Mixed-Methods Evaluation

MIXED-METHODS EVALUATION

A Chinese Women Cancer Screening Program

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UCF Pressbooks
Orlando, FL

Contents

OVERVIEW

Using Visual Diagrams to Communicate Complex Mixed-Methods Research Design Procedures

Mixed Methods in Public Health Research in Taiwan:

Using Visual Diagrams to Communicate Complex Design Procedures

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Abstract

Scholars introduce modern mixed methods research (MMR) and its application in public health research in Taiwan. Specifically, they showcase a multi-phased Taiwan Cervical Cancer Screening mixed methods study using visual diagrams to communicate complex design procedures. While some previous researchers have incorporated quantitative and qualitative data in research, here we hope to provide significant clarity to guide those new to the MMR field. We have structured the paper in the following way. First, we provide a brief overview of mixed methods research. Second, we illustrate the compelling need for MMR from a public health perspective using cancer screenings as an example. Third, we introduce the Taiwan Cervical Cancer Screening Program as an exemplar of MMR application and the utility of visual diagrams. Study methodology can be applied to international researchers and scholars from interdisciplinary fields beyond public health.

Keywords: mixed methods research, Taiwan, public health, cervical cancer screening, visual diagram

Note

This is an Accepted Manuscript of an article published by Health Care for Women International on 28/11/2018, available online: https://www.tandfonline.com/doi/full/10.1080/07399332.2018.1516769

Many public health problems are complex. To date, most researchers have attempted to solve these complex problems by using monomethod research approaches. Monomethod research approaches in essence use exclusively quantitative research approaches or exclusively qualitative approaches (Teddlie & Tashakkori, 2009). Over the past three decades, the mixed methods research paradigm has emerged as a third alternative to quantitative and qualitative research paradigms (Creswell & Clark, 2018). Although modern mixed methods research was established in the late 1980's and still has a relatively short history, researchers around the globe are embracing mixed methods research (Fetters, 2016). By integrating both qualitative and quantitative procedures, mixed methods research offers the power of numbers (quantitative) and stories (qualitative) for investigating complex social, behavioral and health sciences (Pluye & Hong, 2013). Researchers and scholars from public health fields and other social and behavioral science areas can learn the value of modern mixed methods methodology and its development, and how to use visual diagrams to communicate complex mixed methods design procedures.

By definition Mixed Methods Research (MMR) is "a research approach or methodology: (1) focusing on research questions that call for real-life contextual understandings, multi-level perspectives, and cultural influences; (2) employing rigorous quantitative research assessing magnitude and frequency of constructs and rigorous qualitative research exploring the meaning and understanding of constructs; (3) utilizing multiple methods (e.g., intervention trials and in-depth interviews); (4) intentionally integrating or combining these methods to draw on the strengths of each; and (5) framing the investigation within philosophical and theoretical positions" (Creswell, Klassen, Plano Clark, & Clegg Smith, 2011). A hallmark of mixed methods research is a focus on integration. Fetters and Freshwater propose all mixed methods researchers should take the mixed methods challenge, that is, to consider how to integrate both the qualitative and quantitative data together to achieve a whole greater than the sum of the individual parts. They illustrate this concept numerically as 1 + 1 = 3 (Fetters & Freshwater, 2015). Simply stated, this means the whole (3) is greater than the sum of the respective qualitative (1) and quantitative (1) parts. By integrating, researchers can gain new insights, and more robust conclusions. Ironically, while mixed methods seem strange to many researchers, there are many examples of mixed methods thinking outside of the research world. For example, consumers on their favorite shopping website leave and read reviews for the products they purchased using a five-star quality rating system as well as qualitative comments. By looking at both the star rating (quantitative) and the comments (qualitative), consumers can make informed decisions about purchases.

Mixed Methods Research Internationally and in Taiwan

International literature on mixed methods research

The modern field of mixed methods research was established in the late 1980's, and there are over 50 books published on this topic. A number of events signify the growth and vibrancy of the field. The Journal of Mixed Methods Research completed ten years of publication in 2016 (Fetters & Molina-Azorin, 2017), and the International Journal of Multiple Research Approaches re-launched in 2017 after

publication from 2007 to 2015. The Mixed Methods International Research Association (MMIRA) convened the first MMIRA conference in Boston, in 2014 (Mertens, et al., 2016). The Japan Society of Mixed Methods Research became the first affiliate of the MMIRA in 2016. In 2017, the first MMIRA Chapter, the Caribbean Chapter of MMIRA was announced. These developments underscore the growth of mixed methods research internationally.

Rationale for Using MMR in Taiwan

As a rapidly aging society, the population of people in Taiwan with cancers and chronic diseases has reached unprecedented levels that continue to grow (Chen, You, Lin, Hsu, & Yang, 2002). Cancer has continued to be the leading cause of death in Taiwan for more than 30 years. Trends of cancer incidence in Taiwan have shown a significant and persistent increase of 1.7% per year from 2002 to 2012 at rates higher than other countries (Chiang, et al., 2016).

While Taiwan has universal health coverage for regular preventive health services including cancer screenings among middle-aged adults age 40 years and older, cancer screening utilization is disappointingly low. Lessons learned from the few existing studies examining selected cancer-screening utilization among community and worksite groups in Taiwan reveal continued and general need to encourage preventive health services utilization (Hou & Chen, 2004; Hou & Chen, 2005; Hou, Fernandez, Baumler, & Parcel, 2002; Hou, Fernandez, Baumler, Parcel, & Chen, 2003; Hou, Hou, & Hou, 2014; Hou & Hou, 2014). Previous cancer screening studies in Taiwan show that only 62% of married women and 31% of single women from a community sample reported a Pap test in the preceding 3 years (Hou, et al., 2003), and less than 30% of a worksite sample had ever had a fecal occult blood test (FOBT) for colorectal cancer screening (Hou & Chen, 2004). Cancer education and screening programs are critical to relieve the cancer burden as many cancers are potentially preventable via modified behavioral lifestyles or early detection via regular screenings. Culturally tailored and innovative screening interventions have been demonstrated effective to significantly encourage more non-adherent women enrolled in the intervention group than in the control group to receive a pap test within 6 months (50% vs. 32%) (Hou, et al., 2002), and encouraged 74% of a midlife workplace sample to return a completed FOBT within 4 weeks (Hou & Chen, 2004; Hou & Chen, 2005).

Implementing effective cancer screening programs and public health services are complex and require interdisciplinary collaboration of many health professionals including nurses, health educators, physicians, social workers, care managers, as well as various community partners. Culturally tailored and innovative screening interventions require deeper understanding of the complex interplay of social, interpersonal, and individual factors influencing the adoption of preventive and screening behaviors. Evaluation and optimization of the delivery of public health programs requires sophisticated research procedures capable of adequately grasping the complexity of the public health enterprise. Mixed methods research which uses qualitative and quantitative data collection procedures, is particularly appropriate for addressing the complex research problems in the field of public health.

Despite the relevance of mixed methods research procedures for investigating complex public health issues, there are limited mixed methods research articles about public health in Taiwan. We conducted a literature search combining the key terms of "mix methods," "public health," and "Taiwan" using both the EBSCO host databases and "national library database" in Taiwan with no limitation on time period. This search failed to reveal a single article in the National Library Database in Taiwan when

using the terms "mix methods" and "public health". We then just used "mix methods" as the key search term. The search revealed five articles from the National Library Database in Taiwan and only one article in the EBSCO host databases conducted in Taiwan using mixed methods.

Using "mixed methods research" as the sole search term may not return some studies that used mixed methods research procedures in cases when the authors did not use the language of mixed methods research (Molina-Azorin & Fetters, 2016). Thus, it is possible that additional studies could be identified if we had used a different search strategy. However, it is unlikely such studies would have used state-of-the-art mixed methods procedures if they did not include mixed methods in the paper. Thus, like Ivankova & Kawamura (2010), we chose "mixed methods" as our key term as we sought studies where the authors were aware of the mixed methods research paradigm and intentionally used "mixed methods" in their study titles or abstract. As a final step, we examined carefully the actual content of all articles identified in the search as "mixed methods studies," to ensure that all the studies actually met criteria or discussed issues or trends related to mixed methods research.

Based on our literature search in Chinese and English, the few existing mixed methods research articles identified in Taiwan discussed either mixed methodology as a future trend in social and educational research (Hsieh, 2007), or the qualitative-quantitative debates and mixed methods as a new third paradigm (Kuo, 2011). Existing literature in Taiwan mostly pertains to applications in educational research (Tsai & Chauo, 2008; Sung & Pan, 2010). There were two articles identified applying mixed methods in the public health field. One evaluated a health screening program for migrant women to Taiwan (Huang, Mathers, Chia, Shiu, & Kao, 2016), and the other focused on exploring staff understanding and attitudes towards a hospital-balanced scorecard implementation (Ma, Hsu, Huang, Tsai, & Ying, 2011).

Researchers in Taiwan have shown the potential to produce quality mixed methods research. This could be enhanced by better understanding of mixed methods design procedures. Thus, the purpose of this illustration of mixed methods research in public health in Taiwan that follows is to enhance understanding of mixed methods research procedures and to demonstrate the potential for these procedures to be applied much more broadly in public health research. Lessons learned can also be applied to other countries across the world.

An application of mixed methods procedures in public health research

To provide an example of the application of MMR in public health research, here we introduce the Taiwan Cervical Cancer Screening Program, a sophisticated multi-phase mixed methods study, published via a series peer-reviewed articles in *Journal of Community Health, Healthcare for Women International, AWHONN Lifelines,Health Promotion Practices, California Journal of Health Promotion, Preventive Medicine, International Journal of Behavioral Medicine,* and a book chapter (Hou, et al., 2002; Hou, et al., 2003; Hou & Lessick, 2002; Hou, Fernandez, & Parcel, 2004; Hou & Luh, 2005; Hou, 2005; Hou, 2006a; Hou, 2006b). This study, "*Love Yourself before You Take Care of Your Family*", was a hospital-based community outreach program implemented to increase cervical cancer screening among women in Taiwan. This program of research involved a comprehensive process for the development and evaluation of a theory- and evidence-based cancer screening intervention program for Chinese women. This program of mixed methods research involved three major phases: (1) Instrument development and needs assessment (Hou et al, 2003; Hou & Lessick, 2002; Hou & Luh, 2005); (2) Intervention development using

a framework called Intervention Mapping (Hou et al, 2004; Hou, 2006a; Hou, 2006b); and (3) Program evaluation using a randomized-controlled trial (Hou et al, 2002; Hou, 2005). The mixed methods design procedures are illustrated using visual diagrams in order to facilitate communication and understanding [Creswell & Clark, 2018). The visual diagrams of Phase I to IV of the study help provide a new way to communicate and link the complex mixed methods research design phases, procedures, and products together for readers to better understand the methodological approaches (Figures 1-4).

Phase I Exploring Sequential Design for Instrument Item Development

Phase I explored, developed, and tested study instrument items using an exploratory sequential design. As illustrated in Figure 1, the study explored survey items by reviewing existing literature and theories, and then developing qualitative interview questions. The qualitative data collection involved one-on-one interviews with 14 never-been-tested Chinese women to identify key barriers to cervical cancer screenings. Four screening belief constructs (perceived benefits, barriers, norms, and perceived cancer risk), and screening-related knowledge were identified with corresponding items drafted. This quantitative measurement tool was then preliminarily tested with a sample 125 women in Taiwan. The preliminarily quantitative results showed that measurement scales were reliable, and all four screening beliefs and knowledge were significantly related to cervical cancer screening history (Figure 1).

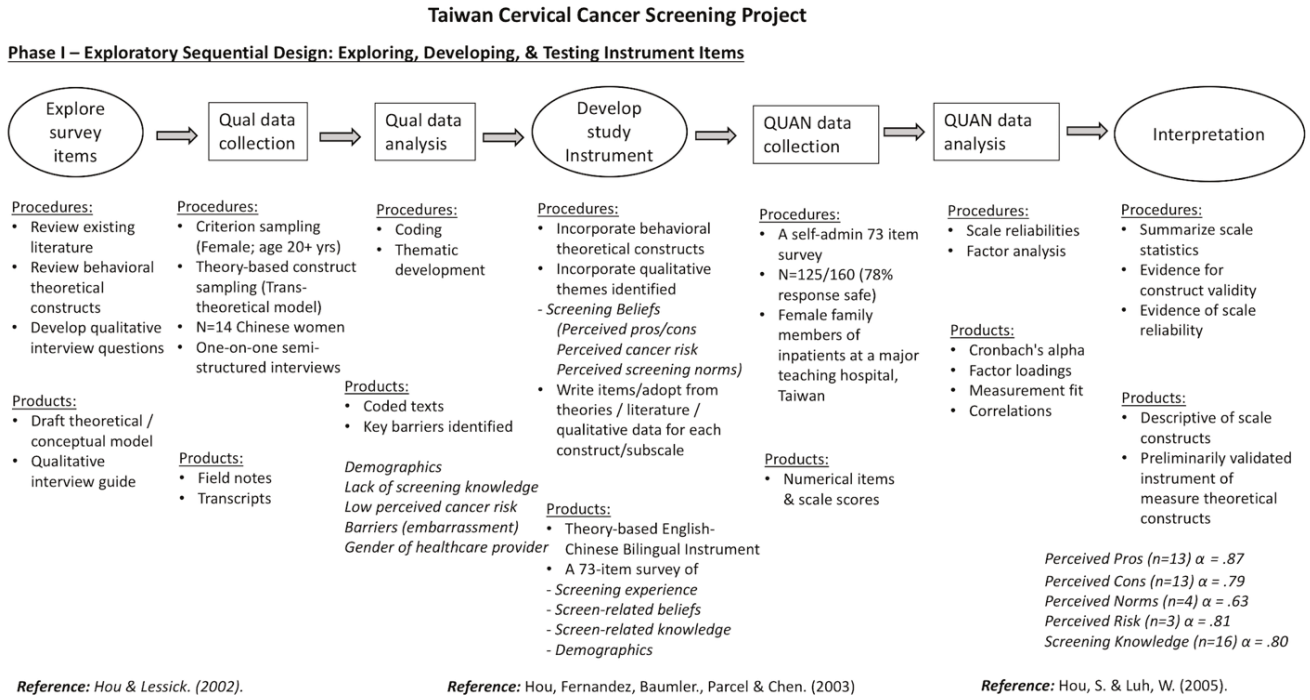


Figure 1 — Exploratory sequential design — Exploring, developing, & testing instrument items

Phase II Intervention Development Using Intervention Mapping Framework

Phase II was designed with lessons learned from Phase I. Researchers produced a three-month direct-

mail campaign intervention program that was pretested in an 8-person focus group. As illustrated in Figure 2, this "*Love Yourself before You Take Care of Your Family*" cervical cancer screening project was developed using the Intervention Mapping framework (IM), an innovative process of designing theory- and evidence-based interventions. Intervention Mapping involves an inter-connected iterative six-step process to ensure that theory and evidence guiding (a) the identification of psychosocial and environmental determinants related to cancer screening behavior, and (b) the selection of the most appropriate methods and strategies to address the identified determinants (Figure 2).

Taiwan Cervical Cancer Screening Project
"Love Yourself before You Take Care of Your Family"

Phase II – Intervention Development & Pre-testing

Step 1: Needs Assessment
Quan data collections & analyses
Qual data collections & analyses

Procedures:
- N=125 Chinese females
- 73-item survey with open-ended items

Products:
- Factors influence cervical cancer screening
- Descriptive & logistic regression results
- Discuss extent to which qual dimensions were validated via the QUAN survey scales

Step 2: Change Objective Matrices
Behavioral:
Women schedule & obtain a pap
Environmental:
Female doctors perform pap tests

Procedures:
- Guided by theories
- Include key constructs/factors identified in Phase I & Step 1 *(Intention, knowledge, pros / cons / norms / risk / cue to action)*

Products:
- Theory & evidence-based matrices of change objectives for program intervention

Step 3: Methods & Applications
Select theory-based intervention methods & practical applications

Procedures:
- Guided by theories & literature
- Use qual & QUAN Data from Phase I & Step 1
- Ensure applications address change objectives
- Expert panel review methods & applications (n=3)

Products:
- A method & strategy matrix matching with key determinants (screening knowledge, beliefs, & environmental factors)

Step 4: Intervention Program
Prog themes / scope / sequence
Materials / protocols / pretest

Procedures:
- Develop program materials based on Steps 1-3 analyses
- Qual focus group pretest (n=8) program materials

Products:
- A 3-mon. direct mail campaign materials

1st month –
[personalized welcome letter / cervical cancer & Pap brochure / quotes of other women's experience / screening schedule w/ dr. info.]

2nd month –
[personalized screening invitation letter / female doctor provide pap test / role model stories / fact sheet / updated dr. schedule]

3rd month –
[phone intervention / letter reminders]

Step 5: Program Adoption & Implementation (A&I)

Procedures:
- Identify A&I barriers
- Stakeholder qualitative interviews & consultation (n=5)

Products:
- Factors influencing program A&I
- A&I matrix
- Design intervention for A&I

Step 6: Program Evaluation

Procedures:
- Review program logic model
- Develop process & outcome evaluation items
- Evaluation design & plan

Products:
Evaluation plan (n=424; 212 intervention / 212 control)
See Phase III Evaluation Study Figure
- *Primary outcome*: Women obtain a pap screening
- *Secondary outcomes*: changes in knowledge, beliefs, etc.
- *Process evaluation* components

Reference: Hou, Fernandez, & Parcel (2004); Hou (2006a); Hou (2006b).

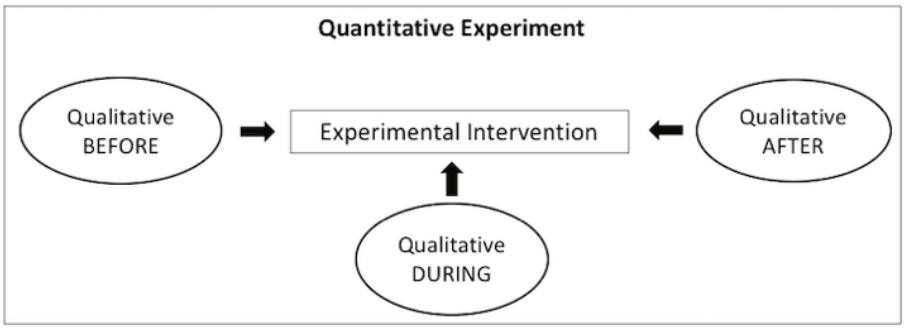
Figure 2 — Intervention Development & Pre-testing

Phase III Evaluation Study Using Embedded Mixed Methods Research Design

Phase III was a randomized controlled trial (RCT) to evaluate the effectiveness of the intervention developed in Phase II. The primary outcome of the RCT evaluation study was receiving a cervical cancer screening (Pap smear test) after the intervention. A secondary outcome was change knowledge and beliefs concerning cervical cancer screening. Female family members of inpatients who were admitted into a major teaching hospital in Taichung, Taiwan were asked about their cervical cancer screening history. Women who had not had a cervical cancer screening in the past 12 months were identified as non-adherent and thus the were eligible to participate in the randomized controlled intervention trial (total n=424; with 212 women in each group). As illustrated in Figure 3, this quantitative-dominant evaluation design embedded qualitative data collection (a) *before*the experiment to gather input on measures, as well as intervention ideas and feasibility; (d) *during*the experiment to document implementation process and fidelity; and (c) *after* the experiment to describe the impact (Figure 3).

Taiwan Cervical Cancer Screening Project
"Love Yourself before You Take Care of Your Family"

Phase III – MMR Evaluation Study (Randomized-Controlled Trial)



Conduct the qualitative Strand BEFORE the Experiment

- ***Objectives:***
(1) Gather input on factors related to pap screening adoption
(2) Obtain ideas on measures, intervention strategies & feasibility factors

- ***Procedures:***
- One-on-one interview (n=14) and focus group interview (n=8)
- Analyze the qualitative data using theme development and quotes identification

- ***Products:*** Data helped with
(1) Instrument development
(2) Intervention material development
(3) Intervention design and recruitment procedures

Conduct the qualitative strand DURING the Experiment

- ***Objectives:***
Describe the program implementation process & fidelity

- ***Procedures:***
- Interviews Implementers (n=6)
- Process evaluation questions
- Program implementation & observations & document review
- Analyze qualitative interview data & documentation reviews

- ***Products:***
(1) Describe the process evaluation
(2) Describe intervention fidelity
(3) Describe issues related to implementation & suggestions on program improvement

Conduct the qualitative strand AFTER the Experiment

- ***Objectives:***
(1) Describe impact of the intervention
(2) Explain why the intervention worked or not

- ***Procedures:***
- Follow-up phone calls to women in the intervention group
- Reached rate: (134/212) = 63.2%
- Analyze post-intervention open-ended survey questions (247/424)=58.0% follow-up rate

- ***Products:*** Findings helped
(1) Describe characteristics of screening early vs. late adopters
(2) Describe the effect of the boost phone intervention on screening adoption
(3) Describe why and when outcomes occurred

Reference: Hou, Fernandez, Baumler, & Parcel (2002); *Hou & Lessick (2002);* Hou, Fernandez, & Parcel (2004); Hou & Luh (2005); Hou (2005); & Hou (2006a).

Figure 3 — Evaluation Embedded Design (Randomized-Controlled Trial)

Results showed women in the intervention group reported a higher rate of receiving cervical cancer screening than women in the comparison group (50% vs. 32%; p=.002). Baseline data from the randomized controlled intervention trial was further used to confirm the final validated study instrument. Reliabilities showed good internal consistencies for the perceived pros, cons, and susceptibilities scales

(alpha ranged from .78 to .87). Factor analysis showed good construct validity revealing concordant patterns with the behavioral constructs used. This validated culturally sensitive and theory-based measurement tool was published with English-Chinese side-by-side to facilitate use by other researchers conducting similar studies (Hou & Luh, 2005). This multi-phase mixed-methods cervical cancer screening program among Chinese women was invited for inclusion in the CDC Chronic Disease Prevention Database to serve as a model to assist researchers and practitioners in planning, implementing, and evaluating health promotion programs in cancer screening (Figure 4).

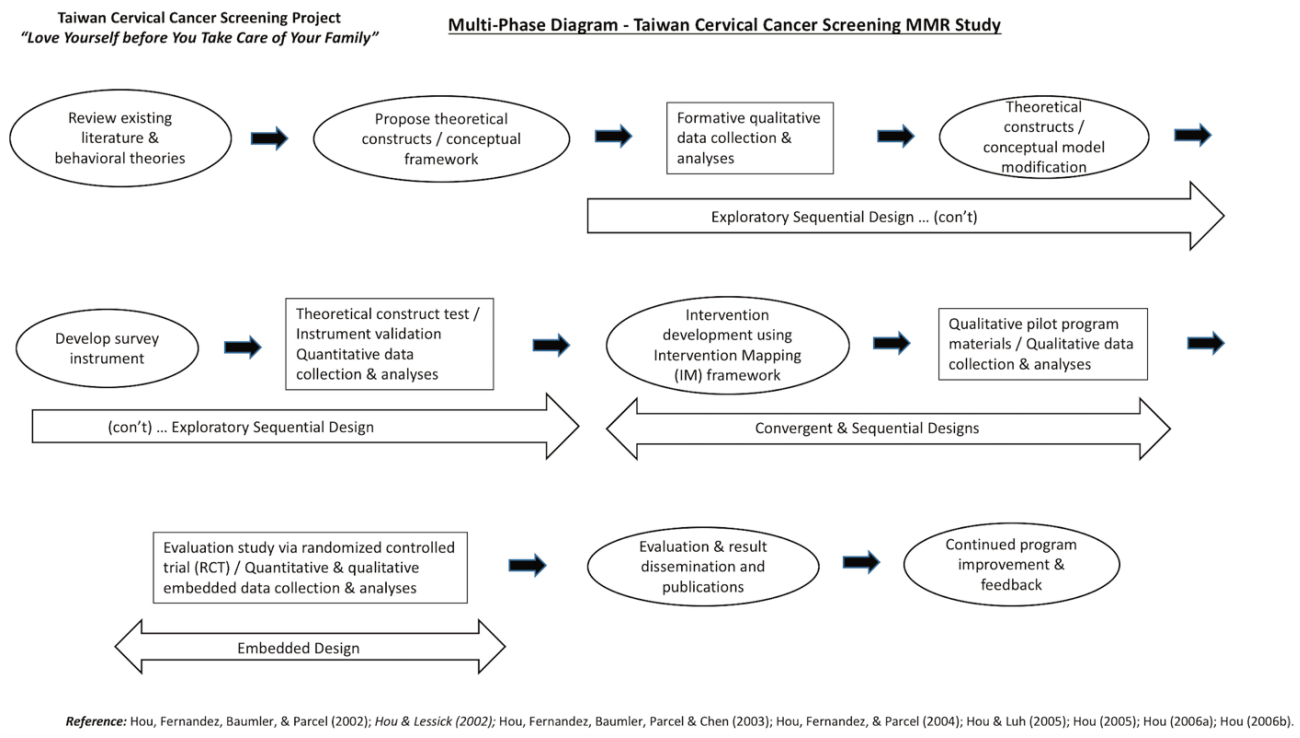


Figure 4 — Multi-Phase Mixed Methods Research Design

This Taiwan cervical cancer screening project was published using the concept of staged integration (Fetters, Curry, & Creswell, 2013) via a series of papers from the single multi-phased mixed methods study, including a qualitative paper (Hou & Lessick, 2002), two quantitative papers (Hou, et al., 2003; Hou, 2006a); an instrument development paper (Hou & Luh, 2005), a mixed methods intervention development paper using the Intervention Mapping framework to link all three major phases together (Hou, et al, 2004), two evaluation papers highlighting the project outcomes (Hou, et al., 2002; Hou, 2005), and book chapter used to introduce comprehensively the overall project through use of figures, tables, and intervention material samples (Hou, 2006b).

In this paper, we have introduced this sophisticated multi-phase project that illustrates the complexity, rigor, power, and synergy for publication resulting from using a mixed methods approach. The mixed-methods diagrams have been found to greatly facilitate understanding of various study phases and designs [Phase I, II, III, and the multi-phase figures], and showcase how a series of multiple papers, including a methodological paper, can be published from a program of mixed methods research and integration via the reporting dimension.

Conclusion

As illustrated by the example presented here, mixed methods research offers the power of numbers and stories for investigating complex social and health problems. Understanding the context for using MMR in Taiwan from a public health perspective underscores the opportunity for applications of mixed methods in public health research. While a concise overview of mixed methods research, this paper illustrates a sophisticated mixed methods cervical cancer screening program of research based in Taiwan as an exemplar of MMR application. Visual diagrams greatly facilitate communication of complex mixed methods design procedures. As illustrated, multiple papers can be published from a mixed method program of research, and this work illustrates mixed methods research integration through the reporting dimension. The methodology discussed can be applied to interdisciplinary fields of research and across the world.

- **Ethical approval:** "All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."
- **Informed consent:** "Informed consent was obtained from all individual participants included in the study."
- **Disclosure of potential conflicts of interest:** "The authors declare that they have no conflict of interest."

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CONCLUSION

Mixed Methods Research: State of the Art Integration Procedures [Chinese version]

混合研究法：創新整合程序

(Mixed methods research: state of the art integration procedures)

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Note

This is an original manuscript / preprint of an article published by Taiwan Journal of Public Health [in Chinese], available online in 2018: https://doi.org/10.6288/TJPH.201808_37(4).107033

混合研究法導論

現代混合研究法肇始於1980年代末，目前約有50本相關書籍。混合研究法期刊(Journal of Mixed

Methods Research) 剛於2016年完成十年出版回顧[1]；國際複合研究方法期刊(International Journal of Multiple Research Approaches)由2007出版至2015，後於2017復刊。國際混合研究法學會(Mixed Methods International Research Association，MMIRA) 2014年於波士頓發起了第一屆MMIRA研討會[2]；日本混合研究法學會(Japan Society of Mixed Methods Research)於2016年成為MMIRA第一個關係組織；加勒比海分會(Caribbean Chapter of MMIRA)於2017年成為MMIRA第一個分會。以上時間點大致勾勒出混合法的發展脈絡。

以整合為主要特色的現代混合研究法

混合研究法誕生的一世紀前，質量並用的研究方法其實早已是自然及社會科學領域的常態[3]。關於混合方法研究存在兩個主要爭議。 第一個質疑與批評主要針對質性建構主義和定量後實證主義哲學基礎的兼容性。此議題是該領域旗艦期刊“混合方法研究雜誌”前十年討論最多的問題之一。 目前至少有五種混合方法研究範式被認為是該領域的哲學基礎，實用主義，參與/變革式，辯證多元主義，批判現實主義，及後現代主義[4]。 儘管仍有一些學者不信服，但這場辯論似乎已基本消退[1]。第二個爭議是關於混合方法是否是新的。例如，Maxwell記錄了在許多學科中將定性和定量研究結合在一起的悠久歷史[3]。Fetters[5]分析了興起於1980年代的現代混合法，其四大特徵如下：1)具分析上的突破，尤其是關於整合質性及量性數據的手法；2)使用混合研究方法專用語言, 使學者即使處於不同的領域也能就方法論交流想法；3)了解相關的哲學假設；以及4) 團隊研究從不同方法論觀點探討問題。Fetters和Molina也更進一步談到了混合研究法整合三部曲，哲學，方法論和方法，以及15個整合維度的機會[1]。

現代混合研究法主要特徵為整合，也就是系統性同時使用質性和量性的研究法[6]。過去的西文研究已系統性地探討健康科學研究如何整合多種研究法[7]，而本文目的則是以中文解說其關鍵整合程序以補足中文文獻的缺陷。

混合研究法主要程序

整合可以在研究問題、研究設計、抽樣、資料收集、分析、推理，以及研究成果彙報等各面向進行，以下將逐一解釋（表一）。

1. 透過研究問題整合

探討社會現象的過程中，質化研究者探討個人經驗，以及個人對現象的詮釋，而量化研究者會尋找變數間的因果關係，或做組間比較。使用混合法的研究問題結合了質量性研究問題的特質。

2. 透過研究設計整合

混合法之研究設計分為漸進設計及固定設計。漸進設計(emergent designs)是因應新浮現的議題而不斷修正的研究設計[2]；固定設計(fixed designs)是事前計畫好並嚴格遵守的研究設計。實務中這兩種研究設計常交互使用。

學術界就混合研究法中的固定設計已有許多討論，最常見的分類法是Creswell 和Plano Clark的三種核心設計(或稱基礎設計)：收斂型設計（convergent designs，又稱同時及平行設計）、解釋型序列設計(explanatory sequential designs)、以及探索型序列設計(exploratory sequential designs) [8]。目前學界將核心設計納入較複雜的研究設計中的專有名詞尚未統一，有稱為進階設計[8]、進階應用[4]、混合法多重流程設計[9]、複雜設計[10]、以及進階架構[6]等。

a) 核心設計

混合法的三種核心設計包含一個收斂型，以及兩個序列型混合法設計。這幾種設計區分了資料收集和分析的時間序。

i) 收斂型設計

此設計法又被稱為多重檢定設計(triangulation design)，其目的是同時收集及分析質量性兩種數據後比較結果。此法需收集量化（趨勢、大數據、一般化）及質化資料（細節、小數字、深入），接著再比對量化和開放性質性資料結果。例如，有研究者在推廣直腸癌篩檢的研究中，收集網路問卷（量化資料）與焦點團體訪談（質化資料），然後加以彙整為總體研究結果[11]。

ii) 解釋型序列設計

此法是先收集量化數據，再以質化資料進一步解釋。例如，某醫院平衡計分卡研究就是解釋型序列設計的應用[12]。研究者首先透過問卷收集資料，再以質性訪談分析動機及其影響。尤其當分析結果顯示統計差異，或當預期結果與實際結果不符時，後續的質化資料有助於解釋分析結果。此研究設計亦可用來選擇質化訪談的受訪者。

iii) 探索型序列設計

此法先進行質性探索，然後才收集量化資料。這種設計可以以質性研究發展出測量工具，並以量化方式驗證，或在變數不明時釐清變數以作量化研究之用。Hou等人在台灣子宮頸癌篩檢計畫中，研究者首先透過質化訪談找出接受抹片篩檢(pap screening)之關鍵因素[13]，之後再依此關鍵變數發展問卷，並以量化方式探討前階段得知的因素與篩檢行為的關係[14]。

b) 進階架構

進階架構包含多階段評值(multi-stage evaluation)、介入措施研究法(intervention)、個案研究，以及參與式（社會正義型）設計。

i) 多階段架構

進階架構是一種通稱，其特徵為多階段資料蒐集並常在評值研究中使用。 此架構之設計元素可能包括序列型、收斂型，以及縱貫型研究設計(longitudinal)。舉例來說，Hou等人在多階段混合法探討台灣子宮頸癌篩檢行為的研究就採用了三個主要階段：(1)發展問卷與需求評估[13-15]；(2)以介入措施架構圖(intervention mapping，IM)發展介入計畫，一種融合理論與實證的創新介入措施發展流程[16,17]；以及(3)使用隨機對照試驗(randomized controlled trial, RCT)以評值篩檢成效[18,19]。

ii) 介入措施架構

介入評值研究如隨機對照試驗，通常以量化為焦點。質性資料可幫助支持評值過程：1)介入前，發展測量工具，找到適合的受試者，並評估可行性；2)介入中，了解執行相關因素或預料之外的變數；3)介入後，解釋結果，例如離群值、未預期結果，或發展前導數據等等。在Hou等人台灣子宮頸癌篩檢的研究中，第二階段即結合了第一階段收集的質量化兩種數據以了解背景因素，並發展過程與結果評值的研究問項[16]，而第三階段利用混合研究嵌入法於介入措施前中後的質性資料，以強化計畫評值結果[18,19]。

iii) 個案研究混合法架構

研究者可先定義案例範圍，然後依據案例特質、可行性要素及研究問題收集詳細的質化及量化數據。比較個案研究法(comparative case studies)即為此架構的延伸。Little et al.就曾使用多種質與量數據來評值日裔美籍婦女的產前照護成效 (prenatal group visit program)[20]。

iv) 參與式（社會研究方法）架構

此設計納入了目標群體的意見，如社區參與研究(community-based participatory research, CBPR)[21]。這種研究常觸及健康差距或社會公義等議題，目的在賦權給社會弱勢團體。Schulz等人就曾和底特律社區合作，運用此架構以提升非裔美籍及拉丁美籍低收入戶的心血管健康[21]。

3. 透過抽樣整合

量化研究多使用概率抽樣(probablistic sampling)，但質化研究使用的是立意抽樣(purposive sampling)[9]。混合法研究中，抽樣面向有：a)抽樣對象，b)時間點，以及c)樣本關係。抽樣對象包含人、文件檔、地點、事件等；時間點指收集不同質量數據的時間順序，如質化及量化數據可能同時收集（但不一定會同時分析）、依序收集（如縱貫型研究），或

在不同時間收集（如前測後測）。樣本關係分為四種：i)一致抽樣樣本，質化和量化數據都是從同一組研究樣本中收集的；ii)巢式抽樣(nested)，由大樣本群內收集量化數據，再由此樣本群內收集質化數據；iii)分開獨立抽樣(separate)，以一組資料當樣本，再由人口特質相近的另一群樣本裡收集另一組資料；iv)多階層抽樣，樣本來來自母群體的數個階層，如校園預防注射計畫中，樣本可來自教育官員、校長、教師、職員，及護理人員群體中取得[9]。

4. 透過資料收集整合

質化與量化的資料結合時，又被稱為「介面點」(the point of interface)。如前所釋，整合可以是把一種資料融入另一種，或是把兩種結合在一起。這些整合方式通常與研究設計有關，例如收斂型設計常使用配對，擴展（資料繞射，data diffraction），建立案例等 。序列設計常使用連接(connecting)或建造(building)等整合方法，介入措施評值設計常使用嵌入式(embedding)的整合法。以上範例請見表二。

5. 透過分析整合

混合研究分析整合有三個面向：典範內程序、核心程序，以及進階程序[22]，範例請見表三。

6. 透過元推理（metainference）整合

元推理是分析了質量兩種資料後形成的推論，共有四種形式[7]：a)收斂(convergence)型，質化及量化資料呈現相同結果；b)互補(complementarity)型，質化及量化數據呈現不同但不相衝突的結果；c)延伸(expansion)型，質化及量化數據呈現同一現象的不同面向；d)不一致(discordance)型，質化及量化數據呈現互相衝突的結果。

7. 通過多篇期刊文章發表來整合一個複雜的混合方法研究計畫

混合方法研究計畫所發表的期刊文章可以是質化研究、量化研究、質量混合研究，混合方法學研究，或以上之任意組合[23]。

討論

公共衛生研究人員可以通過混合方法研究的優缺點來思考自己的工作。在概念上和實踐上，混合方法研究通過利用量性與質性研究法的相互優勢並抵消彼此弱點，為公共衛生研究人員提供了將研究者的觀點以及目標人群的觀點結合起來的機會。至於缺點，混合方法研究通常較為複雜和昂貴，因為它不僅需要使用兩種範式進行嚴謹研究的能力，而且還需要有整合質量性結果的專業知識技巧。

結論

現代混合研究法已興起成為第三種典範[24]，但使用過程中應考慮各種整合面向。比如研究問題、研究設計、抽樣、資料收集、分析、元推理，以及研究結果發表。本文簡述了各種面向整合程序的總體觀念，希望能促進此研究法在台灣公共衛生研究領域的應用。

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表一 混合研究法創新整合程序（根據整合面向與途徑）

整合面向	途徑
研究問題	質化研究問題 量化研究問題 混合研究問題
研究設計	3種核心設計 – 收斂型 – 解釋序列型 – 探索序列型 4種進階架構 – 多階段 – 介入措施評值 – 個案研究法 – 參與式社會研究架構
抽樣	– 一致性抽樣 – 巢式抽樣 – 分開獨立抽樣 – 多階層抽樣
資料收集	配對 擴展（資料繞射） 建立案例 連結 建造 產出 嵌入
數據分析	a) 典範內分析 b) 核心程序 – 螺旋型比對法 – 穿針引線法 c) 進階程序 – 資料轉換及融合 – 繪製聯合顯示圖表 – 視覺化資料
元推理討論	– 收斂 – 互補 – 延伸 – 不一致

報告發表	– 階段式發表出版 (staged) – 質量結果鄰近呈現法(contiguous) – 質量結果交織呈現法(weaving)

表二 透過資料收集整合

整合途徑	例子
a) 透過構面配對達整合目的 此法始於研究設計階段，研究者針對相同構面收集質化及量化兩種數據。	訪談題項和問卷題項配對，如研究者可藉比對訪談和問卷結果以了解癌症病患的生活品質。
b) 透過擴展（資料繞射）達整合目的 此法收集質化及量化的資料，據以探討同一現象的不同構面。	測量母群體對預立遺囑(advance directives)概念之理解，再輔以質性方法解析採取或不採取行動的理由。此法使用「裁剪」或「繞射」來擴展以整合資料[25]。
c) 透過建立案例達整合目的 此法藉質化及量化兩種資料來發展案例，特別是透過多元資訊源來解釋案例。	Shultz等人透過具多樣性的受試者收集到各種質化及量化的資料，並據此評估一項為家庭醫學科住院醫師執行生殖部位檢查的培訓計畫[26]。
d) 透過連結達整合目的 此法重點為連接質化量化兩種形式的數據，也就是以一組數據為本，據此決定另一種形式的數據該如何收集。	Fetters等人在大樣本群中瞭解懷孕婦女的經驗，再從這個樣本群裡抽取少數樣本進行質化訪談，以突破文化及語言障礙來瞭解無痛分娩[27]。
e) 透過建造達整合目的 此法由一個資料庫決定另一個資料庫該如何收集資料。	質化研究可以找出能納入量化問卷的變數，而量化問卷也能點出質化無法解釋的結果或模式。量化問卷結果在後續質性研究中亦可進一步做為訪談綱要的擬定。
f) 透過產出和驗證達整合目的 研究者透過整合質化及量化數據來測試新模式。	這種模型可以透過多種方式改進，例如先收集質性資料再測試量化問卷，或發展出初步量化模型後，再透過質化程序檢視其外在效度。
g) 透過嵌入法達整合目的 研究者引入一種形式的資料以支持另一種形式的資料。例如，在量性的臨床實驗的前中後期收集質化資料。此法最大的特色就是可以在多個焦點上同時連結質化及量化資料。	在台灣子宮頸癌篩檢計畫中，質化及量化的資料皆被用於介入措施發展，以了解此計畫之重要影響因素與成效[16,18]。

表三 透過資料分析來整合

整合途徑	例子
a) 典範內分析法 在分析資料之始，使用質化程序分析質化資料或統計程序進行量化資料分析。	這個程序幾乎在所有混合研究法的初期都會使用，研究者會從兩種方法中取得研究發現。
b) 核心程序 核心程序中通常 包含同時檢視質化和量化資料，連結兩種資料以加速理解研究主題，也能找出共同議題做後續比較。	1. 「螺旋型比對法」－研究者在質量化結果裡螺旋比對，找尋兩種資料的共通點[1]。 2. 「穿針引線法」－研究者選擇一個關鍵主題或研究問題後就緊緊跟隨它，並在另一個資料庫中找尋共同性來做比較[28]。
1. C) 進階程序 進階程序分為三種：資料轉換及融合、聯合顯示圖表、其他視覺化程序。 「資料轉化(conversion)」和「融合(merging)」指的是將一種資料轉換成另一種資料。「繪製聯合顯示圖表」指的是研究者將質量性資料並置一起，利用表格或矩陣來並排顯示資料[29]。其他視覺化程序也不斷進步包括社群網絡分析法或地理資訊系統分析等。	1. 資料轉換－「量化化」是將質化資料轉換成量化資料，「質化化」是將量化資料轉換成質化資料。 2. 聯合顯示圖表－目的是由同時檢視質量化結果以提出新見解，透過將相關資料並列整理成圖表、表格、矩陣等。 3. 其他視覺化程序：Wagner等人使用社群網絡分析法(social network analysis)檢視女性性工作者網絡，並解釋他們跟私生活中男性伴侶的關係[30]。