Systematic Literature Review & Structural Model for Older Driver Safety

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ICADI

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# Acknowledgement

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Background

- Older Driver Safety
  - 19.8 million drivers age 70+ 2003: 1 in 7
  - >40 million in 2020
  - 2029 1of 4 drivers will be 65+
  - 141,000 injured in 2004
  - 5,062 total traffic fatalities in 2004

NHTSA (2006). *Traffic Safety Facts 2004*.
AARP (2006). Fact Sheet. *Older drivers and automobile safety.*

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Motor Vehicle Traffic Fatality Rates by Age Group, 1994-2004

Traffic Deaths per 100,000 Population
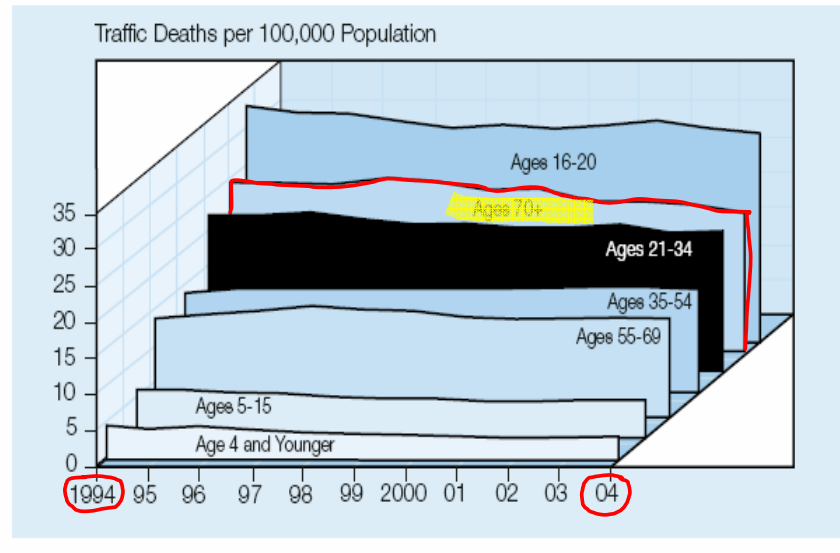
NHTSA (2006). *Traffic Safety Facts 2004*.

High Risk Group

- Medically at risk
- Vehicles
- Driving environments
- Social systems
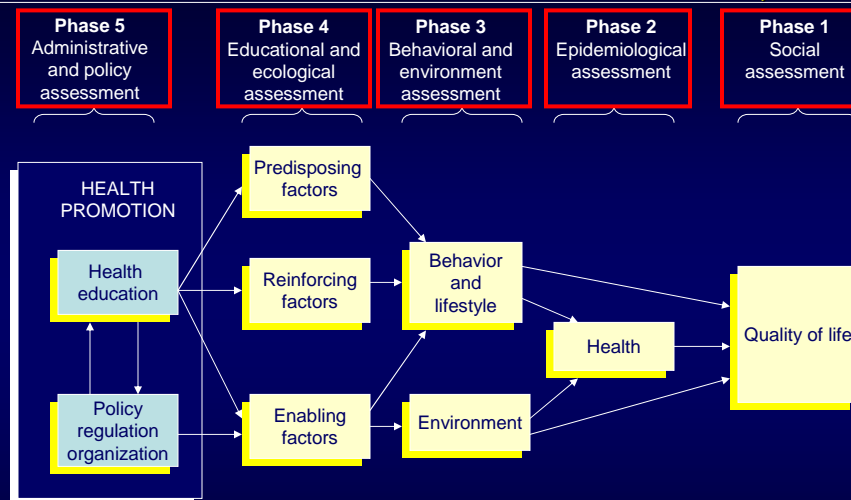- Beyond person level to a public health level

Socio-ecological perspective

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Rationale and Significance

- Older driver safety has not been studied from
  - Socio-ecological perspective

Green & Kreuter (2005). *Health promotion planning*. McGraw Hill.

Precede-Proceed Model of Health Promotion (PPMHP)

Phase 5 Administrative and policy assessment	**Phase 4** Educational and ecological assessment	**Phase 3** Behavioral and environment assessment	**Phase 2** Epidemiological assessment	**Phase 1** Social assessment

HEALTH PROMOTION

Health education

Policy regulation organization

Predisposing factors

Reinforcing factors

Enabling factors

Behavior and lifestyle

Environment

Health

Quality of life

Re-printed with permission obtained from McGraw-Hill Companies.

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Rationale and Significance

- Older driver safety has not been studied systematically examining all the causal factors
  - Systematic literature review

Cooper & Hedges (1994). *The handbook of research synthesis*. Russell Sage Foundation.

Systematic Literature Review (SLR)

SLR is an exhaustive and unbiased search of the literature

- assemble, critically appraise, and synthesize the results of a primary investigation

- efficiently integrate valid information

- provide an evidence-based (EB) rationale for decision making

- five different types

Cooper & Hedges (1994). *The handbook of research synthesis*. Russell Sage Foundation

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SLR Characteristics

Feature	Traditional Review	Systematic Review
Question	Broad in scope	Focused question
Sources and Search	Not specified, biased	Comprehensive sources, explicit search strategy
Selection	Not specified, biased	Criterion-based selection
Appraisal	Variable	Rigorous critical appraisal
Synthesis	Author's summary	Quantitative or qualitative summary
Inferences	Sometimes EB	Usually EB

Purpose

- Using framework of Precede-phase of the PPMHP and an etiological SLR
- Question
  - What are the main risk and protective factors for older driver safety in the U.S?

Methods

1. Formulating a problem
2. Locating and selecting studies (Jan 1985-April 2005)
3. Critical appraisal of studies
4. Collecting data
5. Analyzing and presenting data
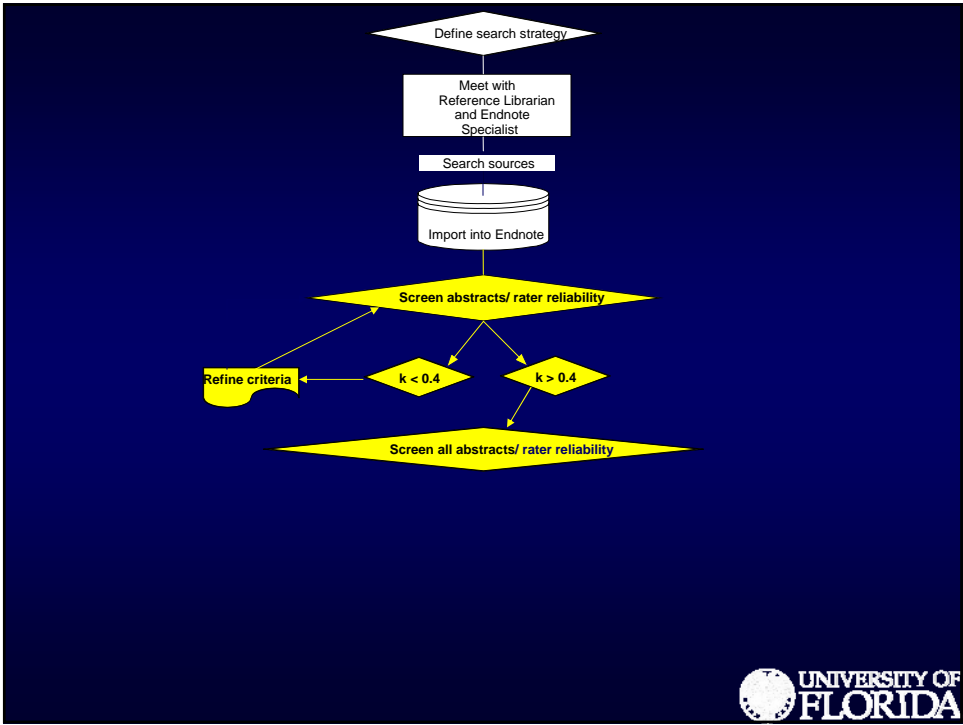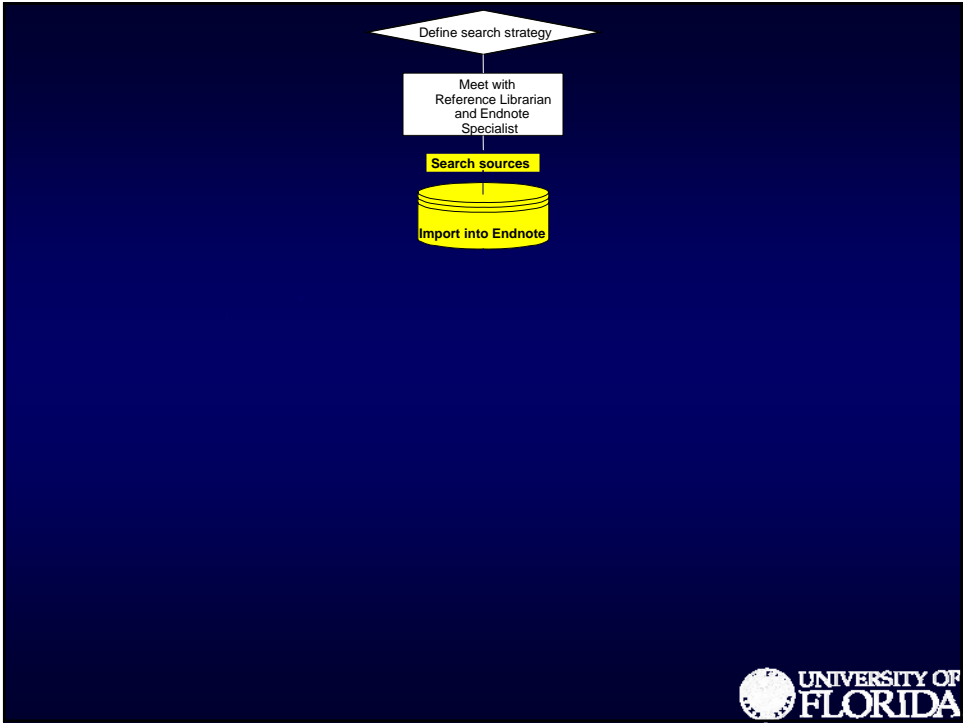6. Interpreting and disseminating the results

Classen, Garvan, Awadzi, Winter, Sundaram, Lopez, & Ferree. Systematic literature review and structural model for older driver safety. *Topics in Geriatric Rehabilitation.* In press.

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Define search strategy

Meet with
Reference Librarian
and Endnote
Specialist

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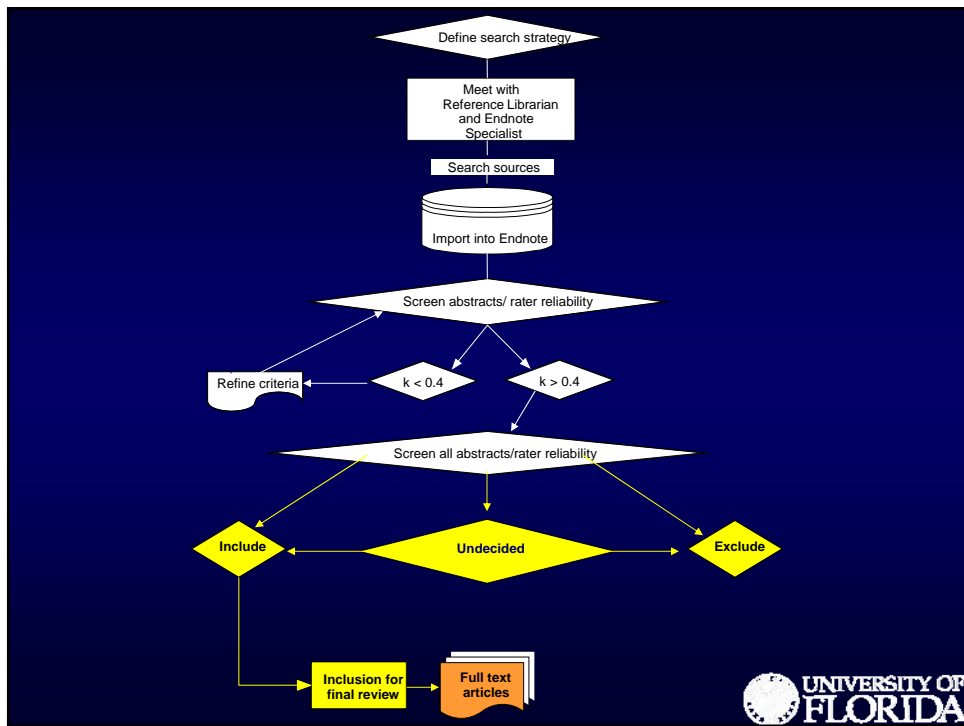
Data Extraction Tool

- Limitations of existing critical appraisal tools
- Developed web-based tool: SPIDER™
  - Systematic Process for Investigating and Describing Evidence-based Research
- Pilot tested
- Refined
- Reliability
- Validity

Classen, Sundaram, & Garvan. Reliability of a data capture tool for a systematic literature review on older driver safety. *Occupational Therapy in Health Care.* Under review.

Analyses

- Descriptive characteristics
- Mixed-methods [1]
  - Qualitative meta-synthesis [2]
    - Thematic analysis of the results
    - Domains, categories and sub-categories
    - Constant comparison
  - Content analysis [3]
    - Quantify the domains, categories and sub-categories

1. Classen & Lopez (2006). Mixed methods approach to explain older driver safety. *Topics in Geriatric Rehabilitation.* In press.
2. Jensen & Allen (1996). Meta-synthesis of qualitative findings. *Qualitative Health Research.*
3. Silverman (2001). *Interpreting qualitative data. Methods for analyzing, test, talk and interaction.*

Results

Source Characteristics

- Screened 2,509 abstracts
  - IRR: *kappa* = 0.4 - 1.0
- Identified 864 primary sources
- Extracted data from 780 full text sources
  - IRR: *kappa* = 0.2 - 1.0
  - Strategies to improve reliability

McGinn et al. (2004). *Canadian Medical Association Journal*, 171, 1369-1373

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Results

- Final sample 201sources
  - 181 peer reviewed journals
  - 14 national transportation reports (grey literature)
  - 3 dissertations
  - 1 conference proceedings
  - 1 from unpublished literature
    - 10% response rate

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Results

- Foci of the sources (n = 201)
  - 65% health domain
  - 60% ecological domain
  - 57% behavioral domain
  - 20% social domain

* Foci are not mutually exclusive

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Results

- Research designs (n = 201)
  - Cross-sectional 52%
  - Cohort 23%
  - Experimental 12%
    - RCT 2%
  - Case control 9%
  - Qualitative 4%
  - Case series, case reports 2%
  - Ecologic <1%

* Designs are not mutually exclusive
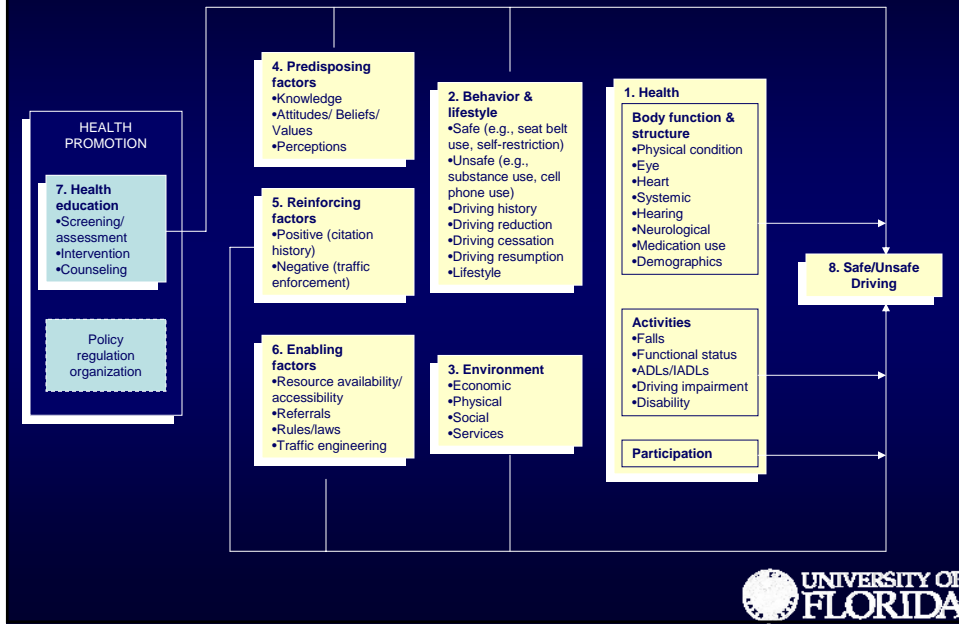
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Results
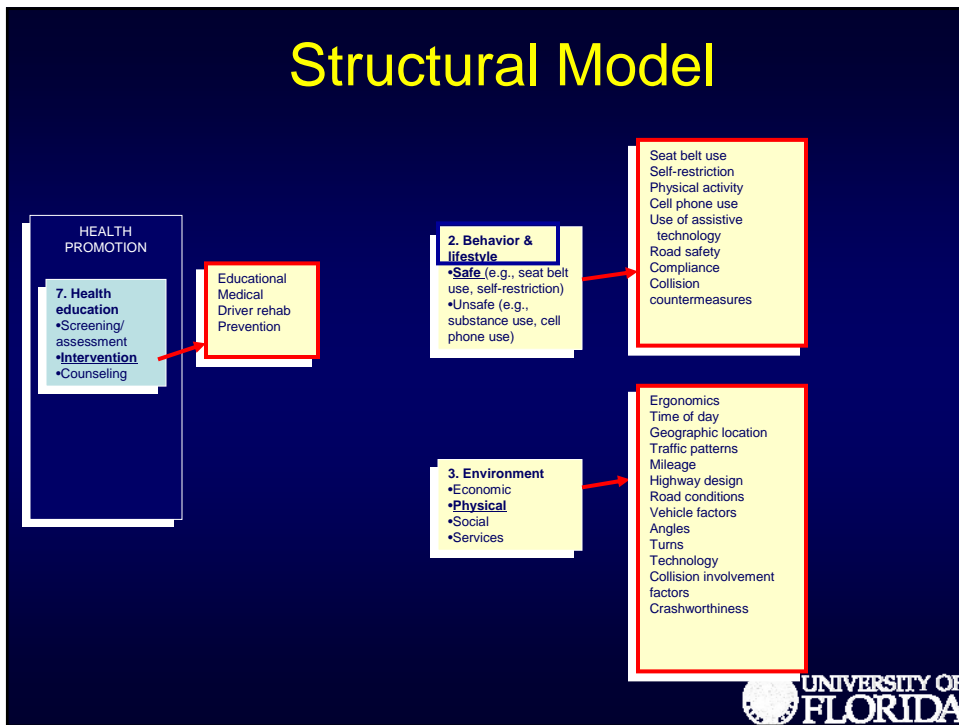
Mixed Methods Approach

1. Meta-synthesis (n = 513)
   - Significant results of sources
   - Risk and protective factors fit all the domains of PPMHP
     - Health
     - Environment
     - Behavioral
     - Predisposing
     - Reinforcing
     - Enabling
     - Health education

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Structural Model

HEALTH PROMOTION

7. Health education
•Screening/ assessment
•Intervention
•Counseling

Policy regulation organization

4. Predisposing factors
•Knowledge
•Attitudes/ Beliefs/ Values
•Perceptions

5. Reinforcing factors
•Positive (citation history)
•Negative (traffic enforcement)

6. Enabling factors
•Resource availability/ accessibility
•Referrals
•Rules/laws
•Traffic engineering

2. Behavior & lifestyle
•Safe (e.g., seat belt use, self-restriction)
•Unsafe (e.g., substance use, cell phone use)
•Driving history
•Driving reduction
•Driving cessation
•Driving resumption
•Lifestyle

3. Environment
•Economic
•Physical
•Social
•Services

1. Health

Body function & structure
•Physical condition
•Eye
•Heart
•Systemic
•Hearing
•Neurological
•Medication use
•Demographics

Activities
•Falls
•Functional status
•ADLs/IADLs
•Driving impairment
•Disability

Participation

8. Safe/Unsafe Driving

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Structural Model

HEALTH PROMOTION

7. Health education
•Screening/ assessment
•**Intervention**
•Counseling

Educational
Medical
Driver rehab
Prevention

2. Behavior & lifestyle
•**Safe** (e.g., seat belt use, self-restriction)
•Unsafe (e.g., substance use, cell phone use)

Seat belt use
Self-restriction
Physical activity
Cell phone use
Use of assistive technology
Road safety
Compliance
Collision countermeasures

3. Environment
•Economic
•**Physical**
•Social
•Services

Ergonomics
Time of day
Geographic location
Traffic patterns
Mileage
Highway design
Road conditions
Vehicle factors
Angles
Turns
Technology
Collision involvement factors
Crashworthiness

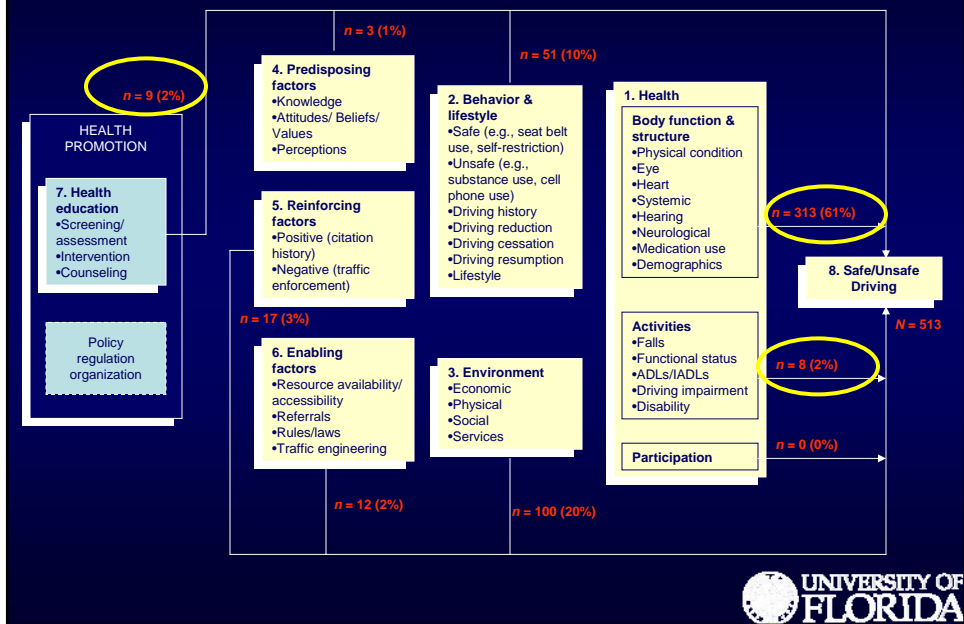UNIVERSITY OF FLORIDA

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Results

2. Content analysis (n = 513)
   - Frequencies of significant risk and protective factors to safe/unsafe driving
     - Health domain 63%
     - Environment 20%
     - Behavioral 10%
     - Predisposing 1%
     - Reinforcing 3%
     - Enabling 2%
     - Health education 2%

Structural Model

Summary

- Final sample
  - Represented published sources
    - Full text studies
    - Grey literature
    - Dissertations
    - Conference proceedings
  - Under represented unpublished sources
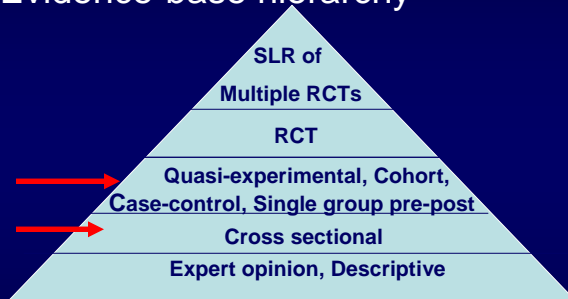
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Summary

- Focus
  - Major focus
    - health domain
    - lesser extent ecological & behavioral domain
  - Under representation
    - social domain (stakeholder perspectives)
    - health education domain (injury prevention)

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Summary

- Designs
    - Evidence-base hierarchy

SLR of	
Multiple RCTs	
RCT	
Quasi-experimental, Cohort, Case-control, Single group pre-post	←
Cross sectional	←
Expert opinion, Descriptive	

    - Majority older river safety research places low

Sackett et al. (2000). *Evidence-based medicine.* Churchill Livingstone
Moore et al. (1995). Evidence-based Everything. *Bandolier 1* (12).

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Summary

- Structural model
    - All domains of PPMHP are represented
    - Over representation of health domain
    - Under representation of all other domains
- Question
    - Have we favored the biomedical perspective and neglected the socio-ecological perspective as it pertains to safe driving?

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Conclusion

- This SLR summarized 20 years of driving safety research in U.S.
  - Identified prevalence of domains of risk and protective factors to safe/unsafe driving
  - Identified the rigor of the research design
- Multiple socio-ecological factors associated with safe/unsafe driving
- Structural model lays the foundation for
  - Further research
  - Multidisciplinary research

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Next Steps

- Within the framework of the PPMHP
  - Perform quantitative & qualitative analyses of national datasets
  - Develop a structural equation model
- Plan an intervention
- Conduct a pilot

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Thanks!

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Additional Slides

- Examples

Keywords (13)	MeSH
Aged	"Aged"[MeSH] AND English[Lang]
Old	"Risk Factors"[MeSH]
Older	"Accidents, Traffic"[MeSH]
Senior(s)	"Automobile Driving"[MeSH]
Elder(s)	
Driving	
Automobile Driving	
Transportation	
Risk Factor(s)	
Accident(s)	
Crash(es)	
Safety	
Traffic safety	

Databases

Databases (26)	Sub Databases (22)
Books	-
Congressional Quarterly	-
First Search Databases	1.Electronic Collection on Line (ECO) 2.Article First 3.PapersFirst
Federal Research in Progress FEDRIP	-
National Safety Foundation Net	-
American Occupational Therapy Association Resource Page	-
PubMed	MeSH
EBSCO	1.Academic Search Premier 2.PsycINFO 3.Psychology and Behavioral Sciences Collection 4.Professional Development Collection 5.Sociological Collection
Administration on Aging (AoA)	None
American Automobile Association	None
National Technical Information Service	None
Safety Lit	All categories checked minus poisoning, protective headgear, school issues, and suicide/self-harm
American Society on Aging	None
Digital Dissertation Abstracts	None
Cambridge Scientific Abstracts	1.Eric 2.Safety Science and Risk 3.Social Services Abstracts 4.Sociological Abstracts

Search strategy for SLR on older driver safety by keywords, MeSH headings and databases.

Thematic Analysis

Spider ID	Serial Number	Textual units of results	Article ID	Themes from meta-synthesis
25	5	Primary collision factor: From age 60, the primary factor changes from alcohol/drug use and vehicle speed to right-of-way violations.	Aizenberg857	collision, driving behavior error, alcohol, age, illicit drugs
25	6	Driver movement preceding collision: Close to 20% of drivers age 60+ are responsible for fatal/injury collisions while making a left turn at an intersection before crashing. By age 80 drivers in fatal collisions are more than 4 times as likely as the high	Aizenberg857	collision, age, risks, crash type, intersection and crashes, collision involvement
25	7	Type of driver collision: In fatal/injury collisions 44.2% of at-fault drivers age 60+ had broadside impacts compared to 29.4% of teens, and 30.9% of all drivers aged 16+, at fault in these collisions.	Aizenberg857	crash type, age, at-fault, collision, collision involvement

Coding by PPMHP Domains

Article ID	Themes from meta-synthesis	PPMHP Domain	Explanatory variables (EV)	Outcome variable (OV)	Statistically Significant	SPIDER ID	Variable 1 (EV)	Variable 2 (OV)	Relationship	Type Relationship
Aizenberg857	collision, driving behavior error, alcohol, age, illicit drugs	8, 1, 2, 2, 5	21, 21, 52	8, 81	Y	25	21	81	SIG	R
						25	21	81	SIG	R
						25	52	81	SIG	R
Aizenberg857	collision, age, risks, crash type, intersection and crashes, collision involvement	8, 3, 1	20a, 32	8, 81	Y	25	20a	81	SIG	E
						25	32	81	SIG	E
Aizenberg857	crash type, age, at-fault, collision, collision involvement	8, 5,1	20a, 52	8, 81	Y	25	20a	81	NS	D
						25	52	81	NS	D

Note. Y=yes; SIG=significant; NS= not significant R= regression; E= estimation; D= descriptive

Coded Spreadsheet

PPMHP domain	Category code	No relationship		Yes Relationship		Relationship/No significance		Relationship/Yes significance	
		N	%	N	%	N	%	N	%
Health education	7	145	11.5	22	2.79	7	12.5	15	2.05
	71	102	8.09	16	2.03	3	5.36	13	1.78
Predisposing	4	65	5.16	5	0.64	0	0	5	0.69
	41	17	1.35	3	0.38	0	0	3	0.41
Reinforcing	5	17	1.35	46	5.84	4	7.15	42	5.75
	51	3	0.24	2	0.25	1	1.79	1	0.14
	52	14	1.11	44	5.59	3	5.36	41	5.61
Enabling	6	36	2.86	16	2.04	0	0	16	2.18
	61	6	0.48	0	0	0	0	0	0
Behavior and lifestyle	2	256	20.29	84	10.67	5	8.94	79	10.81
	21	75	5.95	23	2.92	1	1.79	22	3.01