lewin SA, Skea ZC, Entwistle V, Dick J, Zwarenstein M. Interventions for Providers to Promote a Patient-Centered Approach in Clinical Consultations, vol 4. Oxford: Update Software; 2001.

Managing Fall Prevention by Incorporating Chiropractic Approaches In-to Practice

Cheryl Hawk, DC, PhD

Integrating Chiropractic into Approaches to Fall Prevention in the Elderly

Cheryl Hawk, DC, PhD
Vice President of Research and Scholarship
Cleveland Chiropractic College
Kansas City and Los Angeles

Outline of this presentation

- Overview of chiropractic
- Evidence related to possible effects of manipulative care on balance
- Possible roles for chiropractic in fall prevention

What is chiropractic?

- Broadest definition is *a health care profession providing non-drug, non-surgical treatment of conditions related to the neuromusculoskeletal system*
- Concerned with the relationship of structure, chiefly the musculoskeletal system, to function, as mediated chiefly through the nervous system

Chiropractic health care model

- Emphasis on natural recuperative power of body
- Patient-centered, holistic
- Focus on relationship between structure and function
- Manual treatment plays central role

What do chiropractors do?

- Diagnosis
- Treatment
  - Primary therapeutic procedure: spinal manipulation
  - Secondary procedures
- Recommendations for self-care
- Referral/reports to other providers

Spinal manipulation: primary therapeutic approach of chiropractic

- DCs provide 94% of spinal manipulation in US (RAND 1992)
  - DCs use term "adjustment" to designate correction of areas of joint dysfunction
- Much variation in DCs' manipulative techniques (NBCE 2005)
  - Average of 6 techniques used
  - Most DCs use techniques with different amounts and applications of force

US DCs' manipulative techniques

- 72% use HVLA (Diversified)


Manipulative techniques used by >50% US DCs

- Activator (instrument-assisted, relatively low force)

- Cox Flexion/Distraction (table assisted, low velocity/ low force)

- Sacro-Occipital (very low force, using blocks to assist)

How many adjustments are needed?

- Treatment effects are considered additive, conceptually to "retrain" the body.
- Usually a series of adjustments required, with decreasing frequency, until stable.
- Mean number visits = 8; 40% < 5
  - Compare to mean = 4 for MD back pain care (Feuerstein 2004)
  - Few data available on factors influencing optimum frequency and duration.

Chiropractic training

- 17 accredited colleges in US
- 4-5 year professional education after undergraduate training (10 trimesters)
- Pre-doctoral internship (last program year)

Licensure

- Licensed in all 50 states
- National Board of Chiropractic Examiners
  - Parts I through IV
- State Board Examinations

Insurance coverage

- Majority of health and accident insurance plans
- Medicare
- Medicaid
- Workers' Compensation

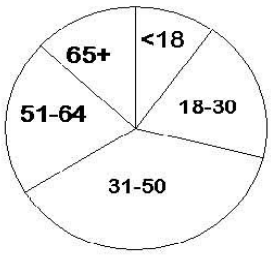
Use of chiropractic by U.S. adults

- 8-12% annual use (Barnes 2002; Hurwitz 2006)
- 90-99% involve musculoskeletal pain, usually spine-related back pain, neck pain and headache (Hurwitz 2006; Hawk 2000)

Who goes to chiropractors?

- Similar to the general population except for race (white)
- Also use medical care
- Chronic conditions
- Many seek *only* chiropractic care for mild to moderate musculoskeletal complaints
- 15-25% of visits: *health maintenance*

Age distribution of chiropractic patients*



* National Board of Chiropractic Examiners, 2005

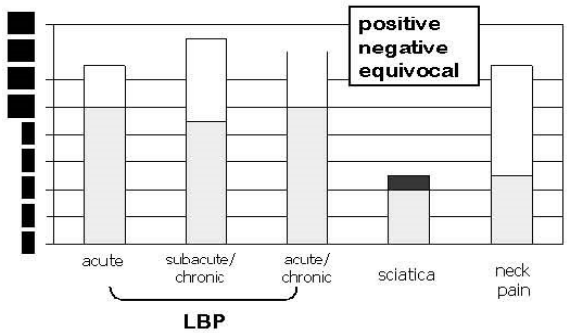
Does manual care have an effect on balance?

Summary of current evidence and possible future directions for research

Possible mechanisms

- Relieve chronic pain and stiffness
  - → Improved functional ability
- Relieve vertigo
- Effect on positional sense?
- Effect on neurological function/ proprioception?

Summary of RCTs for SMT of LBP & NP



Systematic review of chiropractic care for non-musculoskeletal conditions*

14 RCTs (manual procedures, not only chiropractic)

- asthma (3)
- hypertension (2)
- infantile colic (2)
- dysmenorrhea (1)
- vertigo (1)
- otitis media (1)
- nocturnal enuresis (1)
- pneumonia (1)
- phobia (1)
- jet lag (1)

*Hawk et al, JACM 2006. (179 papers on 50 conditions; 122 case reports/series, 47 exp. studies, 9 sys. rev, 1 cohort; through May 2005)

Cervicogenic vertigo

- Adverse events rare and not severe
- "Total package" of chiropractic care appears to provide benefit to patients with cervicogenic vertigo
  - 1 small RCT, 4 small experimental, 5 case reports/case series, 1 systematic review

Chiropractic and balance

- 6 small studies suggesting possible directions for research
  - Postural sway > in cervical OA patients
  - Sense of verticality may be impaired in neck pain patients
  - SMT may improve dizziness when neck pain or dysfunction present
  - SMT may improve balance in patients with impaired balance as assessed by functional measures like the Berg Balance Scale
    - Effect on stiffness/lower body strength?
    - Effect on dizziness/positional sense?

Cleveland Chiropractic Research Center Balance Study*

- 30 patients randomly assigned to:
  - 12 months of chiropractic care
  - 8 weeks of chiropractic care
  - Home exercise only
- 4 assessments; Berg Balance Scale primary outcome measure
- Eligibility
  - 65+
  - OLST < 5 sec.
  - no chiropractic care past 3 mo.

*funding: Foundation for Chiropractic Education & Research

How can chiropractors contribute to national fall prevention efforts?

Fall surveillance*

- Ask older adults about falls annually
- Patients with 1 fall
  - screen for balance and gait problems
  - refer as indicated
- Patients with > 1 fall or gait/balance problems should be screened for risk factors

* Guideline for the Prevention of Falls in Older Persons, AGS 2001

Risk factors for falls*

Modifiable Risk Factor	Mean RR/OR*
Muscle weakness	4.4
Gait deficit	2.9
Balance deficit	2.9
Visual deficit	2.5
Arthritis	2.4
Depression	2.2
Psychotropic meds	1.7

Risk increases dramatically with increase in RFs!

* Guideline for the Prevention of Falls in Older Persons, AGS 2001

Fall prevention interventions*

- Interventions should target RFs and may include:
  - Gait training
  - Balance exercises
  - Treatment of postural hypotension
  - Environmental hazard modification
  - Treatment of CV disorders
  - Review and modification of meds

* Guideline for the Prevention of Falls in Older Persons, AGS 2001

Integration of fall prevention into chiropractic practice

- Include fall RFs in intake form
  - Fall history
  - Medications
  - Depression screener
  - Fluid intake
- Assess fall RFs in exam
  - BP
  - Gait/balance (OLST; Get Up and Go Test)
  - Muscle strength
  - Joint dysfunction
- Provide appropriate intervention
  - Exercise instruction
  - Home hazard checklist
  - Chiropractic manipulation for joint dysfunction/chronic pain
  - Refer to other health professionals as needed
  - *Multiple visits provide opportunity to reinforce instructions*

Integration of chiropractic into national fall prevention efforts

- Develop relationships between nursing homes, assisted living and senior centers and local DCs or chiropractic colleges
  - DC intern rotations
  - Community service
  - Research projects
- Include DCs in fall surveillance efforts
- Develop interprofessional training programs for multiple health professions in fall prevention

Thank you for your attention!

Fall surveillance

Managing and Treating Poor balance with Exercise Regimens Designed for the Geriatric Patient

Yuhua Li, PhD

Tai Chi Exercise for Seniors

Improve balance & prevent falls

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Physical Activities/Exercise & Health

- Physical activities/exercises help seniors stay healthy.
- A life long program of exercise can play an important role in improving quality of life.

What Type of Exercise?

- One of the best exercises suitable for the elderly *Tai Chi*
  - Unique movement features
  - Great health benefits
  - Enjoyment
  - Memory
  - High exercise adherence
  - Low cost

- I Helped four local senior centers develop Tai Chi exercise program since 1995
- Teach Tai Chi at a local senior center
- One of my current research focuses is on Tai Chi exercise intervention for the elderly and arthritis patients

Tai Chi Exercise for Seniors

- What is Tai Chi?
- Why is Tai Chi exercise so popular?
- Health benefits of Tai Chi
- Research on Tai Chi exercise in improving balance and preventing falls
- Develop a successful Tai Chi exercise program
- Teaching Techniques
- Experience Tai Chi movements

I. What is Tai Chi?

- Tai – the universe
- Chi – the opposing energies or forces
- Tai Chi – the opposing energies or forces fill the universe.

- Tai Chi Chuan or Tai Chi exercise
  - a traditional form of Chinese martial arts.

Origin – Martial Arts

- Early Records – developed 400 years ago
- Different styles (Young, Chen, Sun, Wu …)
  - For exercise purpose and self-defense
  - Consists of a series of graceful movements that are slow, relaxed, gentle and continuous movements, coordinated with deep, even breathing and great but natural concentration

- 1956 – simplified form (24-form) to improve fitness and wellness for ordinary people
- Became a sport event in the 1990 XI Asian Games.
- 2000 – practiced all over the world
- The World Tai Chi Day – April 26, 2008

Philosophy

- The nature is governed by the principles of balance and harmony (b/t Yin & Yang).
- Human beings are not exception and thus need to follow these principles.

Chinese Medicine & Health

- Balance of Yin (cold) and Yang (hot)
- Qualitative analysis
- Individualized approach
- Overall perspective instead of localized perspective
  - Systems within the body are interrelated
  - Mind-body connection

II. Why is Tai Chi so popular?

- Low impact and alternative form of exercise
- An ideal exercise for people at all ages, especially for the elderly.
- Offers great physical and mental benefits
- Particularly, improving balance and preventing falls.

III. Research Evidence in General Health

- Physical Benefits
  - Reduce stress, reduce blood pressure
  - Improve circulation and ventilatory response
  - Enhance sensorimotor coordination
  - Improve balance
  - Increase strength and endurance
  - Positive influence on bone density

- Psychological Benefits
  - Enjoy the coordinated and rhythmic movements
  - Concentration and smooth breathing leads to relaxation
  - Foster a calm relaxed mental and emotional state
  - Enjoy each other's fellowship as much as the exercise

- Regular Tai Chi exercise offers great potential in recreation, preventive and therapeutic applications
- Wolf, et al., (1996) - provided scientific evidence that Tai Chi exercise was superior to other exercise format in terms of health benefits for the elderly (FICSIT).
- Reduced falls for the aging population.

IV. Research on Balance and Fall Prevention

Introduction

- Poor balance caused by aging results in increasing the risk of falls and fractures for people over age 65 (Perry, 1982)
- ~6% of the elderly population may incur major injuries from a fall and 1% may result in hip fractures (Gryfe, Amices, & Ashley, 1977)
- Estimated cost of injury from falls of older people in 1984 reached $3.7 billion (Berstein & Schur, 1990)

What Factors Contribute to Falls?

- Muscular Strength
- Bone Strength
- Vision problem
- Sensory-Motor Function Degradation
- Flexibility
- Balance Capability

Related Studies

- Tai-Chi Quan appears to offer great potential benefits in reducing incidences of falls for older population (Ross & Presswalla, 1998)
- A 15-week intervention of Tai-Chi exercise (Wolf, et al. 1996)
  - Reduction in risk of multiple falls by 47.5%
  - Decreases in fear of falling
  - Improved balance, thus reducing falls
  - Promoted confidence

- Static Balance (Schaller, 1996)
  - 10-week Tai Chi intervention resulted in significant improvement in static balance with eyes open
- Dynamic Balance (Yan, 1998)
  - 8-week Tai Chi intervention resulted in significant improvement in dynamic balance using a tabilometer

Proposed Questions

- Which specific neuromuscular system has been mostly impacted through Tai-Chi exercise?
- Was this observed benefit merely a short-term effect or a long-term effect?
- What about therapeutic applications?
- Two studies conducted during the past few years.

Study 1

Effects of Tai Chi Exercise on Balance and Selected Motor Functions

Purpose

- Examine the effects of a 6 and 12 month Tai-Chi exercise intervention upon selected neuromuscular functional performances for the elderly
  - Muscular strength and endurance
  - Flexibility
  - Reaction time
  - Balance abilities

Hypotheses

- The Tai-Chi exercise group would outperform the control group in test performance after a 6-month intervention
- The Tai-Chi exercise group would either maintain its higher performance level or continue to improve after a 12-month intervention

Subjects

- 47 senior volunteers recruited
- 20 subjects completed the study
- M=71.8 years old, SD=7.7
- 16 females, 4 males
- Tai-Chi exercise group (n=11)
- Control group (n=9)

Exercise Intervention

- The Tai-Chi exercise group participated in a Tai-Chi class for one hour a week for 12 months
- The control group had no exercise class, but were instructed to maintain their individual normal exercise activity level
- Questionnaires used to examine activity levels during the study

Procedures & Tests

- Tests were conducted before the intervention (0-month), six months into the intervention (6-month), and twelve months into the intervention (12-month)
  - Finger Choice Reaction Time
  - Lower Limb Muscular Strength and Endurance
  - Ankle Flexibility
  - Static Balance
  - Dynamic Balance
  - No significant differences were found between the two groups in the pre-test

Reaction Time (RT)

- Visual Choice Reaction Time Apparatus
- Measured four-choice RT using the index and middle fingers of both hands
- Responded to a light stimulus by pressing a key as quickly as possible
- 12 trials, each finger 3 times in a pre-determined random order

Lower Limb Muscular Strength & Endurance

- Modified Heel-Rise Test (Lunsford & Perry-1995)
- Subjects required to stand straight and raise their heels to the fullest height to the beat of a metronome
- The maximum number of raises was used for data analysis

Ankle Flexibility

- Leighton Flexometer
- Subjects sitting on the edge of a table, with knees bent at 90°
- Measured full range of motion from plantarflexion to dorsiflexion

Static Balance

- Timed single-foot stance without vision
- Longest time in seconds of two test trials for each foot was recorded
- Average time of both feet were used for data analysis

Dynamic Balance

- Heel-to-Toe Walking down a 10-foot strip of tape on the floor
- Shortest time of two trials was used for the data analysis

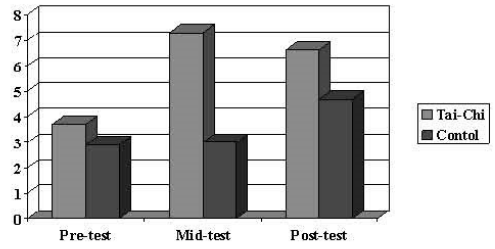
Data Analysis

- 2(group – Tai-Chi vs. Control) by 2(test – pre. vs. post) ANOVA with repeated measures on the second factor was used on all tests
  - Pre vs. 6 months
  - 6 vs. 12 months

Results

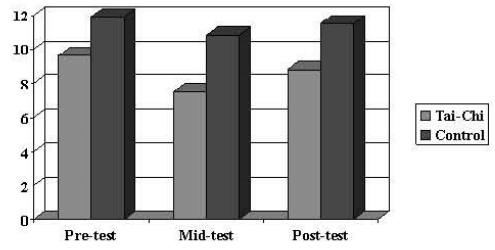
- Results indicated a significant interaction ($p<.05$) on static balance (single foot stance without vision) after the 6 month intervention.
- Tai-Chi group improved significantly after the 6-month intervention, but the control group did not.
- Static balance was maintained up to the end of the 12 month intervention

Static Balance (s)



- The Tai-Chi group was better than the control group in other test performances in general.
- No statistically significant differences between the two groups on the other tests

Dynamic Balance (s)



Discussion

- The data suggest that the observed benefits in static balance possibly attributed to the reinforcement in sensorimotor processing and integration through the unique format of Tai-Chi exercise
- This includes proprioceptive and vestibular systems that play important roles in balance control

- Moreover, the Tai Chi group maintained a higher level in the static balance performance at the end of the 12-month intervention, indicating the benefits on balance through Tai Chi exercise intervention is not limited to a short-term effect.
-
- No positive influence on muscle strength and ankle flexibility was found.

Study 2

Effects of Tai Chi on Gait and Functional Performances

for Individuals Who Have Had Total Hip Arthroplasty

Tai Chi's potential therapeutic effects

Purpose of the Study

To evaluate the effects of a 12-week Tai Chi exercise intervention on gait and functional performance for individuals after THA.

Method

- 12 subjects, age 65-90; 2~4 months after hip- replacement.
- Recommended by their surgeons.
- Screening process and exclusion criterion.
- Signed a consent form.
- Hip-replacement questionnaire and Activities-specific Balance Confidence (ABC) scale were completed.

Design & Procedures

- Assigned into 2 groups: Tai Chi (n = 6) and Control (n = 6).
- Residential locations and availability of transportation were considered.
- Post-surgery days were basically matched between subjects of the two groups (M=94 days).

Intervention:

- consisted of 2 one-hour sessions weekly, for 12-weeks.
- slow walking that focused on foot placement and proper weight shifting techniques from one limb to the other.
- learned and practiced 5 determined Tai Chi forms.

***Control*:**

- maintained normal daily activities.

Pre- & Post-Test

• Included gait analysis and 4 clinical performance tests.

I. Gait Analysis

- GAITRite gait analysis system
- Examined gait pattern when walking at various speeds:
  - 1. Normal (comfortable pace)
  - 2. Quick
  - 3. Backward
- Gait velocity, step-length, and single leg support time % were analyzed to examine gait efficiency.

II. Performance Test

Eight-foot up-and-go

- Assessed how quickly the subject could get out of a chair, walk eight feet and return to the chair.

Forward Reach

- Determined how far the subject could reach forward without losing his/her balance.
- 1 practice trial and 3 test trials

Single Leg Standing

- Measured static balance capability on a single leg with vision.
- All tests were conducted on unaffected side first and then on affected side.

Six-minute walk

- Measured the walking distance within six-minutes.

III. Subjects Self-report:

1. Hip Replacement questionnaire

   Provided subjective information regarding frequency of falls, activity level and demographic information.

2. ABC Scale

   Determined the subjects' confidence in performing various activities of daily living.

Data Analysis

- A 2 (group: Tai Chi, Control) X 2 (test: pre, post) ANOVA with repeated measures was used on all the dependent variables.
- An interaction between the groups and the test was expected.

No differences were expected between the two groups in the pre-test. A significant difference was predicted for the post-test.

Results

Gait Analysis:

1. *Step-length Ratio*

- ratio of affected/unaffected limb for each test trial was averaged for each of the 3 conditions (normal, quick and backward walk).
- A ratio of 1.0 is perfect for a balanced walking pattern. The closer the ratio to 1.0 the better the gait pattern.
- A significant test effect was revealed for Normal and Quick walking (ps< .05)

2. Single Leg Support time (%)

Ratio between the affected/unaffected limb during normal, quick, and backward walking was calculated and analyzed the same way as Step-length ratio.

No significant interaction was revealed for any of the 3 conditions.

3. Gait Velocity

Results revealed no significant interaction between the groups and the test.

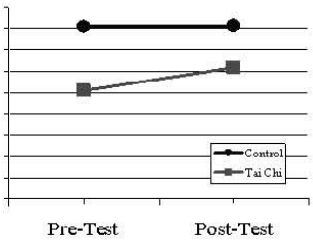
However, a significant group effect was revealed for Normal gait velocity ($p < .05$).

The control group was faster than the Tai Chi group for both pre- and post-test.

Clinical Tests:

- the best of the 3 test trials on all variables except 6-minute walk was used.
- no significant interaction was revealed among any of the variables.
- a significant test effect was revealed for 6-minute walk ($F(1,8) = 5.94$, $p < .05$)

Six-Minute Walk

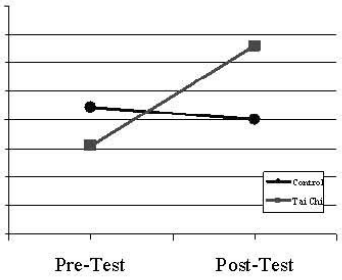


Single Leg Standing

- No statistical significance was revealed.
- An interesting tendency was found:

  In the pre-test, the control group stood for a longer period of time on both aff.& unaff. limbs compared to the Tai Chi group, but it was opposite in the post-test.

Affected Side



Unaffected Side

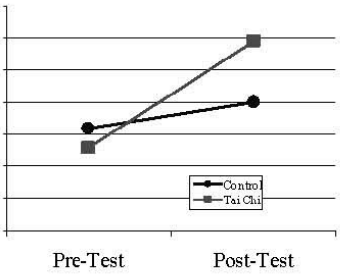


Table 1. Self-Report Data for Tai Chi & Control Groups

	Tai Chi (N = 6)		Control (N = 4)	
Variable	**Pre**	**Post**	**Pre**	**Post**
Incidence of Falls (group frequency)	3	0	3	2
Fear of Falling (M)*	3.33	2.17	2.25	2.50
Activity Level (M)*	2.0	2.0	2.75	2.25
ABC Scale (M)*	5.93	11.23	13.03	13.16

* : The higher the number the more fearful of falling, or the more active of life style, or the higher confidence level.

ABC Scale

- A significant interaction between Group and Test was revealed ($p < .05$). An improvement was revealed for all subjects from pre to post.
- The Tai Chi group made a significant improvement in the post-test, but no change for the control group.

Discussion

A consistent pattern was revealed on most of the dependent measures that the Tai Chi group has made a greater improvement after the intervention.

The data from subjective evaluation supported the observed tendency that Tai Chi group's confidence level in performing daily activities has significantly improved, but not the control group.

One patient reported a significant pain relief on non-effected side and cancelled the pre-scheduled surgery.

All subjects, except one was completely satisfied with the TC intervention program.

All TC subjects practiced TC at home and also felt that TC was beneficial in improving their overall health.

- It was speculated that the neural adaptation might have been been improved through Tai Chi exercise, instead of qualitative changes in muscles (Yue, et al. 1999).
- The results were not conclusive due to the small sample used in the study.

V. Develop a Quality Tai Chi Program

- It requires little equipment
- It is slow, controlled movement involving painless, low impact activities
- It suits to all age groups and abilities
- Qualified instructor to initiate the program
- Improve exercise adherence

VI. Ten Essentials of Tai Chi

- 1. Straightening the head
- 2. Correct position of chest and back
- 3. Relaxation of the waist
- 4. Solid and empty stance
- 5. Sinking of shoulders and elbows
- 6. Using the mind instead of force
- 7. Coordination of upper and lower parts

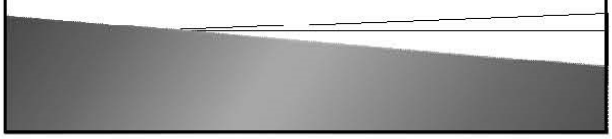
- 8. Harmony between the internal and external parts
- 9. Importance of continuity
- 10.Tranquillity in movement

· By Grant Master: Yang Chenfu

Other Considerations

- Qualified instructor (beginning)
- Suitable style
- Frequency and intensity
- Practice regularly
- Make modification to meet your needs
- Monitor your progress

Enjoy Tai Chi Exercise!



Promoting Patient Safety by Manipulating the Environment

Karen Frank Barney, PhD

Preventing Falls and Other Injuries in Older Adults:

Occupational Therapy Perspective

Karen F. Barney, PhD, OTR/L, FAOTA

Chairperson, Department of Occupational Science & Occupational Therapy

Doisy College of Health Sciences

Saint Louis University

Objectives

Participants will be able to:

- Describe the interaction of intrinsic, extrinsic, and occupational factors in contributing to falls and other injuries in older adults.
- Understand Universal Design principles as they particularly relate to older adults' ability to conduct their lives and prevent falls
- Note the specific environmental design attributes that support and hinder the functional / occupational performance of elders
- Describe Universal Design approaches that put elders at less risk for injury and that promote full participation in activities.
- Discuss the role of occupational therapy in injury prevention for older adults.

Theoretical Model: PEOP
How OT Views Humans and Injury Risk

Person
Who is this elder today and historically?

Occupational Performance/ Participation
What does this elder want / need to do; what are her/his priorities?

Environment
What is the context of what this elder wants to do?

Outcome Target (OT Intervention)
What will enable performance of the elder's priority activities to promote safety and support overall well being and quality of life?

Injury Prevention Role of Occupational Therapy

Assessment & Intervention Focus: Assess and reduce actual or potential hazards wherever possible

- Person: Evaluate abilities
  - Cognitive
  - Socio-emotional
  - Biomechanical (gross & fine motor skills)
  - Sensory (vision, hearing, etc.)
- Environment: Identify environmental hazards
  - Home
  - Work
  - Driving
  - Other
- Occupational History and Lifestyle Inventory
  - Occupational Performance Evaluation
  - Behaviors, habits, and routines

Person: Intrinsic Factors
Normal Age-Related Changes

- Physiological
- Cognitive
- Spiritual
- Neurobehavioral
- Psychological

Person: Intrinsic Factors
Normal Age-Related Changes

- Vision
- Hearing
- Olfaction
- Vestibular Functions
- Cognition
- Proprioception
- Coordination
- Systemic
- Musculoskeletal









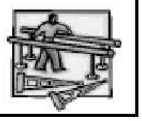
Environmental Factors

Environmental Features:
Extrinsic Factors

- Highways, roads, streets
- Landscaping
- Sidewalks, steps
- Building Entrances
- Interiors / Ambiance
  - Lighting
  - Flooring
  - Color choices
  - Hallways
  - Stairways
- Apt., Room, etc. Entrances
- Room Design
- Furniture
- Safety Considerations
  - Railings
  - Doors
  - Cabinets
  - Appliances
  - Fire, Carbon Monoxide Detectors
  - Toxic Substances
  - Air & Water Quality

Causes of Falls & Injuries

- Age-related decrements in vision, balance, or gait
- Chronic diseases, especially of sensory or musculoskeletal systems
- Medication side-effects
- Environmental design features and obstacles





Occupational Performance & Participation



Occupational Performance & Participation

ADL
IADL
Education
Work / Volunteering
Leisure
Social Participation

Occupational Performance & Participation

- Occupation
- Performance





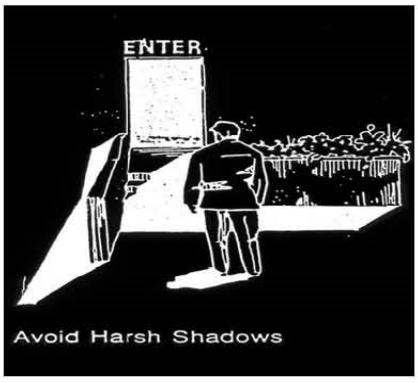

High Fall Risk Locations & Activities

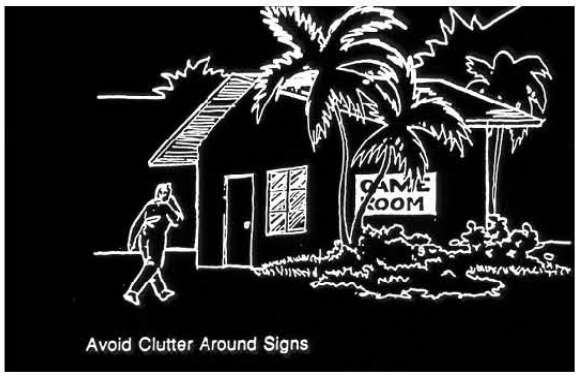
- Getting into or out of the bathtub or shower
- Standing at the sink
- Getting out of bed
- Rising from a chair
- Descending stairs
- Looking up to reach something on a shelf
- Climbing on a chair

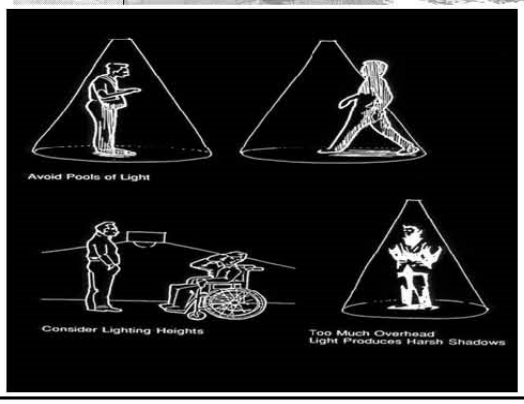
Related Older Adult Needs, Habits & Routines

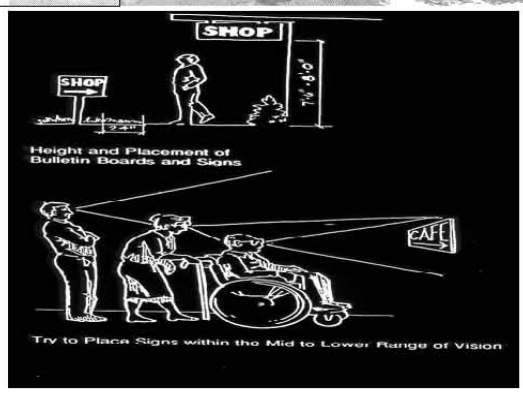
Older adults may experience increased safety challenges purely as a result of their chronic conditions, their environment, or everyday circumstances:

- Leave glasses or keys in another room and rush to retrieve them
- Ascend or descend stairs with arms full and limited field of vision (carried objects are too high)
- Distracted by loud noises, sudden movement by others, pets, etc.









Reception Desks

- Counter Height
- Seating
- Pathways
- Lighting

Apply Universal Design Principles

1. Equitable Use: The design is useful and marketable to people with diverse abilities

Guidelines

1. Provide the same means of use for all users: identical whenever possible; equivalent when not
2. Avoid segregating or stigmatizing users
3. Make provisions for privacy, security, and safety equally for all users
4. Make the design appealing to all users

Examples

- Power doors at entrances with sensors that are convenient for all users
- Integrated, dispersed, and adaptable seating in assembly areas such as sports arenas and theaters

Example of Equitable Use

Universal Design Principles

2. Flexibility in Use: The design accommodates a wide range of individual preferences and abilities.

Guidelines

1. Provide choice in methods of use.
2. Accommodate right- or left-handed access and use.
3. Facilitate the user's accuracy and precision.
4. Provide adaptability to the user's pace.

Examples

- Scissors designed for right- or left-handed users
- Automated teller machines (ATM) that have visual, tactile, and audible feedback, a tapered card opening, and a palm rest

Universal Design Principles

3. Simple and Intuitive Use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines

1. Eliminate unnecessary complexity.
2. Be consistent with user expectations and intuition.
3. Accommodate a wide range of literacy and language skills.
4. Arrange information consistent with its importance.
5. Provide effective prompting and feedback during and after task completion.

Examples

- A moving sidewalk or escalator in a public space
- An instruction manual with drawings and no text

Universal Design Principles

4. Ensure that Information is Perceptible: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines

1. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
2. Maximize legibility of essential information.
3. Enable easy instructions or directions.
4. Provide compatibility with a variety of techniques or devices used by persons with sensory limitations.

Examples

- Tactile, visual, and audible cues and instructions on a thermostat
- Redundant cueing (e.g. voice communications and signage) in elevators, airports, train stations, and subway cars

Universal Design Principles

5. Tolerance for Error: The design minimizes hazards and adverse consequences of accidental or unintended actions.

Guidelines

1. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
2. Provide warnings of hazards and errors.
3. Provide fail safe features.
4. Discourage unconscious action in tasks that require vigilance.

Examples

- A double cut car key easily inserted into a recessed keyhole in either of two ways
- An "undo" feature that allows the user to correct mistakes without penalty in computer software

Universal Design Principles

6. Low Physical Effort: The design can be used efficiently and comfortably, with a minimum of fatigue.

Guidelines

1. Allow user to maintain a neutral body position.
2. Use reasonable operating forces.
3. Minimize repetitive actions.
4. Minimize sustained physical effort.

Examples

- Lever or loop handles on doors and faucets
- Touch lamps operated without a switch

Example of Low Physical Effort

Universal Design Principles

7. Size and Space for Approach and Use: Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of user's body size, posture, or mobility.

Guidelines

1. Provide a clear line of sight to important elements for any seated or standing user.
2. Make reach to all components comfortable for any seated or standing user.
3. Accommodate variations in hand and grip size.
4. Provide adequate space for the use of assistive devices or personal assistance.

Examples

- Controls on the front and clear floor space around appliances, mailboxes, dumpsters, and other objects
- Wide gates that accommodate all users at metro, train, and subway stations

Poor Example of Low Size and Space for Approach and Use

Environment: Extrinsic Factors

Aging-Related Transitions Typically Occur

- Social Support
- Social & Economic Systems
- Culture & Values
- Built Environment & Technology
- Natural Environment

- Filtered background natural lighting
- Indirect overhead lighting
- Seating at table height for various activities

- Indirect lighting
- Objects within easy reach
- Obstacle free
- Counter tops

- **Easy reach:**
  - Upper shelves
  - Counter top
  - Lower: pull-out shelving
- **Indirect lighting**
- **Non-glare flooring**

Preventive Occupational Therapy Intervention Review

Assessment & Intervention Focus: Assess and reduce actual or potential hazards wherever possible

- Person: Evaluate abilities
  - Cognitive
  - Socio-emotional
  - Biomechanical (gross & fine motor skills)
  - Sensory (vision, hearing, etc.)
- Environment: Identify environmental hazards
  - Home
  - Work
  - Driving
  - Other
- Occupational History and Lifestyle Inventory
  - Occupational Performance Evaluation
  - Behaviors, habits, and routines

Management of Polypharmacy in Order to Reduce Fall Risk Management

Hedva Barenholtz Levy, PharmD

Managing Polypharmacy to Decrease Risk of Falls in Older Adults

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314-994-9409

Objectives

1. Summarize the impact of aging on medication use and adverse events.
2. List the medications and drug classes that have been implicated to increase fall risks in older adults.
3. Identify the mechanism by which a specific medication or class of medications is thought to impact falls.
4. Describe the role of vitamin D in fall prevention.
5. Discuss strategies for decreasing a patient's fall risk with regards to medication issues.

I. Background

A. It's in the Mnemonic

D = drugs
E = emotional
L = low 0_2 states
I = infection
R = retention (of urine, feces)
I = ictal status
U = undernutrition/hydration (postural hypotension)
M = metabolic (electrolytes, glucose…)
S = subdural (include neurological causes)

M = multifactorial, medical (acute & chronic), medicines, mental…
E = environmental, eyes, ears, ethanol
O = orthostatic hypotension, OUCH! (pain)
W = weakness of lower extremities

B. Falls and Older Adults (statistics)

1. 30-40% of older adults fall each year
   a. Rates increase with age (≥ 80 yo)
   b. Rates are 2-3x higher in hospitals, nursing homes

Barry et al. Curr Psych Rep 2008;10:37-43.
Hanlon JT et al. Top Geriatr Rehabil 1996;11:38-54.
Walker et al. Am J Health-syst Pharm 2005;62:249-55.
van der Velde et al. Brti J Clin Pharmacol 2007;63:232-7.

C. Medication use and aging

1. Polypharmacy definition
   a. The use of multiple prescriptions and over-the-counter medications."

Stewart RB, Drug use in the elderly. In: Therapeutics in the Elderly, 3rd edition, 2001.

b. "…[Polypharmacy] is not by itself an accurate measure of appropriateness of therapy, because older persons often have many conditions that require treatment." Merck Manual of Geriatrics, 2nd edition, 1995.

2. Disproportionate Use of Medications
   a. Seniors make up 15% of US population
   b. Consume 34% of all prescription drugs
   c. Consume 30% of all OTC products

3. Nonprescription and Herbal Use by Older Adults
   a. Nonprescription medications: 2 to 4 daily on average
   b. Herbals: 14-36% prevalence of use

Everitt, Arch Intern Med 1986;146:2393-6.
Slone Survey, JAMA 2002.
Martin, *Ann Pharmacother* 2003;36:1862-9.

4. Adverse Drug Events in Older Adults -- 3x more common in older adults (Hanlon et al. JAGS 1997;45:945-8.)

ADEs manifest as nonspecific symptoms
↓
Dizziness, weakness, confusion, instability
↓
↑ risk of falls

5. Chronic Illness and Older Adults
   a. **77% of seniors age 65-79 have ≥1 chronic disease state[1,2]**
   b. **85% of seniors >80 have ≥1 chronic disease state[1,2]**
   c. **20% of Medicare beneficiaries have 5 or more chronic conditions[3]**
      - 74% arthritis[1,2]
      - 54% hypertension[1,2]
      - 31% heart disease[1,2]
      - 35% incontinence[1,2]
      - 29% GI conditions[1,2]
      - 15% diabetes[1,2]

1. National Center for Health Statistics, 1999.
2. AHRQ, Medical Expenditure Panel Survey, 2000
3. IOM report: Retooling for an Aging America: building the healthcare workforce, 2008

II. Older Adults at Risk for Medication-related Problems – 4 factors
   A. Multiple Medications: Increased risk adverse reactions, interactions, $$, decreased adherence

   B. Multiple Physicians: 21% older adults see 2 physicians; 11% see 3 physicians; 11% see 4+ physicians
      (Am Society of Health-system Pharmacists Survey, News and Views, Oct. 2001)
      - Rx from 2 physicians → avg. 27 Rx/y
      - Rx from 5 physicians → avg. 42 Rx/y

Polypharmacy and Falls in Older Adults
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9/21/08

■Increased potential for drug errors for seniors
(Medco Health Solutions, press release. Pharm Today 2006:1-2.)

C. Pharmacokinetics: How the body handles a medication
**51% of preventable ADRs = due to inappropriate prescribing
>>Mostly related to not adjusting dose for age-related renal impairment
(McDonnell et al, *Ann Pharmacother* 2002;36:1331-6)

D. Pharmacodynamics: How a medication affects the patient (What the drug does in the body)
1. Overall: increased sensitivity to therapeutic and untoward effects with age
2. Elderly respond differently to many drugs than younger patients
3. Less is known about pharmacodynamic changes & aging

III. Medications Implicated in Fall Risks
- ☐Psychotropics
- ☐Cardiovascular agents
- ☐Analgesics
- ☐Anticonvulsants
- ☐"Other"

*Use of high-risk drugs more common in fallers than non-fallers
*Risk increases with use of multiple fall-risk drugs

A. Mechanisms of Fall Risk
1. Confusion, cognitive impairment
2. Drowsiness, sedation
3. Orthostatic hypotension
4. Dizziness
5. Impaired balance
6. Decreased alertness
7. Drug interactions
8. Medical conditions: urinary incontinence, arthritis, heart failure

B. Evidence for Medications: Psychotropics
1. Antidepressants: Odds ratio 1.66
   - ▪TCAs, SSRIs

Tricyclic antidepressants	**Selective serotonin reuptake inhibitors**
Amitriptyline (Elavil)	Citalopram (Celexa)
Desipramine (Norpramin)	Escitalopram (Lexapro)
Doxepin (Sinequan)	Fluoxetine (Prozac)
Nortriptyline (Pamelor)	Paroxetine (Paxil)
	Sertraline (Zoloft)

2. Sedative/hypnotics, anxiolytics: Odds ratio 1.41
   - BZDs, nonBZDs (Ambien®, Sonata®)
   - ↑ risk with higher dosages, age >80

Benzodiazepines		**Nonbenzodiazepines**
Alprazolam (Xanax)	*Long-acting:*	Eszoplicone (Lunesta)
Lorazepam (Ativan)	Chlordiazepoxide	Zolpidem (Ambien)
Oxazepam (Serax)	(Librium)	Zaleplon (Sonata)
Estazolam (ProSom)	Diazepam (Valium)	
Triazolam (Halcion)		

3. Antipsychotics: Odds ratio 1.51
   - Traditional, atypical

Atypical antipsychotics	**Traditional antipsychotics**
Aripiprazole (Abilify)	Chlorpromazine (Thorazine)
Olanzapine (Zyprexa)	Haloperidol (Haldol)
Quietapine (Seroquel)	Perphenazine (Trilafon)
Risperidone (Risperdal)	Thioridazine (Mellaril)
Ziprasidone (Geodon)	Thiothixine (Navane)

4. Polypharmacy with ≥ 3 psychotropics, OR 4.92

Leipzig et al., JAGS 1999;47:30-9.
Ensrud KE, et al., JAGS 2002;50:1629-37.
Souchet et al. Pharmacoepidemiol Drug Saf 2005;14:11-6.

C. Evidence for Medications: Cardiovascular drugs
   1. Diuretics (dehydration, orthostasis) – OR 1.08
   2. Nitrates -- OR 1.49 for 1 or more falls
   3. Antihypertensives (orthostatic hypotension)
      - Data are inconsistent; increased risk with combination therapy
      - Beta-blockers, clonidine, hydralazine
      - ACE inhibitors, angiotensin receptor blockers, calcium channel blockers (NS differences)
      - Beta-blocker *eye drops* (Arch Ophthalmol 1991;109:205-10. BMJ 2006;332:960-1.)
   4. Antiarrhythmics, class IA – OR 1.22
      - Data are inconsistent; increased risk with combination therapy
      - Quinidine, procainamide, disopyramide: >>hypotension, anticholinergic effects

Leipzig et al., JAGS 1999;47:40-50.
Lee JSW, et al. Age Ageing 2006:35:246-51.
Bulat T, et al., J Am Acad Nurs Pract 2008;20:55-62.

D. Evidence for Medications: NSAIDs, opioids, propoxyphene
   1. NSAIDs : 10x increased risk in hospitalized elderly

(Walker et al, AJHP 2005;62:249-55)

>>Adverse CNS effects include dizziness, drowsiness, confusion, vision impairment in elderly

2. Opioids
   - Data inconsistent; some studies show no relation
   - Odds ratio 1.68 for injurious falls (2003)
   - Hazard ratio 2.25 for hip fracture risk vs. nonusers (2006).
3. Propoxyphene (Darvocet®): Hazard ratio 2.05 for hip fracture risk vs. nonusers.
   - Dose-related effect

Am J Geriatr Pharmacother 2006;4:219-26. Kelly KD, et al. Age Aging 2003;32:503-9.

E. Evidence for Medications: anticonvulsants
1. Mechanism of fall risk: risk of balance disorders; dizziness, sedation
2. Odds ratio 1.51 (agents not specified)

Kelly KD, et al. Age Aging 2003;32:503-9.

3. Odds ratio 1.75 (phenytoin, PB, CBZ, other)

Ensrud KE, et al., JAGS 2002;50:1629-37.

4. 1st Generation Agents
   - phenytoin, phenobarbital
   - Long-term use interferes with vitamin D metabolism
5. 2nd Generation Agents:
   - Oxcarbazepine (Trileptal®), topiramate (Topamax®) associated with increased imbalance risk
   - Less risk with gabapentin (Neurontin®), levitiracetam (Keppra®)

F. Evidence for Medications: *"other"*
1. Bladder relaxants; most data for oxybutynin (Ditropan®), tolterodine (Detrol®)
   - No study evaluated falls as outcome
   - Side effect concerns: CNS adverse events, anticholinergic effects
     - Blurred vision, dry mouth, dry eyes, constipation, difficulty urinating
     - Confusion, impaired cognition
     - Disturbed coordination, muscular weakness

Bulat T, et al. J Am Acad Nurse Pract 2008;20:181-90.

2. Traditional antihistamines, e.g., diphenhydramine
   - Sedation, anticholinergic effects
3. Antispasmodics (Levsin®, e.g.), anti-Parkinson agents, muscle relaxants…

Ancelin ML et al. BMJ 2006;332(7539):455-9.

4. Alcohol
   - Limited studies available; combined with sedative use ↑es fall risk

Stenbacka M, et al. Alcohol 2002;28:9-16.

5. Diabetes medications? Lee JSW et al. Age Ageing 2006;35:246-51

Polypharmacy and Falls in Older Adults
Barenholtz Levy
9/21/08

IV. Interventional Studies

A. Multifaceted approach that includes medication adjustment

a. Decreased # falls in residential care facility; mild cognitive impairment. Adjusted OR = 0.49

Jensen. Ann Intern Med 2002;136-733-41

b. Decreased # falls in community dwelling elderly. Adjusted risk reduction = 0.76 Tinetti. NEJM 1994;331:821-7

B. Medication-focused interventions – 2007 studies (Netherlands; prospective cohort; patients with previous fall) n=139

1. Withdrawal (or decrease dose) of fall-risk increasing drugs
2. 2-month follow-up
3. Reduced falls in withdrawal group
   - 23% vs 31% in group with no drug changes
   - Greatest effect seen with cardiovascular drugs
   - CVS benefit related to improvement in OH

Van der Velde et al. Brit J Clin Pharmacol 2007;63:232-7
Van der Velde et al. JAGS 2007;55:734-9.

C. Fall-focused pharmacist intervention

- Rehab setting; before and after design
- Recommendations written for physician, DON
- Fall rate decreased from 15% to 8%
- Also saw decreased use of risk medicines

Haumschild. Am J Health-syst Pharm 2003;60:1029

D. Clinician-focused Education

a. Physicians, nurse practitioners, OTs, PTs in geographic area encouraged to make interventions (change clinical practice) to ↓ fall risk
b. Medication reduction, gait training, balance
c. Two 3-y periods used as before-after comparison
d. Rate of fall-related injuries reduced >>Adjusted OR 0.91 Tinetti. NEJM 2008;359:252-61.

V. Strategies to Reduce Polypharmacy and Fall Risk

A. Medications

1. Medication review
   i. Obtain good medication history; include OTC, herbals, vitamins
   ii. Decrease dose, gradual discontinuation of fall-risk medications
   iii. Watch for excessive dosing in older adults

2. Monitor medication therapy
   i. Monitor blood pressure, fluid status for OH; glucose control
   ii. Evaluate effectiveness and risk/benefit -- pain relief, incontinence episodes, etc.

3. Are all medicines necessary?
   i. Are medicines effective?
   ii. Consider expected benefit vs. risk of side effects
   iii. Consider time to onset of benefit
   iv. Switch to alternative agent

4. Maximize non-drug strategies: sleep hygiene; diet & exercise; treat underlying cause (e.g., with insomnia)

B. Incorporate multifaceted approach
   1. Educate patient, e.g., rise slowly from seated position, avoid mixing alcohol with medicines, know and watch for side effects (e.g. dizziness, fatigue, weakness…)
   2. Consult pharmacist when choosing OTC, herbal
   3. Address environmental factors
   4. Exercise, improve balance

C. Minimize fall-related injury: osteoporosis therapy and bone health
   1. Adequate calcium & vitamin D; evaluate vitamin D status
   2. Osteoporosis drug therapy
   3. Role of Vitamin D: Low levels associated with muscle weakness
      Fosnight et al. Pharmacotherapy 2008;28:225-34.
      a. Prevalence of vitamin D deficiency or insufficiency: 5-25% of ambulatory elderly; 48-80% of institutionalized elderly
         Johnson KA et al. Clin Geriatr Med 2002;18:773-99.
      b. Vitamin D metabolism (via skin & sunlight=major; via food = minor)
         - 25-OH-vitamin D converted to 1,25-OH-vitamin D
         - Monitor levels of 25-OH-vitamin D in most cases
      c. Risk factors for vitamin D Deficiency: Age, decreased kidney function, long-term use of anticonvulsants, obesity, decreased exposure to sunlight
      d. Vitamin D Studies: Supplemental vitamin D decreases risk of falls
         i. …By 22% (meta-analysis of 5 studies)
            Bischoff-Ferrari. JAMA 2004;291:1999-2006.
         ii. …By 46% in ambulatory females; 65% in less active subgroup (no benefit seen in men)
            Bischoff-Ferrari. Arch Intern Med 2006;166:424-30.
         iii. …By 19% in elderly with previous fall residing in sunny climate (vs. calcium alone) Prince. Arch Intern Med 2008;168:103-8.
      e. Vitamin D Mechanism
         - Vitamin D binds receptors in muscle tissue, leads to protein synthesis and growth of muscle cells
         - Improves balance, gait, strength
         - >500 mg calcium intake necessary, too
      f. Dosage
         - RDA 600 units per day for elderly (>70 y.o.)

- National Osteoporosis Foundation 800 to 1000 units/day
- Growing number of experts recommending 1000 to 2000 units/day for chronic disease prevention
- ***Cholecalciferol*** = vitamin D3 preferred

g. Vitamin D supplementation
- High-risk patients, i.e., reduced sun exposure, elderly (decreased skin synthesis), dark skin, diet low in vitamin D-rich foods, renal dysfunction
- Screen patients for 25(0H)D levels vs. supplement all at-risk persons?
- If 25(OH)D < 30 ng/mL
  >>Optimal 25(OH)D controversial: Consensus suggests ≥32 ng/mL
  >>Baseline calcium supplement (500-1000 mg/d)

VI. Summary and Conclusions
- Older adults are at risk for medication-related problems
- Many medications considered "risk medications"
  - CNS, cardiovascular side effects
  - Look beyond psychotropics
  - Consider the drug's mechanism for increased fall risk
- Medication review is key component!
- Minimize or eliminate fall-risk medications
  - Weigh benefit vs. risk
  - Educate patient
- Remember vitamin D and calcium

Using the Interdisciplinary Team to Manage Fall Risk in Elderly Patients

Joseph H. Flaherty, MD

Disclosures/Disclaimers

1. None

Falls: Objectives

A. Gain knowledge of how common falls are among older persons (i.e. epidemiology, the "So what?")
B. Key components of H & P for those at risk of falls, and for fallers
C. Gait & Balance

Falls: Objectives

D. Key interventions to prevent falls and/or fall injuries
E. Identify ALL potential causes/risk factors for a person who has fallen
   - Case based

Falls: Common and Consequential

1/3 1/2 1/20

- ~1/3 of community-dwellers >75 fall/year
- ~1/2 of fallers fall repeatedly
- ~1 in 20 community-dwelling fallers fracture (~1/6 NH residents)

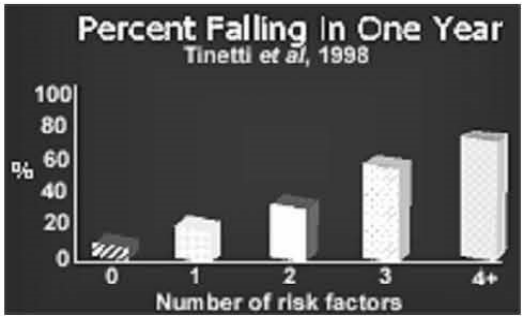
SLU1

Falls: Common and Consequential

MORTALITY

- US: Injury = 6th leading cause of death (age >65) (falls = 2/3 these injuries)
- US: Hip Fractures = 15% hospital mortality, 33% one year mortality
- Australia: Accidental falls = 2% all deaths >65

SLU2



SLU5

Identifying Risk Factors and Causes of Falls

–Multifactorial problem
–Evaluate multiple areas
–Multiple interventions

A 84 year old retired high school teacher with a history of tonic-clonic seizures since age 70 (last seizure was 4 years ago when she decided to stop all her meds), hypertension, OA (mainly hands, knees R>L) and insomnia.

Her family is worried because she was admitted to the hospital after being found down at home and "they didn't find anything except a urine infection." Since being home (2 weeks) she has fallen twice. She says, "I just fall." No LOC, but admits to "dizziness…yes, well, kind of, but also I just feel unsteady."

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- diltiazem
- furosemide
- lorazepam
- amitriptyline
- Tylenol-PM,
- famotidine
- calcium
- colace

Exam: Frail appearing, having lost 6 pounds since hospitalization (ht 5'3", wt 106#); SBP drops 25 mmHg from a supine to a standing position, pulse increases from 68 to 80. "Puffy" ankles. MMSE is 22/30 (she is a college graduate).

A G A I N **I' V E** **F A L L E N**

Risk Factors & Causes of Falls
....
in a 15 minute office visit

A G A I N **I' V E** **F A L L E N**

Risk Factors & Causes of Falls
=> find them
=> fix them
=> or get rid of them

AGAIN I'VE FALLEN

Again….If you fall once,…

AGAIN I'VE FALLEN

Again….If you fall once,…

AGAIN I'VE FALLEN

Gait & Balance

Evaluation:

AGAIN I'VE FALLEN

Gait & Balance

Evaluation:

"Get up and go"

1-leg stand (RR 2.13 for injurious falls)

Tandem or near-tandem

AGAIN I'VE FALLEN

ADL impairment (function)

The Hospital is a

DANGEROUS

Place

Creditor, Ann Int Med, 1993

Change in ADL Function *during* Hospitalization

Decline N=320	Same N=656	Improve N=96	Total N=1072
31%	59%	10%	100%

1279 Community dwelling older persons (>70); 5 hospitals; Acute medical illnesses *OUTCOMES:* Change in Function during hospitalization & Function at 3 months after hospitalization Sager: Arch Intern Med, Volume 156(6),March 25, 1996,645-652

Change in ADL Function *3 Months AFTER* Hospitalization

	Decline 31% N=320	Same 59% N=656	Improve 10% N=96	Total 100% 1072
3 months	⇩	⇩	⇩	⇩
Decline	130 (41%)	56 (9%)	22 (23%)	208 (19%)
Same	157 (49%)	573 (87%)	15 (16%)	745 (70%)
Improve	33 (10%)	27 (4%)	59 (61%)	119 (11%)

"Bedrest is for Dead People"

A G A I N *Illness (acute)*

I' V E

Up to 1 out of 3 patients

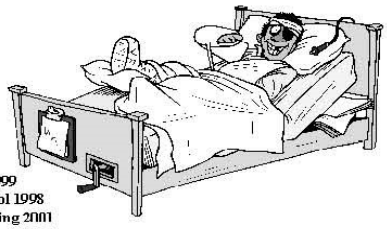
F A L L E N

Fall is a DELIRIUM equivalent

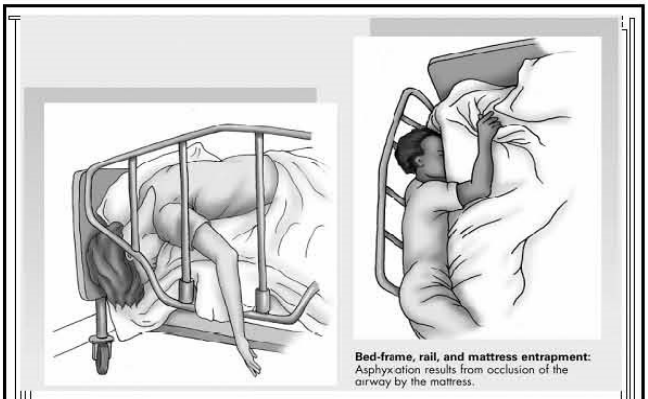
SLU8

Restraints?

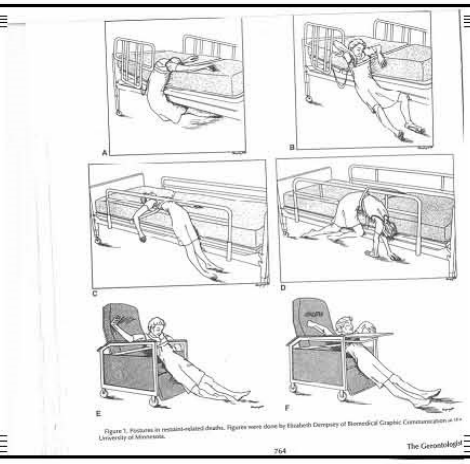
- More harm than "protection"



Neufeld RR, et al. JAGS 1999
Capezuti E, et al. J Gerontol 1998
Dunn KS. J Gerontol Nursing 2001
Powell C, et al. Can Med Ass J 1989



Bed-frame, rail, and mattress entrapment: Asphyxiation results from occlusion of the airway by the mattress.



764 The Gerontologist

AGAIN I'VE FALLEN

Number & Type of Drug

≥4 of any type is a risk factor.

Type of Drug

Type	Pooled odds ratio (95% confidence interval)
Any psychotropic use	1.73 (1.52-1.97)
Neuroleptics (outpatient use)	1.66 (1.38-2.00)
Sedative/hypnotics	1.54 (1.40-1.70)
Any antidepressant	1.66 (1.4-1.95)
Benzodiazepines	1.48 (1.23-1.77)

Leipzig RM, et al. J Am Geriatr Soc 47:30-39, 1999

Notes: **Psychotropic medication** data from meta-analysis, 40 studies, none randomized.
-Groups: age <75 v ≥75, fallers <35% v ≥35% = did not affect pooled OR.
-Increased falls in patients on 2 or more psychotropic
-No difference between long and short acting benzodiazepines

Type of Drug

Type	Pooled odds ratio (95% confidence interval)
Type Ia antiarrhythmics	1.59 (1.02-2.48)
Digoxin	1.22 (1.05-1.42)
Thiazide diuretic	1.06 (0.97-1.16)
Loop diuretic	0.90 (0.73-1.12)
B-blockers	0.93 (0.77-1.11)
Centrally acting antihypertensives	1.16 (0.87-1.55)
ACE inhibitors	1.20 (0.92-1.58)
Calcium channel blockers	0.94 (0.77-1.14)
Nitrates	1.13 (0.95-1.36)
Narcotics	0.97 (0.78-1.20)

Leipzig RM, et al J Am Geriatr Soc 47:40-50, 1999
Cardiac and analgesic medication data from meta-analysis, 29 studies, none randomized.

Type of Drug: Risk for hip fracture

Type	
SSRI's	2.4 (2.0-2.7)
TCA's (secondary-amine)	2.2 (1.8-2.8)
TCA's (tertiary amines)	1.5 (1.3-1.7)

Case-control study, n=8239, age >65, admitted to hospital for hip fracture.
Liu B. et al. Use of SSRI's and TCA's and risk of hip fractures in elderly people. Lancet 351: 1303-7, 1998
With adjustment for potential confounding effects by concomitant drug use and comorbidity, adjusted OR for hip fracture.

AGAIN I'VE FALLEN

In addition to Fall as a DELIRIUM equivalent, Dementia is a risk factor for falls.

Impaired Cognition

	Tinetti, 1986 n=79	Tinetti, 1988 N=272
RR	2.0	2.3

AGAIN I'VE FALLEN

Vestibular dysfunction

Possible age related decline in balance due to accumulation of minute calciferous granules within the stratoconic membrane

Meds leading to vest. Dysfunction (AGs, Aspirin, furosemide, alcohol)

Tinetti ME, et al. NEJM 1989

AGAIN I'VE FALLEN

Eyes and Ears

Age-related changes:
- visual acuity
- adaptation to dark
- peripheral vision
- contrast sensitivity
- accomodation

Common disorders:
- Cataracts
- Macular Degeneration
- Glaucoma

One of the most common reason for hearing deficit in NH→ Cerumen

AGAIN I'VE FALLEN

Feet

- Calluses
- Bunions
- Poor fitting shoes
- Thick or long toe nails

AGAIN I'VE FALLEN

Alcohol

AGAIN I'VE FALLEN

One of the strongest RR for falls

	Tinetti, 1986 n=79	Robbins, 1989 N=149	Lipschitz, 1991 N=126	Tinetti, 1988 N=272
RR	5.4	8.4	4.9	2.4

Lower extremity weakness

SLU10

AGAIN I'VE FALLEN

Lipsitz LA. Syncope in the eldlerly. Ann Intrern Med 1983 (Postprandial hypotension)

	Tinetti, 1986 n=79	Lipschitz, 1991 N=126	Tinetti, 1988 N=272
RR	3.4	NS	NS

Low blood pressure (or OH)

A
G
A
I
N

I′
V
E

F
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L
L
E *Environment*
N

A
G
A
I
N

I′
V
E

F
A
L
L
E
N *Neurological*

A Again
G Gait & Balance
A ADL impairment
I Impaired cognition
N Number and Type of Meds

I′ Illness (Acute)
V Vestibular function
E Eyes, Ears

F Feet
A Alcohol
L Lower extremity weakness
L Low blood pressure (or OH)
E Environment
N Neurological

A 84 year old retired high school teacher with a history of tonic-clonic seizures since age 70 (last seizure was 4 years ago when she decided to stop all her meds), hypertension, OA (mainly hands, knees R>L) and insomnia.

Her family is worried because she was admitted to the hospital after being found down at home and "they didn't find anything except a urine infection." Since being home (2 weeks) she has fallen twice. She says, "I just fall." No LOC, but admits to "dizziness…yes, well, kind of, but also I just feel unsteady."

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Medications
- phenytoin
- diltiazem
- furosemide
- lorazepam
- amitriptlyine
- Tylenol-PM,
- famotidine
- calcium
- colace

Exam: Frail appearing, having lost 6 pounds since hospitalization (ht 5'3", wt 106#); SBP drops 25 mmHg from a supine to a standing position, pulse increases from 68 to 80. "Puffy" ankles. MMSE is 22/30 (she is a college graduate).

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A *Again*
G *Gait & Balance*
A *ADL impairment*
I *Impaired cognition*
N *Number and Type of Meds*

I *Illness (Acute)* ?
V *Vestibular function*
E *Eyes, Ears*

F *Feet*
A *Alcohol*
L *Lower extremity weakness*
L *Low blood pressure (or OH)*
E *Environment* ?
N *Neurological*

SLU11

Identifying Risk Factors and Causes of Falls

- Can we prevent falls?
- Can we prevent fall related injuries?

SLU13

Identifying Risk Factors and Causes of Falls

- Can we prevent falls?
- Can we prevent fall related injuries?

YES, YES

Intervention: MultiD, multifactorial, health/environmental risk factor screening/intervention programs

# Trials	N	Population	RR (CI)
4	1,651	Unselected	.73 (.63-.85)
5	1,176	H/o falls or fall risk factor	.86 (.76-.98)
1	439	Residential care facilities	.60 (.5-.73)

Intervention: Muscle strengthening and balance retraining*

# Trials	N	Population	RR (CI)
3	566	Community	.80 (.66-.98)

*individually prescribed at home by trained professional

Intervention: Tai Chi (15 Weeks)

# Trials	N	Population	RR (CI)
1	200	Community	.51 (.36-.73)

Intervention: Home Hazard assessment and modification

# Trials	N	Population	RR (CI)
3	374	H/o falls	.66 (.54-.81)

Individually prescribed at home by trained occupational

Intervention: Withdrawal of Psychotropic Medications

# Trials	N	Population	RR (CI)
1	93	Community	.34 (.16-.74)

BMJ British Medical Journal

◆ Preceded by: British Medical Journal (ISSN: 0007-1447)

Volume 326(7380) 11 January 2003 p 76

Effect on hip fractures of increased use of hip protectors in nursing homes: cluster randomised controlled trial

Meyer G, Warnke A, Bender R, Mühlhauser I

University of Hamburg, Hamburg, Germany,

JAMA

The Journal of the American Medical Association

Volume 289(15) 16 April 2003 p 1957–1962

Prevention of Hip Fractures by External Hip Protectors: A Randomized Controlled Trial

van Schoor, Natasja M. MSc; Smit, Johannes H. PhD; Twisk, Jos W. R. PhD; Bouter, Lex M. PhD; Lips, Paul MD, PhD

They work if you wear them……

Chan 2000, Ekman 1997, Harada 2001 and Lauritzen 1993

No hip fractures occurred in those who fell while wearing the protectors

Jantti 1996, Cameron 2001, Birks 2004

One fracture in each study (one: pants being too large and the pads slipping out of place; one: protector not properly applied; one: person fell backwards).

Kannus 2000 and van Schoor 2003

Each reported that four hip fractures occurred whilst protectors were being worn.

Interventions

A Again	Target
G Gait & Balance	PT/exercises if eval +
A ADL impairment	OT
I Impaired cognition	Dementia (+/- delirium) w/u
N Number and Type of Meds	Stop diltiazem, furosemide, lorazepam, amitriptyline, Tyl-PM, famotidine, ?colace
I Illness (Acute) ?	Consider acute illness (e.g. delirium)
V Vestibular function	
E Eyes, Ears	
F Feet	
A Alcohol	
L Lower extremity weakness	Strengthening ex. If eval +
L Low blood pressure (or OH)	Stop meds as above
E Environment ?	Home OT eval; hip protectors
N Neurological	

Let's do some exercises (cases)

A 68 year old salesman with a history of hypertension and COPD is referred to you, the neurologist, for evaluation of possible Parkinson's disease. The patient says he has had a tremor in his hands for a long time but his doctor is worried because his walking is not normal and he has fallen twice in the past six months. The tremor usually gets better after lunch time. He can't really remember how he fell but both times were at home. His social history is significant for smoking (half a pack a day) and he drinks alcohol at lunch and dinner "well I'm a salesman you know." He takes diltiazem, furosemide, valium, albuterol and ipatroprium inhalers, and Tylenol-PM. On exam, his systolic blood pressure drops 25 mmHg from a supine to a standing position, and his pulse increases from 68 to 80. The only abnormalities on his exam are his tremor (which occurs when he tries to do something with his hands) and his MMSE which is 20/30 (he is a college graduate).

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A 72 year old retired secretary with a history of atrial fibrillation comes to your clinic unexpectedly on Monday morning. As she points to her black eye, she says "I want the doctor to look at me. I fell down in my apartment over the weekend." She denies any previous falls, and denies any loss of consciousness, dizziness, or chest pain. She does tell you she has been urinating a lot lately, but denies dysuria, and says "oh, it's just because I've been drinking a lot of soda." She takes digoxin, aspirin and no over the counter medications. On exam, she is not orthostatic. Her heart exam reveals an irregular rhythm but the rate is controlled at 72. She walks with a walker which is not new. Although her gait and balance and lower extremity strength exam are not normal, they are no different than a few weeks ago at her last visit. When you go to examine her feet, she takes off her shoes and a paper clip drops out of one of them. She says, "That didn't come out of my shoe did it?" Her MMSE is 28/30 and GDS is 5/30.

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An 83 year old patient of yours just got home from the hospital last week and her daughter is calling you because she has fallen three times. She was in the hospital for two weeks for congestive heart failure. Before this hospitalization, you had seen her every six months for hypertension and arthritis, was doing fine (walking into your clinic using a cane only for balance) and she was only taking lisinopril and ibuprofen. The daughter says she cannot bring her to your office (she is 62 and cannot drive) and refuses to bring her to the emergency room because last time "they had my mother on a gurney for over 12 hours without anything to eat or drink. Then they lost her dentures and her glasses." The daughter says her mother has taken all the medicines as directed by the discharge doctors and nurses (furosemide, lisinopril, digoxin, amitriptyline, famotidine, aspirin, calcium, multivitamin and a laxative). When asked, the daughter says her mother does not have any chest pain, confusion, or shortness of breath. She is urinating quite a bit and "I didn't used to have to help her so much to the bathroom."

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Panel Discussion: Assessing and Managing the Elderly Patient with a History of Falls

Cheryl Hawk, DC, PhD
Yuhua Li, PhD
Hedva Barenholtz Levy, PharmD
Joseph Flaherty, MD

Notes

Notes

Notes

Notes


3rd National Symposium on
Complementary
&Alternative
Geriatric Health Care
Integrative Pain Management
and the 24th Annual Geriatric Research, Education
& Clinical Center Symposium
September 26-27, 2009