Exchanging Information Across Borders:
A Systematic Review of European Health Information Transfer

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Structured Abstract

**Background:** The United States’ health care system is usually accused of being both expensive and wasteful. The inadequacy of structures to coordinate care is often considered one of the causes of these high-cost/poor quality results. Other countries such as the UK, Canada, and Japan have made electronic health records a high priority intervention for better coordination of care. However, little is known about the breadth of medical information exchange methods and their associated levels of success. The European Union Border Regions is a good area to study, as it has a long history of patient travel across borders and a wide breadth of services offered from medically simple (e.g. vaccines) to medically complicated (e.g. oncological treatment).

**Purpose:** Determine methods of health information exchange to coordinate care in the European border regions for patients undergoing micro-movement into non-native countries to receive care.

**Data Sources:** EMBASE and PubMed, any study type, and grey literature cited within other relevant publications.

**Study Selection:** I chose English language studies and reports to answer the primary question. Studies chosen had to include information on case studies or surveys of areas with known medical care between borders. No future study proposals, judicial reviews, or terminology papers were included. Papers had to report on patients undergoing cross-country medical services. Travel for purchase of medications was not included. Patients had to be residents in the border regions of Europe. Any methods of medical information exchange between providers were included. Control/comparison groups of methods of information exchange and outcomes (success/failure indications) were preferred but not necessary.
Data Synthesis: I included 7 cases (3 papers and 4 case studies from grey literature). The majority of the studies I included (6/7) gave general themes without quantifying how frequently these appeared. The literature showed that many approaches to medical information exchange (e.g. direct access to electronic health records, written record exchange, and telemedicine) exist within border regions and between providers caring for patients within them. I didn’t use any pre-defined cutoff for success or failure of a project. Rather it was accepted that a project/case was successful or failed if it was defined/reported as such by the authors of the paper presenting it. No one method or group of methods gave a clear, coherent and easily observed pattern of success or failure.

Model: Given no singularly necessary and consistently successful method of medical information exchange, I created a separate categorization of various information transfer methods/combinations along two variables: technological investment and human capital investment. There were too few data points to create a reliable model. However, the limited model suggests that there is no one method or list of methods that consistently and reliably results in successful health information exchange. Rather, specific combinations of attributes with specific ratios of human capital investment to technological investment are needed.

Limitations: I could not identify any studies that explicitly answered the primary question of the paper. Six of seven cases could give only themes of methods without frequencies of their associated successes/failures. As a result, rather than being able to address the issue of success/failure as a probability, I had to create an overall crude dichotomous grade for outcomes. All of the studies had either sampling or measurement limitations. A full analysis of the value of different information exchange options is made difficult by the paucity of reported information on methodology used.
**Conclusions:** Among many methods of cross-border medical record exchange, no one stood out as a particular success. The paucity of publications and other sources of information may limit conclusions about what works in transmitting patient information across state boundaries, and further research, especially on how the interaction of technology and human capital may smooth the flow of information, may contribute to the development of evidence-based policy.
# Table of Contents

**Introduction** \( \text{1} \)
- Background and Justification \( \text{2} \)

**Methods** \( \text{3} \)
- Study Inclusion/Exclusion Criteria \( \text{3} \)
- Data Sources and Searches \( \text{5} \)
- Grey literature identification and search \( \text{6} \)
- Web-based platform for systematic review management \( \text{6} \)
- Study Selection \( \text{6} \)
- Data Extraction \( \text{6} \)
- Quality assessment and limitations \( \text{7} \)
- Data Synthesis and Analysis \( \text{9} \)
- Role of Funding Source(s) \( \text{10} \)

**Results** \( \text{10} \)
- Search Results and Screen: main branch \( \text{10} \)
- Search Results and Screen: grey literature \( \text{11} \)
- Major themes: themes dominant and provider centric \( \text{13} \)
- Major themes: heterogeneity of medical information exchange and associated success \( \text{13} \)
- Summary of Medical information exchange methods with associated success/failure rating \( \text{16} \)
- Major themes: sample limitation \( \text{16} \)
- Major themes: measurement limitation \( \text{18} \)

**Discussion** \( \text{19} \)
- Limitations in this systematic review \( \text{19} \)
- Model \( \text{20} \)
- Model implications \( \text{22} \)
- Model limitations \( \text{23} \)
- Policy implications, research gaps & future directions \( \text{24} \)

**Conclusion** \( \text{24} \)

**Acknowledgments** \( \text{25} \)

**References** \( \text{26} \)
Tables
Table 1: Eligibility criteria.................................................................34
Table 2 Summary of results for main and grey literature branches.................................34
Table 3. Summary of medical information exchange with associated success/failure rating........35
Table 4. Summary of limitation assessments for main and grey literature..........................37
Table 5. Medical information exchange with rating along technology investment and human capital investment.........................................................40

Figures
Figure 1. PRISMA diagram.................................................................41
Figure 2. Model of success versus failure of information exchanges based on level along human capital and technological investment.........................................................42

Appendices
Appendix A. Detailed Search Term......................................................43
Appendix A1. Pubmed Search terms...................................................43
Appendix A2. EMBASE search terms..................................................43

Appendix B. Inclusion and exclusion of cases within grey literature.........................44
Appendix B1. 7 case studies found in Glinos and Wismar 2013 edited book.................44
Appendix B2. 8 “good practice models” as found in EUREGIO final report may 2007....46

Appendix C. Full Data Extraction..........................................................48
Appendix C1. Data extraction for three primary papers.................................................48
Appendix C2. Data extraction for the grey literature.................................................51

Appendix D. References for articles excluded at full-text review..............................54

Appendix E. References for articles deemed irrelevant.........................................56
Introduction

The United States has one of the most expensive health systems in the world, with the highest per capita spending (Olson, 2000). Many reasons have been cited as possible reasons for such an expensive system.

Some argue that most health care costs can be attached to a particularly sick and expensive minority of patients (Park et al., 2016). Others point to the culture of business and capitalism within the United States (Gawande, 2009). Some argue that health care has become so expensive in the United States because of use of more expensive technology (Squires, 2012).

However, one other cause will be the main focus of the current paper: inefficiencies and waste. Dubbed as the “tapeworm eating at our economic body” by Warren Buffet, waste contributes hundreds of billions of dollars (Buffett, 2010). Unnecessary services have been attributed a $210 billion price (Moriates, Arora, & Shah, 2015).

The lack of coordination of care has been cited as one cause of waste and inefficiency, especially when tests and services are repeated because their results are not communicated between providers (Berwick & Hackbarth, 2012; Moriates et al., 2015).

The issue of care coordination has gained ground in the United States via published articles and legislation. Some researchers proposed greater investment in national guidelines to standardize care (Gold, 2016). Others looked at how care can be improved with the use of electronic records for psychiatric patients (Geltman et al., 2015).

The US government and the Obama Administration have pushed for innovations in health care to meet this need. The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 (amendment to Sec. 3002 of the Public Health Act, Part XIII of
the American Recovery and Reinvestment Act of 2009) mandated the use of electronic health records for the purposes of minimizing waste and simplifying information transfer.

The US was not the only country, though, to see the need for greater care coordination. Countries like Japan (“e-Japan strategy”), England, and Canada (“Infoway”) made significant monetary investments in unified and integrated trans-national electronic record systems without much success (Beaton, 2008; Protti, 2008; Sonoda, 2011).

Elucidation of methods of health information exchange has become, therefore, an interesting area of study. Determining both the various options available and their relative success are both important questions for academic and policy purposes.

**Background and Justification**

The border regions of European Union are an interesting area to study. First, European Union has a sufficiently long history of population and goods movement. Indeed, patient rights have been judicially upheld (e.g. a ruling that orthodontic treatment by citizen of Luxembourg was allowed in Germany despite non-urgency and availability of such treatment in home country) (Kanavos, McKee, & Richards, 1999). Furthermore, this region is technologically complex with widespread use of techniques of modern medicine. As a result, there is a good distribution and diversity of services rendered from the very mundane (e.g. vaccines) to the very complex (e.g. interventional oncological radiation). As such, it can be used to get a greater understanding of a variety of different interactions and not limited to a small subset.
The purpose of this systematic review is to use the literature to determine methods of health information exchange to coordinate care in the European border regions for patients receiving care in their non-native countries.

METHODS

Table 1 about here

Study inclusion/exclusion criteria:

The population of interest had to receive care outside of their home nations in the neighboring country or countries. The exact distance to the border was not formalized. Description as border region or logical proximity to the foreign country was used as an eligibility criteria.

The primary interest was medical record exchange between providers of two different nations for patients receiving care in a non-resident country. Therefore, comparative studies of differences in medical record and health exchange within European countries (e.g. electronic records in UK versus Germany) were not included, as no exchange of services across borders occurred.

I excluded studies of services rendered across greater distances than what can be considered cross-border exchange, because the push/pull variables and specifics of such care could potentially be vastly different from proximity based health care provided across countries in border regions, e.g. an Italian resident of Luino, Italy, seeking care across Lake Maggiore in Ascona, Switzerland. I could not find terminology that would perfectly capture this type of movement, i.e. travel to sources of reasonably proximate care that crosses a national border. As a
result, the aforementioned travel will be referred to as “micro-movement” across borders for the remained of the paper.

I sought studies focusing on people receiving medical care or medical services. I excluded public health and education efforts to ameliorate conditions. Some form of direct health care provision had to take place. Physicians, dentists, and emergency personnel were considered as eligible providers. For the purposes of this paper, pharmacists receiving information from the physicians were also included in the “provider” category. However, travel across border for purchase of drugs without cross-border provider input (e.g. people crossing border to purchase cheap drugs without prescription) was not an eligible “medical” activity in this study. That is to say, there was no direct line of communication between providers in such an exchange.

The intervention of interest was the method of medical information exchange and information communication. As long as it was sufficiently described to enable me to analyze it, I placed no limit on the type of medical information exchange covered (e.g. electronic medical records versus telephone).

Some papers portrayed communication and exchange of information purely from patient to provider in the patient’s non-native country. This type of medical exchange, although interesting, is outside the scope of the current review. Such papers would not have information on how information was relayed from one provider to the other across borders. If, however, publications reported, for example, on how patients were used as a “go-between” for two providers on two opposite sides of the border, that would be eligible, since it would be a method, no matter how haphazard, of communication for cross-border care.
If applicable, any comparison group/s for medical record exchange as defined by a publication was eligible. Outcomes of interest were success or failure of the medical information exchange methods. I preferred to identify studies that included comparisons groups for communication methods. I also preferred to identify studies that defined what a “successful” communication was, but I did not eliminate studies that did not include one or both of these research targets.

To broaden the number of publications eligible for screening, I did not impose time limits.

Given that I wished to determine specific methods used for coordination of care and information exchange, I accepted a large variety of study designs. Studies and reports such as surveys of actual border regions, cohorts in these regions, or randomized control trials were acceptable. Studies that were not yet completed and modeling studies were excluded. Judicial papers and terminology papers were also excluded.

I used EMBASE and PubMed to locate articles. Only articles written in English were included. Given that Europe is a defined MESH term, the list of eligible countries was the same as that used by Medline and PubMed in defining this region.

**Data Sources and Searches**

I created search terms with the help of a librarian to reflect eligibility criteria listed above (Table 1, Appendix A). Early in the search strategy phase, I found that “Euregio” was nomenclature for specific border region health projects. I added “Euregio” to the search strategy.

I conducted the initial search on March 2nd, 2016 and updated it on May 1st, 2016. Searches and relevant number of studies identified with each are listed in the Appendix A.
Grey literature identification and search

I identified papers for possible inclusion at the start of the review process, some of which
did not themselves contain enough information to meet inclusion criteria, but some of them
contained source material that might be eligible for the grey literature search.

Web-based platform for systematic review management

I used Covidence, a web-based platform for systematic review management, to compile
and manage articles (Covidence systematic review software). Most of the duplicate articles were
removed by the software. However, some duplicates remained and were screened out at the
abstract level. The web-based platform was also used for abstract level review and full-text
review. Extraction of information and quality assessment was done separately on the local
computer.

Study Selection

Using Covidence, I conducted an abstract level review with the eligibility criteria listed
in Table 1. I moved papers to full-text review if they received a grade of “yes” or “maybe”. I
did not require a reason for rejection at the abstract level review, but held myself accountable for
providing a reason for elimination at the full text review stage.

The nature of grey literature sources means that I moved relevant cases directly into full
text review. Exclusion and inclusion were based on the same criteria used for the published
literature.
Data extraction

I inspected studies that qualified for full text review for relevant information as described below, and used the same extraction procedure for both main and grey literature branches of the systematic review.

I included study design and how information was gathered. If studies were based on interviews, I extracted further details on participants and presence/absence of comparison groups, as the participants would often be key informants in cross-border projects, rather than the primary population undergoing the intervention (i.e. micro-movement cross-border patients). As a result, I needed to distinguish between types of interview respondents, where appropriate.

I also extracted the population and location covered by studies and noted descriptions of populations when I could find them, as well as whether comparison groups were used.

The primary intervention of interest for which I was searching was the method of medical information exchange across providers and borders for patients receiving care in a country other than their own (non-native country) within European border regions. I sought outcomes of measures of the success or failure of such interventions/communication methods, although such measures were not always available. Indeed, any authors’ assessments of whether these methods of communication were successful were accepted as the outcomes.

Quality assessment and limitations

I assessed possible limitations and quality from how information was obtained and how measurement was reported.
A study can avoid biases for its own primary question, but have insufficient controls on bias for the question of the current review. Accordingly, I based my evaluation of study limitations not purely on how well the original study was done, but how well it was controlled on the parameters I chose for this review. Given that majority of the papers were not statistical analyses of large numbers of cases, were often descriptions of processes, and were sometimes designed to address issues far flung from the primary question of the current paper, I did not try to apply the full quality assessment as described by US Preventive Task Force for RCT papers to give an overall rating (U.S. preventive services task force procedure manual. 2008). However, final consideration for the likelihood of limitations within the studies, as described below, was based on general concepts of control and reliability of information.

Two primary limitations upon which the quality measurement was assessed were sampling and measurement. Sampling referred to the choice of recruitment or coverage of participants who gave information or the population studied. Note that survey studies would have both the participants and the population studies as identical. In contrast, other papers were based on key informants. To account for these differences between in-depth interviews with key informants and mass surveys, I noted who provided the information and who the population of interest was during extraction. For the purposes of quality assessment, a bias or insufficient control of either would illustrate sampling limitation.

Note that “biases” take on different meaning in key informant studies, whose respondents are never meant to be the result of random selection. Concern that the pool of key informants was in some way limited and not representative of the opinions available would be one basis for concern. Other reasons for concern and higher chances of sampling “bias” was lack of information on who these informants were and how they were chosen.
I tried to determine whether the information recorded (types of medical record exchange and success/failure rating) had been obtained in an equal, valid and reliable method. Note that in this case I am grading both the measurement of the primary intervention of interest (method of medical information exchange) and the outcome (success/failure rating) (Table 1). I assigned limitation ratings of low, moderate, and high. High designated greater chances of providing poor results. I recorded the reason for my rating in each case.

**Data synthesis and analysis**

Given the nature of the reports, quantitative synthesis of results was considered inappropriate as frequency and other quantitative information would not be possible to generate from the generally qualitative source material. Meta-analysis was not appropriate in this case due to heterogeneity of information and the limited number of studies assessing common communication methods. Instead, themes and patterns were used to synthesize results.

Although not used in the extraction, a system of classifying method of information exchange along two parameters (technology investment and human capital) was created and used later in the paper. Technology investment refers to any tools of medical exchange. These include electronic health records, written records, radios, telephones, and scripts. Human capital refers to human (provider and facilitator) effort used. Earlier, as the reader will have noted, I mentioned these variables as I described what the studies covered.

Each category includes within it a gradient from low to high intensity. High intensity technology investment, for example, includes advanced electronic records and videoconferencing. Low intensity technology investments, on the other hand, include things like written scripts. The older and the less involved the technology, the lower on the gradient it rests.
A similar gradient from low to high can be applied to human capital. The amount of effort and time can be expressed as intensity, with things that take more time or effort (e.g. personal travel over long distances) rating higher than do shorter duration/easier tasks, like writing a prescription. The involvement of greater number of people would also be captured as a higher rating on the human capital investment.

**Role of Funding Source(s)**

I have not received funding for the current paper, and am unaware of any conflicts of interest within my faculty mentors.

**RESULTS**

**Search results and Screen: main branch**

Of the total 321 papers identified through separate search terms in PubMed and EMBASE, 159 papers moved to abstract level screening and, of them, 135 were deemed irrelevant (Appendix D). I moved 24 to full text review (Figure 1). Twenty-one of the 24 remaining studies were eliminated at full text review stage (Figure 1, Appendix D). Three studies made it to full text extraction (Groene et al., 2009; Panteli, Wagner, Verheyen, & Busse, 2015; Post, 2004).

Two of the papers explicitly considered patients both of interest to the current study, micro-movement cross border, and outside of it, e.g. tourists from more remote areas outside micro-movement range (Groene et al., 2009; Panteli et al., 2015). The aforementioned papers summarized themes for all of their cross-border patients, whether those of interest to us (micro-movement range) or not (greater distance traversed). A third paper covered emergency care
response and triage of patients across medical providers of border region consisting of three
different countries (Post, 2004). It is likely that some non-micro movement cross-border patients
were likely (i.e. tourists in the area), although the paper didn’t address the issue of resident
versus non-resident patients receiving care (Post, 2004). However, I included the paper since the
chances of having true residents engaging in micro-movement care were more likely to occur
than tourists in the very restricted triple country border region studied in this paper.

**Search results and Screen: grey literature**

I identified grey literature separately. Two papers in the full text review discussed border
region health care, but did not contain specific information on medical information exchange and
coordination (Brand et al., 2008; Glinos & Baeten, 2014). However, these papers could be
connected to a larger report and book respectively.

Brand et al. 2008 was a summary of themes that could be found in the EUREGIO project,
a “systematic inventory analysis of cross-border health projects” (Brand et al., 2008). Several
reports emerged from the project; for this study, I chose the final report published in May 2007
(Brand, Holleederer, Ward, & Wolf, 2007). Glinos and Wismar 2014 was a summary paper
referencing a book edited by the two authors. The book was a collection of case studies, which I
screened for relevant information (Glinos & Wismar, 2013).

Figure 1 about here

The Glinos & Wismar 2013 book included 7 separate case studies involving hospitals of
7 different regions: Austria-Germany (Kostera and Burger, 2013), Belgium-France (Kiasuwa and
Baeten, 2013), Germany-Denmark (Augustin, Panteli, Busse, 2013), Finland-Norway (Lämsä,
Kerkimäki, and Kokko, 2013), the Netherlands-Germany (Glinos, Doering, Maarse, 2013),
Romania-Bulgaria (Galan, Olsavszyk, and Vlădescu, 2013), and Spain-France (Miguel Sanjuán and Gil, 2013). Of the 7 case studies, 2 had sufficient information on medical information exchange to move on to the full text review (Augustin, Panteli, & Busse, 2013; Kiasuwa & Baeten, 2013). I excluded four of the studies as they did not report methods on medical information exchange (Appendix B1). I excluded one because it discussed unfinished project with future goals and plans for information exchange (Appendix B1).

The Euregio 2007 report contained detailed information on 8 good practice cases ((Brand et al., 2007)) covering Germany-the Netherlands-Belgium prevention (Brand et al., 2007, page 145-148), Germany-Netherlands hospital (Brand et al., 2007, page 112-118), France-Spain (Brand et al., 2007, page 105-111), Belgium-the Netherlands-Germany rescue services (Brand et al., 2007, page 132-140), Germany-Poland (Brand et al., 2007, page 125-131), France-Italy (Brand et al., 2007, page 119-124), Finland-Sweden (Brand et al., 2007, pages 99-104), and Germany-the Netherlands-Belgium multiple projects (Brand et al., 2007, page 80-98).

Of the 8 cases, Germany-the Netherlands-Belgium prevention (Brand et al., 2007, pages 145-148), Belgium-the Netherlands-Germany rescue (Brand et al., 2007, 132-140), Germany-the Netherlands-Belgium multiple projects (Brand et al., 2007, pages 80-98) had insufficient information on medical information exchange (Appendix B2) by either not containing any or only vague references to medical information exchange methods (Appendix B2). France-Spain was excluded as it contained past planning and future goals only (Appendix B2, Brand et al., 2007, pages 105-111). Germany-Poland was excluded despite having a good coverage of information exchange of providers across borders, as the patients themselves didn’t cross borders (Appendix B2, Brand et al., 2007, pages 125-131). Rather telmedicine was used as consultation tool (Brand et al., 2007, pages 125-131). Finland-Sweden was excluded as information exchange
didn’t occur between providers of different nations as patients were funneled into a joint, dentist clinic (Brand et al., 2007, pages 99-104; Appendix B2).

Two of the studies (Germany-Netherlands and France-Italy) were included as they had sufficient information of medical record exchange across borders (Appendix B2).

**Major themes: themes dominant and provider centric**

Of the total 7 cases/papers that moved onto final extraction, only one reported frequencies (Table 2). However, this paper was a survey with mixed micro-movement and not micro-movement patient pool covered (Panteli et al., 2015). No randomized controlled trials or cohort studies were found in the final extraction pool (Table 2).

Of the 7 cases/papers, 3 had contributions from patients (Appendix C1 and C2 (Groene et al., 2009; Kiasuwa & Baeten, 2013; Panteli et al., 2015)).

**Major themes: heterogeneity of medical information exchange and associated success**

Methods of medical information exchange varied from technology intensive (e.g. videoconferencing and direct electronic record access) to technology cursory (written record exchange, written scripts, patient conveyed) and human capital intensive (shadowing of patient to the other country) to human capital cursory (prescription scripts) (Table 2).

Three papers all derived from grey literature, offered evidence of success rated by the authors. No overarching pattern was present across the three. One was the provider-centric report examining physician happiness with flow of information in a case with direct electronic record access (technologically intensive) and a dedicated telephone line (human capital intensive) (Kiasuwa & Baeten, 2013). The second one rated “best for hospital cooperation” used both video
conferencing (technologically intensive) and direct observation by physicians (human capital intensive but technology elemental) methods of communication (Brand et al., 2007). The third one rated as a “model for telemedicine” used electronic record intensive methods (videoconferencing and direct electronic record access (Brand et al., 2007)). The aforementioned papers reported neither failures of medical record exchange nor absence of them (Table 2).

Three of the papers identified via PubMed and EMBASE reported failures of communication for at least some of the medical record exchange methods employed within them. One reported problems with prescription receipt due to naming and dosage differences across countries (Groene et al., 2009). It also reported common problems of difficulty in contacting family physicians at admission and discharge (Groene et al., 2009). For the latter, however, the paper was not specific about the type of medical record exchange employed to contact primary care physicians (Table 2) (Groene et al., 2009).

Problems with prescriptions were echoed by the second paper (Table 2), where 12% of patients given prescriptions encountered problems with them (Panteli et al., 2015). This is the one paper that can give us frequencies attached to failures and successes. In this case, the interpretation of whether this is a failure or success is difficult, as 88% of people didn’t encounter an associated problem. However, as the authors didn’t specify whether they thought script writing was a failure or a predefined percentage above which the exchange method was unacceptable, it was difficult to categorize this as either failure or success. I attempted to locate literature benchmarks on percentage of script failure that were acceptable, but was ultimately not successful.
Additionally, this survey study covered other methods of medical record exchange like patient facilitated communication and written record exchange (Panteli et al., 2015). It, however, did not record whether these methods were successful or not. The paper also reported that people who received planned care abroad were more likely to have provider information exchange and were less likely to rely on patient facilitated communication (Panteli et al., 2015). A third paper that focused on triage and emergency operations noted difficulty with post-discharge follow-up, poor radio communications between emergency medical services of three different countries, and language barriers (Post, 2004). Besides the radio communication, however, the latter paper didn’t specify the method of medical information exchange associated with the aforementioned failures (Post, 2004).

Much like papers with evidence of success reporting, the three papers with failures in communication reported neither the presence nor absence of successes (Table 2).

The final paper, reporting on an a priori written record exchange made no claims about either failure or success within the body of the paper (Augustin et al., 2013). In this case study, hospitals made an agreement to send all of the relevant information as written records (technological intermediate, human capital intermediate) from one hospital to the other (Augustin et al., 2013).

Taking the papers together, both human capital based and technologically based methods of information exchange were associated with both successes and failures. Success and failure are variously defined, or not defined at all, in these papers, making it difficult for me to ascertain whether any one method appears to be associated consistently with success or failures. Perhaps successes of certain exchanges were available, but simply not communicated well. If we
disregard the missing information, then a possible theoretical pattern may be seen and will be discussed in the discussion section.

Table 2 about here

**Summary of medical information exchange methods with associated success/failure rating**

Given the heterogeneity of the information above, the available methods of medical information with associated success/failure ratings were synthesized below (Table 3). Note that some cases didn’t have single methods, but rather a combination of several methods as their approach (Kiasuwa & Baeten, 2013). I reported and treated these as a whole. If the case was successful, it was difficult to determine which method may have contributed most to that success, whether methods worked synergistically, or which competed with one another. So I chose to treat the combination of methods as a single unit.

Alternatively, the Euregio Germany-Netherlands case presented two successful hospital departments who had different approaches. Given that the two departments were separate and both rated as successful, these were considered as two different combinations of medical information exchange methods.

I excluded methods with no determination of medical success.

Table 3 about here

**Major themes: sample limitations**

No study could be rated as relatively free of limitations (Table 4). The papers were split between those with medium and those with high numbers of limitations.
The sampling limitations arose from two categories of problems. One was the issue of a population that did not include micro-movement patients (Groene et al., 2009; Panteli et al., 2015). In Panteli et al., a survey-based paper, information was not stratified by micro-movement patients versus longer distance patients. Assessment of whether micro-movement patients were a majority was not possible. The paper reported that 16% of patients intentionally travelling for care lived less than 30 km from border (Panteli et al., 2015). However, patients intentionally travelling for care were a minority (19%) of total patients receiving care abroad (Panteli et al., 2015). As such themes found for the total surveyed population were used as a proxy for micro-movement patients. Yet, the reliability of such an assumption is questionable. Similarly, Groene et al., 2009 considered all types of cross-border patients. It did not survey patients but, rather, asked key informants to consider all types of cross-border patients, creating the same lack of differentiation of patients and patient circumstances.

In contrast, the remaining papers had higher numbers of limitations (Table 4) especially on sampling grounds, due to difficulty in recruitment of members/participants from whom information was obtained. As these papers used in-depth and key informant interviews, I rated strategies on both the presence of pre-approved recruitment strategy and how well it was conveyed in the papers. Papers that may have had a formal recruitment guideline and would have qualified for “low” limitations were bumped up to “medium” and “high” if those guidelines were not readily available or analyzed (Augustin et al., 2013). High non-response rate or unknown response rate was another reason for reception of higher grades on limitation scale (Augustin et al., 2013; Brand et al., 2007). Even with perfectly created and communicated guidelines, if only a specific sub-population responded during recruitment stage, the pool of information available to researchers would be limited and prone to potential bias. One paper covered both populations...
containing mixed patient types and had potential participant/informant identification issues, as can be seen in Table 4, (Post, 2004).

**Major themes: measurement limitations**

The ambiguity of information on methods of medical information exchange could reflect two possibilities. First, there was true absence of control along this parameter. Second, there was some control, but it was not reported in the final written manuscript. For this reason, I gave studies that had this possible weakness as their primary limitation a medium rather than high grade.

The one case with a grade of high limitations had two major problems (Augustin et al., 2013): ambiguity in how information to be exchanged was recorded and synthesized. Additionally, key stakeholders were asked to check over final results of the case. This could have insured that the information was accurate to what the stakeholders meant to communicate. On the other hand, it also allowed for bias to enter if the stakeholders had a skewed vision of the truth (Augustin et al., 2013). This could have introduced additional bias to the measurement (Table 4).

Other reason for higher grades on measurement limitation score were differential guidelines based on participant (not equal) (Kiasuwa & Baeten, 2013).

Table 4 about here
Discussion

Limitations in this systematic review

Six of seven studies didn’t report frequencies for their findings (e.g. percentage of stakeholder expressing a particular view). As a result, we received a lot of information on the possible themes available, with good potential coverage of extremes (e.g. one of a kind success stories and terrible disasters). However, we were not able to get a sense of frequency. For example, written scripts had problems in 12% of the cases in one study (Panteli et al., 2015). This number doesn’t give us a good sense of whether scripts in general were successful or not. There was no cutoff above which the problems were deemed a failure.

Indeed, this approach of not treating success or failure as a dichotomous variable but rather a continuous variable may have been more useful. A dichotomous mark of success or failure may obscure that some projects were more successful than others. Furthermore, it would let us avoid the pitfalls and complications of deciding what should and should not be defined as success. However, lack of consistent frequency information resulted in the need to treat success and failure as a binary variable.

Third, most of the studies were provider-centric. Those reporting patient perspectives oftentimes had provider input. However, the assumption that both provider and patient would have equivalent understanding of what designates success is just that, an assumption. Indeed, Panteli et al. (2015) found that 87% of those with unplanned care and 84% of those with planned were less in favor of exchange of information (86% overall didn’t think it was necessary)(Panteli et al., 2015). Similar attitudes may not be apparent in the physician population. In addition, this statistic and the fact that information was more often exchanged in planned care cases (Panteli et
al., 2015) point out that information exchange may vary across services rendered. In other words, definition of success and what elements contribute to it may vary based on whether interaction was an emergency situation or a planned case.

Indeed, this may not only apply to planned and unplanned services. It may also apply to the types of services rendered. The varied approaches to information exchange in Germany-Netherlands case based on the department assignment may be coincidental or may indicate a true divergence of interests (Table 2). Lastly, the European border regions capture problems that would not be applicable in every case, especially the United States of America. Differences in language may be prominent in Europe, but are less pronounced in the United States with English as the major administrative language (Appendix C).

Model

Despite the inability of the included studies to answer the main question of the current review, I believe a model of possible interaction can be created. The model I propose below breaks down methods or combinations of methods used in distinct projects along two variables. These are technology investment and human capital investment as described earlier in the methods.

An application and breakdown of the methods of information exchange or combinations of them within projects allows me to place them in a theoretical model. Given that only 7 instances of medical information exchange/combination had rating of success and failure, we are limited to that number (Table 3). Furthermore, we cannot break down the model by the types of medical care provided (e.g. emergency, radiology, etc.) as there are too few case studies already. We also cannot break the model down by the source of material (published paper or grey
literature). For this first attempt at using the model, I simply treat all 7 case studies together. Because the number of cases is small, I created a simple ordinal indicator of parameter strength.

The failure of script writing as a medical information exchange method, identified in the combined study of all types of cross border patients, received a grade of “low” on both technology investment and human capital investment. Only a limited number of people were involved (the physician writing the script, patient and pharmacist) with very limited technology involved.

The case of Belgium-France, on the other hand, involved dedicated phone lines (significant human capital) and direct electronic record access (significant technological investment). So it received high marks on both.

The problems with radio frequency exchange in an emergency setting received medium grades on both, as technology was involved but it was older (radio). Furthermore, the available people necessary were not minimal but would not greatly differ from the human capital of EMT service already in place. No new workers had to be dedicated to the radio frequency exchange.

The remaining 3 studies dedicated themselves to one or the other category. Germany Netherlands vascular department (video-conferencing and electronic health record) and France-Italy (telemedicine) were examples of technologically investment heavy approaches. Note that some human capital investment would be needed, but not to a greater extent than was already in place. On the other hand, Germany-Netherlands neurophysiology (physician travel) involved a great deal of human capital (travel of physicians across borders to observe surgeries) but little current technological investment.
As can be seen from the breakdown across the two categories, high investment in no one category was necessary. Various combinations of the two were able to get success.

Table 5 about here

After mapping the studies across the two axes, a possible hint of a model may emerge (Figure 2A). As can be seen, cases were arranged along the two axis with indications of failure (red, striped) and success (green, solid). The resulting scatter plots have too few end points to make a definitive call. However, it is possible that there is a relationship between the two. It may be linear or non-linear. It may be competitive, additive, or synergistic. Perhaps there is a saturation curve. As can be seen in figure 2A, there are too few points in the scatterplot and any relationship (including no relationship) can be filled in between the two.

Figure 2 about here

Nevertheless, if we assume that the relationship is linear, we can see that a form of predictive model emerges. If the methods/comination of methods lies above the predictive line, the method of medical information will be successful and visa-versa (Figure 2B).

Model implications

The ultimate goal of the current review was to determine one or several methods of medical record exchange across geographic borders that would result in success. As has been seen by the conflicted results of the review, I have not reached that goal.

However, the model suggests that there may not be a singular solution. Rather the right combination of contributing forces needs to be deployed to achieve a successful relationship.
This would explain how some were able to succeed with minimal contribution of technology and others relied on advanced electronics.

Indeed, different countries/states/actors can use the predictive model to determine where to invest their efforts. Not all may be able to afford the highly integrated but technologically and infrastructural costly “one smart card” policy like that used by Taiwan (Tsai & Kuo, 2007). Similarly, countries/states/institutions that are failing may be able to assess their position and determine which component of their system is determining the failure.

This model would also ensure that if a plateau effect is possible, countries do not spend excessive amounts of effort on one type of intervention if more success could be achieved through work using the other component.

Model limitations

Given that the model stems from the review, it is plagued by the same limitation. First, there are too few points on the model. In addition, important variability in medical information exchange in emergency versus non-emergence and planned versus not-planned interactions is ignored.

Second, the model is focused on predominantly provider-generated information with little patient input. Using the World Health Organization definition of responsiveness (World Health Organization, 2000), the responsiveness of methods to patients may be more important than what providers think. If patient concerns on medical information exchange are considered, a very different relationship may emerge. Unfortunately, there is not enough information to give any guess as to what that relationship may be or include it to great extent in this review.
**Policy implications, research gaps & future directions**

Given the importance of such a model for steering state and national policies (i.e. determining the path of least resistance to successful medical information exchange), more effort should be made to study and record the information.

Brand et al. has stated in their paper that the majority of the Euregio projects neither published nor planned to publish their findings (Brand et al., 2008). The lack of interest in publication of such information is disheartening. As has been seen, even imperfectly designed information, at least from the standpoint of answering the current review question, may be used to glean valuable results.

Overall, publications of the results of such projects may not only be useful to fill up the missing data points in the current proposed model, but also help other researchers in their pursuits.

The major endpoint of the current review was to show the importance of the study of border region medical care.

**Conclusion**

A careful search returned a limited number of studies to answer questions about the methods of medical information exchange in European border region for micro-travel patients. The levels of success/failure were inconsistently reported. Synthesis of the information was difficult.

I did, however, find certain things. First, there are many methods and combinations of methods for medical record exchange. Second, no one method stood out as a success amongst
others. Third, no one method was necessary over others. Despite that, I could derive a possible model based on interaction across two variables, technology investment and human capital investment, to show that combinations of things may be done to achieve similar results. More deliberate studies can generate the wide variety of data we need to put the model to a more complete test.

**Acknowledgements**

I would like to thank Dr. Tolleson-Rinehart for being an outstanding advisor with immense patience and bountiful advice. I would like to thank Dr. Dan Jonas for being an excellent preceptor with wise insight on tackling an unusual research design. I would like to thank Dr. Harris, whose mentorship was invaluable in establishing for me an important background in systematic research design and conduct. I would also like to thank Ms. Lara Handler and the health science library research teams for helping me create searches and find resources.

I couldn’t do this without the help of my parents, classmates, and the wonderful staff at UNC School of Public Health.
References


*Covidence systematic review software*. Melbourne, Australia: Veritas Health Innovation.

Available at www.covidence.org


<table>
<thead>
<tr>
<th>Table 1. Eligibility Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
</tr>
<tr>
<td>Inclusion</td>
</tr>
<tr>
<td>- People receiving care in the border region of two countries, where they were a resident in a border region and received their care from hospital/provider in the neighboring country.</td>
</tr>
<tr>
<td>- People residing in border regions of Europe</td>
</tr>
<tr>
<td>Exclusion</td>
</tr>
<tr>
<td>- no simple drug purchases</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>Methods of medical information exchange and communication between providers (direct medical services and pharmacists if communicating with other eligible providers)</td>
</tr>
<tr>
<td>- a single joint project where no information exchange between providers in different countries occurred (i.e. assumption of all care by one entity)</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
</tr>
<tr>
<td>- If available, different methods of medical information exchange and information communication</td>
</tr>
<tr>
<td>- No comparison group was also accepted</td>
</tr>
<tr>
<td>n/a</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
</tr>
<tr>
<td>- If available, whether the method was successful or not at exchanging information well</td>
</tr>
<tr>
<td>- No outcome was also accepted</td>
</tr>
<tr>
<td>n/a</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
</tr>
<tr>
<td>No limit</td>
</tr>
<tr>
<td>n/a</td>
</tr>
<tr>
<td><strong>Study design</strong></td>
</tr>
<tr>
<td>Case reports, case series, RCT, surveys of true cases/border regions</td>
</tr>
<tr>
<td>-future studies</td>
</tr>
<tr>
<td>-terminology papers</td>
</tr>
<tr>
<td>-judicial papers</td>
</tr>
<tr>
<td><strong>Language</strong></td>
</tr>
<tr>
<td>English primary, English translation provided for the entirety of the paper</td>
</tr>
<tr>
<td>Non-English</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
</tr>
<tr>
<td>Europe</td>
</tr>
<tr>
<td>Anything other than Europe</td>
</tr>
<tr>
<td><strong>Source</strong></td>
</tr>
<tr>
<td>PubMed, EMBASE</td>
</tr>
<tr>
<td>n/a</td>
</tr>
</tbody>
</table>
Table 2. Summary of results for main and grey literature branches

<table>
<thead>
<tr>
<th>Author, year</th>
<th>Study Design</th>
<th>Method of Medical Information Exchange</th>
<th>Success/failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Semi-structured guideline led interviews</td>
<td>- Script writing</td>
<td>Failures: Problems obtaining medications in pharmacies due to differences in names or dosages</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Other unspecified methods of information exchange</td>
<td>Other listed failures: difficulty with communication with family doctors for validation of history and discharge planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Success: n/a</td>
</tr>
<tr>
<td>Panteli D.; Wagner C.; Verheyen F.; Busse R., 2015</td>
<td>An anonymous postal survey</td>
<td>Among those who indicated that information had been exchanged (n = 2743):</td>
<td>Failures/Success: For prescription: n=4208 were given prescription, 12% encountered a problem of some type (n= 453)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- patients (58%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- written correspondence (33%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- telephone 6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fax 2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- email 1%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- more likely to occur amongst planned versus unplanned cases</td>
<td></td>
</tr>
<tr>
<td>Post, G.B. 2004</td>
<td>- File and literature searches - Interviews from administration to ground level</td>
<td>- collaboration as part of triage of where to send people between &quot;providers&quot; of urgent care across borders</td>
<td>Failures: - no coverage of post-emergency care medical exchange back to the &quot;home base&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- radio and pre-approved agreements</td>
<td>- difficulties with communication over radio frequencies for all three countries and their respective ambulances</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- language barriers for the coordination of care</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Successes: n/a</td>
</tr>
<tr>
<td>Régine Kiasuwa and Rita Baeten, 2013</td>
<td>- Desk research - Interviews with field actors - Questionnaire to patients</td>
<td>- direct electronic access to the records and direct telephone access</td>
<td>Failures: n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Successes: French GP happy with the flow of information</td>
</tr>
<tr>
<td>Uta Augustin, Dimitra Panteli and Reinhard</td>
<td><strong>Small sample Qualitative</strong> - Desk research - Expert</td>
<td>- written correspondence sent from one facility to the other</td>
<td>Failures: n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Successes: n/a</td>
</tr>
<tr>
<td>Source</td>
<td>Methodologies</td>
<td>Outcomes</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Busse, 2013</td>
<td>Interviews</td>
<td>Various: -vascular (integrated joint center): video conference, direct technological links to patient files -Neurophysiologist: in person (attend operation)</td>
<td>Failures: n/a Success: reported as successful model for hospital cooperation</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Survey of the project bodies and workshop; followed by interviews of representatives of the &quot;best-practice&quot; projects chosen as a result of the aforementioned screen.</td>
<td>- telemedicine conferences and data protected transmission of records to jointly look at findings</td>
<td>Failures: n/a Success: reported as successful model for telemedicine medical information exchange not directly appraised</td>
</tr>
</tbody>
</table>

White cells indicate papers identified through main branch of the search. Grey cells indicate papers identified through grey literature. Full information synthesized here can be found in Appendix C1 and Appendix C2.
<table>
<thead>
<tr>
<th>Source study/s</th>
<th>Method of medical information exchange</th>
<th>Success/Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Script writing</td>
<td>Failure</td>
</tr>
<tr>
<td>Post, G.B. 2004</td>
<td>EMT use of radio frequencies</td>
<td>Failure</td>
</tr>
<tr>
<td>Régine Kiasuwa and Rita Baeten, 2013</td>
<td>Direct electronic access to the records and direct telephone access</td>
<td>Success</td>
</tr>
<tr>
<td>Euregio, 2007 (Germany-Netherlands)</td>
<td>Video conference and electronic record</td>
<td>Success</td>
</tr>
<tr>
<td>Euregio, 2007 (Germany-Netherlands)</td>
<td>In person attendance of surgeries abroad</td>
<td>Success</td>
</tr>
<tr>
<td>Euregio, 2007 (France-Italy)</td>
<td>Telemedicine</td>
<td>Success</td>
</tr>
<tr>
<td>Author, year</td>
<td>Sampling limitation</td>
<td>Justification</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>High</td>
<td>participants in the study (convenience sample) but diversified types of participants involved, population involved both micro-movement patients of interest to the review and outside of it with no separation in report of which themes are universal/applicable to which group</td>
</tr>
<tr>
<td>Panteli D.; Wagner C.; Verheyen F.; Busse R., 2015</td>
<td>High</td>
<td>all types of cross-border patients were considered again, difficult to parse out micro-movements although obviously present as seen by 16% within 30 km of the border in the planned category</td>
</tr>
<tr>
<td>Post, G.B. 2004</td>
<td>Medium</td>
<td>could have snowballed interviews into a very specific sub-population for participant interviews but a wide breadth of types of people interviewed, population may include non-micro movement patients but less likely than resident use of the services</td>
</tr>
<tr>
<td>Régine Kiasuwa and Rita Baeten, 2013</td>
<td>High</td>
<td>some non-response to the initially planned sample and no great detail in what type of female patients were recruited for the questionnaire make chances of biased sample high</td>
</tr>
<tr>
<td>Uta Augustin, Dimitra Panteli and Reinhard Busse, 2013</td>
<td>Medium</td>
<td>there is methodology for choosing interviewers but not described to great extent, no comment if any contacted originally didn't respond</td>
</tr>
<tr>
<td>Euregio, 2007 (Germany-Netherlands)</td>
<td>Medium</td>
<td>medium (possible bias introduced due to non-response at the survey stages and limited number of people interviewed for the final information gathering)</td>
</tr>
<tr>
<td>Euregio, 2007 (France-Italy)</td>
<td>Medium</td>
<td>medium (possible bias introduced due to non-response at the survey stages and limited number of people interviewed for the final information gathering)</td>
</tr>
</tbody>
</table>

White cells indicate papers identified through main branch of the search. Grey cells indicate papers identified through grey literature. Full information synthesized here can be found in Appendix C1 and Appendix C2.
Table 5. Medical information exchange with rating along technology investment and human capital investment

<table>
<thead>
<tr>
<th>Source study/s</th>
<th>Method of medical information exchange</th>
<th>Success/Failure</th>
<th>Technology investment</th>
<th>Human capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Script writing</td>
<td>Failure</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Post, G.B. 2004</td>
<td>EMT use of radio frequencies</td>
<td>Failure</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Régine Kiasuwa and Rita Baeten, 2013</td>
<td>Direct electronic access to the records and direct telephone access</td>
<td>Success</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Euregio, 2007 (Germany-Netherlands)</td>
<td>Video conference and electronic record</td>
<td>Success</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Euregio, 2007 (Germany-Netherlands)</td>
<td>In person attendance of surgeries abroad</td>
<td>Success</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Euregio, 2007 (France-Italy)</td>
<td>Telemedicine</td>
<td>Success</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Figure 1. PRISMA diagram

Articles identified through database searching (PubMed, EMBASE) (total n = 321)

- Articles identified through grey literature
  - 7 case studies in Glinos & Wismar 2013 book
  - 8 "good practice models" in Euregio Report 2007

Duplicates (PubMed, EMBASE)
157 duplicates removed by Covi-dence.org
5 studies identified as duplicates by reviewer

Articles screened after duplicates removed (PubMed, EMBASE) (total n = 159)

- Articles identified through grey literature
  - Not applicable for abstract/title review

Excluded at title and abstract review (total n = 135 irrelevant)

Full-text articles assessed for eligibility (EMBASE, PubMed) (n=24)

- Full cases assessed from grey literature (n=15)

Excluded at full-text review (Pubmed, EMBASE) (total n=21)
1 — library couldn’t locate or borrow the paper
7 — no discussion of information exchange
3 — not English
7 — not European border region
1 — future study, description of project goals
1 — insufficient amount of information presented
1—patients not receiving care in non-resident country

Full-text articles for extraction (EMBASE, PubMed) (total n=3)
1 — emergency healthcare provision
2 — mixed micro-movement and other types of cross-border patients

Excluded at full-text review grey literature
1 — future plans for medical info exchange
1 — past planning and future goals
1 — patients didn’t cross borders
1 — new joint clinic
7 — insufficient information on medical information exchange

Full cases assessed from grey literature (n=4)
2 — cases from Wismar and Glinos edited book (Belgium-France, Germany-Denmark)
2 — "good practice models from Euregio Report" (Germany-Netherlands, France-Italy)
Figure 2A. Scatterplot of methods/combinations along the 2 axis of human capital and technology investment. Red stripped are failures. Green solid are successes. Two dotted lines represent possible relationship. Figure 2B. Illustration of success achieved above the threshold of the linear relationship.

Solid green designates success. Stripped red designates failure. Record exchange type and success/failure based on Table 2.
Appendix A. Detailed Search Term

Search terms were created with the help of research librarian. Initial search was conducted on March 2\textsuperscript{nd}, 2015. Repeat search was done on May 1\textsuperscript{st}, 2015 to update the results.

Appendix A1. Pubmed Search terms:

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Number of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>delivery of health care AND europe AND international cooperation AND border</td>
<td>54</td>
</tr>
<tr>
<td>delivery of health care AND europe AND international cooperation AND cross-border</td>
<td>46</td>
</tr>
<tr>
<td>Europe AND international cooperation AND cross-border AND health information</td>
<td>21</td>
</tr>
<tr>
<td>Europe AND cross-border AND health information</td>
<td>55</td>
</tr>
<tr>
<td>europe AND international cooperation AND cross-border</td>
<td>91</td>
</tr>
<tr>
<td>Euregio AND border</td>
<td>11</td>
</tr>
</tbody>
</table>

Appendix A2. EMBASE search terms

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Number of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>'europe'/exp OR europe AND 'cross border' AND international AND ('cooperation'/exp OR cooperation) AND ('health'/exp OR health) AND ('information'/exp OR information)</td>
<td>25</td>
</tr>
<tr>
<td>Euregio AND border</td>
<td>18</td>
</tr>
</tbody>
</table>
Appendix B. Inclusion and exclusion of cases within grey literature

Appendix B1. 7 case studies found in Glinos and Wismar 2013 edited book (Glinos & Wismar, 2013)

<table>
<thead>
<tr>
<th>Author</th>
<th>Region</th>
<th>Hospitals/stakeholders involved</th>
<th>Presence of information on medical information exchange</th>
<th>Include/exclude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas Kostera and Renate Burger</td>
<td>Austria-Germany</td>
<td>Braunau and Simbach hospital collaboration</td>
<td>No</td>
<td>Exclude, insufficient information on medical information exchange</td>
</tr>
<tr>
<td>Régine Kiasuwa and Rita Baeten</td>
<td>Belgium-France</td>
<td>Flow of French patients from “la botte de Givet” into hospitals and polyclinics in the Belgian Ardennes</td>
<td>Yes</td>
<td>Include</td>
</tr>
<tr>
<td>Ufa Augustin, Dimitra Panteli and Reinhard Busse</td>
<td>Germany-Denmark</td>
<td>Radiotherapy for Danish patients in Flensburg Malteser hospital</td>
<td>Yes</td>
<td>Include</td>
</tr>
<tr>
<td>Riika Lämsä, Ilmo Keskimäki and Simo Kokko</td>
<td>Finland-Norway</td>
<td>Sami people using cross-border care in the Teno River Valley</td>
<td>No</td>
<td>Exclude, insufficient information on medical information exchange</td>
</tr>
<tr>
<td>Irene A. Glinos, Nora Doering, and Hans Maarse</td>
<td>The Netherlands-Germany</td>
<td>Maastricht-Aachen University hospital collaboration</td>
<td>No</td>
<td>Exclude, insufficient information on medical information exchange</td>
</tr>
<tr>
<td>Adrianna Galan, Victor Olsavszky and Cristian Vlădescu</td>
<td>Romania-Bulgaria</td>
<td>Călărași and Silistra hospitals</td>
<td>No</td>
<td>Exclude, insufficient information on medical information exchange</td>
</tr>
<tr>
<td>José Miguel Sanjuán and Joan Gil</td>
<td>Spain-France</td>
<td>Cerdanya Hospital</td>
<td>Partial, future plans for clinical record only</td>
<td>Exclude, future plans are not qualified for the review</td>
</tr>
</tbody>
</table>
Appendix B2. 8 “good practice models” as found in EUREGIO final report may 2007 (pages 73-148)

<table>
<thead>
<tr>
<th>Region</th>
<th>Hospitals/stakeholders involved</th>
<th>Component that served as good practice model</th>
<th>Presence of information on medical information exchange</th>
<th>Include/exclude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany, the Netherlands, Belgium</td>
<td>Euregio Meuse-Rhine, risk behavior among young people</td>
<td>Prevention</td>
<td>No</td>
<td>Exclude, insufficient amount of information on exchange of medical information between providers</td>
</tr>
<tr>
<td>Germany, the Netherlands, Belgium</td>
<td>Two university hospitals: the academisch ziekenhuis Maastricht (azM) on the Dutch side and the University Hospital of Aachen (UKA) on the German side</td>
<td>Hospital cooperation</td>
<td>Yes</td>
<td>Include</td>
</tr>
<tr>
<td>France, Spain</td>
<td>Regions of Cerdanya and Capcir, “Hospital of Cerdanya” as a project</td>
<td>Hospital cooperation</td>
<td>No</td>
<td>Exclude, description of past planning stages and future goals of the project</td>
</tr>
<tr>
<td>Belgium, the Netherlands, Germany</td>
<td>Euregio Meuse-Rhine, emergency medical assistance programs and cooperation agreements</td>
<td>Rescue services</td>
<td>No</td>
<td>Exclude, insufficient amount of information on exchange of medical information between providers</td>
</tr>
<tr>
<td>Germany, Poland</td>
<td>Pomerania region, tumour patients (region between Poland,</td>
<td>Telemedicine</td>
<td>Yes</td>
<td>Exclude, patients didn’t cross borders</td>
</tr>
<tr>
<td>Country Combination</td>
<td>Description</td>
<td>Telemedicine</td>
<td>Mobility</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>Germany and Sweden</td>
<td>but rather telemedicine was used to provide services across borders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France, Italy</td>
<td>University Hospital of Nice infectious diseases and San Remo Hospital departments for infectious diseases</td>
<td>Telemedicine</td>
<td>Yes</td>
<td>Include, case conferences and data protected transmission</td>
</tr>
<tr>
<td>Finland, Sweden</td>
<td>Scarcely populated Karesuando region, Sweden side containing a dental clinic</td>
<td>Mobility</td>
<td>Not applicable</td>
<td>Exclude, established a new “joint” dental clinic so no exchange of information is possible as information concentrated in one source</td>
</tr>
<tr>
<td>Germany, Netherlands, Belgium</td>
<td>Multiple projects: “Integration Zorg op Maat (IZOM)”, “Euregio Health Portal”, “Health Card international” and “Contracting Belgian Health Care”</td>
<td>Mobility</td>
<td>Insufficient information</td>
<td>Exclude, insufficient amount of information on exchange of medical information between providers</td>
</tr>
</tbody>
</table>
### Appendix C. Full Data Extraction

**Table: Data extraction for three primary papers (part 1)**

<table>
<thead>
<tr>
<th>Details not provided</th>
<th>Details not provided</th>
<th>Interviews - entry with administrative level(s) included</th>
<th>Primary Data Sources, review, and methodology</th>
<th>Study design, year, and population</th>
</tr>
</thead>
</table>

#### Study Design

**Interviews**
- Start with administrative level(s) included
- Non-random, participant in MRC/ES Project
- Not applicable

**Participant description if applicable**
- Sampling frame
- Study Design
- Year

---

**Comparison Group if applicable for the participants**
- Participants, 70 professionals and doctors
- Participants, 35 professionals and doctors
- Participants, 35 professionals and doctors

**File and literature searches**
- Anon letter survey sent out in 2012
- Semi-structured guidelines led interview conducted between 2005 to 2006 guideline
- Study Design

**Sample size**
- 16% of those planned resided less than 30 km from the border
- Gender ratios (F/M 52%/48%)
- Average age of 57.2 years
- Older age 70–79 (24.7%) and 60–69 (21.8%)

---

**Sampling type**
- 41% response rate (n=18339) with 796 excluded due to invalid responses or exclusion criteria, 17543 people available for analysis
- 81% unplanned and 19% planned (n=3307)
- 16% of those planned reside less than 30 km from the border
- Gender ratios (F/M 52%/48%)
- Average age of 57.2 years
- Older age 70–79 (24.7%) and 60–69 (21.8%)

---

**Exclusion criteria from survey recruitment:**
1. Identified individuals who had a data confidentiality clause
2. TK employees
3. Persons under legal guardianship
4. Persons residing permanently abroad
5. Persons who had in the meantime terminated their fund membership or had their entitlement to services suspended
6. Persons with some level of long-term care dependency or in hospice care
7. Children below the age of 18
8. Insured who had been surveyed for different reasons in the previous 180 days or had requested not to be included in surveys at all

---

**Participation in MRC/ES Project**
- Non-random, participant in MRC/ES Project
- Interview conducted
- Sample size

---

**Participants, 70 professionals and doctors**
- Study Design
- Year

---

**Comparison Group if applicable for the participants**
- Participants, 35 professionals and doctors
- Participants, 35 professionals and doctors
- Participants, 35 professionals and doctors

---

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**Participation in MRC/ES Project**
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- Interview conducted
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---

**Participants, 70 professionals and doctors**
- Study Design
- Year

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**Participation in MRC/ES Project**
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- Interview conducted
- Sample size

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**Participants, 70 professionals and doctors**
- Study Design
- Year

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---

**Participation in MRC/ES Project**
- Non-random, participant in MRC/ES Project
- Interview conducted
- Sample size

---

**Participants, 70 professionals and doctors**
- Study Design
- Year
## Appendix C: Data extraction for three primary papers (continued)

<table>
<thead>
<tr>
<th>Authors, year</th>
<th>Comparison group</th>
<th>Measurement</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panteli D.; Wagner C.; Verheyen F.; Busse R., 2015</td>
<td>Separate questionnaire for those receiving planned care</td>
<td>Same as patient</td>
<td>Same as patient</td>
</tr>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Separate questionnaire for those receiving planned care</td>
<td>Separate questionnaire</td>
<td>Separate questionnaire</td>
</tr>
</tbody>
</table>

### Notes:
- No formal methodology for data given, however themes approach is likely as it relates to various topics across the three countries.
- Changes to focus on patient satisfaction and continuity of care with additional space for comments.
- No question generated based on previous studies (iterations of the Europabefragung) with changes to focus on patient satisfaction and continuity of care with additional space for comments.
- Themes extracted from data obtained from them.
- No available.

### Population

<table>
<thead>
<tr>
<th>Authors, year</th>
<th>Comparison group</th>
<th>Measurement</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panteli D.; Wagner C.; Verheyen F.; Busse R., 2015</td>
<td>Same as patient</td>
<td>Same as patient</td>
<td>Same as patient</td>
</tr>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Separate questionnaire</td>
<td>Separate questionnaire</td>
<td>Separate questionnaire</td>
</tr>
</tbody>
</table>

### Primary measurement/outcomes recorded

<table>
<thead>
<tr>
<th>Authors, year</th>
<th>Comparison group</th>
<th>Measurement</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Panteli D.; Wagner C.; Verheyen F.; Busse R., 2015</td>
<td>Same as patient</td>
<td>Same as patient</td>
<td>Same as patient</td>
</tr>
<tr>
<td>Groene O.; Poletti P.; Vallejo P.; Cucic C.; Klazinga N.; Suñol R., 2009</td>
<td>Separate questionnaire</td>
<td>Separate questionnaire</td>
<td>Separate questionnaire</td>
</tr>
</tbody>
</table>
Appendix C.1 Data extraction for three primary papers (continued)

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post, G.B. 2004</td>
<td></td>
</tr>
<tr>
<td>Groene, O.; Poletti, P.; Vallejo, P.; Cucic, C.; Klazinga, N.; Suñol, R., 2009</td>
<td></td>
</tr>
</tbody>
</table>

- **Post, G.B. 2004**
  - **Conclusion**: Collaboration across borders is part of the process of ensuring that patients receive appropriate medical care. This involves the exchange of information and the coordination of care between healthcare providers.
  - **Method of Medical Information Exchange Discussed (Intervention):**
    - **Success/failure designation for medical information exchange**
    - **Examples**
      - **Success:** Providers of urgent care can exchange information via a common platform.
      - **Failure:** Communication issues hinder the exchange of medical information between healthcare providers.

- **Panteli, D.; Wagner, C.; Verheyen, F.; Busse, R., 2015**
  - **Purpose:** To evaluate the effectiveness of cross-border communication in healthcare.
  - **Data Extraction:**
    - **Post-exchange Between Triage of Where to Send People**
      - among those who indicated that information had been exchanged (n = 2743), the most common mode of communication was through the patients themselves (58%), followed by written correspondence (33%) for those who had obtained planned care compared with those who had required unplanned services (21%).

- **Groene, O.; Poletti, P.; Vallejo, P.; Cucic, C.; Klazinga, N.; Suñol, R., 2009**
  - **Communication Issues:**
    - **Success/failure designation for medical information exchange**
      - **Success:** Providers of urgent care can exchange information via a common platform.
      - **Failure:** Communication issues hinder the exchange of medical information between healthcare providers.

- **Communication via script writing, other provider interactions described, but method of medical information exchange not specified.**

- **Major Results:**
  - **Problems obtaining medications in pharmacies due to differences in names or dosages.**
  - **Failures with communication with other providers (e.g., patients who exchanged medical information with their doctors at home).**

- **References:**
  - **Professionals confirmed the lack of communication between providers for cross-border patients—"Professionals confirmed the lack of communication during the admission and discharge phases."**
  - **Barriers are not universal, some regions are better at cross-border care than others."**

- **Conclusion:** Communication via script writing, other provider interactions described, but method of medical information exchange not specified.
Appendix C2. Data extraction for the grey literature

<table>
<thead>
<tr>
<th>Domain</th>
<th>Sample size and description of the sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>- 12 semi-structured interviews face-to-face with female health care professionals in the region of Southern Denmark, including representatives of regional and national public authorities and health care professionals.</td>
</tr>
<tr>
<td>Italy</td>
<td>- 12 semi-structured interviews face-to-face with female health care professionals in the region of Southern Denmark, including representatives of regional and national public authorities and health care professionals.</td>
</tr>
<tr>
<td>Germany</td>
<td>- 12 semi-structured interviews face-to-face with female health care professionals in the region of Southern Denmark, including representatives of regional and national public authorities and health care professionals.</td>
</tr>
<tr>
<td>Netherlands</td>
<td>- 12 semi-structured interviews face-to-face with female health care professionals in the region of Southern Denmark, including representatives of regional and national public authorities and health care professionals.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Study of the project bodies and workshop followed by interviews of representatives of the &quot;best practice&quot; projects chosen as a result of the aforementioned screen desk research and expert interviews.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Study of the project bodies and workshop followed by interviews of representatives of the &quot;best practice&quot; projects chosen as a result of the aforementioned screen desk research and expert interviews.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Sampling type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Non-probability sample (purposive)</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Non-probability sample (purposive)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Authors, Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Uta Augustin, Dimitra Panteli and Reinhard Busse, 2013</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Régine Kiasuwa and Rita Baeten, 2013</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Desk Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>- Medline and KBV (Cooperative Library Network Berlin-Brandenburg, a national library database) used.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>- Danish cancer patients couldn't be directly contacted but Danish Cancer Society used as proxy.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>- Chief physician of the radiation therapy department at the Malteser St Franziskus Hospital in Flensburg for healthcare provider perspective.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>- Region of Southern Denmark: representative of the management and chief physician of the oncological departments.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>- Members of the Ministry of the Social Affairs in Denmark.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Expert Opinions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>- Expert opinions and desk research.</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>- Expert opinions and desk research.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Comparison Group if applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Not available</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Not available</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Not available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table</th>
<th>Participants and application for the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Participants description if applicable</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Participant description if applicable</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Participant description if applicable</td>
</tr>
<tr>
<td>Euregio, 2007</td>
<td>Participant description if applicable</td>
</tr>
<tr>
<td>Authors, Year</td>
<td>Population Understudy</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Uta Augustin, Dimitra Panteli, Reinhard Busse, 2013</td>
<td>Authors not available</td>
</tr>
<tr>
<td>Régine Kiasuwa, Rita Baeten, 2013</td>
<td>Authors not available</td>
</tr>
</tbody>
</table>

**Major project steps**
- Project partners: project organisation, communication
- Objectives of project and outcomes
- Public relations
- Project evaluation
- Continuation of activities after project completion / expiration of ERDF funds
- External support (e.g. by political decision makers, Euregios)
- Hindering and promoting factors, factors for the success of the project, problem solutions
- Transferability of the experiences to other border regions
- Useful hints for other projects

**Data extraction for the grey literature (continued)**
- France, Italy: 'University Hospital of Nice Infectious Diseases' and San Remo Hospital departments for Infectious Diseases
- Germany - Netherlands: patients of two hospitals: the academisch ziekenhuis Maastricht (azM) on the Dutch side and the University Hospital of Aachen (UKA) on the German side
- Cancer patients from Denmark sent for radiotherapy in German Malteser St Franziskus Hospital in Flensburg
- French patients from 'la botte de Givet' receiving care in the Belgian hospital at Dinant (CH de Dinant)
- Population undergoing cross-border care (description/demographic) not available
- Project description for the grey literature (continued)
<table>
<thead>
<tr>
<th>Authors, Year</th>
<th>Method of Medical Information Exchange Discussed (Initiatives)</th>
<th>French GP happy with flow of information</th>
<th>Successful Implementation for Medical Information Exchange</th>
<th>Reported as Successful Model for Hospital Cooperation</th>
<th>Medical Information Exchange Not Directly Measured</th>
<th>Findings</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euregio, 2007</td>
<td>Recommended the exchange of records in joint project</td>
<td>- Euregio, 2007</td>
<td>- Uta Augustin, Dimitra Panteli and Reinhard Busse, 2013</td>
<td>- Régine Kiasuwa and Rita Baeten, 2013</td>
<td>- Telemedicine conferences and direct transmission of records to jointly look</td>
<td>- Unequal levels of cooperation; of those mentioned in greater detail, vascular operations (joint center of excellence) - both have permanently employed physician and nursing teams whereas Prof. Jacobs travels, communication with staff members is possible via video conference, corresponding technological solutions enable AZM to retrieve information such as patient files stored in Aachen and vice versa - neurophysiologists of the AZM attend the operation in Aachen, and developing IT system to enable monitoring of the operation in Aachen from the department in AZM (plans) - after decision is made by Danish patient to undergo radiotherapy in Germany, referring hospital contacts German Flensburg Malteser hospital for availability - sends all required documents to German Hospital - German Flensburg Malteser hospital sends back all of the final reports to referring hospital - direct electronic access to the records and direct telephone access to the department</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D. References for articles excluded at full-text review


Appendix E. References for articles deemed irrelevant


Kostera T. (2013). Subnational responsibilities for healthcare and Austria’s rejection of the EU’s patients’ rights directive. *Health Policy (Amsterdam, Netherlands),* 111(2), 149-56. doi:10.1016/j.healthpol.2013.03.016


