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CONCEPTUALIZATION OF CROSS-SECTIONAL MIXED METHODS STUDIES IN HEALTH SCIENCE: A METHODOLOGICAL REVIEW

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ABSTRACT: *The purpose of this review was to discuss some methodological issues inherent within cross-sectional mixed methods designs in health sciences, and to provide an initial conceptualization of cross-sectional mixed method designs in health sciences by conducting a methodological review of empirical studies through the end of 2014. The results identified three basic commonly-used cross-sectional mixed methods designs that have been used by the researchers in health sciences, and several methodological issues corresponding to the cross-sectional mixed methods designs, and suggest recommendations and implications for both applied researchers and methodologists interested in using cross-sectional mixed methods approaches in health sciences.*

KEYWORDS: Mixed methods designs, Cross-sectional survey, Health sciences, Cross-sectional convergent design, Cross-sectional explanatory sequential design, Cross-sectional exploratory sequential design

INTRODUCTION

More and more researchers in health sciences have become interested in using complex mixed methods designs such as longitudinal mixed methods designs (Plano Clark et al., 2014; Rayburn, 2013; Van Ness, Fried, & Gill, 2011) and cross-sectional mixed methods designs (Bowling, 2009; Chow, Quine, & Li, 2010; Hasan, Muhaddes, Camellia, Selim, & Rashid, 2014) to investigate different health-related issues across countries. While the longitudinal mixed methods designs have been used to combine quantitative and qualitative approaches to investigate phenomena that change over time such as developmental processes, responses to interventions, and social trends longitudinal research (Plano Clark et al., 2014), the cross-sectional mixed methods are well suited for examining studies that cross different sections by combining quantitative and qualitative approaches to make inferences about a population of interest (universe) at one point in time (Bowling, 2009; Prentice et al., 2011; Riegel et al., 2010; So et al., 2013). Although health and medicine counts the greatest number of mixed methods studies and covers various disciplines (Ivankova & Kawamura, 2010), little is known about how healthcare researchers have applied cross-sectional mixed methods designs in their specific disciplines (Ivankova & Kawamura, 2010), what methodological issues these applied researchers should pay attention to when they used the cross-sectional mixed methods designs in their studies, and how to conceptualize cross-sectional mixed methods designs that can help novice researchers conduct their own cross-sectional mixed methods studies in health sciences (Bowling, 2009; Ivankova & Kawamura, 2010).

Research Problem

In the current study, methodological review was used to provide novice researchers in health sciences and methodologists with some ideas and insights by describing empirical cross-sectional mixed methods studies that were published in different peer-reviewed journals

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through the end of 2014 and discussing methodological issues related to cross-sectional mixed methods designs in health sciences. My research questions were as follows:

1. What methodological issues have risen when different researchers conducted cross-sectional mixed methods studies in health sciences?

2. Are there any commonly-used cross-sectional mixed methods designs that can be recommendable for fellow researchers in health sciences to use?

The rest of this article consists of four sections. I begin by discussing two conceptual perspectives in cross-sectional mixed methods designs. Next I turn to the method in which a methodological review was conducted to locate and describe the empirical cross-sectional mixed methods studies in health sciences through the end of 2014 via EBSCO. This is followed by presentation of the results. In the last section, I give conclusions and ideas for future research to both applied researchers in health sciences and mixed methods methodologists based on the results.

LITERATURE REVIEW

In order to better understand cross-sectional mixed methods designs in this methodological review, two different conceptual perspectives were first introduced, which are the context of cross-sectional research, and different purposes and designs in mixed methods research.

The Context of Cross-sectional Research

The cross-sectional research is a research approach in which the researchers investigate the state of affairs in a population at a certain point in time (Bethlehem, 1999). Instead of using a census or a complete enumeration to get information in the target population, in practice, the researchers collect data on only a small part of the population to get information about the sampled elements of the population as a whole. Very often, the elements in the sample survey are selected at random to make inference about the population as a whole. Therefore, in the cross-sectional research, sample surveys are frequently used by the researchers in diverse fields.

Purposes and Designs in Mixed Methods Research

Different researchers use mixed methods designs for different purposes. Collins, Onwuegbuzie, and Sutton (2006) have profiled the rationales for using both quantitative and qualitative methods in diverse fields as participant enrichment, instrument validity and reliability, treatment integrity, and significance enhancement. Greene, Caracelli and Grahan (1989) suggested five purposes of using mixed method research: triangulation, complementarity, development, initiation and expansion. In *triangulation*, researchers use more than one method to gather and analyze data about the same phenomenon by seeking convergence and corroboration of results for the purpose of eliminating the inherent bias associated with using only one method (Onwuegbuzie & Leech, 2006). The objective of triangulation is to test the consistency from both quantitative results and qualitative findings (Patton 2002). In *complementarity*, researchers use different phenomena to amplify and enhance the results from one research approach with the findings from another methodology (Johnson, Onwuegbuzie, & Turner, 2007). In *development*, researchers use results from one

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stage of research in a sequential design to inform the development of the methods for the next stage (Ngulube, Mokwatlo, & Ndwandwe, 2009). In *initiation*, researchers try to seek contradictions and new perspectives in order to find out the causes of existing inconsistencies and paradoxes (Ngulube, Mokwatlo, & Ndwandwe, 2009). In *expansion*, researchers use different methods to extend breadth and scope of an investigation for various components of the search.

According to Creswell and Plano Clark (2007), mixed methods is primarily viewed as a method approach. Figure 1 presents a diagram of the essence of mixed methods research (Creswell, 2010). Creswell (2010) stated that mixed methods is more than simply the collection of two independent strands of quantitative (QUAN) and qualitative (QUAL) data. Essentially, mixed methods involves the connection, integration, or linking of both quantitative and qualitative data, and intersection of both QUAN and QUAL data strands. The circle constructed on this intersection (Figure 1) is considered as mixed methods (Creswell, 2010). Different groups of scholars and researchers have entered this circle and used mixed methods procedures within their traditional designs in diverse fields such as evaluation, public health, education, and primary medical care (Creswell & Plano Clark, 2007).

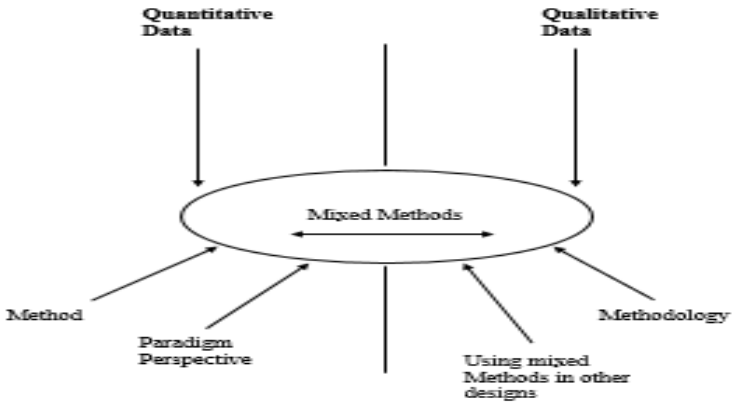

Figure 1. **The Essence of Mixed Methods Research Diagram.** SOURCE: Creswell, 2010.

In the spirit of helping beginning mixed methods researchers, Creswell (2015) presented three basic mixed methods designs (i.e., convergent design, explanatory sequential design, and exploratory sequential design) as the core designs that underlie all mixed methods studies.

1. The Convergent Design: In the convergent design, quantitative data and results yield general trends and relationships, while qualitative results provide in-depth personal perspectives of individuals. The combination or merging of both quantitative and qualitative results add up to not only more data, but also a more complete understanding than what would have been provided by each database alone. As a result, by using convergent design, the mixed methods researchers can advance multiple perspectives or even validate one database with the other.

2. The Explanatory Sequential Design: In the explanatory sequential design, a study begins with a quantitative component, and a subsequent qualitative component of the same study is followed. As a result, by using the explanatory sequential design, the mixed methods researchers can draw inferences about how the qualitative results help to explain the quantitative results.

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3. The Exploratory Sequential Design: In the exploratory sequential design, a study begins with a qualitative data collection and analysis, develop an instrument or intervention, and a subsequent quantitative phase of the same study is followed. As a result, by using the exploratory sequential design, the mixed methods researchers can report how the new quantitative component (e.g., measures, instruments, or activities) improves upon the existing set of variables, provides a new and better contextualized instrument, enhances the workability of the intervention, or adds insights into generalizability to a large sample.

As Creswell's designs differ in terms of purposes for the quantitative and qualitative data collection and data analysis, different cross-sectional mixed methods designs that correspond with the collection of quantitative data using different quantitative cross-sectional surveys (i.e., across two or more sections at one point in time) were used by healthcare researchers. In the current study, different cross-sectional mixed methods approaches in the reviewed empirical articles were described, and their common characteristics were presented and discussed here.

METHOD

In order to address the research questions of current study, a methodological review was conducted (Khan, Kunz, Kleijnen, & Antes, 2003). An online database EBSCO was used to locate the peer-reviewed full text empirical journal articles with reference available that were published through the end of 2014 using the terms "cross-sectional" and "mixed methods" in the titles and/or in the abstracts. After the first round of search was completed, a total of 108 search results were found that met the above-mentioned criteria. The second round of search review was conducted by reviewing the title, abstract, and method section of all 108 articles. The author took notes to make sure that all these 108 articles were empirical studies with both cross-sectional research (i.e., using a cross-sectional survey or several cross-sectional surveys to investigate the state of affairs in a population across different sections at a certain point in time) and mixed methods design (i.e., integrating quantitative and qualitative components concurrently or in a sequence) used in the same single study. Based on the second round of review, a total of 82 articles were identified as cross-sectional mixed methods studies.

As health and medicine counts the greatest number of mixed methods studies and cover various disciplines (Ivankova & Kawamura, 2010), the third round of full-text reviews was conducted to make sure that all 82 cross-sectional mixed methods studies were published in health sciences through the end of 2014 via EBSCO database. Seventy eight out of 82 articles were finally identified to meet this criterion.

The codebook was then created based on the conceptual framework and categories firstly used by Creswell (2015) and Creswell and Plano Clark (2011). Coding categories included (a) name of the cross-sectional mixed methods design labeled by the author(s); (b) type of mixed methods design used; (c) discipline in the health science; (4) type of integration; (5) purpose of the study; (6) author(s) and publication year; (7) title of the article, (8) title of the journal, and (9) notes for the analyst to add any comments to the article.

After all 78 cross-sectional articles were coded, a well-trained mixed methods methodologist was invited to review the quantitative and qualitative analyses and corresponding codes to make sure any discrepancies can be resolved and the agreements can be reached before the results were adequately presented and corresponding discussion was made. In the following

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sections, a brief summary of the basic information about the articles was presented first, followed by the description of the methodological issues regarding methods and methodology such as research questions, sampling issues, purposes and rationales for using mixed methods, integration of quantitative and qualitative data sources and analyses, and other possible methodological issues, and a framework for conceptualizing cross-sectional mixed methods design typologies in health sciences.

RESULTS

Descriptive Statistics about the Articles

After three round of search via EBSCO database, seventy eight empirical articles were identified using the cross-sectional mixed methods designs in health sciences that were published through the end of 2014 (see Figure 2). The earliest single empirical article was published in 2003 (Harwood et al., 2003). There was a highest number of 15 cross-sectional mixed methods empirical articles published in 2010. The graph (see Figure 2) presents the trend of using the cross-sectional mixed methods designs in the health and medicine through the end of 2014.

All 78 cross-sectional mixed methods empirical articles in 61 journals were mostly published by teams (the number of authors ranged from 1 to 13, with M=4.9, SD=2.6). Only four articles were written by sole authors.

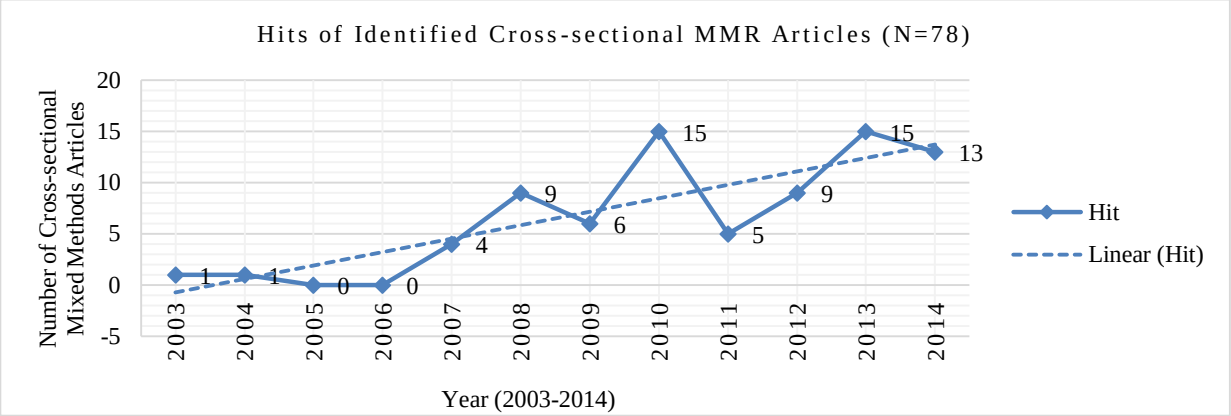

Figure 2. Hits of Identified Cross-sectional MMR Articles from 2003 to 2014.

Among all 78 articles, 39.7% of the articles (n=31) included authors from the United States, 12.8% (n=10) from the United Kingdom, 10.3% (n=8) from Canada. Authors were also from Australia, Bangladesh, Belgium, China, Denmark, Germany, India, Ireland, New Zealand, Portugal, Slovakia, Sweden, the Netherlands, and 10.3% (n=8) of the articles were co-authored by the researchers from two or three different countries such as USA and China; USA and India; The Netherlands and Belgium; Norway, Ethiopia and Sweden; South Korea and USA; USA and Australia, and Canada and Uganda (see Figure 3.).

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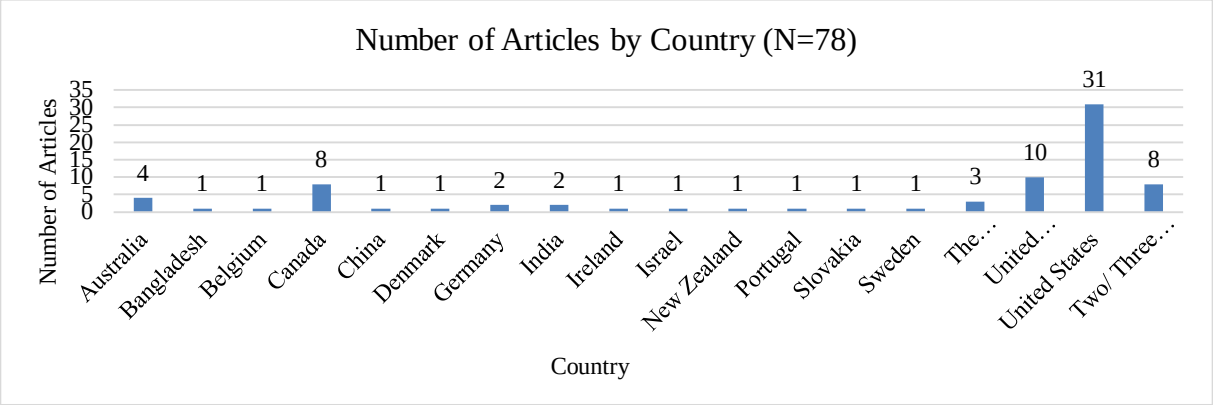

Figure 3. Number of Articles by Country (N=78).

Only a minority of the articles (n=27) correctly labeled the term "mixed methods" in their studies. The majority of the articles used the term "mixed method (n=11)", "mixed-method (n=21)", "mixed-methods (n=17)", or others (n=2) to label the studies (see Figure 4). Only a minority of the articles (n=11) used the words "sequential", "explanatory sequential", "exploratory sequential", or "convergent" to label the studies.

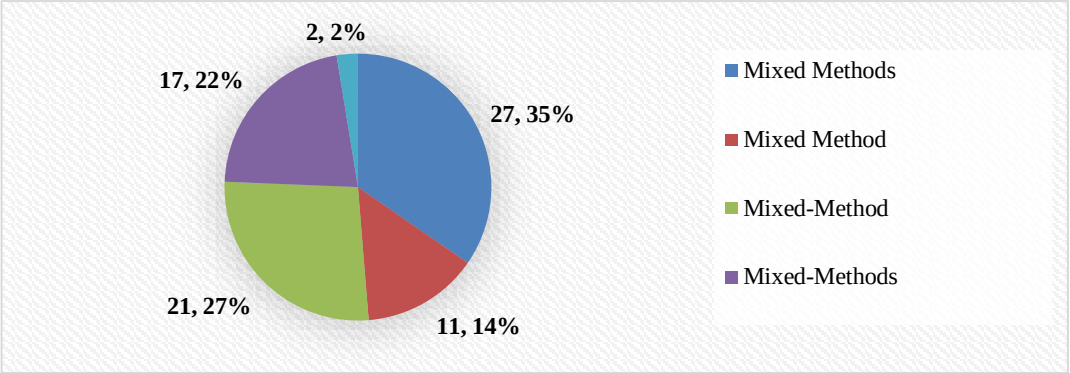

Figure 4. Different categories of Labeling Mixed Methods Studies.

Purposes and Rationales for a Cross-sectional Mixed Methods Design

The purposes and rationales for choosing a cross-sectional mixed methods design varied as the research topics and disciplines were different in the health and medicine sciences. Half of the

articles (n=39) examined or investigated health-related issues from different perspectives, such as comparing the perceptions of adult patients, family carers, nurses and dietitians regarding home percutaneous endoscopic gastrostomy feeding (Brotherton, Abbott, Hurley, & Aggett, 2007b), examining family caregivers' role in promoting adherence to antiretroviral therapy (ART) (Fredriksen-Goldsen et al., 2011), examining a long-term follow-up evaluation of CF genetics (Cavanagh, Compton, Tluczek, Brown, & Farrell, 2010), investigating meaning-making appraisal for spinal cord injury survivors (deRoon-Cassini, de St. Aubin, Valvano, Hastings, & Brasel, 2013), and investigating and describing the role of drug service user groups in local service user involvement (UI) (Patterson, Weaver, & Crawford, 2010). Eighteen articles with the purpose of exploring the association between variables, such as exploring how gender influences the healthcare leadership (Bartels, Goetz, Ward, & Carnes, 2008); exploring and comparing the perceptions of parents to those of pediatric outreach nurses and pediatric

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dietitians (Brotherton, Abbott, Hurley, & Aggett, 2007a), or the unfolding of an experience at a certain point in time, such as exploring hospitalizations of the patients in the last three months of life (De Korte-Verhoef et al., 2014), exploring women's and couples' motivations to terminate pregnancies (Gipson & Hindin, 2008), exploring cultural attitudes toward caregiving and long-term care and their influence on patterns of long-term care use among Mexican American family caregivers of relatives aged 50 and older (Herrera, Lee, Palos, & Torres-Vigil, 2008), and exploring the knowledge, attitude & behaviors of people in mid-life towards cancer prevention (Keeney, Mckenna, Fleming, & Mcilfatrick, 2010), and exploring teenagers' views of pregnancy (Bell, Glover, & Alexander, 2014). In addition, some articles (n=8) reported the development of the measures, prevention, assessment, or intervention programs. For example, Alcorn et al. (2010) conducted a study to inductively derive core themes of religion and/or spirituality active in patients' experiences of advanced cancer to inform the development of spiritual care interventions in the terminally ill cancer setting. Ginsburg et al. (2009) conducted a study to define patient safety event (PSE) learning response and provided preliminary validation of a measure of PSE learning response. Graham, Pemstein, & Palfrey (2008) measured enrolment of children with mechanical respiratory support needs and described challenges in execution of individual family service plans (IFSPs).

Regarding the rationales for using the mixed methods and cross-sectional surveys, the majority of the articles (n=58) mentioned explicitly or implicitly a rationale for using mixed methods. A rationale indicated for the need for a mixed methods approach can be summarized as follows: 1) to use qualitative results to develop cross-sectional surveys or to form quantitative variables (Dilles, Elseviers, Van Rompaey,Van Bortel, & Stichele, 2011; Doran et al., 2007; Ginsburg et al., 2009), 2) to use the qualitative data to enhance, explain, support, verify quantitative results, or to clarify specific quantitative issues (Egan et al., 2011; Eley, Boyes, Young, & Hegney, 2009; Ferrajão & Oliveira, 2014; Harding & Molloy, 2008), 3) to use the qualitative data to reveal significant gaps from quantitative data, or to explore further topics that are not included in the quantitative survey (Ganju, Mahapatra, & Saggurti, 2013;, 4) to merge or combine both quantitative and qualitative data complementarily to provide a richer source of information about an issue or to suggest a high level of confidence (Fredriksen-Goldsen et al., 2011; Jeppesen, Madsen, Marquardt, and Rahbek, 2010). For example, Jeppesen, Madsen, Marquardt, and Rahbek (2010) stated that triangulation allows "for complementary perspectives" (p. 16). Meisels, Wen, and Beachy-Quick (2010) pointed out that qualitative results used to uncover potential explanations for research questions (p.69). So et al. (2013) stated that "the combination of both quantitative and qualitative methods provide a richer source of information about the supportive care needs of H&N cancer survivors and the effects of perceived unmet needs on their QOL" (p.2755). Waldrop, Clemency, Maguin, and Lindstrom (2014) considered that quantitative and qualitative results together suggested a high levels of confidence" (p. 340).

Commonly-used Cross-sectional Mixed Methods Designs

Based on the three basic mixed methods designs presented by Creswell and Plano Clark (2007), the reviewed articles were classified into three main different categories (see Table 1.). Table 1 tells us that 40% (n=31) of the reviewed articles began with a quantitative strand first followed by a qualitative strand, which was labeled as the explanatory sequential designs, 33% (n=26) of the reviewed articles collected qualitative data first followed by the collection of quantitative data, which is labeled as the exploratory sequential designs, 24% (n=19) of the reviewed articles collected both quantitative and qualitative data simultaneously, which is

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labeled as the convergent designs, and 3% (n=2) of the reviewed articles used the community-based participatory approach that were classified as "other" because they did not meet the definitions of any of the three approaches Several dimensions were used to differentiate three types of designs that were used in the reviewed studies, which are classification of the design, sites and sampling scheme, measures, overall sequence of quantitative and qualitative strands, the location of data integration, and type of data integration. These dimensions are summarized in Table 2.

Table 1. Description of the Cross-sectional Mixed Methods Design Used in the Reviewed Articles

Design[a]	Name	Number and Percentage	Author(s) and Year
Cross-sectional Mixed Methods Design	The Convergent Design	19 (24%)	Botezatu, Hult, Kassaye Tessma, & Fors (2010); Brock, Northcraft-Baxter, Escoffery, & Greene (2012); Brotherton, Abbott, Hurley, & Aggett (2007a); Cavanagh, Compton, Tluczek, Brown, & Farrell (2010);Courtney-Pratt, FitzGerald, Ford, Marsden, & Marlow (2012); Gipson & Hindin (2008); Halkitis et al. (2009); Jones et al. (2012); Joshi, Mohan, Grin, & Perin (2013); Lipsky, Cristofalo, Reed, Caetano, & Roy-Byrne (2012); Lundberg, McIntire, & Creasman (2008); Martin, Keswick, Crayton, & LeVeck (2012); Miller et al. (2009); Moore (2008); Patterson, Weaver, & Crawford (2010); Rose, Friedman, Annang, Spencer, & Lindley (2014); Sabo et al. (2013); Samarova, Shilo, & Diamond (2014); Worthington et al. (2010)
	The Explanatory Sequential Design	31 (40%)	Bartels, Goetz, Ward, & Carnes (2008); Bhatnagar, Brown, Saravanamurthy, Kumar, & Detels (2013); Chow, Quine, & Li (2010); De Korte-Verhoef et al. (2014); Eley, Boyes, Young, & Hegney (2009); Ganju, Mahapatra, & Saggurti (2013); Graham, Pemstein, & Palfrey (2008); Hasan, Muhaddes, Camellia, Selim, & Rashid (2014); Hayashi et al. (2013); Herrera, Lee, Palos, & Torres-Vigil (2008); Jeppesen, Madsen, Marquardt, & Rahbek (2010); Kouwenhoven et al. (2013); Lau, Markham, Hua Lin, Flores, & Chacko (2009); Matevosyan (2010); Meisels, Wen, & Beachy-Quick (2010); Mishtal & Dannefer (2010); Molla, Emmelin, Berhane, & Lindtjørn (2009); Mishtal & Dannefer (2010); Molla, Emmelin, Berhane, & Lindtjørn (2009); Park & Han (2010); Perkins, Ball, Kemp, & Hollingsworth (2013); Riegel et al. (2010); So et al. (2013); Svavarsdottir (2010); Sweeney et al. (2014); Thomson, Vandenberg, & Fitzgerald

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			(2012); van der Spek et al. (2013); Wagner & Gregory (2014); Waldrop, Clemency, Maguin, & Lindstrom (2014); Wood, Low, Molassiotis, & Tookman (2013); Wool & Dudek (2013);Wynne et al. (2014); Zibrowski, Weston, & Goldszmidt (2008)
	The Exploratory Sequential Design	26 (33%)	Alcorn et al. (2010); Bell, Glover, & Alexander (2014); Brotherton, Abbott, Hurley, & Aggett (2007b); Decker et al. (2014); Doran et al. (2007); deRoon-Cassini, de St. Aubin, Valvano, Hastings, & Brasel (2013); Dilles, Elseviers, Van Rompaey, Van Bortel, & Stichele (2011);Doran et al. (2007); Egan et al. (2011); Ferrajão & Oliveira (2014); Fredriksen-Goldsen et al. (2011); Ginsburg et al. (2009); Harding & Molloy (2008); Harwood et al. (2003); Keeney, Mckenna, Fleming, & Mcilfatrick (2010); Kelcíkova, Skodova, & Straka (2012); Körner, Ehrhardt, & Steger (2013); Leemans et al. (2014); Maudsley, Williams, & Taylor (2007); Maudsley, Williams, & Taylor (2008); Moses (2011); Müller et al. (2013); Parsons, Missildine, Van Ora, Purcell, & Gómez (2004); Siminoff, Thomson, & Dumenci (2014); Wallace, Ye, & Chhuon (2012a); Wallace, Ye, McHugh, & Chhuon (2012b); Wang et al. (2013);
Other	Community-based Participatory Approach	2 (3%)	Baker et al.(2010); Prentice et al. (2011)
Total		78 (100%)	

Designs based on the Designs suggested by Creswell and Plark Clark (2007).

The Cross-sectional Convergent Design. Nineteen articles used the convergent design in the studies. Here I proposed to use the cross-sectional convergent designs to label all cross-sectional mixed methods studies that use both quantitative and qualitative approaches concurrently to test the consistency of both quantitative results and qualitative findings, or to amplify and enhance the results from one research approach with the findings from the other methodology. For example, in Jones et al.'s study (2012), a purposeful sample of 22 American Indian women with previous gestational diabetes were recruited using one demographic questionnaire, four different cross-sectional surveys, and one medical record to collect quantitative data about their metabolic syndromes, their cardiometabolic knowledge, self-efficacy, and risk perception from four different clinics of a large tribal health care system. Meanwhile, a purposeful sample of 17 women were selected from 22 women to conduct semi-structured interviews to know more about these women's perceptions and self-efficacy beliefs about risk for type 2 diabetes and cardiovascular disease in the context of American Indian culture (see Figure 5). Jones et al. (2012) analyzed the quantitative and qualitative data separately and merged the quantitative results and qualitative findings by connecting four

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categories that emerged from the qualitative data analysis to the quantitative data analysis and by making overall interpretations of the different levels of knowledge and risk perception to the promotion of self-efficacy that were used to prevent cardiometabolic disease among American Indian women with previous gestational diabetes.

Table 2. Dimensions in Different Cross-sectional Mixed Methods Designs

Dimension	Function	Options
Classification of the design	What specific mixed methods design is used in the study	Convergent design Explanatory sequential design Exploratory sequential design Other
Sampling scheme	What sampling strategies/schemes are used	Purposeful sampling Simple random sampling Convenience sampling Snowball sampling Stratified sampling Maximum variation sampling Focus group Other
Instrument (s)	What instruments are used to collect both quantitative and qualitative data	Valid surveys Self-developed Surveys Medical records Other
Overall sequence	Sequence of quantitative strand and qualitative strands are followed	QUAN+QUAL QUAN—>qual QUAL—>quan Other
Location of data integration	Where the quantitative strands and qualitative strands are integrated	Date collection Data analysis Results section
Types of data integration	How the quantitative strands and qualitative strands are integrated	Merging of the data Explanation of the data Connection of the data Building of the data Other

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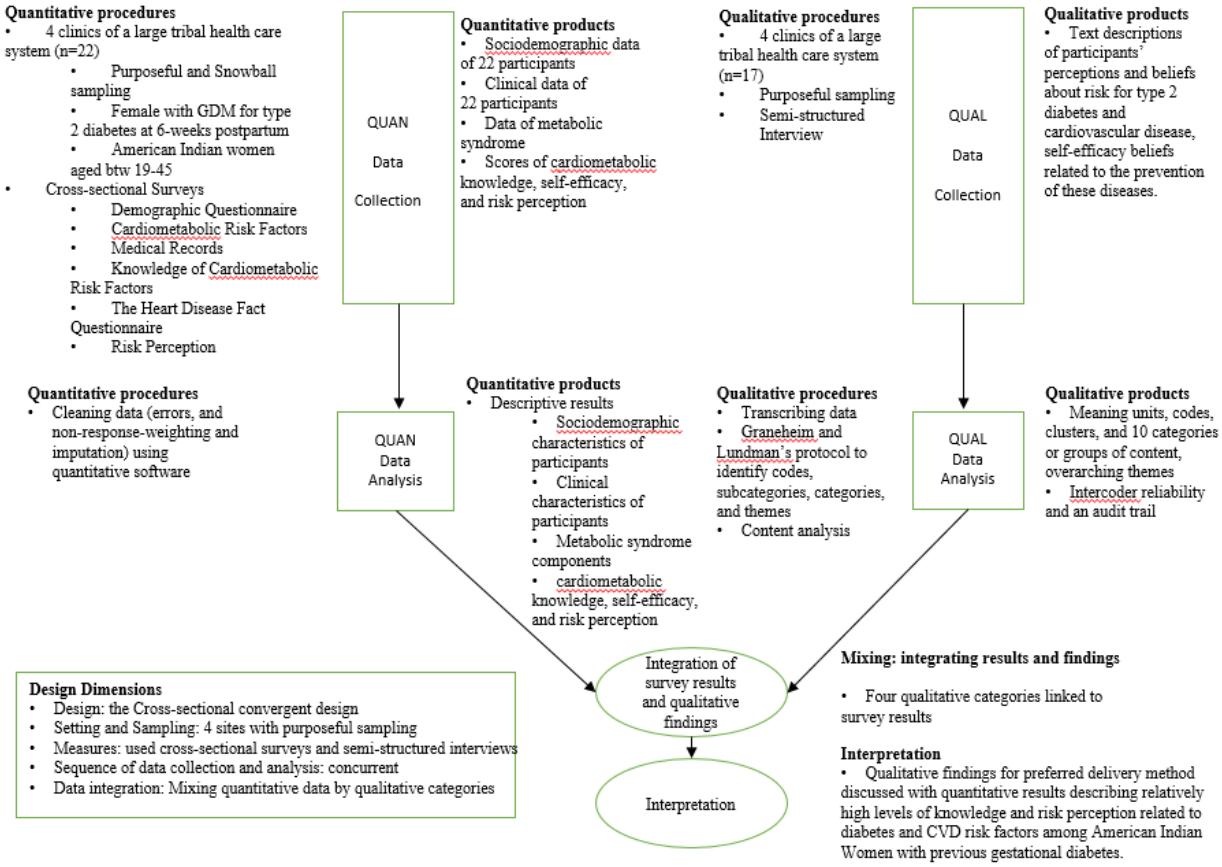

Figure 5. Diagram for a Study That Used the Cross-sectional Convergent Design.

Note: Diagram based on Jones et al's study (2012).

The Cross-sectional Explanatory Sequential Design. Although many researchers did not explicitly labeled an explanatory sequential design used in their cross-sectional mixed methods studies, based on the sequence of first using quantitative methods and subsequent using qualitative methods to explain the quantitative results (Creswell & Plano Clark, 2010), thirty one articles were identified as explanatory sequential studies. Here I proposed to use the cross-sectional explanatory sequential designs to label all cross-sectional mixed methods studies that use results from quantitative stage of research in a sequential design to extend breadth and scope of the same study by conducting a qualitative research, or researchers try to seek contradictions and gaps from the quantitative strand in orders to find out the causes of existing inconsistencies or new perspectives by conducting a qualitative study. For example, in Hasan, Muhaddes, Camellia, Selim, and Rashid's study (2014), a purposeful sample of 226 ever-partnered women with disabilities were recruited using a cross-sectional survey of the prevalence of intimate partner violence (IPV) to collect quantitative data about their socio-demographic characteristics, different forms of violence experiences, and association between lifetime experience of violence and sociodemogrpahic characteristics from four districts of Bangladesh.

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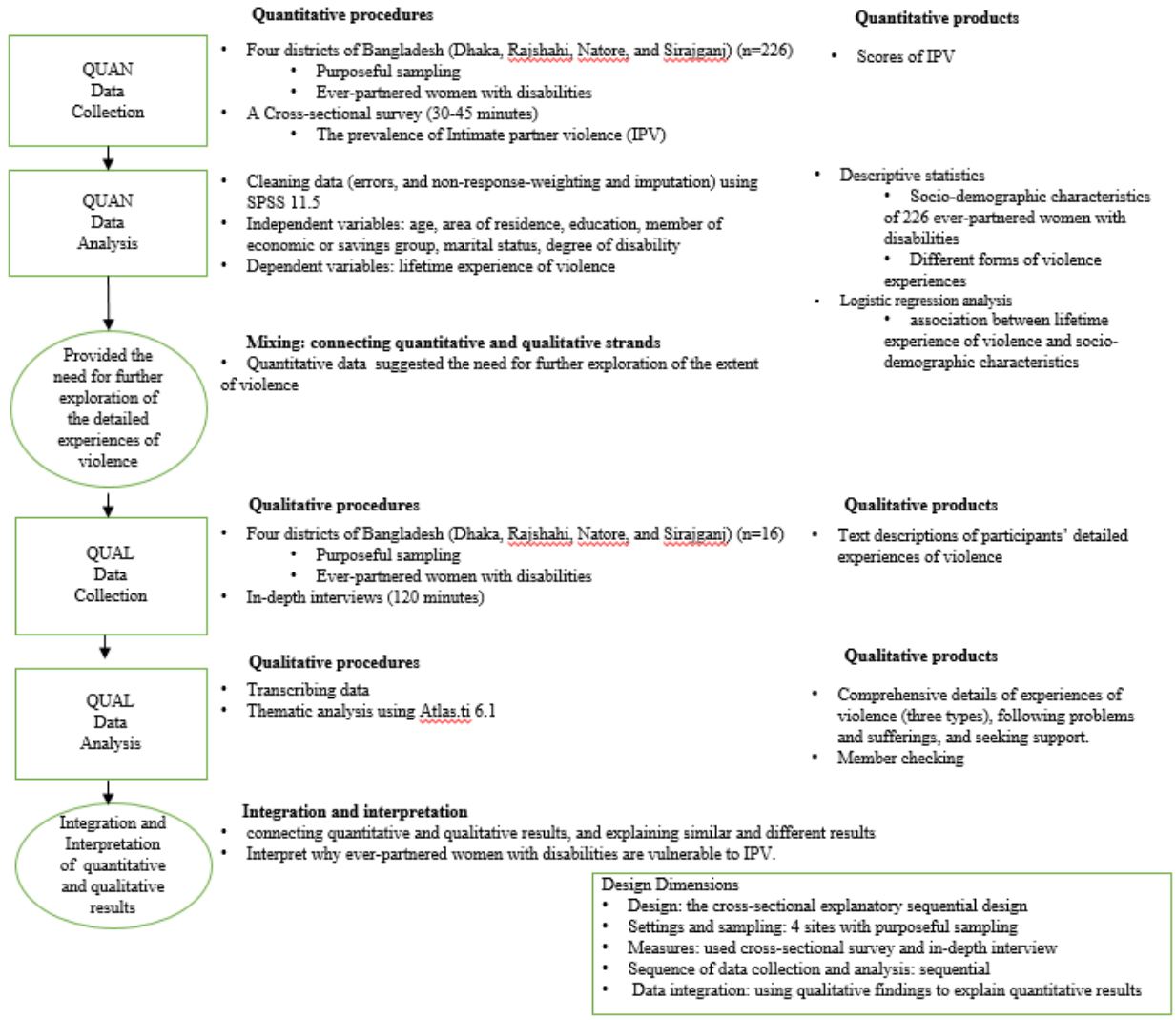

Figure 6. Diagram for a Study That Used the Cross-sectional Explanatory Sequential Design.

Note: Diagram based on Hasan, Muhaddes, Camellia, Selim, & Rashid's study (2014).

The results from the quantitative analysis provided the need for further exploration of the detailed experience of violence in the qualitative strand. A purposeful sample of 16 women were selected from 226 women to conduct in-depth interviews to get comprehensive details of experiences of three types of violence, following problems and sufferings, and seeking support. Hasan, Muhaddes, Camellia, Selim, and Rashid (2014) analyzed the quantitative data first and connected quantitative and qualitative strands that suggested the need for further exploration of the extent of violence. After the qualitative data were analyzed, they connect quantitative and qualitative results again to explain similar and different results. They finally interpreted the factors why ever-partnered women with disabilities were vulnerable to IPV.

The Cross-sectional Exploratory Sequential Design. Twenty six articles used the exploratory sequential design in the studies. Here I proposed to use the cross-sectional exploratory sequential designs to label all cross-sectional mixed methods studies that researchers use results from qualitative strand of research in a sequential design to inform the

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development of the methods, instruments, or research questions at the quantitative stage. In Müller et al.'s study (2013), a purposeful sample of 17 later-career nurse ≥ 45 years from different units at a university hospital in South Germany were interviewed to explore their 'age sensitive' physical and psychological job demand, and job-specific manifestations of three action strategies selection, optimization, and compensation (SOC) in nursing. The qualitative results were used to develop a 45-item SOC-in-nursing-scale. In the quantitative phase, a convenience sample of 438 nurses from the same location were recruited to take this newly-developed SOC-in-nursing-scale. Müller et al. (2013) analyzed the qualitative data first and used the qualitative results to build a SOC-in-nursing-scale. They validated the SOC-in-nursing-scale by conducting exploratory factor

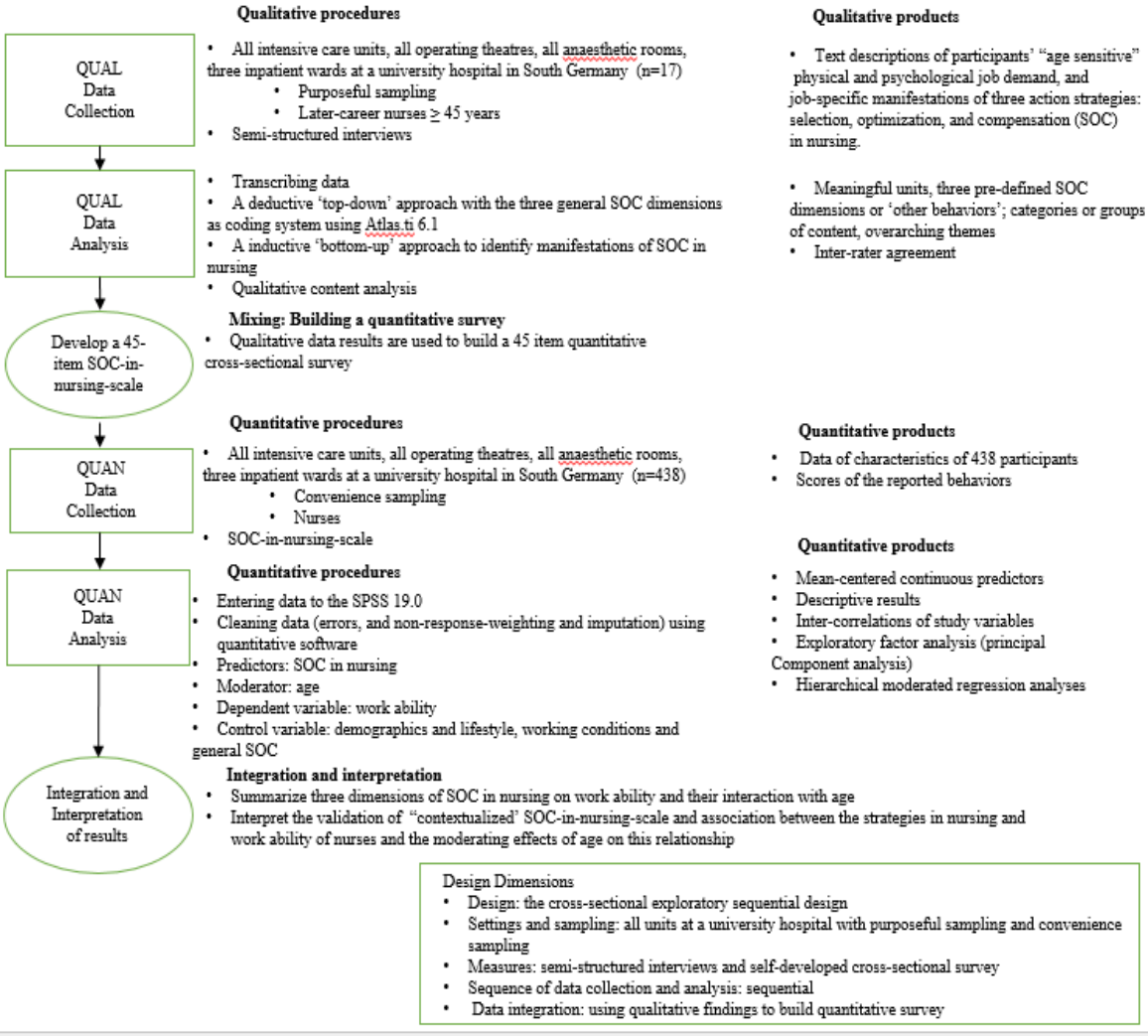

Figure 8. Diagram for a Study That Used the Cross-sectional Exploratory Sequential Design.

Note: Diagram based on Müller et al.'s study (2013).

analysis and investigated the association between the strategies in nursing and work ability of nurses and the moderating effects of age on this relationship by conducting hierarchical moderated regression analyses, and concluded that selection, optimization, and compensation in nursing contribute positively to work ability, particularly in older nurses.

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Other cross-sectional mixed methods designs. Although most reviewed articles were identified explicitly or implicitly using one of the three basic approaches, two studies did not followed the designs that were suggested by Creswell and Plano Clark (2007). Therefore these two studies were classified as "other" and did not discussed in the current study.

CONCLUSION

The purpose of this study was to answer two research questions: 1) what methodological issues have risen when different researchers conducted cross-sectional mixed methods studies in health and medicine? 2) Whether or not there are any basic commonly-used cross-sectional mixed methods designs that can be recommendable for fellow researchers in health sciences to use. A methodological review was conducted in response to these two research questions. The EBSCO database was uses in this methodological study to locate the all cross-sectional mixed methods articles through the end of 2014, and systematically reviewed all 78 empirical peer-reviewed studies in health and medicine that met the search criteria.

Invankova and Kawamura (2010) have stated that health and medicine counts for the greatest number of mixed methods studies and covers a variety of disciplines. The results from this study confirmed that health and medicine researchers have been actively using different approaches to conduct cross-sectional mixed methods studies in various disciplines, and there is an increasing trend for researchers in different fields to use cross-sectional mixed methods designs to conduct their studies around the world.

Results from the study indicate some formal training in mixed methods research is needed for many health and medicine researchers. Although mixed methods as a third approach have been widely used by different researchers in many different fields (Creswell, 2010), authors of many reviewed articles failed to use the term "mixed methods" to correctly label their studies. Although many researchers explicitly indicated a mixed methods design was needed to investigate their research issues, they failed to propose the mixed research questions that could correspond to their results. Instead, most reviewed articles used qualitative word such as "explore" or quantitative word "examine" in their studies. In addition, although authors of many reviewed articles successfully collected and analyzed both quantitative and qualitative data, they did not mention if the quantitative and qualitative data were collected concurrently or in a certain sequence, and whether or not they should integrate both quantitative and qualitative data either during data collection, data analysis, or results section, and how they should integrate both quantitative and qualitative data such as either merging of the data, explanation of the data, building of the data, or embedding of the data. Authors of many articles indicated that a 'cross-sectional mixed methods design' was used, however, they did not mention which specific approaches they have used to conduct their studies.

IMPLICATION TO RESEARCH AND PRACTICE

This review study provides an initial conceptual framework for the novice researchers in health sciences to conduct their own studies across various disciplines. Researchers who apply these designs can use the identified dimensions to anticipate and address challenges that are likely to occur and to make their own innovative efforts by mixing the cross-sectional aspects with the mixed methods to meet their specific research needs.

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Three basic mixed methods designs presented by Creswell and Plano Clark (2007) are suggested here as basic commonly-used cross-sectional mixed methods approaches in health sciences across different disciplines to conceptualize, implement, and report a cross-sectional mixed methods study. These three commonly-used cross-sectional mixed methods approaches are: 1) the cross-sectional convergent design, 2) the cross-sectional explanatory sequential design, and 3) the cross-sectional exploratory sequential design. The cross-sectional convergent design can be used when the results of the analyses of quantitative and qualitative data need to be merged to provide a richer source of information, or to suggest a high level of confidence, or to synthesize complementary results. The cross-sectional explanatory sequential design can be used when qualitative data are used to explain the results of the quantitative data, to clarify specific quantitative issues, or to reveal significant gaps from quantitative gap, or to explore further topics that are not included in the quantitative strand. The cross-sectional exploratory sequential design can be used when the qualitative results is used to develop a cross-sectional survey or typology, to form quantitative variables, or to generate new programs or intervention features.

Several limitations should be considered when different researchers in health sciences try to use these results. Because this study only reviewed articles from one database EBSCO, many empirical cross-sectional mixed methods studies from different databases were not included. It is very likely that variations can be found from different published empirical studies in health sciences. Therefore, the results from this methodological review cannot be generalized beyond this sample. It is suggested that different dimensions and advanced cross-sectional mixed methods designs are to be proposed and investigated.

FUTURE RESEARCH

Further study is needed to provide researchers with the conceptualization of advanced designs in cross-sectional mixed methods research to investigate more complicated research issues in health sciences. In addition, such issues as how to integrate quantitative and qualitative data, and how to visualize both quantitative results and qualitative findings in a way that improves data analysis in cross-sectional mixed methods designs in health sciences should also be fully explored and investigated.

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