



Review Article

The planning and reporting of mixed methods studies on the built environment and health



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ABSTRACT

Researchers examining the influence of the built environment on health are increasingly using mixed methods approaches. The use of more than one type of methodology to address a single research question is compelling in this field because researchers investigating the impact of the built environment on health have been faced with proposing solutions to a complex societal problem involving interacting systems and social uncertainties. Mixed methods studies can help researchers to gain a better understanding of the relationships that exist between humans and their environment by drawing on qualitative and quantitative methods. Mixed methods studies could also be instrumental for providing effective policy solutions. This is because they allow researchers to identify built environment determinants of health in a population of interest and to understand the social and cultural factors that might influence the uptake of an intervention by this population. The objective of this paper is to assist those conducting research on the built environment and health who may have little background in mixed methods. We provide an overview of mixed methods research designs and provide concrete techniques for the integration of diverse methods. We also discuss the recommendations for mixed methods research in the field of built environment – health research, drawing on specific examples from published studies. Reporting a research design and an integration strategy in mixed methods studies could help to strengthen our ability to gain new insights into the multidimensional nature of the relationship between the built environment and health.

1. Introduction

Researchers examining the effect of built environments on health are increasingly using a mixed methods approach (i.e., using quantitative and qualitative methods) in their research studies (Alexander et al., 2015; Brownson et al., 2012; Christensen et al., 2011; Clark et al., 2010; Colabianchi et al., 2014; Dulin-Keita et al., 2015; Evenson et al., 2012; Guell et al., 2013; Heesch et al., 2012; Hennessy et al., 2010; Kipke et al., 2007; Lehning, 2011; Martínez-Andrés et al., 2012; Stathi et al., 2012; Walford et al., 2011). Studies, for example, have employed questionnaires and semi-structured interviews to examine the relationship between the neighborhood environment and fruit and vegetable consumption (Park et al., 2011), or have employed GPS technologies and walking interviews (Zandieh et al., 2016) to examine how the environment influences physical activity.

Researchers investigating the impact of the built environment on health have been faced with proposing solutions to a complex societal problem involving interacting systems and social uncertainties (Rydin et al., 2012). Mixed methods research uses multiple methods

(quantitative and qualitative) that can help to bring to light the different dimensions of a phenomenon, giving it the potential to stimulate the methodological creativity needed to address complexity (Mertens et al., 2016). This is because quantitative research is limited in understanding contextual factors and qualitative research may fail to identify important impactful features of the built environment that are not captured by participants perceptions of the environment.

Mixed methods research on the built environment can provide a better understanding of how features such as urban form (Zandieh et al., 2016), transportation (Northcutt Bohmert, 2016), access to healthy foods (Chrisinger, 2016), and green spaces (Honold et al., 2016) are influencing health. Mixed methods studies could also be instrumental for providing effective policy solutions. This is because they allow researchers to identify built environment determinants of health in a population of interest and to understand the social and cultural factors that might influence the uptake of an intervention by this population. Many mixed methods studies in the built environment and health do not specify their methods, which could limit the transparency, reproducibility, and rigor of studies in this field. In this paper, we

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attempt to improve cross-disciplinary translation of knowledge between mixed methods studies on the built environment and health and those conducted by leading scholars in mixed methods research from other domains. Our paper provides researchers with a mixed methods roadmap to improve the rigor of studies, and knowledge of how to apply mixed methods approaches to research on the built environment and health. The main objective of this review paper is to lay out the foundations of key guiding practices and inform the planning and reporting of studies by providing an overview of mixed methods research designs and concrete integration strategies. We also perform an exploratory search of the literature to provide readers with a set of examples of self-identified mixed methods studies from the built environment and health literature that have adopted each of the research designs and integration strategies. We then discuss the recommendations for mixed methods research in the field of built environment – health research, drawing on specific examples from published studies in this field.

2. What is mixed methods research?

In mixed methods studies, researchers integrate quantitative and qualitative methodologies and methods, allowing researchers to tap into different aspects of a social phenomenon (Creswell and Clark, 2011). This research orientation should not be confused with multi-method studies, studies that use two or more research methods that both fall within the same research approach (quantitative or qualitative) (Tashakkori and Teddlie, 2003). The “paradigm war”¹ shaped the development of mixed methods research. The paradigm war was characterized by considerable debate on the compatibility of quantitative and qualitative methods, with some scholars arguing in favor of the “incompatibility thesis” (Guba and Lincoln, 1985; Smith and Heshusius, 1986). The incompatibility thesis posits that one should not include both quantitative and qualitative research in the same study, as they adopt different world views that are incompatible due to their conflicting epistemological and ontological stances (Guba and Lincoln, 1985; Smith and Heshusius, 1986). The incompatibility thesis has been largely refuted within the mixed methods literature with contemporary mixed methods researchers embracing world view and methodological pluralism (Teddlie and Tashakkori, 2012). The community has now moved beyond the idea that there is an “ownership” of methods by worldviews. As contended by Teddlie and Tashakkori (2012), “if researchers want to use “QUAN or QUAL methods exclusively then this decision should be based on their research question, not some link between epistemology and methods”(p.780). Most contemporary mixed methods researchers now ascribe to a variety of philosophical orientations including pragmatism, critical realism, Campbell’s post-positivism, Hacking’s social constructionism, and critical theories (Campbell, 1978; De Waal, 2005; Hacking, 1999; Sayer, 2000; Teddlie and Tashakkori, 2012; Tyson, 2014).

Creswell and Clark 2011 propose that a central premise of mixed methods research is that “the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone” (Creswell and Clark, 2011, p.5). For example, in Zandieh et al., 2016, their mixed methods design allowed them to both identify built environment determinants of walking and to gain an understanding of how participants’ perceptions of the environment might influence their walking behavior. They were able to point to evidence in support of neighborhood, safety, quietness and aesthetics, as being important for walking levels because their qualitative and quantitative results converged for these three factors.

Many other rationales for conducting mixed methods research have been identified including: to corroborate quantitative and qualitative

data, to offset the weaknesses and maximize the strengths of quantitative and qualitative research approaches, to answer questions that require the use of both approaches (Bryman, 2006; Pluye and Hong, 2014), and to explain unexpected findings (Bryman, 2006; Doyle et al., 2009; Greene et al., 1989). Mixed methods research can also yield rich sources of data producing a deeper understanding of participants’ experiences. This feature of mixed methods studies is particularly compelling because it reinforces the value of using mixed methods to understand complex social systems and inform policy (Stewart et al., 2008) – an attribute particularly well-suited for studies on the built environment and health.

There are many challenges associated with conducting mixed methods research. It can be difficult to find researchers that are comfortable with or are skilled in both quantitative and qualitative research methodologies (Teddlie and Tashakkori, 2012), and working with researchers with different backgrounds can potentially lead to tensions between team members subscribing to a diversity of worldviews and methodological orientations (Pluye and Hong, 2014). Researchers may also encounter difficulties when trying to design complementary quantitative and qualitative research questions (Stewart et al., 2008; Teddlie and Tashakkori, 2012), combining quantitative and qualitative sources of data, interpreting diverse sources of data, and interpreting divergent findings.

3. Mixed methods designs

3.1. Types of mixed methods designs

A mixed methods research design specifies the combination of quantitative and qualitative components and articulates when the integration of these components will occur (e.g., during the analysis or interpretation) (Creswell and Clark, 2011; Doyle et al., 2009). Authors should specify, define, and reference the mixed methods design that will be adopted in their study. Typically, these designs will be one of three main types: the convergent design, the explanatory design, and the exploratory design (Creswell and Clark, 2011)(Fig. 1).

3.1.1. Convergent design

In a convergent design, findings from a quantitative and qualitative strand are compared to develop a more comprehensive understanding of a phenomenon. In this design, the collection and analysis of quantitative and qualitative data will typically occur during a similar time frame. The collection and analysis of complementary data for the quantitative and qualitative strand are followed by integration of the sources of data during the results or interpretation stage (Creswell and Clark, 2011; Fetters et al., 2013). In the convergent design, the researcher is often seeking to compare complementary sources of quantitative and qualitative data, with the aim of identifying convergence/divergence in the results. For example, in their convergent mixed methods study, Zandieh et al., 2016 examined the relationship between potential neighborhood built environment features and walking levels using hierarchical linear regression modelling in their quantitative phase. These results were compared to participants’ perceptions of the influence of the neighborhood environment on walking from the qualitative phase to identify converging/diverging findings.

3.1.2. Explanatory design

The sequential explanatory design begins with a quantitative phase – the researcher first collects and analyses the quantitative data. The findings from the first quantitative phase are then used to inform the design of the qualitative data collection and analysis. This type of study generally prioritizes the quantitative phase when addressing the study’s research questions (Creswell and Clark, 2011) and aims to help explain the results of the quantitative phase by exploring participant viewpoints in greater detail (Ivankova et al., 2006). For example, Gichunge et al., 2016 used a sequential explanatory design to examine the availability

¹ Debate during the 1980’s over the controversy of combining quantitative and qualitative methods due to the incompatibility of their paradigms.

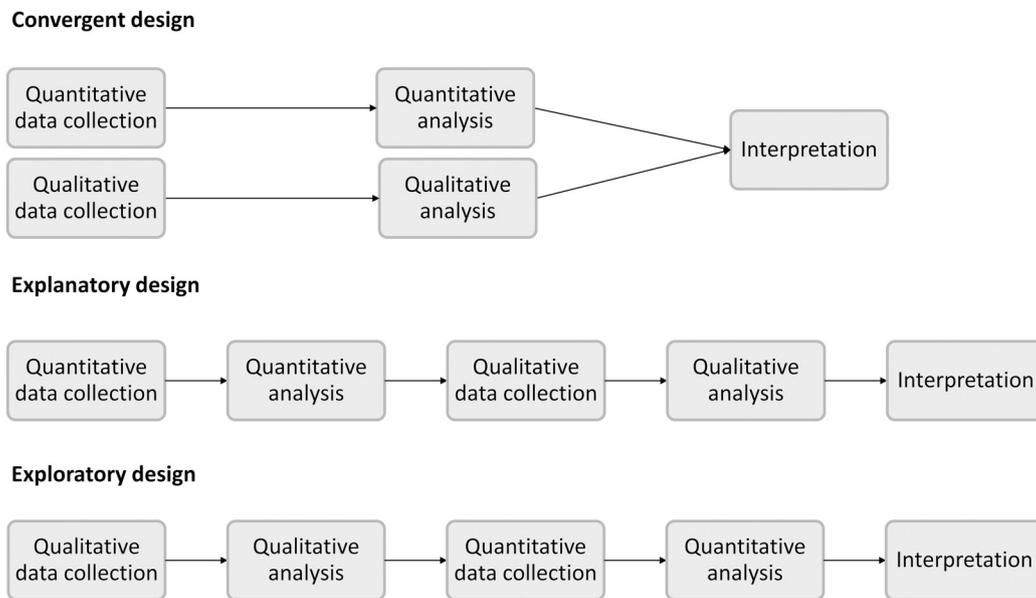


Fig. 1. Diagram of the three main mixed methods designs.

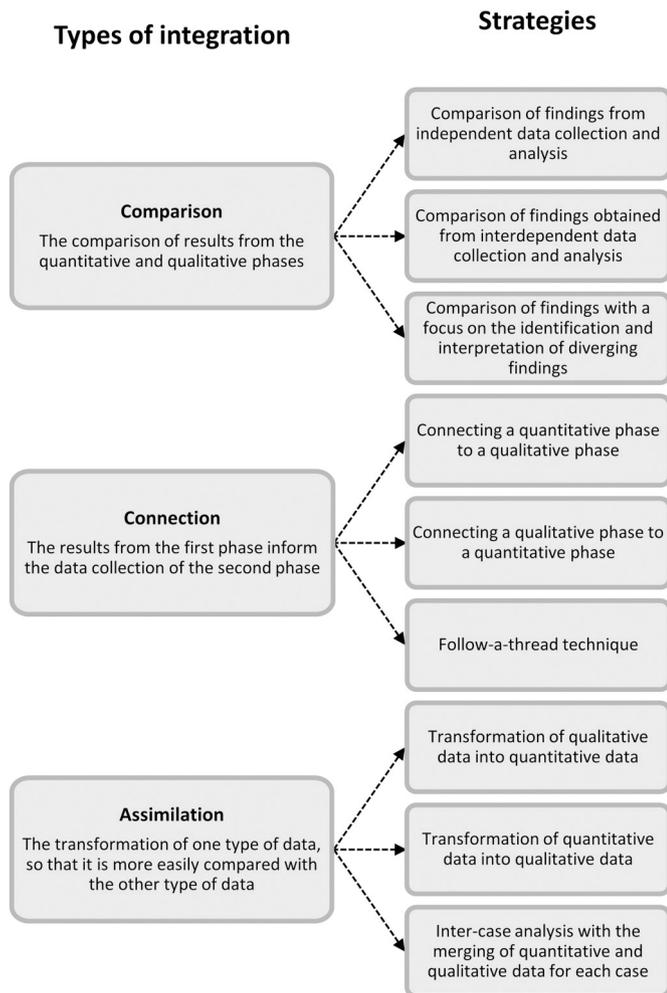


Fig. 2. Diagram of comparison, connection, and assimilation mixed methods integration strategies.

and consumption of African vegetables among resettled refugees. Quantitative results revealed that individuals that were older, employed, gardened, and had a supermarket in their neighborhood, were more likely to have traditional vegetables in their home. A qualitative interview guide was subsequently developed to further explore and extend the quantitative findings.

3.1.3. Exploratory design

The exploratory design begins with the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. The exploratory sequential design will generally prioritize the qualitative phase of the study when creating or addressing the study's research questions. The second quantitative phase is designed based on the findings of the first phase and will often aim to test or attempt to generalize the initial qualitative findings (Creswell and Clark, 2011). In Keddem et al., 2015, the authors used an exploratory design to examine how contextual neighborhood factors contribute to asthma control. They first used a semi-structured interviewing technique, to gain an understanding of the neighborhood characteristics that participants perceived as influencing their asthma control. The researchers then selected neighborhood characteristics based on the emerging themes of the qualitative analysis and tested the influence of these neighborhood characteristics on asthma control.

4. Integration

4.1. Types of integration strategies

Integration, the combination of quantitative and qualitative worldviews, and/or methods (e.g., integration at the design, data collection, or analysis stage of the research), is an integral part of mixed methods research. As noted by Creswell and Tashakkori, "Mixed methods research is simply more than reporting two distinct 'strands' of quantitative and qualitative research" (Creswell and Tashakkori, 2007, p.108). A mixed methods study should also mix or integrate findings. Integration can occur by comparing findings or through the connection of phases (Creswell and Clark, 2011; Creswell and Tashakkori, 2007). Connection usually occurs in sequential designs and comparison can occur in any type of design (Fetters et al., 2013). Integration strategies have been described in detail in previous work (Creswell and Clark, 2011; Fetters et al., 2013; O'Cathain et al., 2010; Pluye et al., 2018; Pluye et al., 2009). In this section, we describe the integration

framework from [Pluye et al., 2018](#) that outlines three distinct types of integration strategies: 1) the comparison of qualitative and quantitative results, 2) the connection of qualitative and quantitative phases, and 3) the assimilation of qualitative and quantitative data ([Fig. 2](#)). These strategies may be used in combination and are not hierarchical (i.e., comparison of results is not superior to phase connection).

4.1.1. Comparison of results

Researchers using the comparison strategy will compare the results from the quantitative and qualitative phases using a variety of approaches. Investigators may identify the findings in agreement or those that complement one another, but they may also identify findings that are discrepant, and point out where there are silences (a theme arises in one method and not the other) in the data ([O’Cathain et al., 2010](#)) to inform their interpretation of the findings. Often comparisons are presented by juxtaposing a list of findings from both strands on the same page or by placing the results in a table. For example, a category/theme joint display can be used to array the categories or continuous data (rows) from the quantitative analysis by themes (columns) from the qualitative analysis. A joint display can also be used to array the qualitative results and quantitative results (columns) by key themes (rows). A final method of comparing the results is to present the quantitative results followed by one or many quotes from the qualitative phase (or vice versa) in the results or discussion section, followed by a discussion of the convergence/divergence of these results ([Creswell and Clark, 2011](#)).

There are three different comparison integration strategies. The first comparison strategy is the *comparison of results from the quantitative and qualitative phases obtained from independent data collection and analysis*. For example, in [Leedahl, Leedahl et al., 2014](#), the authors examined strategies for discharging nursing home residents with mental health issues to the community. The researchers collected quantitative data on the characteristics of individuals discharged from nursing homes and their transition patterns, and they complemented the results from this phase with qualitative findings on successful discharge strategies that were provided by nursing home staff.

The second strategy is the *comparison of findings obtained from interdependent data collection and analysis* ([Creswell and Clark, 2011](#)). In this strategy, the researcher will also compare the results using a comparison strategy, as was described above, except the researcher will also consider the *interdependency* of the data collection and analysis in their interpretation of the results. Interdependencies can be, for example, quantitative variables derived from qualitative themes or qualitative phase participants recruited from the sample of quantitative participants. For example, in [DiSantis et al., 2016](#), the authors conducted a study on food shopping, where they first created a map using the location of participants routine destinations, and food stores located near routine destinations. In the semi-structured interviews, each participant was shown the map of their geospatial routine. The authors emphasized how showing the participants a map of their geospatial routine during the interviews revealed patterns in shopping practices that participants may not have noticed and subsequently discussed if the maps had not been present.

The third strategy is derived from the first two strategies and consists of focusing the comparison of quantitative and qualitative results on the *identification and interpretation of diverging findings*. Divergence occurs when the findings from the two sources of data contradict one another. The divergence of quantitative and qualitative data can lead some researchers to discard or ignore findings preventing them from gaining unanticipated insights into the nature of the phenomena under study. Strategies for accounting for divergence include reconciliation and initiation. Reconciliation involves the researchers explaining why the divergence in findings is plausible within the context of the study and in some cases can lead researchers to re-analyze their data or to propose a new conceptual framework ([Pluye et al., 2009](#)). For example, in a study conducted by [Crane et al., 2016](#) on the community impact of

installing a new bicycle pathway, qualitative interviews revealed that community members that had never ridden a bicycle believed that only individuals living outside of the local neighborhood would use the bicycle pathway. However, in the quantitative phase, a survey revealed that most cyclists using the pathway were local residents. The authors made sense of this diverging finding by proposing that there may be a misperception among residents regarding who a cyclist is, since some residents perceived that cyclists are only those that dress in cycling apparel ([Crane et al., 2016](#)).

The strategy of initiation typically implies that divergent findings provoke new research questions that lead to new data collection and analysis ([Pluye et al., 2009](#)). For example, in a study by [Moffatt et al., 2006](#) the authors evaluated the effect of an intervention that delivered welfare rights advice to older adults on well-being and health. The quantitative analyses suggested that there was no difference in health and social outcomes between the intervention and control groups. However, views from the qualitative interviews suggested that the participants believed that the intervention had a positive effect on their well-being. To verify these findings, the researchers collected additional follow-up quantitative and qualitative data to confirm that the positive impacts of the intervention were experienced by more than just the smaller sub-sample of participants that had participated in the initial qualitative interviews.

4.1.2. Connection of phases

Integration by the connection of phases occurs when the results from the first phase inform the data collection of the second phase. This integration technique is usually applied in sequential mixed methods designs. The first connection strategy consists of *connecting a qualitative phase to a quantitative phase*. For example, in the exploratory design, the qualitative phase 1 results inform the phase 2 quantitative data collection and analysis. This strategy has several aims including: to test or generalize qualitative findings to a larger population, create an instrument, validate an instrument, develop a conceptual framework, or design an intervention. For example, in [Ferrer et al., 2014](#), the authors used a connection strategy to assess how individual circumstances and neighborhood contexts influenced opportunities for diet and activity in individuals with obesity or diabetes. They conducted focus groups in a community sample of individuals. Emerging themes from the focus groups were used to develop a structured questionnaire that was administered to 300 respondents.

A second connection strategy consists of *connecting a quantitative phase to a qualitative phase*. For example, in the explanatory design, the quantitative phase one results inform the qualitative phase two data collection and analysis. The aim of this strategy is to validate an instrument or to have the qualitative findings explain the quantitative statistical analyses (e.g., to better understand the differences between groups or understand extreme cases). For example, in the [Stathi et al., 2012](#) investigation of the personal, interpersonal, and environmental factors that influence older adults' physical activity in their neighborhood, the authors integrated by connecting a quantitative phase to a qualitative phase. The quantitative analyses identified findings requiring further clarifications (e.g., very high accelerometry-derived activity levels) that were then explored through careful probing during semi-structured interviews. The interviews also allowed participants to extend the author's findings by discussing the influence of barriers that were not included in the questionnaire.

A final connection strategy is the *follow-a-thread technique* that is applied during the analysis stage of the research. In the follow-a-thread technique, the researchers will first conduct preliminary analyses for both phases and if they identify themes (from the qualitative strand) or statistical results (from the quantitative strand) that require further exploration they will follow these across to the other strand and conduct further analyses. A good example of the use of this strategy comes from the literature on occupational health. In [Boot et al., 2016](#), the authors conducted an analysis of factors that are important for work

participation in workers with health issues. The quantitative data from the first phase was used to inform the interview guide of the second qualitative phase consisting of semi-structured interviews and qualitative analyses. Based on the qualitative findings, the authors conducted further quantitative analyses as new potential predictors emerged.

4.1.3. Assimilation of data

There are multiple strategies for assimilation of data that all involve the transformation of one type of data, so that it is more easily compared with the other type of data (Creswell and Clark, 2011). One approach to assimilation is the *transformation of qualitative data into quantitative data*. For example, researchers can use quantitative content analysis to transform the qualitative results into numerical counts and variables and then compare this quantitative data to results obtained from the quantitative strand. A second assimilation strategy is the *transformation of quantitative data into qualitative data* by transforming statistical results into a narrative using interpretive analysis such as a thematic analysis. For example, in Reichwein et al., 2015, the authors conducted a study to identify the potential users of family planning interventions in Uganda and Vietnam. The authors created profiles of current user groups using service statistics from family planning services. These profiles were compared to profiles of potential users created from a health survey data analysis and literature review. A qualitative analysis was then performed to fill knowledge gaps regarding potential users.

The final assimilation strategy involves performing an *inter-case analysis with the merging of quantitative and qualitative data for each case*. This can be conducted with a sample or sub-sample of respondents with quantitative and qualitative data for each case. The data is summarized in a matrix with the rows representing the cases and the columns displaying the quantitative and qualitative data collected for each case. This allows researchers to examine the convergence or divergence in the data for each case and then to examine patterns emerging across all cases (O’Cathain et al., 2010; Pluye et al., 2013; Wendler, 2001). For example, in Pluye et al., 2013, the authors examined family physicians’ use of an electronic knowledge resource. The quantitative data consisted of family physicians’ responses to a questionnaire on their searches performed using the electronic resource and the qualitative data consisted of observations, log reports, archives, and interview data from a sub-sample of searches. They created clinical stories (i.e., vignettes) by merging the quantitative and qualitative data for each search, they then built a meta-matrix in excel with the vignettes as rows and the quantitative and qualitative data for each case as columns. The meta-matrix facilitated a critical examination of the evidence available for each case (i.e., search performed by a physician).

5. Why is specifying a mixed methods design important?

Scholars have argued that specifying a mixed methods design can help to convey methodological rigor and has the potential to provide guidance for researchers with little mixed methods experience (Bryman, 2006; Doyle et al., 2009). Methodological and epistemological disagreements have had the effect of many researchers only acquiring methodological experience in either quantitative or qualitative research with even fewer researchers acquiring training in mixed

methods (Hesse-Biber, 2010). Specifying a mixed methods design when conducting a mixed methods study on the built environment and health can help readers to understand the justification for using a mixed methods approach and to understand how this approach will assist in answering the research question (Doyle et al., 2009). It can also help to provide a more detailed account of how the study was conducted. For example, in Alexander et al. (2015), the authors’ described their concurrent (convergent) mixed methods design. They specified that their concurrent design involved separate data collection, data analysis, and interpretation of the quantitative and qualitative data, and that the data collection, analysis and interpretation of the quantitative and qualitative phases occurred concurrently. They also described how this design allowed for the collection of different but complementary data to be used to answer their research question. Providing such a detailed account of how the study was conducted enhances the reproducibility of the study. It can also help readers to understand and evaluate methodological rigor.

6. Why is specifying an integration procedure important?

There are many reasons why researchers may omit integration in their studies including methodological preferences, epistemological divisions, one set of data rearing more interesting results than the other, the tendency of journals to prioritize either quantitative or qualitative methodologies (Bryman, 2007), and little formal training in the planning and reporting of mixed methods (O’Cathain et al., 2010). What is apparent is that in studies on the built environment and health, integrating can make the conclusions and the process by which they were drawn more explicit for the reader. For example, in Zandieh et al. (2016), a study on the influence of the built environment on walking levels in older adults, the use of a joint display facilitated comparison of quantitative and qualitative findings. The summary table showed that, despite the authors finding perceived inequalities in built environment features, in their qualitative analysis, these inequalities were unlikely to influence older adults walking levels because these attributes were not significantly associated with walking levels in the quantitative phase. Another advantage of reporting an integration procedure is that studies that describe their mixed methods integration procedure enhance the reproducibility of the study. Integration is a step of the analysis process in mixed methods studies and describing an integration procedure ensures that the researcher is fully transparent about this process. Evaluation and comparison of research findings becomes difficult in the absence of a clear messaging about the integration of methods and can impede progress in knowledge creation.

Other writers have also emphasized the importance of integrating mixed methods findings (Creswell and Clark, 2011; Fetter and Freshwater, 2015; Johnson et al., 2007; Pluye and Hong, 2014). An important aim of mixed methods research is to have mutually informative quantitative/qualitative strands to develop a more comprehensive understanding of a phenomena (Bryman, 2007; Creswell and Clark, 2011). A lack of integration can result in significant methodological deficiencies, since strands of a mixed methods study are unlikely to inform each other in a meaningful way if they are presented as parallel compartmentalized components. This is because the mixing of findings can offer insights that may not arise when analyzing strands

Table 1
Summary of the advantages of specifying a mixed methods design and integration strategy.

Research design	Integration strategies
Provides guidance for researchers with little knowledge of mixed methods research designs	Facilitates drawing conclusions
Assists readers in understanding the justification for adopting a mixed methods approach	Provides guidance for researchers with little knowledge of mixed methods integration strategies
Enhances the reproducibility of the study	Enhances the reproducibility of the study
Enhances the transparency of the research process	Enhances the transparency of the research process

with distinct quantitative and qualitative approaches (Bryman, 2007). Integration allows the two strands to complement, compare or expand on each other and will ideally facilitate drawing an overall conclusion. Therefore, many scholars argue that studies that do not integrate their findings are not mixed methods studies (Fetters and Freshwater, 2015; Johnson et al., 2007; Pluye and Hong, 2014) and that integration is one of the most critical steps of a trustworthy mixed methods study (Creswell and Tashakkori, 2007).

7. Do researchers conducting mixed methods studies on the built environment and health specify their design and integrate their findings?

Guiding frameworks outlining criteria to follow when reporting and appraising a mixed methods study include the Good Reporting of A Mixed Methods Study (GRAMMS) (O’Cathain et al., 2008) criteria and the Mixed Methods Appraisal Tool (MMAT) (Pace et al., 2012). These frameworks suggest that mixed methods studies should report their mixed methods design and integration strategy.

We wanted to provide readers with a set of examples of self-identified mixed methods studies from the built environment and health literature that have adopted each of the research designs and integration strategies. We also wanted to gain a better understanding of the extent to which mixed methods studies on the built environment and health report a mixed methods design and an integration procedure. Therefore, we conducted an exploratory search on Scopus®, an abstract and citation database of peer-reviewed research. The studies identified by the search are provided in a table (Supplementary files, Table 1).² Our Scopus® search identified 267 articles, 50 articles were empirical mixed methods studies that explored the influence of the built environment on health and were written in English or French. 26% (13) of these studies specified their mixed methods design, 34% (17) of studies specified that they had integrated their quantitative and qualitative results³ and 44% (22) of studies described an integration procedure⁴ (Table 1). Our exploratory search of the literature suggests that less than half of mixed methods studies report their research design and report integrating their findings, which could have a negative impact on the quality of the planning and reporting of mixed methods studies produced in this field.

8. Conclusion

The main objective of this paper was to assist researchers, with little background in mixed methods, with the planning and reporting of their studies by providing an overview of mixed methods research, mixed methods designs (i.e., the convergent, explanatory, and exploratory design), and concrete integration strategies (i.e., the comparison, connection and assimilation strategy). We identified many advantages associated with specifying a mixed methods design and integration. Specifying a mixed methods design can help readers to understand the justification for using a mixed methods approach and to understand

² We searched for empirical mixed methods studies published in 2011 to 2016 with the following query: ((TITLE-ABS-KEY(“mixed methods”) AND TITLE-ABS-KEY(“built environment” OR “urban form” OR streetscape OR “physical environment” OR “community design” OR “urban planning” OR neighborhood)) AND DOCTYPE(ar) AND PUBYEAR > 2010 AND PUBYEAR < 2017). We only included studies that used at least one quantitative (e.g., close-ended interviews) and one qualitative method (e.g., focus groups or semi-structured interviews) and that examined the relationship between the built environment and a health outcome or health behavior (e.g., physical activity, or consumption of fruits and vegetables) and that were written in either English or French.

³ Authors specified that they integrated (triangulated, combined) the quantitative and qualitative results

⁴ Authors described an integration procedure with or without mentioning that they integrated results

how this approach will assist in answering the research questions. Studies that specified a mixed methods design and integration procedure are more transparent about the overall design and research procedure, which enhances the reproducibility of the study. Transparent research designs and procedures can facilitate evaluating and comparing research findings and can promote progress in knowledge creation. Integrating findings can also make the conclusions and the process by which they were drawn more explicit for the reader. Our exploratory search of the literature suggested that less than half of mixed methods studies report their research design and report integrating their findings, potentially impacting the quality of mixed methods studies produced in this domain. To strengthen our ability to gain new insights into the multidimensional nature of the systems governing the linkages between the built environment and health, this paper provided guidance for researchers to help improve the quality of the planning and reporting of their mixed methods studies.

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Declaration of Competing Interest

The authors have none to declare.

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