Methodology

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Analyzing the concept of spillover effects for expanded inclusion in health economics research

K Jane Muir*,[1] & Jessica Keim-Malpass[1]

[1]Department of Acute and Specialty Care, University of Virginia School of Nursing, Charlottesville, VA 22903, USA
[1]

*Author for correspondence: kjm5xw@virginia.edu

Background: The incorporation of spillover effects in health economic research is recognized by regulatory agencies as useful for valuing health interventions and technologies. To date, spillover effects are not universally used within economic evaluations and conceptual definitions of spillover effects are vague within the context of health economics research. **Materials & methods:** In an effort to enhance awareness of spillover effects for health economic evaluations, a concept analysis using Walker and Avant's approach was performed to elucidate the key attributes, definitions, antecedents and consequences of spillover effects across a range of disciplines. **Results:** Key attributes included lack of intention, positive and negative impacts, and two entity/domain involvement. Antecedents included an initial action and desired outcome. Consequences involved spillovers across industries, work life to personal life domains, patient to family member domains and across healthcare markets. **Conclusion:** The analysis provides greater clarification around the dimensions of spillover effects and reveals opportunities to enhance methodological approaches to assessing spillovers.

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Health economic evaluations have been indicated to facilitate decision-making around medical interventions, technological advancement, pharmaceutical innovation, healthcare professional workforce projections and other healthcare-related topics [1–3]. Given rising US healthcare spending, information gleaned from economic evaluations can lead to the appropriate allocation of resources needed to improve patient outcomes, healthcare systems, health policy and other healthcare-related decisions [3].

Economic evaluations are commonly classified as cost–effectiveness analyses, cost–utility analyses and cost–benefit analyses [4]. The various economic evaluation techniques similarly compare costs in the form of monetary units and differ with regards to measuring consequences [4,5]. For example, cost–effectiveness analyses, as described by Drummond and colleagues [4], measure a single consequence in the form of a natural unit, such as blood sugar reduction, life years gained or averted missed work days. Cost–utility analyses can measure outcomes of interventions based on preferences or utility weights. Cost–utility analyses are considered a broader type of cost–effectiveness analysis. A common cost–utility measurement is the quality-adjusted life year [4]. Cost–benefit analyses focus on a single cost and benefit measurement in the form of a monetary unit alone [4,5]. The availability of multiple economic evaluation techniques is beneficial for evaluating health programs and interventions, as well as resource allocation decision making where value judgments may vary by research question or approach [4,5].

An important concept discussed in the health economics literature is spillover effects, known as the health impacts and costs that extend beyond a health intervention or program's targeted recipient (the patient) to unintentionally impact other recipients either in a positive or negative way [6,7]. Health economic studies have predominantly assessed spillover effects within the family unit, where a patient's health status spills over to impact the quality of life of a family member [6]. Despite acknowledgement by the Second US Panel on Cost–Effectiveness in Health and Medicine that spillover effects are needed to enhance cost and benefit estimates of health interventions, a gap exists

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Table 1. Spillover effect concept characteristics.

Attributes	Antecedents	Consequences
• Unintentional • Positive or negative impacts • Two entity/domain involvement	• Initial action • Desired outcome	• Unintentional impact from one entity to a second entity • Cross-industry, interpersonal, professional life to personal life domain

in health economics research regarding universal inclusion of such effects [8]. A potential cause of such spillover effect exclusion could be uncertainty around the concept of spillover effects, given the existing focus in health economics on the family caregiver spillover domain [9,10].

The purpose of this analysis was to examine the concept of spillover effects in order to identify defining attributes, antecedents and consequences across a variety of academic disciplines. An expanded analysis of the concept across multiple disciplines can inform increased integration of spillovers within health economic evaluations. Additionally, an analysis of the concept may expand the types of spillovers evaluated in health economic studies. The concept analysis consists of an eight-step process outlined in subsequent paragraphs, followed by implications for health economics research.

Concept analysis of spillover effects

In analyzing the concept of 'spillover effects', a systematic eight-step procedure was conducted using Walker and Avant's concept analysis process [9]. The Walker and Avant [9] concept analysis process consists of: selecting a concept, determining the purpose(s) of the analysis, identifying uses of the concept, defining attributes, identifying a model case, identifying contrary cases, identifying antecedents and consequences and defining empirical referents. The first two steps of Walker and Avant's approach (concept selection and purpose development) are addressed in the introduction; the remaining steps are discussed in the following sections [9].

Materials & methods

The concept of interest for the analysis was spillover effects, which is identified in a variety of terms in the literature as 'spillovers', 'spillover effects' and 'externalities' among a wide range of academic disciplines. These terms were all considered related to the identified concept of spillover effects. For the analysis, the literature search was restricted to health economics, psychology, sociology and business. A comprehensive search of the literature was conducted using PubMed, Google Scholar and Ovid Medline to understand the range of definitions and uses of spillovers. The primary search terms and Medical Subject Headings terms used either in combination or alone were 'spillover', 'spillover effects', 'externalities', 'economic', 'economic evaluation', 'economic modeling', 'Markov', 'cost–effectiveness', 'health', 'nurse', 'nursing', 'physician', 'caregiver', 'psychology', 'sociology' and 'business'. The search was filtered such that keywords were identified in the title and abstract of the articles. The article inclusion criteria included: articles or white papers that included the words 'spillovers' or 'externalities' written in English language within the past 15 years. Papers published in non-peer-reviewed journals, as well as gray literature and editorials were included.

A total of 50 articles that met the inclusion criteria were initially reviewed. A total of 34 articles were selected [10–41,44,45]. A total of 21 articles were from the health economics discipline, six from psychology, four from sociology and three from business. The majority of excluded articles discussed mathematical modeling of spillover effects, which was not relevant to the current research topic. The identified literature was reviewed and analyzed to identify attributes, antecedents and consequences of spillover effects (Table 1).

Identifying uses of the concept

The initial step of the analysis involved examining the definition of 'spillovers' in the dictionary and uses in the relevant published literature. According to Merriam-Webster [42], 'spillover' refers to 'an extension of something, especially when an excess exists'. Use of the term 'spillover effects' are discussed in the following sections within the domains of health economics, psychology, sociology and business. A total of 23 of the articles explicitly described a definition of spillover effects, while the remaining articles described examples without clear definitions.

Uses in health economics

Spillover effects were examined within the academic discipline of health economics and were discussed as either 'spillovers', 'spillover effects' or 'externalities'. Within the health economics field, spillovers were most commonly discussed in relation to a health intervention, scientific advancement or technological development. Gold [7], discusses spillovers, synonymous with externalities, as a positive or negative market exchange impacting individuals or groups who are not direct participants in such exchanges (p. 66). In a case study discussion on measuring spillover effects of patients with meningitis, Bhaduri and colleagues [22], refer to spillovers as 'wider health benefits' impacting patients in addition to individuals who are close to the patient (p. 1). Lakdawalla and colleagues [26], defined spillovers within the concept of scientific spillovers as the benefit of a scientific advancement imparted upon future knowledge development. Scientific spillovers occur when one advancement is made and other scientists, researchers or innovators expand on the given idea or advancement over time.

Much of the health economics literature studied spillovers in the context of the family caregiver or informal carer. Caregiver spillover effects, first introduced by Basu and Meltzer [6], refer to the various conditions, treatments and contacts that impact the welfare of family members. Spillovers manifest as the caregiver health effects and/or informal care time costs resulting from the health status/condition of a family member or close individual [13]. Spillovers have also been explored in terms of their impact on healthcare markets and provider practice patterns. A study by Johnson and colleagues [27], posited that decreases in fee-for-service traditional Medicare spending resulted from the spillover effect of increased Medicare Advantage penetration within states. Baicker and Robbins [16], found that a 10% increase in Medicare Advantage state penetration was associated with an approximate US$250 reduction in fee-for-service traditional Medicare resource use per patient. Cost-controlling measures within Medicare Advantage, such as the presence of health maintenance organizations, resulted in decreased costly inpatient hospitalizations and more cost-reducing outpatient service use. Overall, the health economics literature considered spillovers the impacts that extend beyond a patient and impact individuals or groups within a social network of a patient.

Uses in psychology

Within the psychology discipline, spillovers were discussed as an attitudinal or behavioral transfer from one life to domain to another [30,32]. In studying shift work among nurses with families, Kunst and colleagues referred to spillovers as "*. . . transfers of mood, energy and skills from one sphere to another*" [30]. Spillovers were described in psychology as bidirectional in movement, occurring between work and family life domains [30]. Behavioral spillovers were a particular domain of spillovers in the psychology literature defined as a secondary process that can lead to larger-scale societal and scientific consequences [33]. Nash and colleagues described behavioral spillover theory as, "*a way to catalyze broad lifestyle change from one behavior to another in ways that generate greater impacts than piecemeal interventions*" [34]. Behavioral spillovers have been contextualized within environmental impacts within countries, where the concept of a conscious spillover can be cultivated in countries that value pro-environmental behavior [34]. Additional behavioral spillovers have evaluated exercise and healthy eating practices [34]. Overall, spillovers in psychology emphasized behaviors and the transfer of emotional or behavioral influences from one life or societal domain to another.

Uses in sociology

Uses of spillover effects in the sociology literature shed light on intersections between individual disparities, institutions and social outcomes. Timmermans and colleagues situated their qualitative study on lack of health insurance spillovers based on neoclassical economic underpinnings [37]. Within this study, spillovers were discussed as 'collateral effects' and 'externalities' that are costs or benefits resulting from activities impacting "*an otherwise uninvolved party who did not choose to incur that cost or benefit*" [37]. Spillovers were further described as a tool to examine the effects of activities between entities that are unrelated but seemingly impacted by one another [37]. In studying the spillover effects of deterrence strategies to reduce crime, Braga and colleagues did not explicitly define spillover effects, but reference them as synonymous with indirect effects [38]. Hagan and Foster [36], assessed spillovers in the context of incarcerated mothers and the associated 'social costs' incarceration can have on children's education. Thus, the identified sociology literature referred to spillovers as the unintentional impacts of a policy, process, or phenomenon on societal institutions and outcomes.

Uses in business

In the business literature, spillovers were discussed in the context of innovation and idea expansion between groups. Frischmann and Lemley [39], define spillovers as the, "*uncompensated benefits that one person's activity provides to another*". Grillitsch and Nillson [41], examined knowledge spillovers in Swedish firms that are located within industrial 'clusters' or regions of high local knowledge density versus firms that are located within a knowledge 'periphery'. The study found that innovative firms in the knowledge periphery collaborate with external firms to compensate for the lack of knowledge spillovers that are gained by firms located within the knowledge/industrial cluster [41].

In a business advertising context, Sahni analyzed the impact of online advertisements on advertiser competition [40]. The findings from the randomized field experiments from a restaurant-search website suggested that spillovers were significant when advertising efforts were of the lowest frequency, while minimal spillovers occurred with high-intensity advertising techniques. Thus, the stronger intensity advertising techniques saturated consumer interest in the main advertiser, which offset spillovers toward other competitors [40]. Business spillover effects in the identified literature referenced spillovers in the context of innovation, marketing influences and consumer activities.

Defining attributes

The determination of defining attributes is central to identify and define characteristics central to the concept under study. Based on the relevant review of the literature, three common attributes of spillover effects were noted: lack of intention, positive or negative impacts and two entity/domain involvement.

Lack of intention (unintentional)

The majority of the literature examined described spillovers as unintentional in nature. Frischmann and colleagues [38], described spillovers as never planned nor calculated from the outset of an activity, process, intervention, or phenomenon. Thus, the receiving individual or third party is not privy to a transaction or compensations [19,22,39]. Sahni discusses the unintentional nature of advertisement techniques that invoke consumer memory recall of associated brands or products [40]. The literature described advertising techniques as having an unintentional consequence of priming a consumer to recall a non-advertised option in addition to the primary product/service advertised [40]. Health economics spillover effects around health interventions were described as an unintended effect on informal caregivers, family members, or other individuals within the social network of a patient. The majority of the identified spillover literature in the psychology and sociology disciplines discussed spillovers within the frame of being unintentional. One domain of psychology with a greater level of intentionality described was within behavioral spillovers specifically within environmental research. For example, Nash and colleagues [34] described behavioral spillovers as strongly influenced by "*behavioral interventions, changes in awareness, availability of infrastructure and resources and technological advances and policy change.*" Across the identified literature, spillovers were not intentionality imparted upon the indirect recipient.

Positive or negative impacts

Each of the disciplines characterized spillovers as capable of causing positive or negative effects. Within the realm of business and innovation, spillovers were cited as a social benefit that expands the influence of ideas to wider groups [39,40]. The social benefit of such a spillover is viewed as the advancement of an idea or innovation for the benefit of an industry. Furthermore, ideas cultivated in one industrial field were considered to commonly spill over into other fields – considered an interindustry spillover – in which case the benefit of these spillovers are accrued by both fields [39]. Frischmann and Lemley [39] attributed, in part, the 1980s computer boom to positive spillovers effects due to knowledge spillovers moving freely within Silicon Valley. Similarly, Grillitsch and Nillson's examination of knowledge spillovers between firms further supports the notion of positive innovation spillovers within regional clusters [41]. The study demonstrated that innovative spillovers between firms is positive, valuable and firms will strive to obtain these spillovers either through geographical means (internal access) or through collaborations externally [41]. Sahni discussed spillovers within advertising as positive or negative, based on the advertising effort companies implement [40]. Lower frequency advertising strategies resulted in positive spillovers for the advertising company's competitors, while higher frequency techniques resulted in positive spillovers for the advertising company.

In the discipline of psychology, spillovers have been described as both positive and negative within the work–family life spheres. Amstad and Semmer [32] describe work as a positive spillover where workers can develop

beneficial time management and efficiency habits that benefit productivity and communication within the family unit. Conversely, work is described as a negative spillover when stress transfers from the work domain to the home life domain [32]. Negative spillovers manifest as the undue stress imparted to family members by an employee ruminating at work within the family setting [31].

Much of the literature on spillover effects within health economics described the negative spillovers from a patient illness to a family member or individual close to the patient. Caregiver spillover effects, first introduced by Basu and Meltzer [6], refer to the various conditions, treatments and contacts that impact the welfare of family members. Such spillovers manifest as caregiver health effects and/or informal care time costs resulting from the health status/condition of a family member or close individual [13]. Al-Janabi and colleagues [22], describe family caregiver spillovers as the psychological, physical, financial and emotional burden that family caregivers experience while caring for a sick family member. Family caregiver spillovers have been studied among parents of children with medical complexity and autism, as well as spouses of adult patients; such effects include increased parent absenteeism, physical injury, depression and anxiety [10,12]. Bhadhuri and colleagues assessed meningitis family spillovers and found that long-term morbidity for meningitis survivors caused negative spillovers in the form of family member health losses [23]. Thus, negative spillover health impacts toward family members/caregivers predominated the health economics literature.

Two entity/domain involvement

A unifying theme across the spillover effect literature was the involvement of two entities or domains impacted by an action or process. Specifically, spillovers were described to have a direct impact on a targeted entity (or domain), as well as a second entity unintentionally. This common characteristic manifested within the business literature as innovation spillovers from one entity, or industry, to another. Within one sociology study, one family entity, an incarcerated mother, had an unintentional impact on her child's performance in the school domain [36]. An additional sociology perspective assessed the impact of a health insurance domain on societal institutions (schools and churches) [37]. Among the identified literature, there were noted similarities between psychology and health economics in that family members were the two entities frequently impacted by spillovers [10–13,30–32]. As mentioned previously, spillover effects studied within the psychology discipline assessed professional life spillovers to the home and family setting [30,32]. Within the health economics literature, spillover effects were most commonly referenced as well-being impacts on family members of patients. Further health economic studies referenced changes in innovation from a present scientific to future scientific domain [26].

Identifying a model case & contrary case

Model case

Model case construction is the fifth step of Walker and Avant's [9] concept analysis and consists of including the identified attributes in a model case based on literature or invention by the author. The following case was created by the author and discusses the spillover impacts of a healthcare unit systems-level intervention on patient outcomes.

Elkwood Hospital Emergency Department (ED) provides adult, pediatric and women's health services. It has a triage section, a main ED treatment area and a pediatric treatment area. Recently, the ED has experienced a surge in patient volumes due to local population growth. The department decides to implement a new triage workflow configuration for patients after identifying that 70% of all presenting ED patients are low acuity and do not need to be seen in the main ED treatment area. Thus, the department initiates a 'triage quick assessment' process facilitating quick assessment and treatment of low-acuity patients in order to free up bed and clinician resources for high-acuity patients and to reduce patient wait times.

In order to increase efficiency in the new triage center, patients are initially brought into a triage room after patient registration where vital signs, initial assessments and labs are taken by a nurse. After this process, the patient is returned to the waiting room where they wait to be called back into the triage room for a physician assessment. As the first patient waits in the waiting room, new low-acuity patients are brought into the triage room to go through the same process by the nurse.

The new triage configuration is efficient in that it facilitates a quick assessment of every patient, where a nurse can identify if a patient is truly stable (or not) and return patients to the waiting room until their physician assessment. The additional benefit of the quick assessment process is that it allows for continuous bed availability should a high-acuity patient present in need of immediate stability and subsequent transfer to a permanent room.

Over time, the ED observes significant drops in patient wait times due to this new configuration. However, although the process has benefited overall patient time metrics in the ED, the process has been detrimental to patient satisfaction ratings. Patients have reported negative feedback regarding the constant transport between the triage room and the waiting room and report perceived fragmented care imparted by the staff. Additionally, the department has observed a 10% increase in clinician turnover since implementation of the new triage configuration. Nurses on the unit cite increased moral distress due to the rising time pressures and increased time constraints related to quickly completing patient registration, assessments and labs. The physicians have reported missed nursing care on common tasks, such as incomplete vital signs and delayed medication administration. Upon closer evaluation, the director of the ED has noted rising patient re-admissions to the ED. Despite quick evaluations among these low-acuity patients, approximately 30% are returning within one week to the ED again.

This case addresses the defining attributes of spillover effects wherein the intervention resulted in unintentional impacts such as decreased patient satisfaction, clinician turnover, nurse moral distress, patient adverse events and increased patient re-admissions. The department did not intend from the outset for a systemic intervention to cause clinician moral distress impacting clinician performance and patient outcomes. The resulting spillovers of increased efficiency in one arena (reducing wait times) included increased clinician error detrimentally impacted patient outcomes and/or reduced patient satisfaction impacting patient utilization.

The case results in negative spillovers, evidenced by increased patient utilization, clinician error, moral distress and patient dissatisfaction. Though the same entities are involved (patients, clinicians and the emergency department), different domains, or 'arenas' as mentioned in the psychology literature base, are impacted. Overall, the primary intention of the intervention was to increase patient efficiency (domain 1), while a variety of secondary domains were unintentionally impacted through spillovers (patient satisfaction, quality of care delivery, clinician turnover, patient health status, patient utilization).

Model case: methods expansion

This case additionally highlights the need for close examination of the methods used to measure the identified spillovers. A mixed-methods approach could be used to elucidate such effects mentioned within the case, particularly within an economic evaluation [43,44]. For example, a cost–benefit analysis could be conducted to quantify the impact of the new triage intervention, with spillover effects evaluated through increased patient re-admission costs and clinician turnover-rate costs. Furthermore, qualitative methodologies could be used to elucidate the systemic impacts on clinician challenges linked to fulfilling the identified workflow. Mixed-methods approaches could be employed to assess the quantifiable aspects of these spillovers, with qualitative methods informing the moral distress, intention to leave the workplace and patient dissatisfaction [43,44]. Thus, a variety of measurement strategies could be employed to best understand spillovers in the context of a health system intervention.

Contrary case

An ED creates a triage configuration to rapidly assess patients. Upon evaluating performance metrics, ED identifies that on a daily basis, 70% of the total patients seen in the ED who are low-acuity patients are successfully being treated and discharged from this new triage configuration. The physicians and nurses who work in the main section of the ED have noticed that the time to treat patients who are high acuity has decreased, meaning clinicians are seeing the sickest patients faster than before the intervention. This is a contrary case to a spillover because the implementation of the new triage configuration is intended to increase efficiency for low- and high-acuity patients. The ED aimed to treat 70% of the patients through a rapid assessment configuration in order to increase time to treat efficiency for high-acuity patients. Only one domain is impacted in this case – patient efficiency – given that it is the ED's intent to reduce wait times for all patients due to a workflow change. Thus, this case lacks the attributes of two entities and being unintentional in nature.

Identifying antecedents

Antecedent identification helps to understand the characteristics of attributes of spillover effects that exist prior to fulfillment of the concept [9]. There are two antecedents of spillovers: an intentional first action and a desired outcome. The intentional first action is the act of delivering or implementing a primary process. The desired outcome is inherently linked to the first action. A first action would be considered, for example, the development of a new healthcare technology to help patients with chronic pain. The desired outcome of technological advancement would be to reduce a patient's perceived or pathophysiologic suffering from pain. An initial action and desired

outcome are an antecedent because it determines the first entity or domain impacted in the spillover effect cascade. The secondary aspect, or consequences of the spillover effect involves impacts to secondary entities. Consequences are discussed in subsequent paragraphs.

Identifying consequences

Consequences are resulting events or phenomena that emerge from the identified concept [9]. As previously described, consequences of spillovers are considered the unintentional impacts resulting from an intentional first action and can have positive or negative impacts. The magnitude of the spillover effect consequences varied among the disciplines reviewed and provided rich perspectives on micro- and macro-level impacts among various entities under study. For example, the business literature predominantly described spillover effects as having a large-scale impact as various industries were involved [39–41]. Geographic context strongly influenced the transference of knowledge and innovation spillovers [39,41].

Similarly, health economic spillovers were discussed in the context of scientific innovation, however the majority of studies discussed spillover impacts between individuals [26]. Specifically, individuals with illnesses and their social networks were the focus of health economic spillover effect research [19,20]. Health economic studies, therefore focused mostly on individual versus industry spillovers. A noted methodological consequence of measuring spillovers relates to the issue of double-counting [25]. An example is in the case of a patient experiencing depression or anxiety related to watching a family or clinician caregiver provide challenging care. This situation poses a methodological risk of double counting, in which the quality of life decrement is 'counted' as a utility for the patient when it could already be 'counted' in the utility of the caregivers [25].

The discipline of psychology also discussed smaller magnitude spillovers within the family unit, however behavioral spillover literature addressed environmental spillovers on a national level of larger magnitude [32,33]. Finally, spillovers within the sociology context assessed broader societal impacts of policies, processes, or access challenges [35–37]. Though individual family unit spillovers were assessed, a broader spillover focus was on societal impacts. The analyzed literature expressed a variety of spillover effect impacts that are important to consider in developing research around spillovers.

Identifying empirical referents

The final stage of Walker and Avant's approach [9] is identifying empirical referents, specifically how the concept is measured. The measurement of spillover effects was identified as highly variable across the various disciplines. Although definitions of spillovers across the disciplines overlap, there existed noted differences in the measurement of spillovers among the examined literature.

Spillovers evaluated within the fields of psychology, sociology and business have used both qualitative, quantitative and mixed-methods approaches to assess spillover effects. In the sociology context, Timmermans and colleagues [37] evaluated how lack of health insurance affects religious institutions and school (kindergarten–12th grade) functioning. Using in-depth, qualitative interviewing methods, the authors found negative education spillovers relevant to increased student absenteeism, as well as increased ED utilization rates and 'waiting illnesses out' (p. 367) [37]. In examining spillover crime impacts, Braga and colleagues [38] used a quasi-experimental design and regression analysis to examine gang shooting trends. During data collection for the study, the team employed qualitative interviewing to gain insight into shooting events, relationships between gang victims and other contextual information relevant to gun-related gang activity [38]. Spillover inclusion in the examined business literature has predominantly included quantitative regression analyses of market impacts or consumer behaviors [39,40].

Within the health economic literature, quantitative approaches to assess spillovers have dominated over qualitative approaches. Health economic studies have assessed spillovers using state-preference valuation techniques, such as surveys like the EuroQoL-5 Dimension (EQ-5D-3L) and the Short Form-6 Dimension (SF-6D) to assess individuals' health status [45,46]. Such surveys ask participants to rate their health within a wide range of dimensions such as sleep quality, anxiety/depression, pain/discomfort and more. Data from these surveys are then quantitatively evaluated using regression-based or correlational analyses to understand associations between patient health quality and caregiver quality to determine potential spillovers [23].

Additional spillover assessments in economic evaluations include discrete choice experiments, where caregivers are given a set of scenarios and are asked to select their preferences of variables/choices within specific scenarios [15]. Such assessments are useful in determining willingness-to-accept values regarding caregiver informal care payment [20,28].

Other spillover assessments include accounting for displaced time due to caregiving through opportunity costs in economic models and recording caregiver tasks in diary logs [13].

Qualitative approaches have been used sparsely in health economic studies [47]. One identified study by Canaway and colleagues [19] used in-depth interviewing and hierarchical mapping to identify the social networks of end-of-life (EOL) patients [19]. The authors found that EOL patient caregiving network size was dependent on disease trajectory; EOL patients had an average of eight close family members/and or caregivers. Information gleaned from the interviews can be used by economists to assess the emotional and personal connectedness spillover effects of EOL caregiving within a network [19].

Despite the use of mixed-methods and qualitative approaches in the fields of psychology and sociology, qualitative methodologies are less prominent in health economics literature. No general consensus existed among the selected literature on how to universally assess spillovers. The implications of the identified diverse approaches to assessing spillover effects is discussed in subsequent paragraphs.

Implications for health economics & comparative effectiveness research

Implications from this concept analysis include expanding the types of spillover effects assessed in economic evaluations, as well as the methods used to assess spillovers. First, this concept analysis demonstrates an opportunity to expand spillover effect analyses to include entities beyond family caregivers or scientific innovation advancement in the future. Health economic studies have evaluated spillovers between healthcare markets in a similar manner to inter-industry spillovers in the business literature. However, increased opportunity exists in quantifying spillovers beyond the patient social network to include frontline caregivers, systems-level spillovers of health interventions (i.e., increased outpatient clinic visits, ED re-admissions) and health intervention spillovers to manufacturing industries [19]. Additionally, there is a gap in understanding the existence of and potential impact of multiple spillovers occurring at the same time. Future research is needed to understand multidimensional spillovers, where, for example, an entity experiences multiple spillover effects at once. Family caregivers, for example, may experience health spillovers while informally caring for a sick loved one while simultaneously experiencing financial spillovers from a new medication for the patient's symptom relief.

Second, the examined methods used to assess spillover effects (empirical referents) from the examined literature can be applied to health economic studies to further elaborate on spillover effects comprehensively. Qualitative methodologies, for example, can be used to best elaborate on spillover effects that may be challenging to quantify in traditional spillover effect measures such as regression analyses, choice experiments or surveys. Dopp and colleagues [44] suggest that qualitative perspectives can facilitate mixed-method approaches in economic evaluations to fill a 'qualitative residual' where stakeholder and contextual information is traditionally absent (p. 2). The mixed approaches to assessing spillovers, for example in the sociology literature, where qualitative methods were used, suggests that spillovers may employ rich, descriptive contextual perspectives that are well-suited to compare health interventions [18,37]. Qualitative methodologies are well suited to assess spillovers due to inherent epistemological underpinnings in thick, contextual descriptions, emic–etic (insider, outsider) perspectives and observational data on drivers and mechanisms of topics under study [48–50,53]. Inclusion of qualitative methods to assess spillovers in economic studies may result in the investment of healthcare resources that are appropriately allocated to targeted populations. The subsequent section addresses factors to consider when integrating spillover effect assessments into health economic research.

Expanding spillover effect inclusion in health economic studies

Figure 1 can be used as a framework to guide spillover effect inclusion in health economic evaluations. Adapted from Galizzi and Whitmarsh's [29], methodological recommendations for behavioral spillovers, relevant questions to consider about spillover effect inclusion based on Figure 1 factors are listed below.

Context: What is the setting where the spillover effect(s) takes place?

Entities: What are the entities, domains and/or populations involved? What is the intended (directed) and unintended impact? What are any targeted interventions targeting directed outcomes?

Magnitude: What are the potential outcomes from the intended outcome? What is the breadth and depth of the impacts?

Methods: Can these spillovers best be elucidated through experimental or non-experimental approaches? Are there opportunities for qualitative or mixed-method approaches?

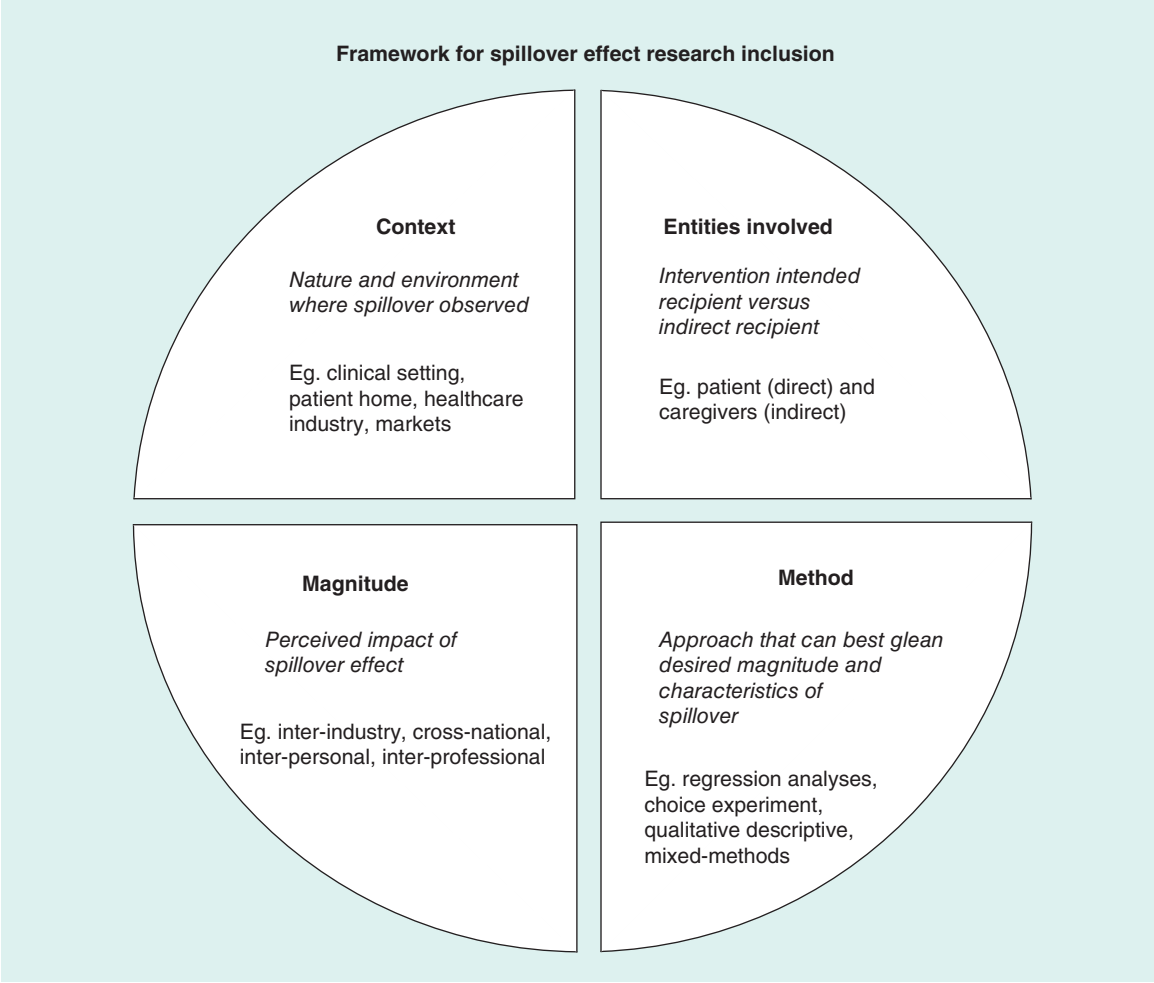

Figure 1. Framework for spillover effect research inclusion.

The highlighted factors are gleaned from the concept analysis and were developed after assessing relevant attributes, antecedents, definitions and overall characteristics of spillover effects. The first relevant factor–context describes the need to identify the environment where the spillover effect takes place. Such settings could include a hospital, a patient/family home, a healthcare corporation, or an academic evaluation of a healthcare market. The second important factor to consider is entities and domains. This factor aims to identify what/who is the entity intended to be impacted and which entity is receiving a potential spillover impact. Subsequently, the third domain is the magnitude or overall impact of spillovers. Magnitude can be considered a geographic, interpersonal or interindustry impact. Estimating the potential magnitude can aid in understanding the extent to which the spillover needs to be studied. A final consideration is the methods approach. Finally, methods selection should be guided by the contextual, entity and magnitude considerations. Such evaluation of important factors driving spillover effects, as determined from this concept analysis, can guide spillover effect integration in health economic studies.

Conclusion

This concept analysis expands definitions and characteristics of spillover effects for consideration in health economic studies. Few health economic studies to date adequately incorporate spillover effects and when incorporated, most evaluations focus on family spillovers evaluated quantitatively [20]. Spillover effects serve a role in enhancing the societal perspective of a study, given that they reveal contexts and unintended effects of a strategy or intervention on various groups or entities that have been traditionally overlooked in a traditional economic model [25,51]. This concept analysis used a multidisciplinary lens to identify defining characteristics of spillover effects to expand considerations of spillover effects for use in health economic evaluations.

Summary points

- Within health economics research, spillover effects are traditionally considered the health impacts of an intervention unintentionally imparted upon the family member of an ill individual. Broader considerations of spillover effects can enhance economic evaluations.
- A concept analysis was conducted across academic disciplines. Key attributes included: lack of intention (unintentional), positive or negative impacts and two entity/domain involvement. An initial action and targeted outcome were identified antecedents of spillover effects. Consequences varied in terms of magnitude and domain of impact across industries, life domains and interpersonal relationships.
- Expanded conceptualizations of spillover effects can strengthen economic evaluations. Economic evaluations assessing spillovers should consider the context, entities and magnitude of spillovers to inform method selection.

Author contributions

KJ Muir contributed substantially to manuscript conception and design, literature review and drafting of manuscript work. J Keim-Malpass contributed substantially to manuscript conception and design, drafting of manuscript work and revisions of drafts. Both authors agree to be accountable for all aspects of the work, inclusive of manuscript integrity.

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