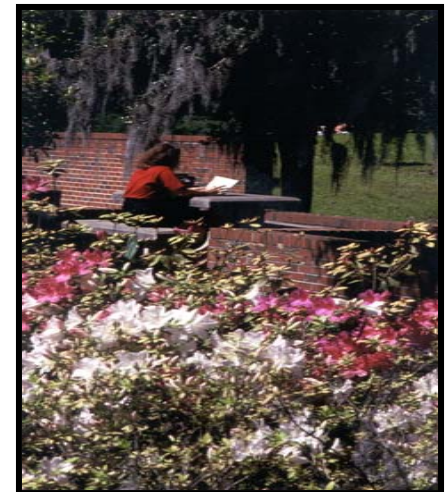


Health Promotion Perspective for Older Driver Safety: Conceptual Model to Intervention Plan

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AOTA Short Course: Driving and Community Mobility
American Occupational Therapy Conference
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college of

Public Health and Health Professions



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Objectives

- Background
- Model-Driven Research
- Three Projects
 - Systematic Literature Review (SLR)
 - Secondary Analyses
 - National Dataset FARS (Fatality Analysis Rating System)
 - Meta-Synthesis of Six Qualitative Studies
 - Expanded Coverage
 - Integration and Comparison of above findings
- Health Promotion Plan

Squaring of the Population

Men

Women



Population of the United States, by Age and Gender,
1950-2050 (millions)

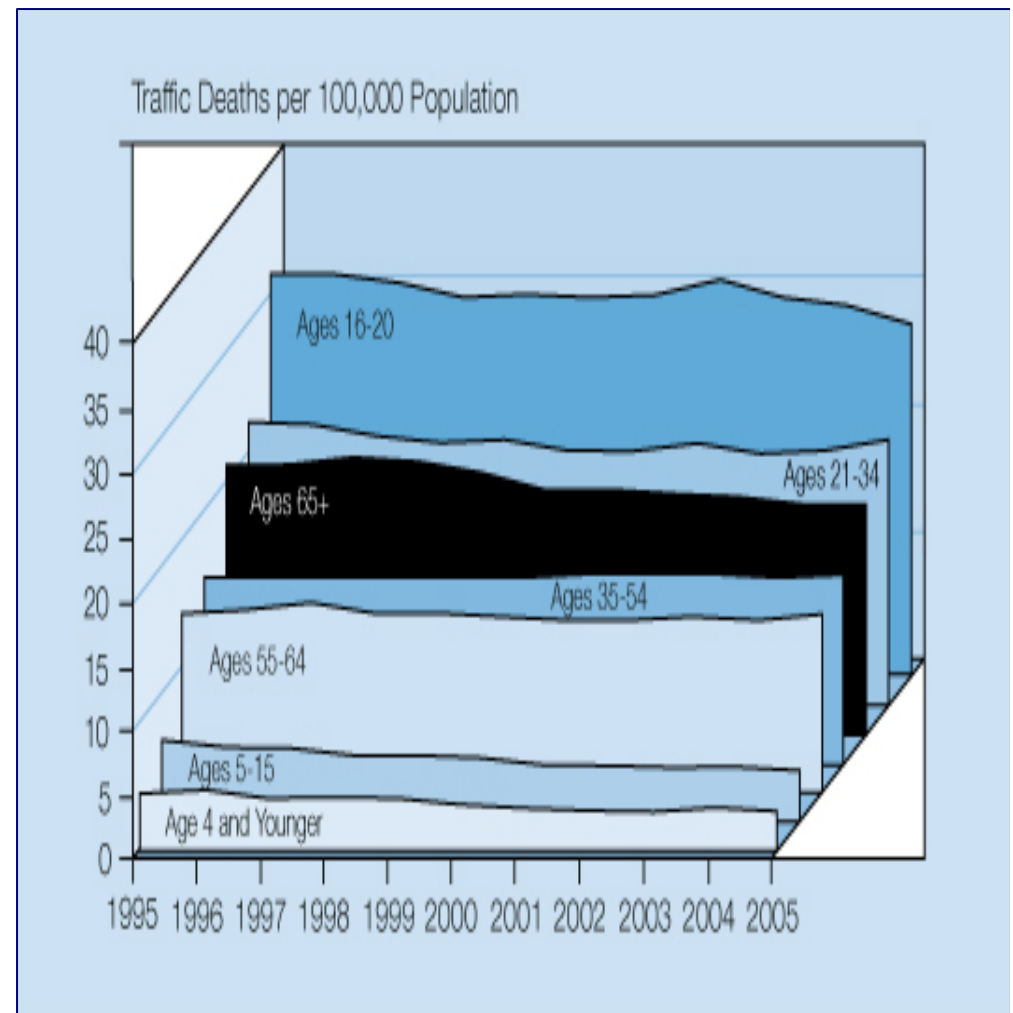
Source: [International Data Base](#), U.S. Census Bureau

Back ground

NHTSA 2005 Facts

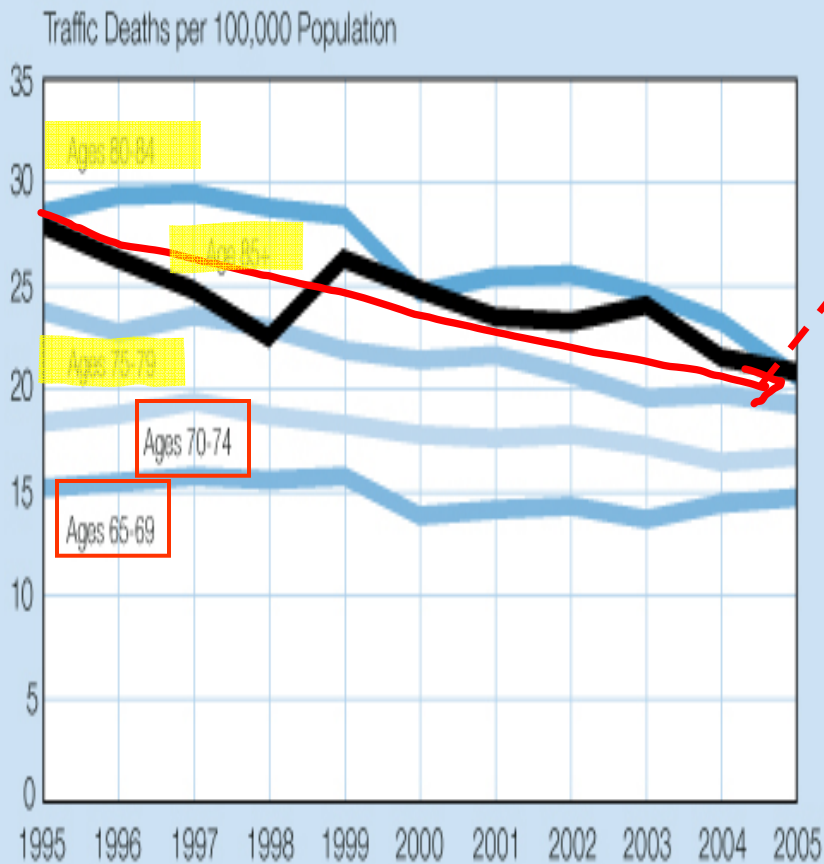
- 12% (36 million) of total US population >65
- Older drivers account for 15% (28 million) of all licensed drivers
 - 7% (191,000) injured in crashes
 - 15% (6,512) traffic fatalities
 - 14% all vehicle occupant fatalities
- Economic cost
 - \$60,400 injury or \$1,150,000 fatal injury (NSC, 2004)
 - Annual cost of all MV injuries and fatalities \$150 Billion (CDC, 2005)

3rd highest risk group for traffic fatalities

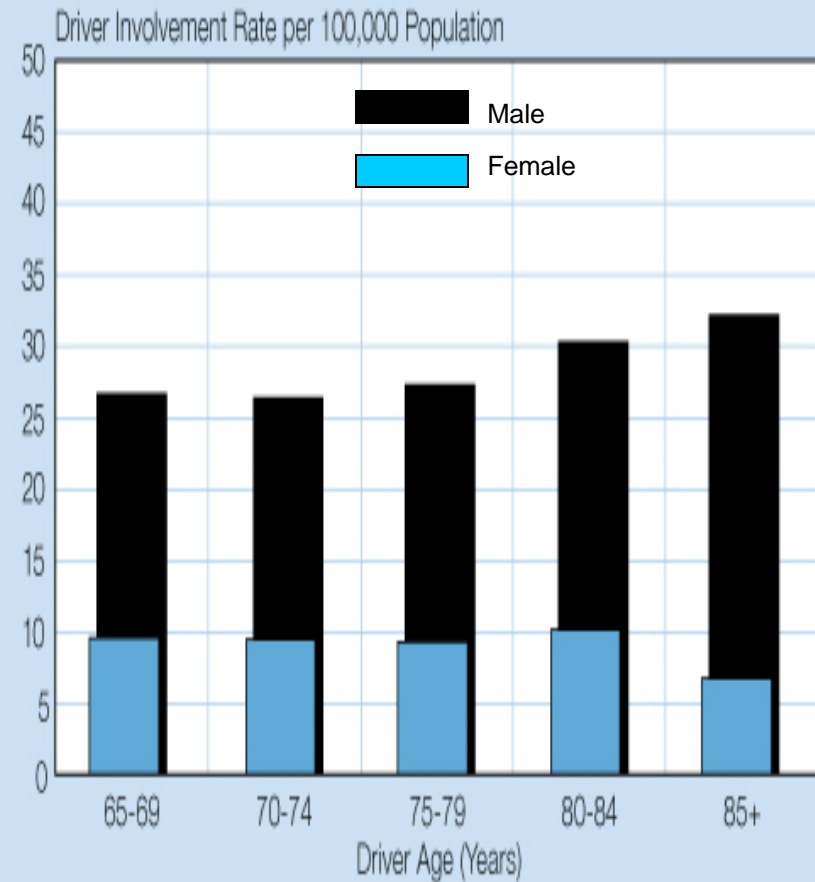


200,000+ injuries and fatalities can be avoided and health care expenses can be curtailed

Back ground

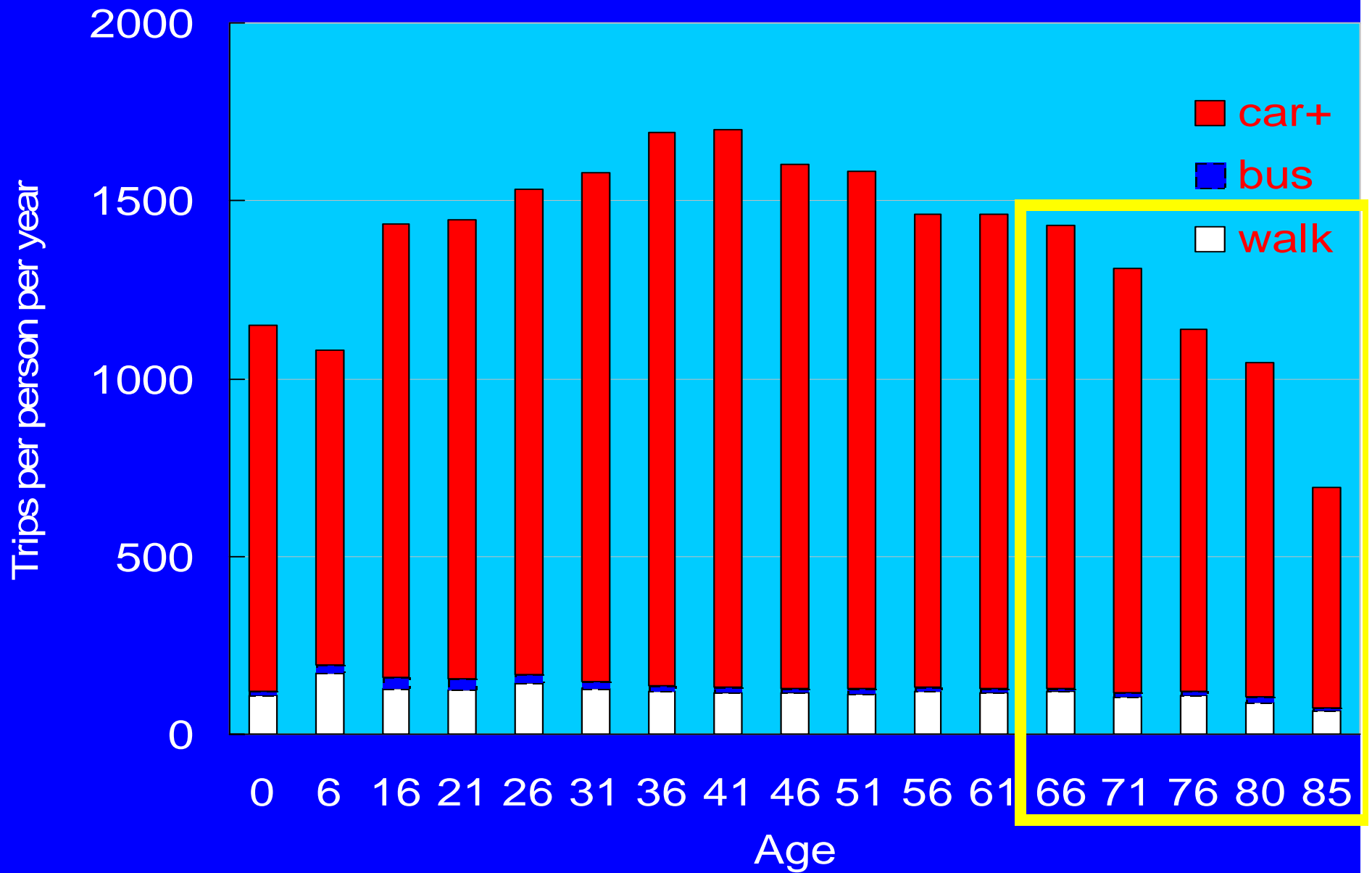


Function of older driver initiatives started in 1990's
 Question: What will happen to the slope of the curves when the baby boomers reach 65+?



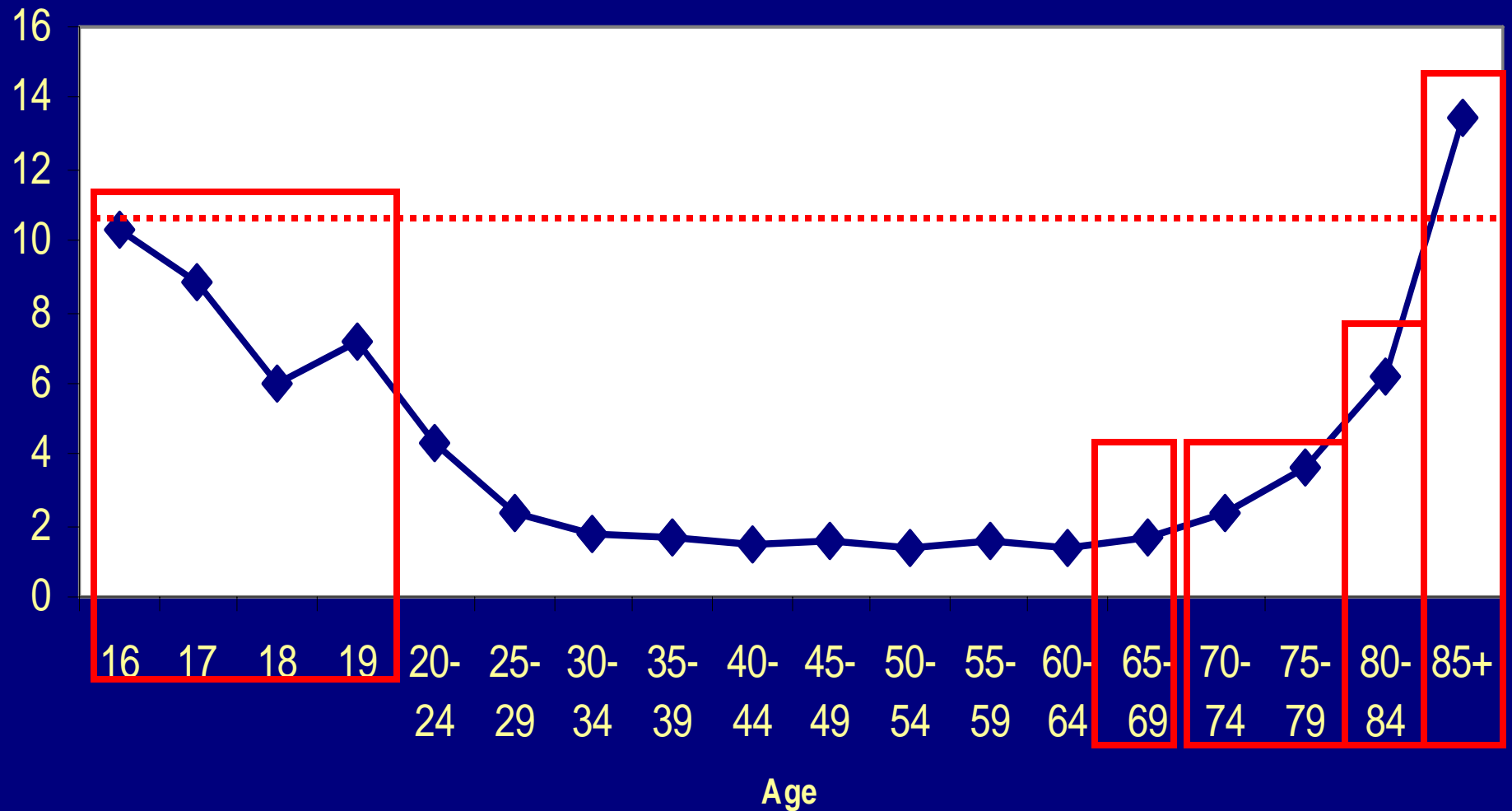
More men are involved in crashes, but more older women suffer crash related injuries and fatalities

TRIPS PER YEAR USA - NHTSA 2001



Fatal Crash Involvement per 100 million miles by Driver Age, 2001-02

Deaths in 100's

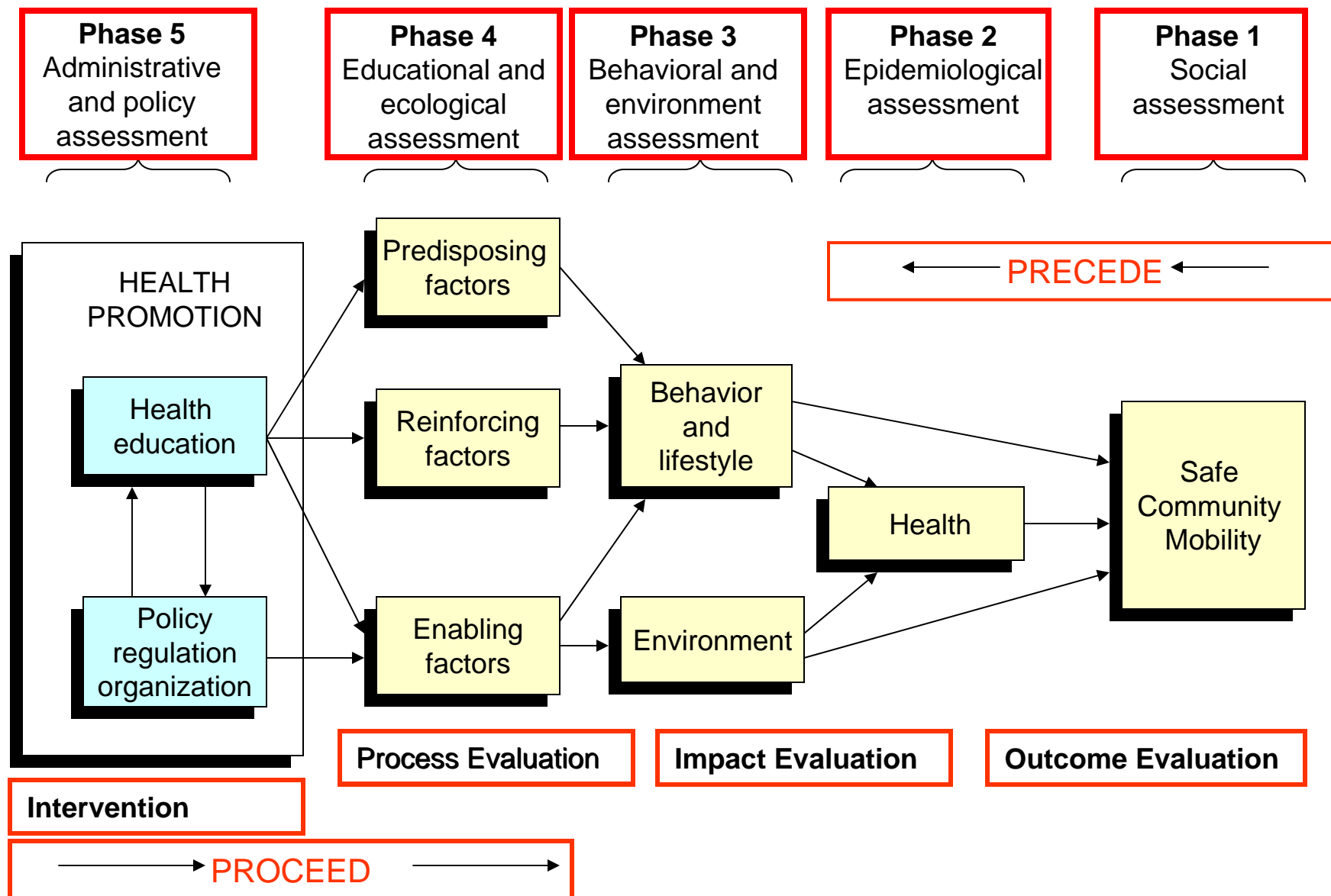




Model-Driven Research

- What are the determinants (factors) underlying older driver safety?
 - Expected: Multiple risk and protective factors
 - Across many domains
- Socio-ecological model

Precede-Proceed Model of Health Promotion (PPMHP)



Classen et al., 2006

Classen & Lopez, 2006



Older Driver Safety Research

Update on Completed Work (2005)

1. Systematic Literature Review
2. Analysis of FARS
3. Analysis of 6 qualitative datasets
4. Expanded Coverage
5. Health Promotion Plan

Research Question

Do the significant risk and protective factors of older driver safety, identified in the literature (1985-2005), fit the theoretical constructs of the PPMHP; If so how; What is the level of the evidence?



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

Cooper & Hedges (1994).



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



Systematic Literature Review (SLR)

- Five different types of questions in SLR
 - Effectiveness of intervention
 - Frequency rates
 - Diagnostic tests
 - Etiological or risk factor identification
 - Prediction or prognosis



SPIDER Tool

National Health and Medical Research Council (1999).
Classen et al. AJOT. In Press



Methods and Procedures

Step 1: Formulating a problem

What are the main risk and protective factors for older driver safety in the U.S (1985-2005)?

Step 2: Locating and selecting studies

27 databases, 4 reviewers, IRR Kappa= 0.6-1.0

Step 3: Critical appraisal of studies

N=2,509

Step 4: Data collection

n=201

Step 5: Analyzing and presenting data

Step 6: Interpreting the data

Step 7: Dissemination

Cooper & Hedges (1994).

Classen & Lopez, (2006).



Analyses

- Descriptive profile of all studies
- Mixed-Methods
 - Meta-synthesis
 - Significant results across 201 sources (n=513)
 - PPMHP's framework
 - Inductive and deductive coding
 - Constant comparison
 - Categories, sub-categories, themes

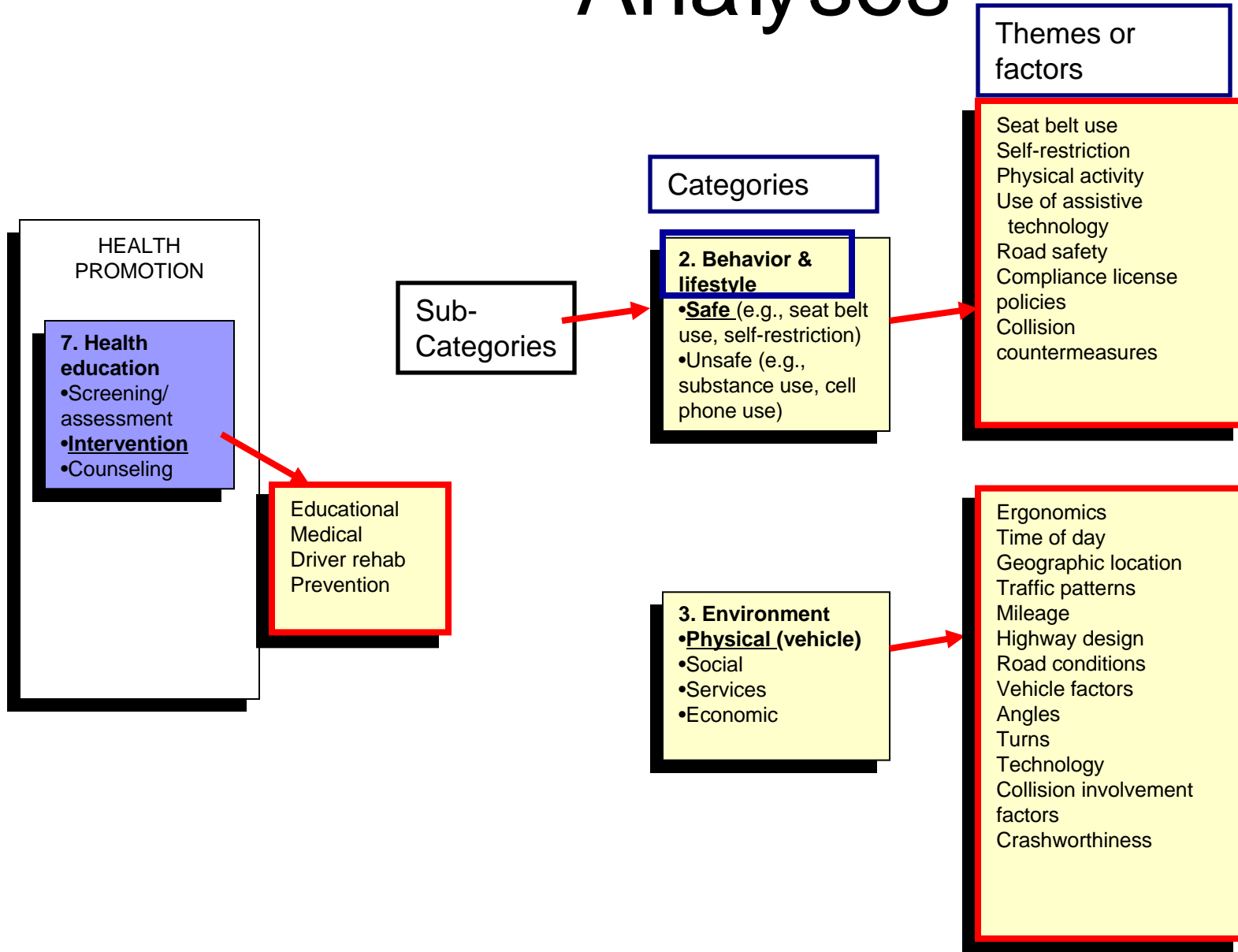
Creswell, Fetters, & Ivankova (2004)

Jensen & Allen (1996)

Classen & Lopez (2006)

Classen et al., AJOT. In press

Analyses





Analyses

- Mixed-Methods

- Content analysis

- Information was noted on a Microsoft Excel Spreadsheet
 - Determined the frequencies of statistically significant risk and protective factors, by domain, to unsafe/safe driving

Creswell, Fetters, & Ivankova (2004).
Jensen & Allen (1996).



Results

- Descriptive characteristics (n=201)
 - 193 quantitative sources
 - 8 qualitative sources
 - 181 peer reviewed journals
 - 14 national transportation reports
 - 3 dissertations
 - 1 conference proceedings
 - 1 from unpublished literature

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%

Results from the SLR

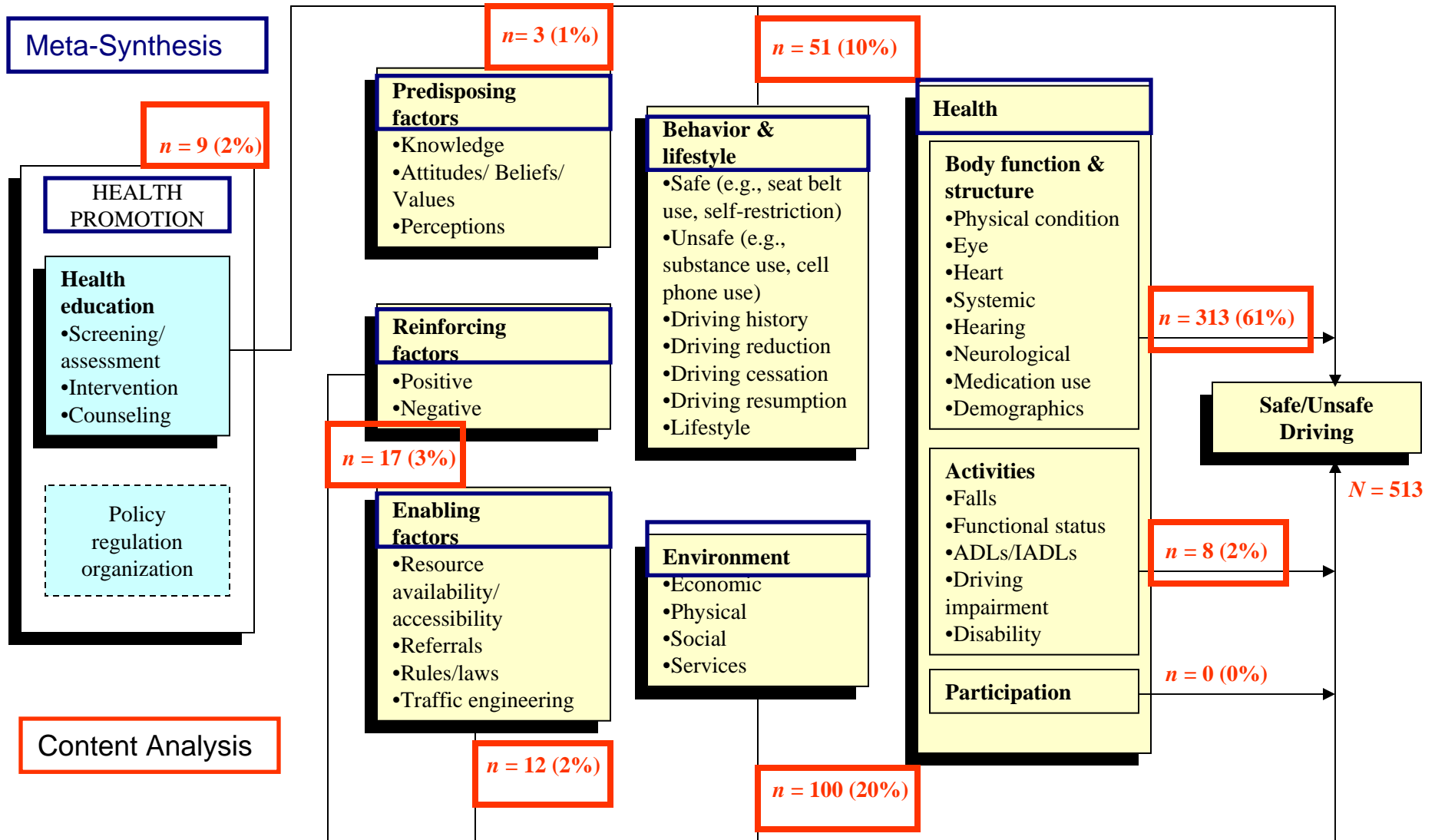
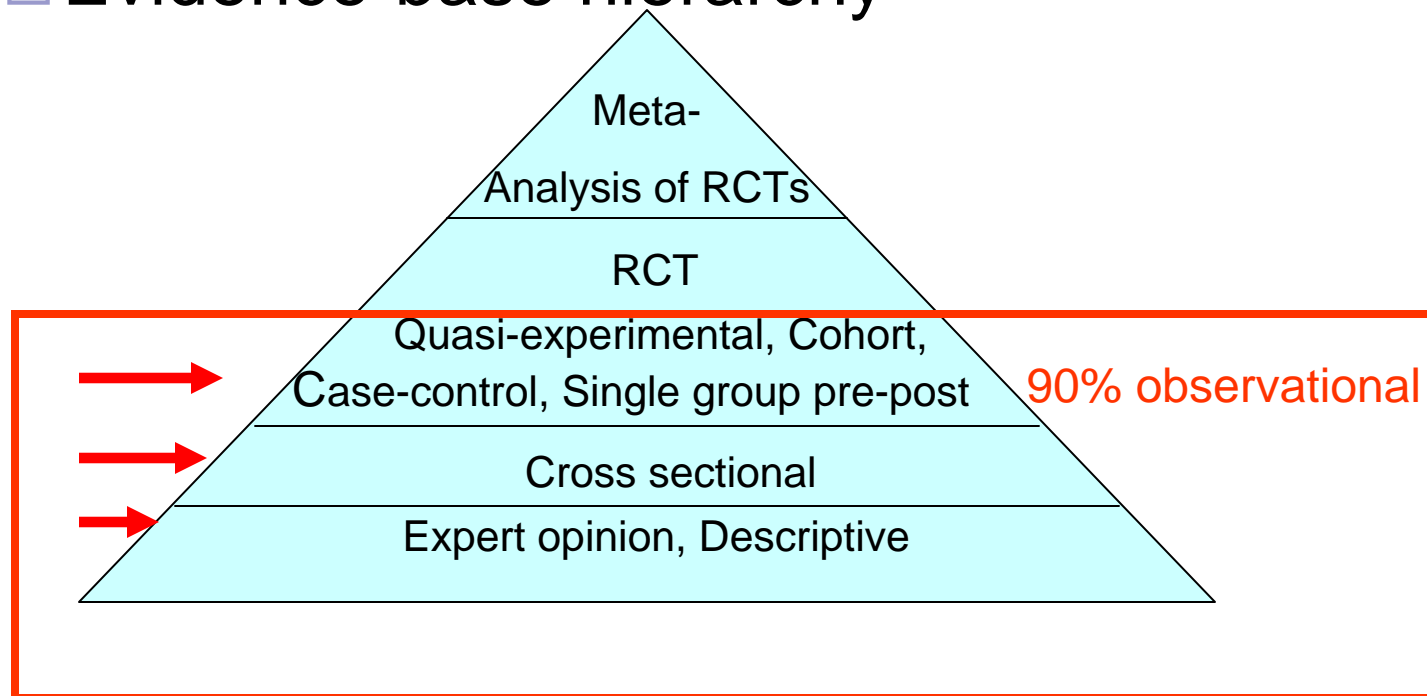


Figure. Structural model for older driver safety indicating significant frequencies of risk and protective factors by PPMHP domains and categories to safe/unsafe driving rounded to the nearest %.

Summary

■ Designs

□ Evidence-base hierarchy



Sackett et al. (2000).

Moore et al. (1995).



Summary

- Structural model

- 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 older driver safety?



Older Driver Safety Research

Update on completed work (2006)

1. SLR
2. Fatality Analysis Rating System (FARS)
3. Analysis of 6 qualitative datasets
4. Expanded Coverage
5. Health Promotion Plan

Research Question:

From a national crash dataset (FARS 2003), what are the risk and protective factors and age interaction among these factors to crash-related injury (yes/no) for older drivers?



Dataset Development

- 2003 FARS dataset
 - Person level data merged through unique identifiers from three files (person, vehicle, crash)
- Sample
 - Sample size N=19,782
 - Younger Drivers (35-54) n=14,083
 - Older Drivers (65+) n=5,774
- Variables
 - 178 independent variables
 - 70 conceptually meaningful
 - 32 tested for multi-co linearity
 - Age modulating variable
 - Outcome variable – Injury/Fatalities (yes/no)



Analyses

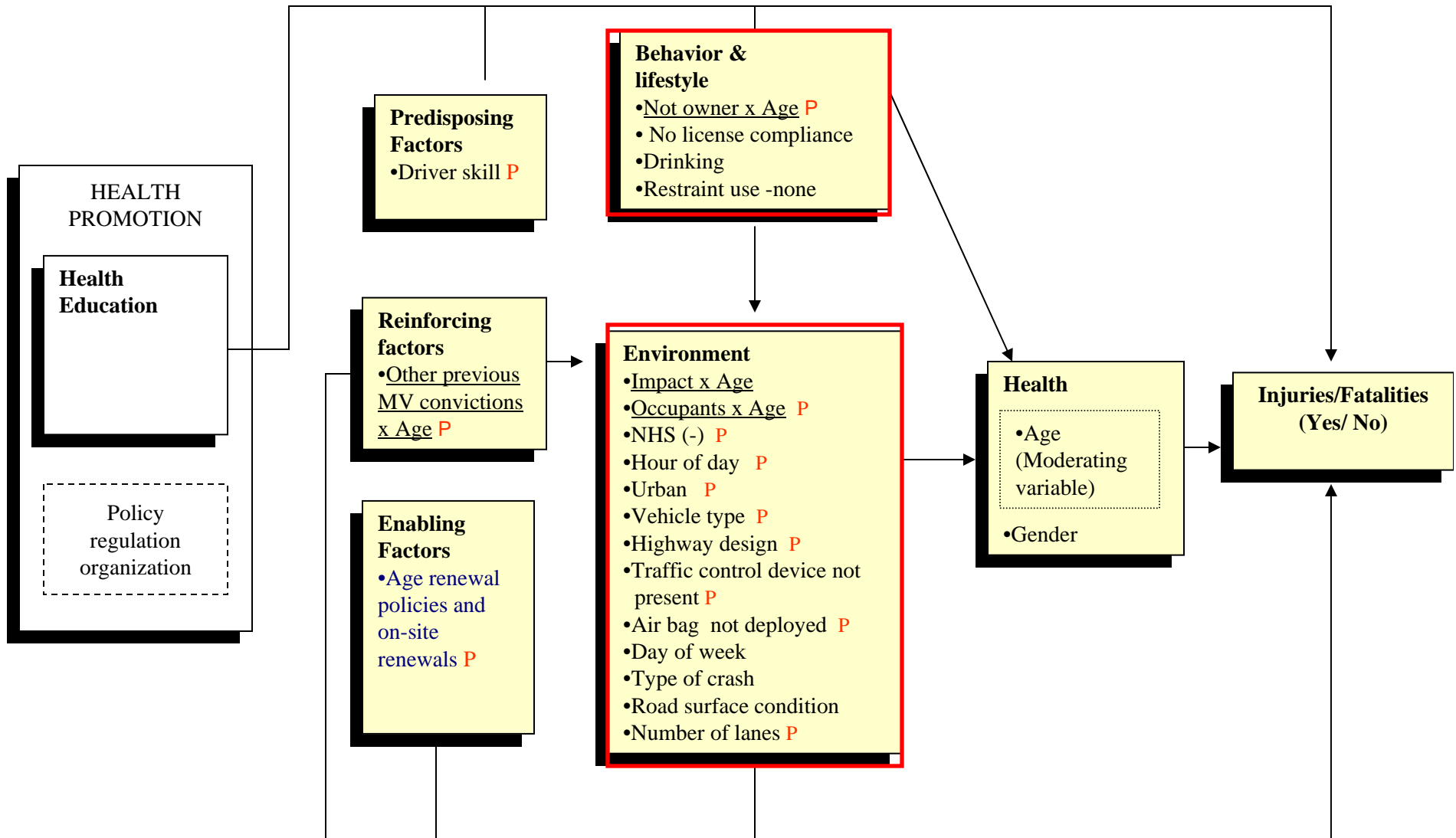
- Univariate analysis
 - Excluded variables > 8% missing data
- Bivariate analysis
 - Chi-square; T-test
 - State policies for licenses (Bonferroni correction)
 - Reduced renewal cycles
 - States with tests
 - Age renewal policies
 - On-site renewals
- Binary logistic regression
 - Hosmer and Lemeshow goodness-of-fit test statistic
 - $p = 0.68$
 - Nagelkerke R-Square variance
 - 57.20%
 - Model correctly classified 87.9% of cases in predicting injury outcome

Results from the FARS Analysis

PROTECTIVE FACTORS	RISK FACTORS
Other previous motor vehicle convictions <u>x Age</u>	Point of Impact <u>x Age</u>
Number of passengers <u>x Age</u>	Gender
Registered vehicle owner <u>x Age</u>	Driver's license non compliant
Hour of day	Drinking
Highway design (intersection)	No restraint system use
No traffic control device	Type of crash
Vehicle (vans, light trucks)	Day of week
Airbag not deployed	Adverse road surface
Not on NHS	
Urban	
One lane roadways	
Driver skill Lane changes, stopping, braking, left turns	

Legend: 12 Protective and 8 Risk Factors: 4 Age Interactions [Variable x age = interaction effects]

Results from the FARS Analysis



Legend: 12 Significant (**P**) Protective and 8 Risk Factors : 4 Age Interactions [Variable x age = interaction effects]

Haddon's Matrix-Injury Prevention

	Person	Vehicle	Kinetic Energy	Environment	
		Car		Physical	Social
Pre-Event					
Event					
Post-Event					

Results of FARS in Context of Haddon's Matrix

Phase	Person (Host)	Kinetic Energy (Vector)	Vehicle (Agent)	Environment		
	OR $p \leq 0.05$	OR $p \leq 0.05$	OR $p \leq 0.05$	Physical	Social	Policy
PRE-INJURY PRIMARY PREVENTION <u>Risk [6]</u> <ol style="list-style-type: none"> No restraint system use Drinking and driving Female gender Adverse road surface Not valid driver's license Day of the week: Tue-Sat Age <u>Protective [8]</u> <ol style="list-style-type: none"> One lane Highway design: Intersection 2 or more passengers Other previous MV convictions Driver not registered MV owner Hour of day <ol style="list-style-type: none"> 2-8 PM 8AM-1PM No traffic control device 	6.2 2.0 1.5 1.4			1.5 1.2-1.6 0.32 [68%] 0.59 [41%] 0.63 [37%] 0.72 [28%] 0.79 [21%]	0.60[40%]	0.65[35%]



Protective factors



Risk factors



Older Driver Safety Research

Update on completed work (2006)

1. SLR
2. Analysis of FARS
3. Analysis of 6 Qualitative datasets
4. Expanded Coverage
5. Health Promotion Plan

Research question

From a qualitative meta-synthesis, how do the older driver and stakeholder perspectives, needs, and goals for safe and unsafe driving support or inform the salient factors found in the FARS dataset?



Qualitative Dataset Development

■ Six studies

- Decision making for driving (Sterns et al., 1997; Johnson, 1998, 2002)
- Use of vehicle or alternative transportation (Kerschner & Aizenburg 1999)
- Driving reduction and cessation (Kostyniuk & Shope, 1998)
- Consequences of mobility and driving (Burkhardt et al., 1998)

■ 690 participants

- (older adults, friends and professionals)

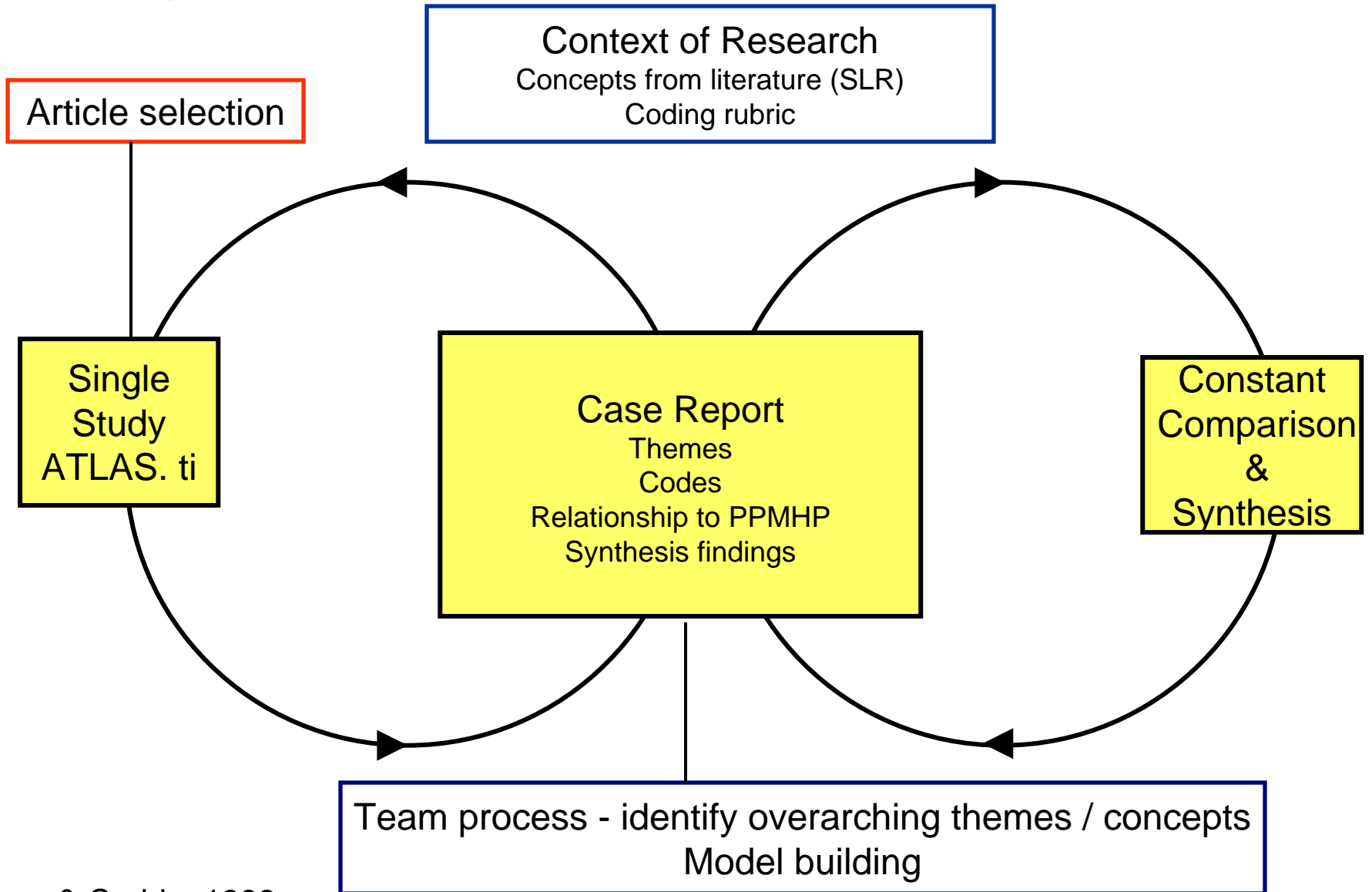
■ Geographic area: 10 states



Analysis

- ATLAS.ti software program
- Descriptive profile
 - Funding source, research questions, study method, and demographics of respondents
- Coding
 - Deductive coding
 - Coding rubric based on the structural model developed from the SLR
 - Inductive coding
 - Open coding to capture new themes in the studies
- Constant comparison method (Strauss & Corbin 1998)
- Over-arching themes
 - Explore the relationships among the studies
- Iterative process
- Meta-synthesis

Analysis



Strauss & Corbin, 1998
Jensen & Allen, 1996

Results

- Represent all domains PPMHP

- Core construct

Driving is innately connected to autonomy, independence in community mobility, and engagement in social participation

- Five themes

1. Assessing risks
2. Getting involved
3. Effective communication
4. Cessation: an unbearable loss
5. Denial is “a great gift”

- “4D’s”

1. Drugs (medications)
2. Destinations
3. Disconnect
4. Diverse mobility options



Older Driver Safety Research

Career development work (2007)

1. SLR
2. Analysis of FARS
3. Analysis of 6 qualitative datasets
4. Expanded Coverage – Compare and Integrate
5. Health Promotion Plan

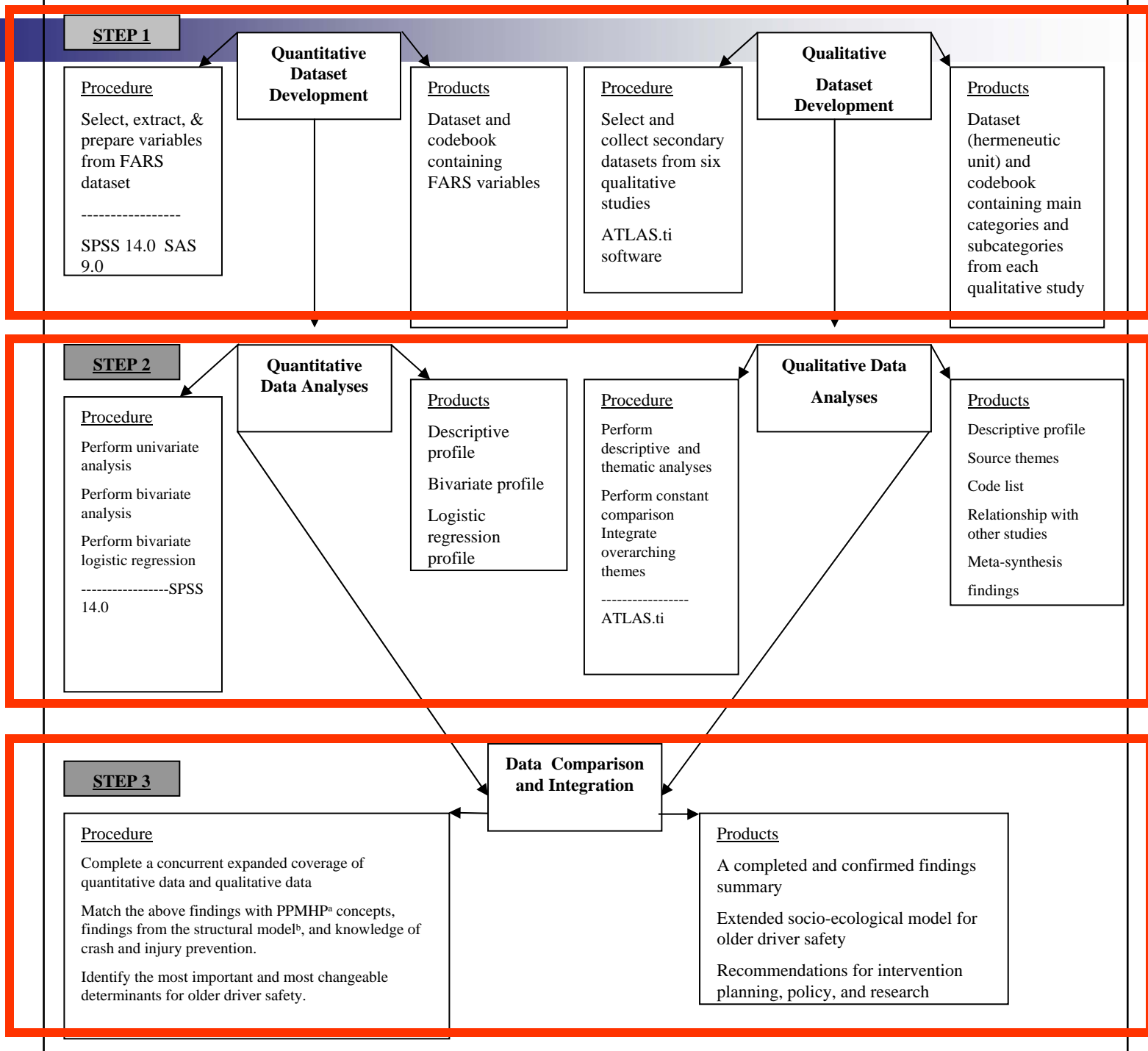
Research Question

Given the findings of questions 2 and 3, what are the modifiable determinants (important and changeable risk and protective factors) of unsafe (injurious) driving?



Mixed Method

- Expanded Coverage (Denzin 1989)
- Alternative to triangulation
 - Multi-Method Meta-Matrix
- Core method is quantitative (QUAN)
 - QUAN → follow-up qualitative
 - Compare or integrate findings



Multi-Method Meta-Matrix

PPMHP Domain

Quantitative

Significant finding from the logistic regression model

Description and interpretation of the significant finding

Referent category

Level 1

Significant protective or risk factor

Level 2

Significant protective or risk factor

Qualitative

Description and interpretation of a comparable theme from the meta-synthesis, corresponding to the above mentioned finding from the logistic regression model.

Relevant data (quotes) from the stakeholders with citations

Description and interpretation of a comparable theme from the meta-synthesis, corresponding to the above mentioned finding from the logistic regression model.

Relevant data (quotes) from the stakeholders with citations

Description and interpretation of a comparable theme from the meta-synthesis, corresponding to the above mentioned finding from the logistic regression model.

Relevant data (quotes) from the stakeholders with citations

Comparison or Integration Discussion

Synopsis and interpretation of the compared data.

Triangulated findings discussed in terms of the existing literature, the PPMHP and implications for intervention planning.

Example Multi-Method Meta-Matrix

Table 2		PPMHP Domain: Social Environment:		
Quantitative	Variable (interaction effect): Number of passengers in the vehicle x age			
	Compared to older drivers without any passengers in the vehicle, older drivers with two or more passengers were 40% less likely to sustain injuries following a MV crash			
	Driver only (Referent category)	1 Passenger No significance	≥ 2 Passengers (Protective)	
Qualitative	<p>Drive alone to prevent distraction as a safe driving behavior (Bédard & Meyers, 2004; Burkhardt, Berger, Creedon & McGavock 1998; Hing, Stamatiadis & Aultman-Hall, 2003)</p> <p>"It's very limited [my driving] in when I go and where I go and I don't take anyone with me. I just drive by myself and give it my complete attention." (older adult, driver, male) (Burkhardt et al., 1998, p. 73)</p>	<p>Drive with a companion not alone (on longer trips)</p> <p>"I used to drive to Virginia alone without a thought of flying but I've lost my confidence in the last four years, maybe because I have a 10-year-old car. I would drive with a companion, but not alone since I'm not confident with my old car with the speeds on highways and the trucks driving so fast." (Kostyniuk & Shope, 1998, pg. 12).</p>	<p>Passengers are observing and giving feedback on driving errors.</p> <p>"People driving with me noticed that my driving was getting worse. They said I was driving too close to other cars...." (Kostyniuk & Shope, 1998, pg. 24).</p>	
Interpretation	Compared to older drivers without any passengers in the vehicle, older drivers with two or more passengers were 40% less likely to sustain injuries following a MV crash. Individual responses are congruent to the quant. findings in terms of driving with a companion, or driving with two or more people. Conversely, a qualitative finding show that driving alone can be or benefit for the older driver as it pertains to avoiding distractions (Hing et al., 2003).			
Discussion	<p>Within the PPMHP, the social environment encompasses the presence of passengers. Consistent with the literature and the qualitative findings (Bédard & Meyers, 2004; Burkhardt et al., 998; Hing et al., 2003), at least some older adults are aware of the protectiveness of driving (way finding or alerting drivers to avoid adverse events) with passengers. Conversely, if passengers are a distraction to the older driver (Bédard & Meyers, 2004; Burkhardt et al.; Hing et al., 2003) and reduce the driver's attention to task, it may pose a safety risk. The social environment may contribute to protect or place an older driver at risk. These findings may have implications for intervention planning by which older adults may choose (behavior) driving with passengers (social network) as a protective strategy. However, this strategy needs to be tested prospectively in an intervention trial.</p>			



Limitations and Strengths

■ Limitations

- Heterogeneity of datasets
- Different purpose of two methodologies
- Distilled effect of the qualitative data
- Researcher bias

■ Strengths

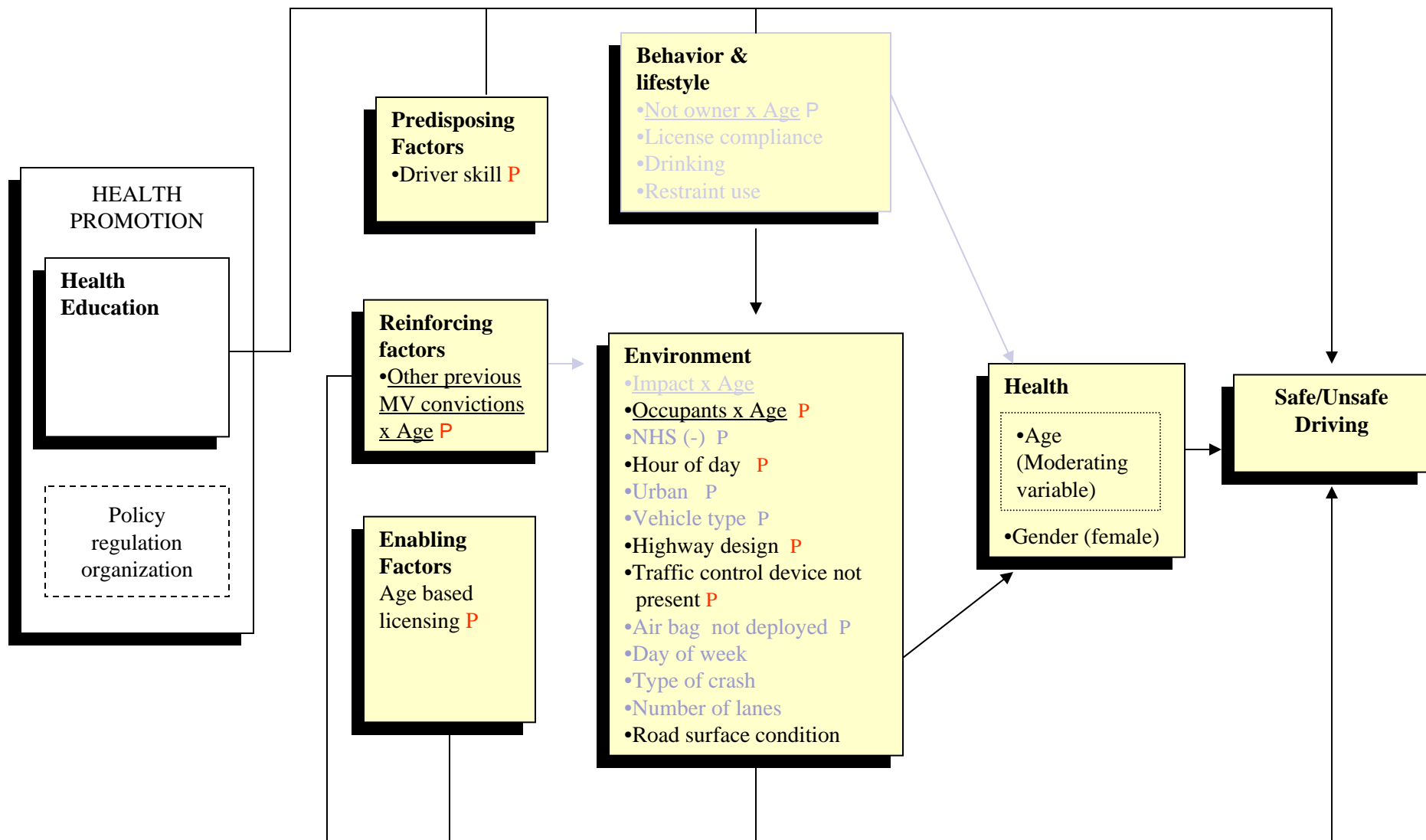
- Understand our data within a broader social and public health context
- Identified the multi-causal modifiable and important determinants
- Benefit laying the foundation for developing a health promotion plan

Variables from Expanded Coverage

PROTECTIVE FACTORS	RISK FACTORS
*Other previous motor vehicle convictions x <u>Age</u>	*Point of impact x <u>Age</u>
*Number of passengers x <u>Age</u>	*Gender
Registered vehicle owner x <u>Age</u>	Driver's license compliance
*Hour of day	Drinking
*Highway design (intersection)	No restraint system use
*No traffic control device	Type of crash
Vehicle type	Day of week
Airbag not deployed	*Adverse road surface
Not on NHS	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>* Age renewal policies</p> <p>On-site renewals</p> </div>
Urban	
One lane roadways	
* Driver skill Lane changes, stopping, braking, left turns	

Legend: 7 Protective and 3 Risk Factors [*] Expanded coverage

Expanded Coverage Design



Legend: 7 Protective (P) and 3 Risk Factors: 3 Age Interactions [Variable x age = interaction effects]



Older Driver Safety Research

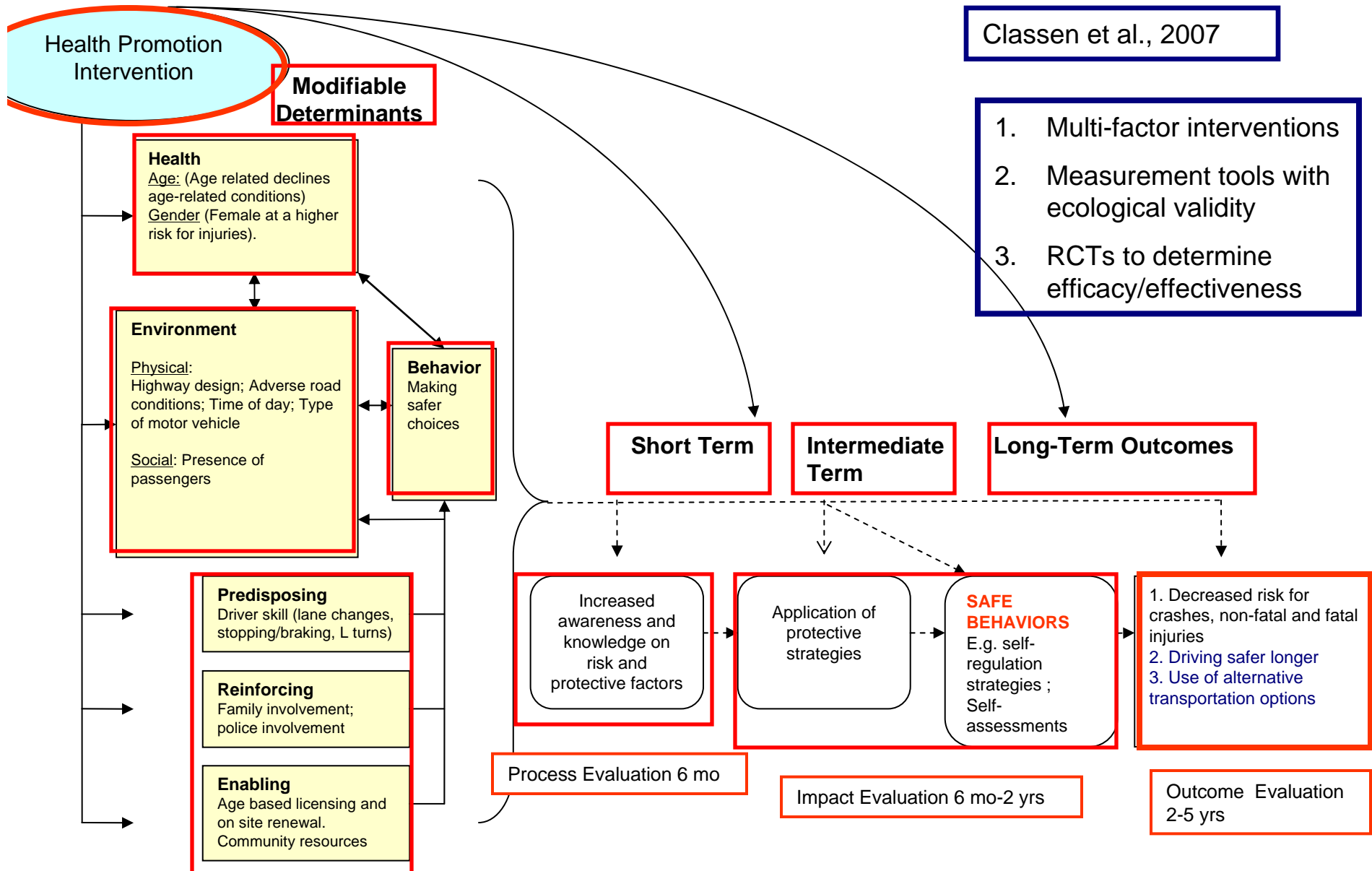
Update on completed work (2006)

1. SLR
2. Analysis of FARS
3. Analysis of 6 qualitative datasets
4. Expanded Coverage
5. Health Promotion Plan

Research Question

What are the main components, and intermediate and long-term objectives of an intervention to curtail unsafe (injurious) driving and promote safe driving on a population-based level?

Health promotion intervention for older drivers to reduce motor vehicle crash related injuries.



SYSTEMATIC LITERATURE & ANALYSIS OF EXISTING CRASH DATABASES

<p>Systematic Literature Review and Model for Older Driver Safety.</p>	<p>Classen, Garvan, Lopez</p>	<p>Precede Proceed Model of Health Promotion was used to synthesize key features of published older driver safety literature.</p>	<p>Significant risk and protective factors were classified into the domains of health, behavior, and environment and policy.</p>	<p>Classen, Garvan et al. 2006. <i>Topics in Geriatric Rehabilitation</i> 22(2)</p>
<p>Determinants of Older Driver Safety from a Socio-Ecological Perspective.</p> <p>Predictors of Injury among Older and Younger adults Following Fatal Motor Vehicle Crashes</p>	<p>Awadzi, Classen</p> <p>Awadzi, Classen, Hall, Duncan, & Garvan.</p>	<p>Examination of two national crash datasets revealed risk and protective factors. These factors were categorized into person factors, behavioral factors, and environmental factors.</p>	<p>Increased risk was found for women, drinking and driving, non-seatbelt use, roll-over crashes, and crashes with fixed objects. The environment emerged as a catalyst for crash related injuries and fatalities and these findings have implications for injury prevention programs.</p>	<p>(Awadzi, Classen et al. 2006). <i>Topics in Geriatric Rehabilitation</i> 22(2).</p> <p>(Awadzi, Classen, et under peer review) <i>Accident Analysis and Prevention</i></p>
<p>Multi-factor interactions for crash-related injury among older adults.</p>	<p>Classen, Awadzi, Mkanta</p>	<p>Using the domains of the Precede Proceed Model of health promotion and an analysis conducted of the FARS dataset, we examined the interactions among the main predictors of crash related injury /fatality among older adults.</p>	<p>Log linear modeling indicates that <u>multiple</u> factors, from the person, environment and vehicle domains, are contributing to crashes/ injuries/ fatalities among older adults.</p>	<p>Classen, Awadzi, Mkanta (In Press) <i>American Journal of Occupational Therapy</i></p>
<p>Meta-synthesis of Qualitative Studies on Older Driver Safety and Mobility</p>	<p>Classen, Winter, Lopez</p>	<p>Analyzing and synthesizing 6 qualitative dataset: 350 participants > 10 states in US.</p>	<p>Core construct emerged, 4 D's: <u>d</u>rugs-not talked about; <u>d</u>iverse mobility options are needed; <u>d</u>estinations are important; <u>d</u>isconnect between services and drivers/stakeholder knowledge.</p>	<p>Classen, Winter, Lopez (In press). <i>Occupational Therapy Journal of Research</i></p>
<p>Population Based Health Promotion for Older Drivers</p>	<p>Classen, Lopez</p>	<p>Using a mixed methods approach, findings from a national crash dataset were examined.</p>	<p>11 modifiable factors for driving safety, representing health, behavioral, and environmental domains were identified.</p>	<p>Classen, Lopez et al. (2007). <i>Clinical Interventions in Aging</i>, 2(4), 677-693</p>



Future Steps

- Refine the Health Promotion Plan (MFI)
 - Classen, Awadzi, Mkanta, AJOT (In Press).
 - R-34 Planning Grant
- Develop Self-Reported Safe Driving Behaviors Measure
 - R-21 Grant Funded April 1, 2008
- Conduct MFI Efficacy Study (2009)
 - R-01
 - Test the intervention plan



Thank you

Contact Information

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