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Mixed Methods Approach Explaining Process of an Older Driver Safety Systematic Literature Review

Sherrilene Classen, PhD, MPH, OTR/L; Ellen D. S. Lopez, PhD, MPH

In this article, we drew from a recently completed etiological systematic literature review (SLR) using a mixed methods approach (1) to explain the process for analyzing and synthesizing the results of 201 sources and (2) to comment on the use of Creswell et al's criteria for mixed methods approaches. We provided a detailed process description of the steps involved in this SLR, and demonstrated that a mixed methods approach, traditionally not associated with a SLR, can be used, comprehensively and explicitly, to plan, collect, analyze, synthesize, and interpret data. We offered guidelines for rehabilitation professionals who are considering performing similar studies. **Key words:** *investigative techniques*, *mixed methods*, *older driver safety*, *systematic literature review*

OLDER driver safety represents a complex phenomenon that extends beyond the individual level to multiple administrative, environmental, behavioral, health, and societal systems. These complex and interrelated systems are perhaps best understood within the context of a socioecological model, such as the Precede-Proceed Model of Health Promotion (PPMHP). The PPMHP is a multidimensional model that provides a framework for systematically evaluating the quality of life, health, behavioral, environmental, predisposing, reinforcing, enabling, and health promoting aspects of an issue, such as older driver safety.[1] As clinicians, researchers, and policy makers are constantly inundated with literature pertaining to older driver safety, they may find it onerous to appropriately use the vast array of information to inform effective decision making.[2] To synthesize the literature for determining the main risk factors associated with safe and unsafe driving,[3] we studied older drivers using a systematic literature review (SLR). The SLR is an exhaustive method that uses rigorous and reproducible guidelines to find, collect, analyze, synthesize, and present information on a topic of interest.[4] The Cochrane Center[5] provides methodological guidelines for SLRs aimed at evaluating the effectiveness or efficacy of interventions. Still, a paucity of literature exists to discuss the guidelines necessary for an etiological SLR (ie, one that identifies the risk and protective factors of an outcome).

The findings of one etiological SLR[3] revealed that in terms of the US older driver safety literature (spanning January 1985 to April 2005), quantitative studies have typically identified risk/protective factors and provided estimates or causal effects for these factors. Qualitative studies, in contrast, have mainly captured the perspectives of persons

From the Departments of Occupational Therapy (Dr Classen) and Rehabilitation Counseling (Dr Lopez), College of Public Health and Health Professions, and the National Older Driver Research and Training Center (Dr Classen), University of Florida, Gainesville, Fla.

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Corresponding author: Sherrilene Classen, PhD, MPH, OTR/L, Department of Occupational Therapy, College of Public Health and Health Professions, PO Box 100164, University of Florida, Gainesville, FL 32611 (e-mail: sclassen@phhp.ufl.edu).

or stakeholders. Without comprehensive synthesis of both quantitative and qualitative studies, there can be no overarching or detailed picture of the inherent complexity of older driver safety, nor will there be a truly clear understanding about the relationships within and among the studies.

Mixed methods or multimethod research holds potential for methodologically sound investigations in rehabilitation and public health research. Mixed methods investigation involves integrating quantitative and qualitative data collection and analysis within a single study or program of inquiry.[6] More than merely collecting qualitative or quantitative data, this research method requires data to be integrated, compared, contrasted, appraised, and synthesized. The underlying logic of mixing quantitative and qualitative data is that, on their own, neither method is viewed to be sufficient in capturing the nuances, details, and trends of the topic under study. When used in combination, quantitative and qualitative data complement one another and yield a more complete analysis.[7]

Although a novel concept, mixed methods research was actually introduced 16 years ago.[8] More recently, a National Institutes of Health[9] task force issued guidelines for conducting rigorous qualitative and multimethod investigations. These guidelines underscore the value of combining methodologies, and called for researchers to specifically describe their research protocol and show how findings are integrated. According to several investigators, the utility of using both quantitative and qualitative methods is to collect qualitative data *before* quantitative data where variables are unknown, or to use qualitative methods to expand quantitative research, and as such advance the study objectives.[6,7,10] Crabtree offers another opinion and suggests using mixed methods to serve as a bridge between qualitative and quantitative research, to preserve the inherit complexity of the research domain, and to add to the client's voice and context.[11]

Creswell et al[7] summarized the findings of several studies and identified 6 major areas for developing a taxonomy of interrelated design criteria for the mixed methods approach. These 6 criteria involved describing and identifying the first 3 processes and examining the next 3: (1) content or context; (2) rationale for mixing quantitative and qualitative data; (3) types of data collected and analyzed; (4) priority given to qualitative and quantitative research in a given study, (5) implementation sequence (concurrent or sequential), the phase of research during which quantitative and qualitative data collection and analysis are integrated; and (6) type of design model. Creswell et al issued a challenge to healthcare professionals, and other researchers, to examine this taxonomy for appropriateness and to further refine the criteria for mixed methods approaches.

PURPOSE

In this article, we intend to draw from a recently completed etiological SLR study (1) to explain the process for analyzing and synthesizing the results of 201 sources and (2) to describe and comment on the appropriateness of using Creswell and colleagues' 6 criteria for the SLR that used mixed methods.[7]

PROCESS DESCRIPTION

In this description, we will use Creswell et al's first 3 criteria (context/content, rationale for mixing quantitative and qualitative data, and types of data collected and analyzed), and describe those in the context of our SLR. Next, we will discuss the appropriateness of Creswell et al's next 3 criteria (characteristics of the design—priority, implementation and integration, and type of design model used) to our study.

Describing our study according to Creswell et al's first 3 criteria

The context

In a recently completed SLR on older driver safety, we analyzed, synthesized, and presented the results of 201 sources (published and unpublished literature).[3] Figure 1 illustrates the 14 major steps of the SLR process.

Using a specific search strategy (key words and MeSH headings), and multiple databases (eg, PubMed, Web of Science, EBSCO*host*, Academic Premier, TRIS, MEDLINE), a total of 2059 published and unpublished sources were identified. Figure 2 presents the complete search strategy by key words, MeSH, and databases.

Using specific inclusion and exclusion criteria (eg, studies had to be in United States, written in English, pertaining to drivers 60 years and older, and focused on safe/unsafe driving outcomes), 2 teams of reviewer pairs evaluated the abstracts of the 2059 identified sources and deemed 864 appropriate for full-text review (team 1: $\kappa = 0.8$–1.0; team 2: $\kappa = 0.4$–0.6). Of these, we were able to retrieve 780 full-text sources, on which the 2 teams of reviewers performed a second review (team 1: $\kappa = 0.2$–0.8; team 2: $\kappa = 0.4$–1.0).[12] After this second review, 201 sources met the criteria to be included in the final SLR data collection.

To facilitate the SLR data collection, we developed the paper and the Web-based versions of the data extraction tool, the Systematic Process for Investigating and Describing Evidence-based Research (SPIDER), which contained both quantitative and qualitative sections. The SPIDER tool consists of a list of literature-informed, predetermined variables to assess the quality of sources. After development, the tool was field-tested, refined, and evaluated for its psychometric properties. Validity studies are still in progress. While detailed reliability rates are documented elsewhere,[12] results from initial testing of the tool's interrater reliability were deemed undesirable ($\kappa = 0.2$). As such, revisions were made to refine the items, improve conceptual definitions of the variables, and enhance the Web-based version of the tool. Although we did not calculate a follow-up κ, we used cross-tabulation calculations to quantify each of the 4 reviewers' test-retest ability of the quality indicators. The latter was calculated by determining the frequency of reliability using 3 categories of consistency (poor <50%; moderate 50%–74%; good-excellent 75%–100%). All 4 reviewers' intrarater reliability ranged from moderate to good (55%–76%).[12]

Data extraction of results involved breaking the results sections of each of the 201 sources into specific and complete textual units. As such, each source could have one or several results associated with it. Because the SPIDER was designed with the capacity to export the information entered into it into a database format, the textual units from each of the sources were exported to an MS Excel file. Table 1 shows the textual units of the results sections of one of the sources—along with the source's assigned SPIDER identification number [25], serial numbers [5–7], and article identification number [Aizenberg857].

Rationale for mixing

According to the SLR protocol guidelines,[4] the results of all sources are to be analyzed, synthesized, interpreted, and disseminated. Analysis can be completed via either a *meta-analysis* (statistical pooling of effect sizes around a specific topic) for homogeneous studies or a *narrative synthesis* (researcher summary) for heterogeneous studies. Because of the heterogeneous nature of the sources for this SLR (ie, variability between and among sources differing in samples, designs, and analyses), a meta-analysis was not considered appropriate, and performing a general narrative synthesis might have diminished the rigor of the analysis.

Mixed methods are not generally identified as the standard method of data collection and analysis in an SLR. In the study of Classen et al,[3] we used a mixed methods approach in all stages of the research process including the planning, SPIDER tool development, data extraction, and data analysis. Our decision to use mixed methods was driven by our aim to achieve a thorough and explicit understanding of the multiple complexities underlying older driver safety, and to provide a true reflection of the synthesized literature.

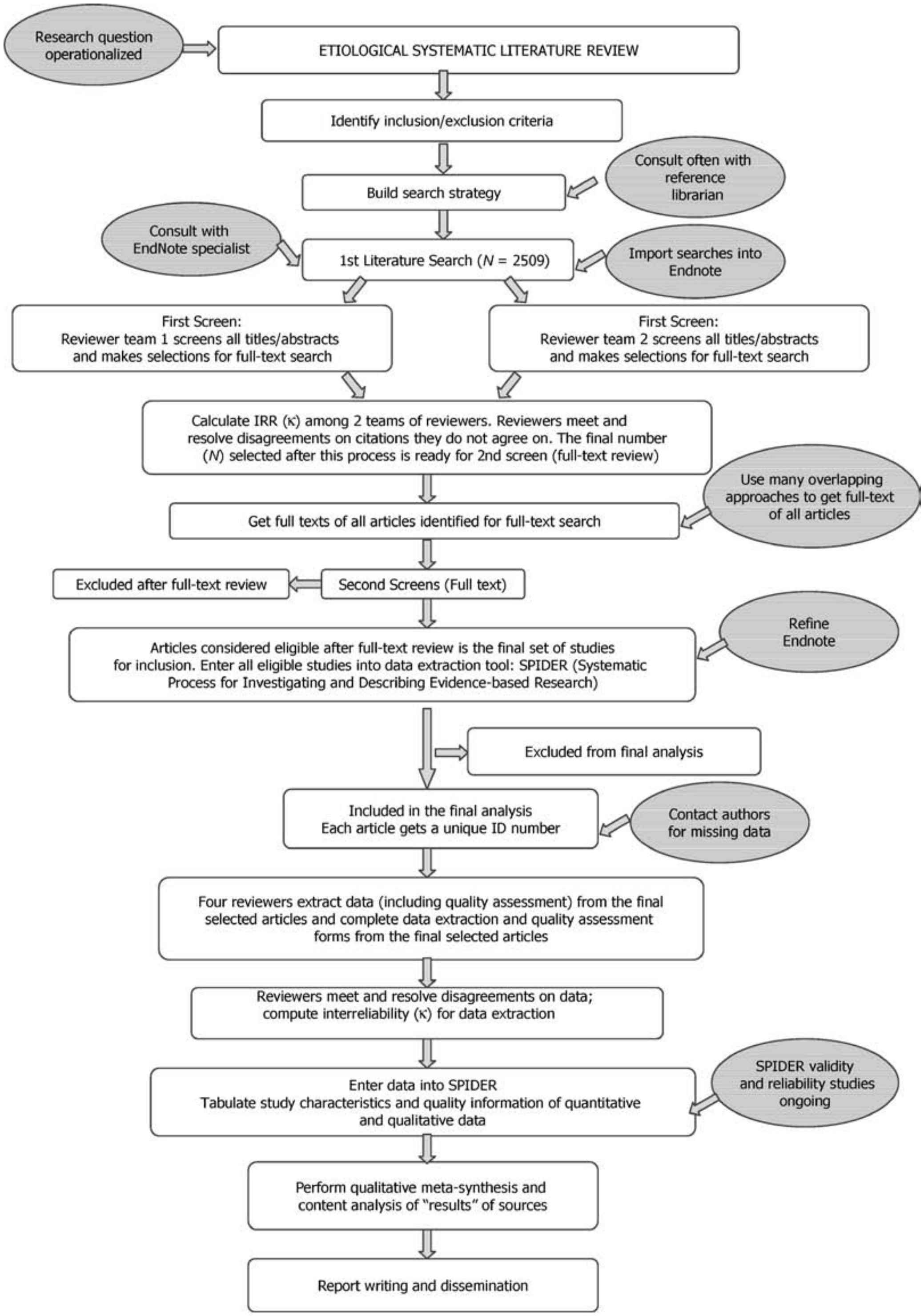

Figure 1. Flow diagram indicating the steps in the systematic literature review.

Key words
Aged
Old
Older
Senior(s)
Elder(s)
Driving
Automobile driving
Transportation
Risk factor(s)
Accident(s)
Crash(es)
Safety
Traffic safety

MeSH
"Aged"[MeSH] AND English[Lang]
"Risk Factors"[MeSH]
"Accidents, Traffic"[MeSH]
"Automobile Driving"[MeSH]

Databases	
Sources	**Sub Databases**
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
Grey Literature	New York Academy of Medicine Library
Statistical Analysis and Retrieval System	None
EBSCOhost	Pre-CINAHL CINAHL using key words
EBSCOhost	CINAHL using subject heading
WebSPIRS	Ageline
Transportation Research Information Service	
Transportation Research Board	
National Transportation Library	
Web of Science	
Beverly Foundation Resource Page	
Letters to researchers and scientists	GSA list; ASA list; ICADI List Consensus Conference

Figure 2. Search strategy for systematic literature review on older driver safety by key words, MeSH headings, and databases.

Table 1. Extraction from the Excel spreadsheet illustrating the textual units of the results by SPIDER ID, serial number, article ID, and themes*

SPIDER ID	Serial no.	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	Aizenberg 857	Collision, driving behavior error, alcohol, age, illicit drugs
25	6	*Driver movement preceding collision:* Close to 20% of drivers aged 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 highest risk groups, teens, to be involved in these crashes.	Aizenberg 857	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 aged 60+ had broadside impacts compared with 29.4% of teens, and 30.9% of all drivers aged 16+, at fault in these collisions	Aizenberg 857	Crash type, age, at-fault, collision, collision involvement

*SPIDER indicates Systematic Process for Investigating and Describing Evidence-based Research.

Forms of data collection

Using the paper version of the SPIDER data extraction tool, we extracted key features of the 201 quantitative and qualitative sources. We then entered these data into the Web-based version of the SPIDER, and included items such as literature cited, studies funded, sample considerations, study design, analysis, main results, conclusions, implications, key words, etc.

Analytical procedure

The types of analyses conducted for this study included descriptive analysis and 2 mixed methods procedures, meta-synthesis and content analysis.

Descriptive analyses. Using frequencies and percentages, we described the key features of the 201 sources. Specifically, we first imported the extracted data, which was organized and stored in our password-protected computer and server network, into an MS Excel spreadsheet, and then imported the data into SAS Version 9.1.[13] We identified the key features of the sources, such as focus of the work, research designs, and statistics used,[4] and described those with summary statistics (n, %). Findings are published in the Classen et al's article in this issue of the journal.[14]

Meta-synthesis. To ensure that our findings reflected transparency and believability, we employed the mixed methods approach, meta-synthesis, to analyze the textual units of results from the 201 sources.[7,10] This meta-synthesis followed the steps outlined by Jensen and Allen.[15] As a team, the 4 reviewers and a coinvestigator trained in qualitative techniques carefully read the textual units from each source, giving attention to details and contextual relevance, and assigned at least one conceptual label to each result. As common themes began to emerge within and across sources, the conceptual labels were collapsed into broader thematic categories and subcategories.[16] Interrater reliability rates were not calculated for the meta-synthesis process, but agreement had to be achieved by all 4 reviewers before a code was accepted or assigned. The thematic categories and their subcategories became the building blocks for developing a coding rubric that was continually refined as more sources were examined and coded.[15,16]

Specifically, all codes were organized under domains of the PPMHP (health, behavioral, environmental, predisposing, reinforcing, enabling, and health education).[1] Under each domain were the categories, subcategories, and themes that emerged during the meta-synthesis. Figure 3 illustrates the codebook with the PPMHP domains and their corresponding categories and subcategories. From this figure one can see how the driving behavior, *Self-restriction*, was classified as a subcategory under the category, *Safe behavior* [21], which was placed under the PPMHP domain *Behavior and lifestyle* [2].

To ensure consistency in the assignment of codes, we used reciprocal translational analysis[10] and constant comparison.[16] This means that we interpreted the findings of each source in the light of the assigned codes and compared them to other textual units with similar content. For example, to code the conceptual label, driving *citations*, 3 coding options were possible: negative reinforcing [52], physical environment [32], or unsafe behavior [22]. In considering each code, within the particular source, and with the textbook definition of each PPMHP domain,[1] driving citation emerged as a subcategory of a negative reinforcer (under the PPMHP domain, *Reinforcing*). We then compared this instance to other source results that had driving citation conceptual labels assigned to them. The fit was appropriate, and we concluded that our decision to code driving citation as a negative reinforcer was valid. By using this method, the subcategories and codes were refined and the codebook adjusted to reflect the changes.

The refined coding structure, illustrated in Table 2, provides an example of how the textual units of one source were coded by article identification number [Aizenberg857], themes from the meta-synthesis, PPMHP domains, explanatory variables (EV), outcome variable (OV), statistical significance, SPIDER identification number [25], relationship (SIG = significance, NS = not significant) of variable 1 (EV) to variable 2 (OV), and type of relationship (regression, estimation, or descriptive).

Content analysis. Next, we completed a content analysis as a means to synthesize study results by providing a systematic way to categorize and count categories and subcategories.[17,18] Each of the PPMHP domains and categories was treated as a variable (explanatory or outcome), and was assigned a numeric identifier. For example, the domain, *Behavior and lifestyle*, was given the code number [2], with the subcategory, *Self-restriction*, a subcategory of the category, *Safe behavior*, given the code number [21] (Fig 3).

From the coded data, we used the PPMHP domains, categories, and subcategories to calculate the results of the analysis using frequencies and percentages. Table 3 presents an example of the coded spreadsheet used for content analysis by PPMHP domain, category code, relationship of the EV to the OV (no/yes), and significance (no/yes) of this relationship.

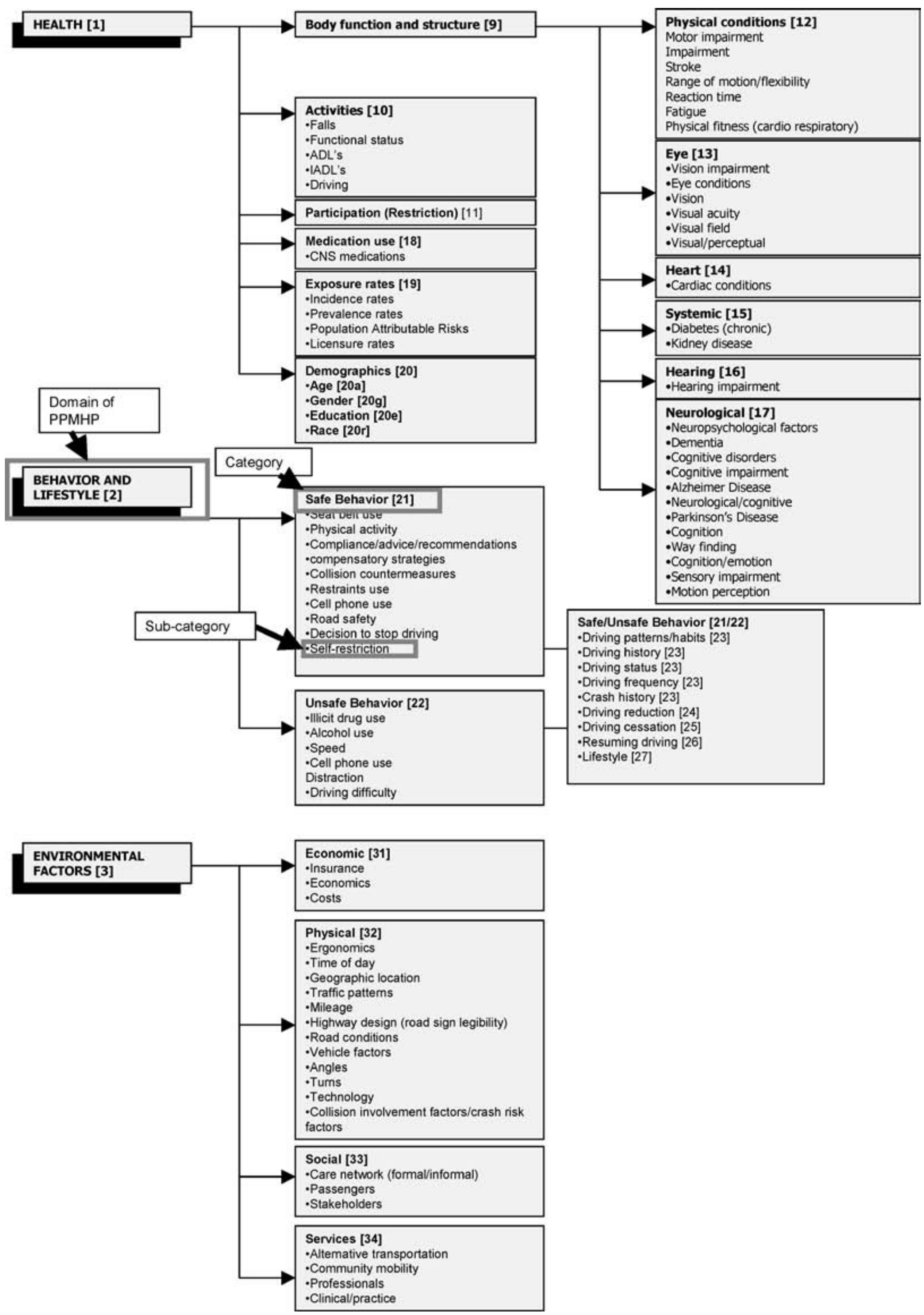

Figure 3. Codebook describing the domains, categories, and subcategories.

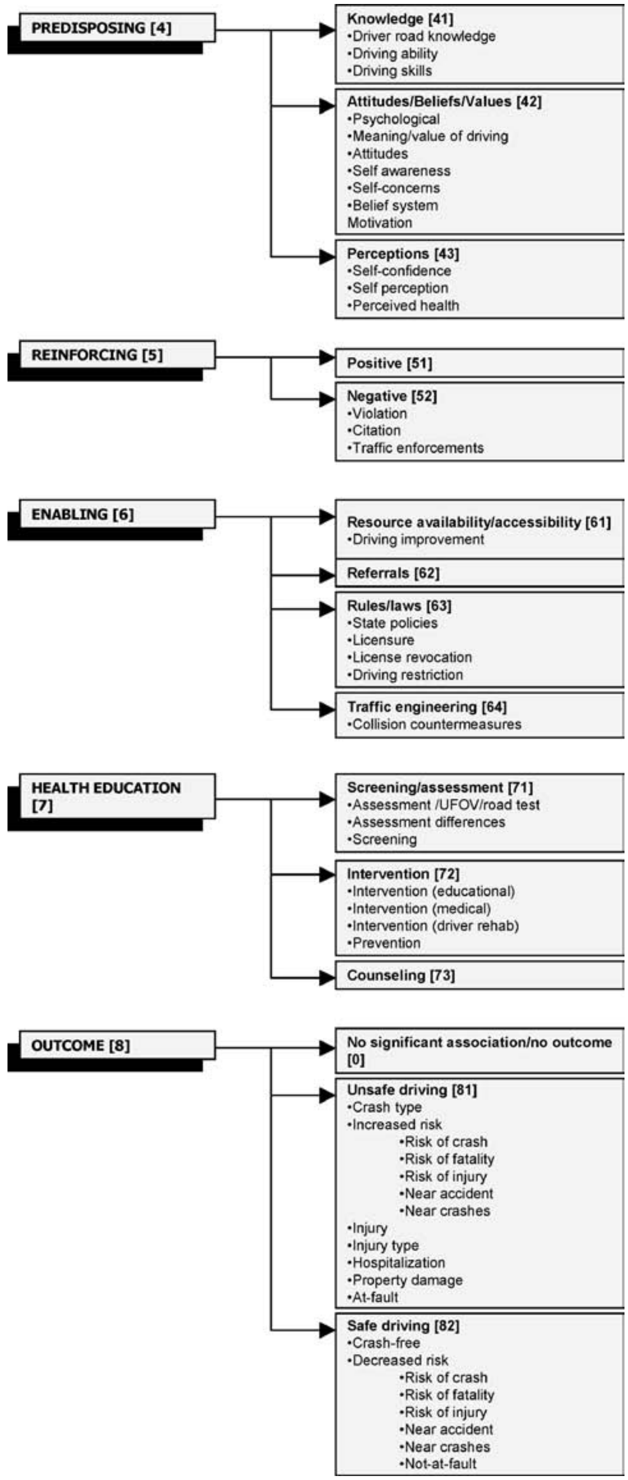

Figure 3. *(Continued)*.

Table 2. Final content analysis by article ID, themes, PPMHP domain, explanatory variables, outcome variable, statistical significance, SPIDER ID, variable 1, variable 2, relationship, and type of relationship*

Article ID	Themes from meta-synthesis	PPMHP domain	EV	OV	Statistically significant	SPIDER ID	Variable 1 (EV)	Variable 2 (OV)	Relationship	Relationship type
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

*PPMHP indicates Precede-Proceed Model of Health Promotion; SPIDER, Systematic Process for Investigating and Describing Evidence-based Research; EV, explanatory variable; OV, outcome variable; Y, yes; SIG, significant; NS, not significant; R, regression; E, estimation; and D, descriptive.

Table 3. Example of the coded spreadsheet used for content analysis by PPMHP domain, category code, relationship of the explanatory variable to the outcome variable (no/yes), and significance (no/yes) of this relationship*

		Relationship†		Relationship significance†	
PPMHP domain	**Category code**	**No**	**Yes**	**No**	**Yes**
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)

*PPMHP indicates Precede-Proceed Model of Health Promotion.
†Values given are number (percentage).

Appropriateness of using Creswell et al's remaining 3 criteria

Characteristics of design

Priority. Traditionally, "priority" is determined by the researcher who either places a primary emphasis on quantitative or qualitative data or ascribes both with equal importance.[7] Since the inception of this study, our stance has been to afford equal emphasis and status to both qualitative and quantitative methods. This approach was especially useful in study planning, SPIDER tool development, data identification, data extraction, and analysis stages. It not only helped us to formulate, find, explore, and describe the various sources and their main characteristics but also enabled us to interpret and quantify the results in a contextually relevant, thorough, and explicit manner. In the end, we felt confident that our synthesis of the literature included the nuances and specificities involved with safe driving, and reflected the main risk and protective factors from the persons/stakeholders perspective, as organized under the domains of the PPMHP.

Furthermore, we used an approach of equality for quantitative and qualitative methods in our study's planning, hiring of personnel, instrument design, and data collection stages. For example, (1) in the planning stage of our study, we formulated the research question to include both qualitative and quantitative sources; (2) during the appointment of study personnel, we hired researchers and research assistants with quantitative and qualitative expertise and interests; and (3) during the creation of the data extraction tool, we developed both quantitative and qualitative sections.

Implementation. Implementation refers to whether the quantitative and the qualitative data are collected in sequential phases or gathered simultaneously.[7] During the data collection stage of our study, we simultaneously collected both quantitative and qualitative primary research studies. However, during the data analysis stage, we used a sequential qualitative-quantitative approach. That is, we first performed a meta-synthesis of the textual units as a means to qualitatively code the domains, categories, and subcategories, and then conducted the content analysis to quantify the emergent codes.

Integration

According to Creswell et al,[7] priority and implementation decisions in the design of the study set the stage for the logical and appropriate use of mixed methods. As such, integration refers to the point in the research process (data collection, analysis, interpretation, or even discussion stages) during which the investigator mixes or integrates the quantitative and qualitative data collection and analysis.

Creswell et al[7] in their analysis of 5 studies using mixed methods approaches, identified 2 stages in the process where integration was achieved: when data analysis leads to further data collection decisions and when results were reported. In our study, we used integration in 7 distinct stages, that is, (1) formulating the research question; (2) appointing the study personnel; (3) building our search strategy; (4) developing a quantitative and qualitative data extraction tool; (5) collecting and analyzing the data; (6) discussing the data; and (7) disseminating our findings.[3,19]

Type of design model

On the basis of the different stages during which quantitative and qualitative integration occurred, we employed different design models to advance our work. In our study, we used principles consistent with the assumptions of the 3 approaches proposed by Creswell et al,[7] that is, the instrument design model, the data transformation design model, and the triangulation design model. However, another approach, *a study planning model*, not discussed previously, emerged from our research process.

Instrument design model. The intent of the instrument design model is to develop a data collection tool that is grounded in the views of the participants.[7] In our study, we realized that existing data extraction tools did not reflect the level of objectivity and comprehensiveness that we required for an etiological SLR. In response, we developed, field-tested, enhanced, and tested the quantitative and qualitative SPIDER tool psychometrically to facilitate scientific rigor. The SPIDER afforded us the capability to extract and synopsize the literature on older driver safety in an objective, believable, and transparent manner.

Data transformation design model. The data transformation design model encompasses correlational designs and observational studies (eg, cross-sectional, case control, and cohort). This model allows the researcher to gather textual data, analyze it for codes and themes, and determine the frequency at which they emerged.[7] In terms of Creswell et al's criteria, the priority favors quantitative data collection, the implementation is concurrent, and the integration occurs at the data analysis stage of the research process. This model clearly represents how we chose to collect and analyze the 201 source results, first qualitatively through a meta-synthesis and then quantitatively through content analysis.

Triangulation design model. The triangulation design model integrates the numeric and textual data to best understand a research topic or problem. This model typically ascribes equal priority to the quantitative and qualitative data and analysis, involves concurrent or simultaneous data collection, and integrates both types of data in the results, interpretation, or conclusion stages.[7] Although we completed the meta-synthesis first, and then quantified the data through content analysis, we integrated both the quantitative and the qualitative data into our results as we were establishing our codebook. The analyzed data were interpreted within the context of both quantitative and qualitative results, showing that these processes were consistent with the principles of the triangulation model.

Study planning model. The *study planning model* that emerged set the stage for conceptualizing the study, and as such provided a blueprint for further decision making. When the decision is made during the inception of the study to use (or not use) a mixed methods approach, all other research-related tasks are affected. In our study, we demonstrated how the proposal to use an SLR, consisting of both quantitative and qualitative studies, evolved to actually formulating the research question, developing a proposal, appointing study personnel, and developing data extraction tools consistent with both types of data. Without the conceptualization of a mixed methods approach in the planning stage, this study would not have captured the rich reflection of existing sources, nor would we have been able to synthesize, analyze, and disseminate the findings of those.

DISCUSSION

This study explained the process for analyzing and synthesizing the results of 201 studies in a recent etiological SLR on older driver safety, and demonstrated how we applied and expanded the criteria for the mixed methods taxonomy summarized by Creswell et al.[7]

Study purpose 1: Process for analyzing and synthesizing the results

Although the methodology for SLRs pertaining to intervention studies are described in the Cochrane Collaboration guidelines,[5] little guidance exists for describing the process of an etiological SLR. In response, we offered a flow diagram that outlines the main steps in this process, and provided an illustration of our comprehensive search strategy. As a result, this study provided an orientation and guide for researchers interested in embarking upon an etiological SLR.

Generally, SLRs are synthesized and analyzed using a meta-analytic or a narrative synthesis approach.[4] There is a dearth of literature focusing on SLRs using a mixed methods approach for synthesizing and analyzing data. In our study, we demonstrated and provided examples illustrating how we used the mixed methods approach during the planning, instrument development, data identification, data extraction, data analysis, and dissemination stages. Although it is beyond the scope of this article to provide a comprehensive description of our process, the steps described above will aid researchers in conceptualizing and potentially applying mixed methods in their own studies.

Creswell et al[7] suggest using the mixed methods for primary studies, but we have shown that this approach can be used successfully in applied research, such as an SLR. By using the mixed methods approach, we were afforded the opportunity to synthesize the qualitative and quantitative sources pertaining to older driver safety literature, providing a comprehensive, systematic, and integrative description.[3] To our knowledge, this type of synthesis had not yet been achieved.

Study purpose 2: Use of the Creswell et al's criteria for the mixed methods taxonomy

Creswell et al[7(p12)] challenge "other health disciplines, such as nursing, allied health, and critical care," to examine the mixed methods taxonomy for appropriateness in their fields and to "refine criteria for evaluating the quality" of mixed methods studies. Our study successfully met both of these challenges and introduced new information. First, we discussed each of the 6 processes proposed by Creswell et al, illustrating their relevance to our study, and thereby helping to confirm the appropriateness of the taxonomy. We also expanded the use of one of the models suggested by Creswell et al, that is, the instrument design model. By developing the quantitative and qualitative SPIDER data extraction tool, we were able to extract and synopsize the literature on older driver safety in an objective, believable, and transparent manner, thus adding another dimension to the use of the instrument design model. Next, we demonstrated that a study planning model, not previously described by Creswell et al, emerged from this process. This study planning model not only set the stage for the conceptualization of the study but also provided a blueprint for all subsequent decision making.

In conclusion, from our experience of conducting an etiological SLR, we were able to provide a process description pertaining to the steps involved in this type of review. Our study demonstrates that a mixed methods approach can be used in a thorough and explicit manner to collect, analyze, synthesize, and interpret primary sources, traditionally not associated with SLR. In this article, we have offered guidelines for researchers who are considering performing similar studies, and provided an orientation and starting point for embarking on this arduous task. Through discussing the criteria posed by Creswell et al,[7] we have not only shown the applicability of their proposed taxonomy but also refined the criteria pertaining to the instrument design model, and demonstrated the emergence of a study planning model. It is our hope that the discussion started here will hold promise for expanding the scope and knowledge of an etiological SLR using mixed methods, and that the rigor of this approach will be subjected to testing by way of analytical studies.

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