HOW TO PREVENT AND CONTROL NOSOCOMIAL URINARY TRACT INFECTIONS IN GERMAN HOSPITALS WITH EHEALTH TECHNOLOGY: A CONTEXTUAL INQUIRY

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Samenvatting

Het doel van huidig onderzoek is om de context van nosocomiale urineweginfecties (nUTI) binnen de Duitse ziekenhuissetting te onderzoeken, om eHealth-gebaseerde technologie te ontwikkelen, die nUTI kan voorkomen en beheersen. Een overzicht van relevante internationale literatuur is gecombineerd met een focusgroep om de risicofactoren en bijbehorende oplossingen met betrekking tot nUTI in kaart te brengen, evenals factoren die relevant zijn voor de Duitse gezondheidszorg. De focusgroep vond plaats in een Duits universitair ziekenhuis, georganiseerd in samenwerking met een nauw verbonden instituut voor ziekenhuishygiëne. De resultaten tonen convergentie aan tussen de internationale literatuur en de Duitse context met betrekking tot risicogedrag en determinanten die kunnen leiden tot nUTI, zoals vertraagde katheterverwijdering of onvoldoende hygiënische voorzorgsmaatregelen. Er is echter een vicieuze cirkel van onduidelijke nUTI-gerelateerde kosten en een gebrek aan toezicht geïdentificeerd die uniek is voor het Duitse systeem, dit belemmert de uitvoering van oplossingen die door de internationale literatuur effectief zijn bewezen. De resultaten leveren verder een aantal barrières op die de implementatie van voorzorgmaatregelen, die effectief zijn gebleken in de internationale context, in de weg staan bijvoorbeeld het gebrek aan gestandaardiseerde evaluatiecriteria voor surveillance of checklists met een duidelijk schema voor katheterverwijdering. Geconcludeerd kan worden dat het huidige systeem niet in staat is om nUTI effectief te voorkomen. Tot slot biedt dit verslag een eHealth oplossingsmodel die verschillende benaderingen in één raamwerk integreert dat is aangepast aan de speciale behoeften van de Duitse ziekenhuissetting en moet worden ingebed in een mogelijke eHealth technologie. Het werkt in combinatie met de gedigitaliseerde documentatie van patiënten, het maakt actief toezicht mogelijk en vraagt om verwijdering van de katheter, dit zal uiteindelijk leiden tot nUTI reductie door de katheter op tijd te verwijderen en naleving van hygiënische voorzorgsmaatregelen via directe feedback.

Abstract

The purpose of this research is to investigate the context of nosocomial urinary tract infections (nUTI) within the German hospital setting, in order to develop eHealth-based technology that can prevent and control nUTI. A review of relevant international literature has been combined with a focus group in order to assess risk factors associated with nUTI and associated solutions, as well as factors that are additionally relevant for the German health-care context. The focus group took place in a German university hospital, organised in cooperation with a closely connected institute for hospital hygiene. The results demonstrate convergence between international literature and the German context with regards to risk behaviours and related determinants that can lead to nUTI incidence, such as delayed catheter removal or insufficient hygiene precautions. However, a vicious circle of nUTI-related cost ambiguities and a lack of surveillance has been identified that is unique to the German system and that hinders the implementation of solutions that are proven to be effective by international literature. Furthermore, the results yield several barriers that hinder the implementation of precaution strategies that are proven to be effective in the international context, for example a lack of standardised evaluation criteria for surveillance or checklists that clearly schedule catheter removal. It can be concluded that the system in place is not capable of preventing nUTI effectively. Finally, this paper offers an eHealth solution model that incorporates several approaches into one framework that is adapted to the special needs of German hospital settings and should be embedded in a possible eHealth technology. It builds on digitalised patient documentation that enables active surveillance and prompts for catheter removal and which will ultimately lead to nUTI reduction through on-time catheter removal and compliance to hygiene precautions via direct feedback.

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1. Introduction

1.1 Problem statement

Urinary tract infections are the most common hospital-acquired infection (nosocomial infection) across various countries and care settings, explaining about 40% of infection variance (Tenke, Kovacs, Bjerklund, Matsumoto, Tambyah & Naber, 2008). According to the German Nosocomial Infections Surveillance System (KISS), there were on average 1.87 nosocomial Urinary Tract Infections (nUTI) on intensive care units (ICU) per 1000 patient-days. This represents 4.5% of the annual 146.1 million patient-days. The incidence is estimated at approximately 155,000 nosocomial UTI every year, with a rate of 6.8 infections per 1000 urinary catheter-days. Each nUTI costs about 1,000 euros per incidence (Vonberg, Behnke, Rueden & Gastmeier, 2008). Consequently, if proper prevention programs were in place, the annual health-care costs could be reduced by approximately 14,500 euros on average for every German hospital. However, Gastmeier, Behnke, Schwab and Geffers (2011) state that the costs based on KISS data are underestimated because nUTI surveillance is not integrated within every German hospital. Furthermore, this estimation is restricted to the direct cost consequences of nUTI and does therefore not include costs associated with nUTI-associated sepsis and mortality. Although there are nUTI-related hygiene guidelines implemented in the German care setting, an eHealth-based system may support the efficacy and close the gap between guidelines and related compliance.

1.2 EurSafety Health-Net

While Europe is growing together, new challenges for medicine are arising, for example growing concerns about the spread of antibiotic-resistant bacteria as European citizens can get medical consultation across different countries that differ in their methods of treatment and hygiene precautions. The EurSafety Health-Net is a cross-border project initiated by the European Union that aims to improve quality of care in the Dutch/ Belgium/German border region. To achieve this

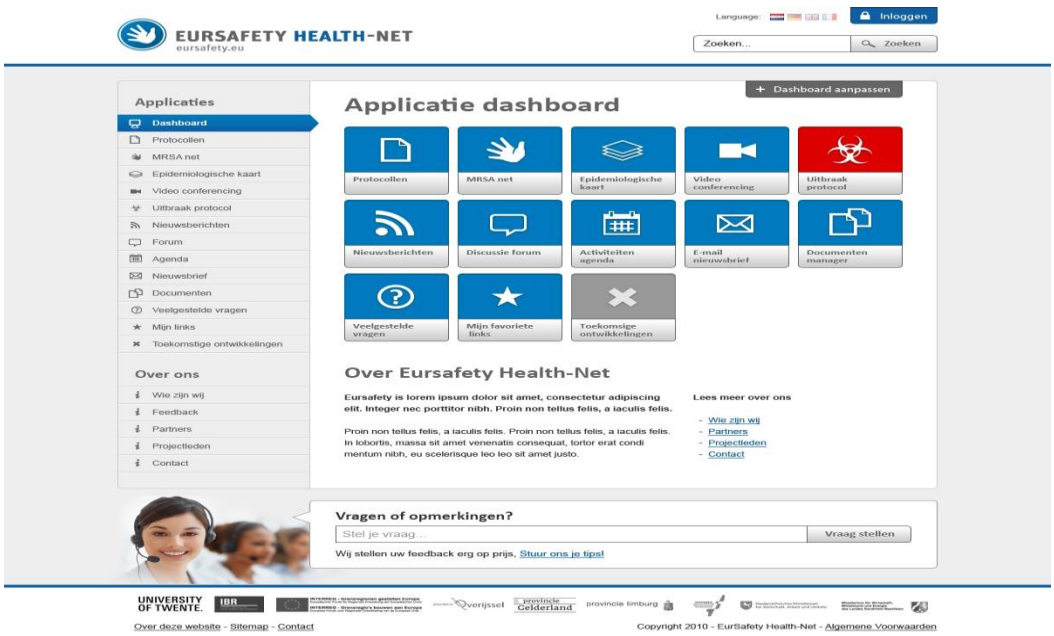
goal, the organisation designs an infrastructure to tackle issues of antibiotic resistance with a cross-cultural, combined approach.

The University of Twente contributes to the EurSafety Health-Net by designing a multicomponent eHealth website as digital infrastructure for knowledge exchange and infection management (www.infectionmanager.nl). The overall objective is to facilitate the information exchange between health-care providers and assist in applying the latest standards for patient safety. The interface of the website is a dashboard which has a modular structure that enables dynamic extensions of embedded eHealth applications (see figure 1). Each user can open an account and tailor it to his/her needs by arranging the module as they wish.

Although the focus in the past has been on antibiotic resistance, possible new content areas will be explored. In the context of this project, this research aims to evaluate possibilities for an nUTI preventive eHealth technology that can be embedded in the dashboard or use its infrastructure.

Figure 1:

The Dashboard



1.3 EHealth 2.0 in clinical settings

The emerge of web 2.0 technologies and associated portable devices allow new approaches in clinical information management, offering new viewpoints on preventive and controlling interventions through the optimisation of information flows and their integration in daily work routines. A recent systematic review (Black et al. 2011) provided a conceptual mapping of eHealth technologies in the care sector, allowing for three broad types of technology and assumed benefits for the quality of care. Data storage and management and retrieval systems, for example electronic health records, make patient-related information easier and faster for care providers to access, leading to the obvious benefit of increased accessibility, search ability and preservation of data and therefore improved organisational efficacy. Support of clinical decision-making systems, for example computerised provider order entry systems (CPOE), enable physicians to enter, modify, review and communicate about orders and test results and thus facilitate decision making and cross-functional communication, yielding improved patient safety and organisational efficacy. The third concept, facilitating care from a distance, refers mostly to computerised decision support systems (CDSS), which integrate clinical and demographic patient information and can be integrated within the other two systems as discussed above. It aims to provide sophisticated support for decision making by clinicians, leading to improved clinical decision making and a better quality of care standards and associated disease control. As nUTI typically emerge within a complex environment with different professions involved, the improvement of communication about what has been done in relation to what has to be done is of great importance.

However, besides these common-sense promises, the empirical evidence for the impact of these technology approaches is weak and inconsistent (Black et al., 2011). Furthermore, severe risks are associated, for example threats to patient safety caused by flawed system design or privacy issues associated with electronic health records. Although the how and why interventions based on these technologies work or do not work is insufficiently understood, the number of eHealth

interventions is growing, which is a threat for effectiveness. A systematic review of 16 eHealth models (Gemert-Pijnen et al. 2011) highlighted a number of shortcomings that are associated with low impact. The first issue refers to a lack of user centeredness and insufficient stakeholder identification and participation. The second states that technology-driven approaches will lead to high-tech solutions with low impact, which is closely associated with a lack of end-user participation. The third refers to the use of theories from social sciences without end-user relevance, thus over-theorised approaches. The fourth claims that contextual factors, such as organisational characteristics, are not included within the developmental process, which can be a barrier for the implementation of new approaches. Conclusively, more emphasis should be put on stakeholder involvement to improve the impact of eHealth technology. In view of this study, stakeholders from the German health-care context will therefore participate from the very beginning.

1.4 Roadmap for eHealth development

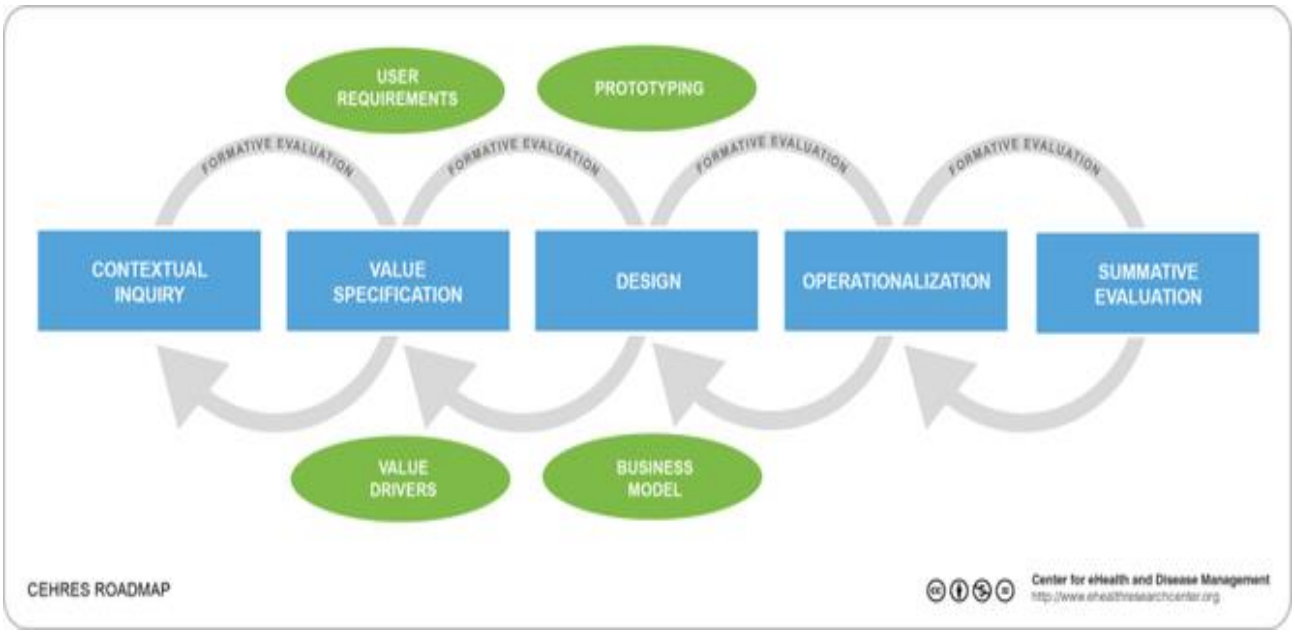
For the strategic development of such an eHealth technology, a roadmap has been created that combines human-centred design, persuasive technology design and business modelling approaches (Gemert-Pijnen et al., 2011). In order to fit end-user needs, persuasive and human-centred design principles are used to enhance capacities and capabilities to facilitate behaviour change. Through combining these approaches with business modelling, dialogue, ownership and co-creation will be enhanced by all participating stakeholders. Business cases can be constructed to facilitate successful implementation. The resulting CeHRes Roadmap (figure 2) provides an iterative framework for the development of an efficient eHealth technology that can be subdivided into five basic elements. It starts with a contextual inquiry that aims to identify all problems and needs of possible stakeholders, highlighting the contextual environment in order to provide an overview of problems and needs that should be targeted. Once stakeholders and their problems are identified, key stakeholders will provide their values concerning the new technology (cultural,

socio-economic, clinical). Critical decision-making systems are used to rank order different values. After the contextual inquiry has been conducted and values have been specified, the findings are used to design the technology, putting emphasis on functional requirements and technical requirements, involving experts and engineers. Then, relevant stakeholders will evaluate the design again, providing an iterative feedback loop. In the next step, operationalisation takes place. Business modelling activities are used to develop an implementation strategy. Again, relevant stakeholders participate in this process. The whole process will be monitored by evaluation cycles that make use of formative and summative methods, testing the effects on a clinical, behavioural and organisational level.

In this study, the contextual inquiry will be conducted to decide if eHealth technology is promising in reducing nUTI incidence. If the results yield good reason to engage in further actions, the next stages of the CeHRes roadmap will be tackled by additional research.

Figure 2

CeHRes roadmap.



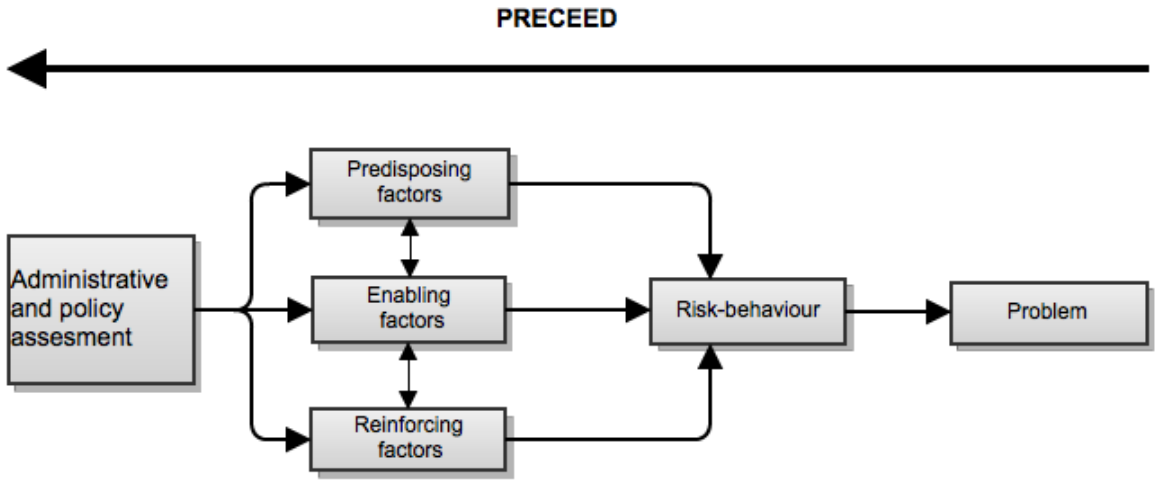
1.5 Contextual inquiry with PRECEED

This research aims to develop a scientific foundation for the development of an eHealth solution that helps hospital staff to prevent and control urinary tract infections. According to the roadmap, the first step is thus a *contextual inquiry*, which aims to get a deep understanding of the problem dimension and the context within which it occurs. The PRECEED model (Bartholomew, Parcel, Kok, Gottlieb & Fernandes, 2011) offers a structural framework for context-specific problem analysis (see figure 3). It has been successfully applied on the evaluation of infection control guidelines (Verhoeven, 2009), suggesting a high relevance for this research.

First the problem has to be defined properly. In this case, it is the incidence of nUTI within German hospitals, which could be avoided by compliance to evidence-based guidelines. In the next PRECEED step, behaviour that leads to problems should be identified. This could be, for example, the lack of proper urinary catheter maintenance. The urgent and associated next step in the PRECEED approach involves identifying determinants of this undesired behaviour, which can differ in their type of relationship. The model distinguishes between predisposing, enabling and reinforcing factors. Once these determinants are assessed the model focusses on administrative or policy factors that are related to the determinants. The core rationale is consequently that the relationship between undesired behaviour and contextual determinants has to be fully understood in order to develop strategies for behaviour change that ultimately lead to problem reduction. Once the problem dimension is fully understood, related solutions will be evaluated in terms of feasibility as well as possible barriers to and facilitators of implementation. Once determinants and possible interventions are evaluated, it will be considered how these could be integrated in eHealth technology successfully. One possible example would be the role of eHealth as decision support system in the event of nUTI incidence or the digital storage of patient data and related surveillance and aetiology.

Figure 3

PRECEED model adapted from Bartholomew et al. (2011) and Verhoeven (2009)



One strong advantage of the model is its emphasis on different ecological levels in which the above-described processes take place. Health-care workers' behaviour that leads to nUTI can be determined by factors related to different levels, for example intra-personal factors, such as attitudes towards hygiene guidelines, inter-personal factors, such as communication between health-care workers, and organisational factors, such as a time-consuming patient–caregiver ratio. Once the problem dimension is fully understood, the intervention can target all relevant determinants exclusively, taking their importance and interdependence with regards to their ecological levels into account.

1.6 The role of risk awareness

As mentioned in the problem statement, nUTI is underestimated within the German health-care system. If the outcome of desired behaviour is nUTI reduction, health-care workers (HCWs) should be motivated to engage in precautions. The Transtheoretical Model of Behaviour Change (TTM) distinguishes between three phases one has to go through to perform a particular behaviour

(Prochaska, Redding & Evers, 2008). First the motivational stages have to be sufficiently solved. Then, once one is aware of a risk and willing to change behaviour, one enters the preparation and action stage. Once behaviour is in place, maintenance is a critical issue. Consequently, health-care workers should first be aware that catheters and associated nUTI require attention (motivational stage), and then they should have enough education/information (preparation and action stages) and motivation to adhere to the guideline (maintenance stage). With regards to the PRECEED mapping, low levels of awareness can be considered as predisposing for nUTI incidence, whereas high levels may reinforce the success of intervention implementation. Therefore the issue of risk awareness will be addressed explicitly with special emphasis on possible awareness-increasing mechanisms, as it is central to the success of a possible eHealth technology. Without health-care workers' motivation, the implementation of a new technology is prone to failure. According to Prochaska et al. (2008), the best way to increase risk awareness is conscious-raising, based on presenting relevant information, and feedback or confrontation about the causes or consequences.

1.7 Research questions

To get the most valid insight into the problem dimension, which is essential to determine how promising an eHealth approach would be and how it should look like, deductive and inductive research will be combined. In the first step, relevant nUTI literature will be systematically reviewed in order to identify reported causes and suggested solutions of nUTI, thus trying to get information about risk behaviour and related determinant as suggested by PRECEEDs, as well as advice for strategic change.

These findings will then be used within a focus group with relevant stakeholders to check if findings from international literature match the German care context, as well as identifying additional causes/solutions on different ecological levels that should be explicitly targeted by a possible intervention.

The umbrella research question of this paper is thus: how can nosocomial urinary tract infections be controlled and prevented in German hospitals with eHealth technology? It is important to mention that the contextual inquiry does not focus on eHealth-related interventions exclusively, as it aims to get an overall overview about all possible determinants and related solutions, which then could be translated into eHealth technology, taking the dashboard as a possible platform into account.

Consequently, the research questions for the literature study are:

1.Which risk factors are related to nosocomial urinary tract infections?

2.Which precautions may prevent/control nosocomial UTIs?

3.Who are the nosocomial UTI-relevant stakeholders associated with suggested precautions that should participate in the focus group?

For the focus group, the research questions are:

1.How can nUTI-related risk awareness be efficiently increased?

2.Are there factors that are specific to the German care context that should be taken into account for the development of an intervention in order to prevent and control nUTI?

3.What are the possible barriers for the implementation of solution-related mechanisms?

4.What are the possible facilitators for the implementation of solution-related mechanisms?

5.Which values are associated with possible solutions?

2. Method

2.1 Literature review

In order to get an overview about risk factors and underlying conditions that can lead to the development of UTI as well as related solutions, a systematic literature review has been performed.

2.1.1 Procedure

For the literature review, a search was performed in the database Pubmed (between February and March 2012). The search terms were “Urinary tract infection AND nosocomial AND urinary catheter AND prevention”, “Urinary tract infection AND nosocomial AND urinary catheter AND control”, “Urinary tract infection AND nosocomial AND control” and “Urinary tract infection AND nosocomial AND prevention”. Results were limited to the publication years 2000–2012. Criteria for inclusion were a focus on risk factors and precautions associated with nosocomial urinary tract infections within hospitals and settings within western countries (e.g. Europe, United States, Australia). Clinical studies, such as observational, quasi-experimental and experimental, in German or English were included. Criteria for exclusion were review papers, low validity in terms of missing data or references, book chapters, and settings in developing countries. Review papers were excluded to avoid possible bias through the authors' interpretation.

3.2 Focus group

2.2.1 Underlying rationale

In general, nUTI emerge in a complex environment where different professions interact on several levels and with differences between health-care departments. Therefore, nUTI-related risk factors are not only supposed to be attributable to individual levels, but also to the process of communication itself. In contrast to traditional interviews, the focus group enables access to information that goes beyond an individual’s opinion and can emerge from dynamic group

interactions (Gibbs, 1997).Using a small number of guiding questions, the focus group can generate in-depth considerations of participating stakeholders, leaving leeway for unexpected insights (Mauro & de Quiros, 2009). Conclusively, applying a focus group to the context of this research can deliver results that are not covered by mere empirical data on nUTI epidemiology.

2.2.2 Setting

The focus group took place in a German university hospital in Oldenburg, organised in cooperation with the closely connected institute for hospital hygiene. The invited stakeholders work at the department of urology, which performs 3000 operations each year in three operating theatres. In total, the urology department has a capacity of up to 49 beds. The department works closely together with an interdisciplinary anaesthesiological surgery department. The focus group itself took place in the institute for hospital hygiene.

2.2.3 Participants

Possible stakeholders were discussed with an expert in the field of infection control, namely a consultant of clinical microbiology. Identified stakeholders were a nurse manager of urology, a link nurse, an operative physician and a consultant clinical microbiology.

The participants were informed about the purpose of this research and the confidential treatment of the gathered information. They were asked to sign a written informed consent form that enabled audio/visual recording of the focus-group session. They were not compensated for their participation and took part voluntarily.

Due to a lack of time resources, the operative physician was not able to participate, but the head of clinical microbiology provided insight into the missing dimension. The focus group was led by the researcher, together with a Dutch consultant in clinical microbiology.

2.2.4 Procedure

The focus group was designed based on the review results and suggested solutions (see figure 6 and figure 8).

After having signed the informed consent, the participants were asked to introduce themselves with an emphasis on their profession and role within the hospital. They were instructed to think of themselves as representatives of their particular profession. In order to increase their perceived relevance of the focus group and stimulate participation, a short introduction provided them with findings from the German KISS system (Gastmeier et al., 2011), stating that UTI is an underestimated problem in the German care sector. Furthermore, the Dutch head of microbiology presented data from the Netherlands that provided more in-depth insight into the incidence and consequences of nUTI, enabled through more sophisticated surveillance and monitoring in the Dutch care sector.

Then, the participants were asked to think about possible solutions to increase the general risk perception of nUTI as a serious problem. First, they were asked to reflect on the solution suggested by Gastmeier et al. (2011), who suggested incorporating nUTI into every hospital surveillance system, aiming at reducing cost ambiguities and proper incidence evaluation. The guiding questions were: what is your general opinion about this approach? What are possible barriers? What are possible facilitators? They were instructed to answer three questions on Post-it notes which were then gathered for a final discussion. The underlying rationale of letting them write it down first was to overcome suppressions of thoughts as a result of hierarchy-related interactions, so every stakeholder could formulate his/her opinion without bias. Second, the stakeholders were asked to reflect on arguments for conscious-raising that are supposed to be relevant for each profession, again using Post-it notes and a final discussion.

Afterwards, the stakeholders were confronted with a case scenario that targeted a lack of catheter removal and guideline compliance (see Appendix A). Guiding questions were provided in

order to clarify which role each profession could have played in the emergence of this nUTI incidence, what has to be done in such a situation where information is needed and where they experienced conflicts or problems. Again, all stakeholders answered on Post-it notes first and then discussed each sub-question together.

The scenario from the latter step was constructed on the anticipated results of inappropriate catheter maintenance and delayed removal. The stakeholders were asked to reflect on solutions as proposed by the literature study, which were the use of reminders/prompts and proper guideline-related education. They were instructed to write their thoughts concerning their general opinions, barriers, facilitators and other modalities on Post-it notes. Then, again, the results were discussed for each part separately.

2.2.5 Data analysis

A coding scheme has been developed based on the research questions presented above which derived from the PRECEED & TTM approaches (see figure 4).

As *general nUTI-related risk awareness* has been identified as a major issue by the review and precedes behaviour as stated by the TTM, a corresponding overarching category has been created that summarises the participants' state of awareness, the determinants that cause the lack of awareness, as well as arguments that are relevant for conscious-raising as implied by the TTM.

For identifying factors that are specific to the German care context and thus not reported in international literature, the category *context and processes of nUTI-related care* has been created. It reflects the PRECEED dimensions of risk behaviour and associated factors, which can differ in type and relationship. Accordingly, these issues are reflected in the categories *risk behaviour*, the *hierarchy of communication* and problems that were explicitly mentioned by the stakeholders, such as the *lack of surveillance, feedback and risk awareness* or issues of *accountability, allocation of blame and the lack of standardisation.*

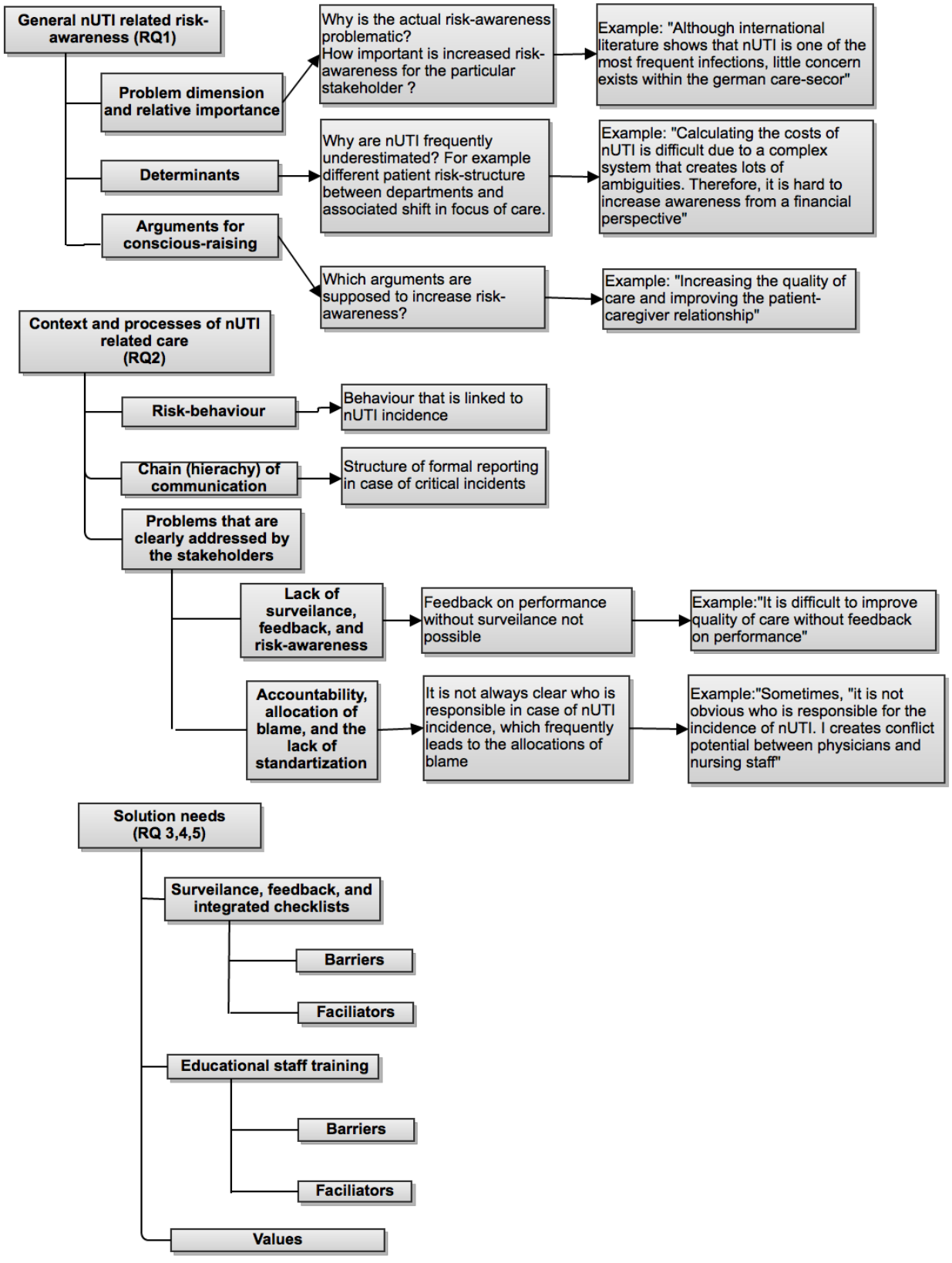
Another overarching category has been created for solution needs. It reflects the two broad approaches that derived from the PRECEED analysis of the literature review results: *surveillance, feedback and integrated checklists* and *educational staff training* and barriers and facilitators for implementation as well as general values concerning a possible solution.

The interview has been subdivided into text fragments that were assigned to the labels of the coding scheme. If fragments did not match a label, the scheme was adjusted, thus yielding iterative improvement.

An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency among raters with regards to assigning fragments to the coding scheme labels. In total, 93 text fragments were compared. For reporting, relevant fragments were translated into English and checked with a native German to ensure no loss of information through translation.

Figure 4:

Coding scheme based on the research questions, PRECEED and TTM.



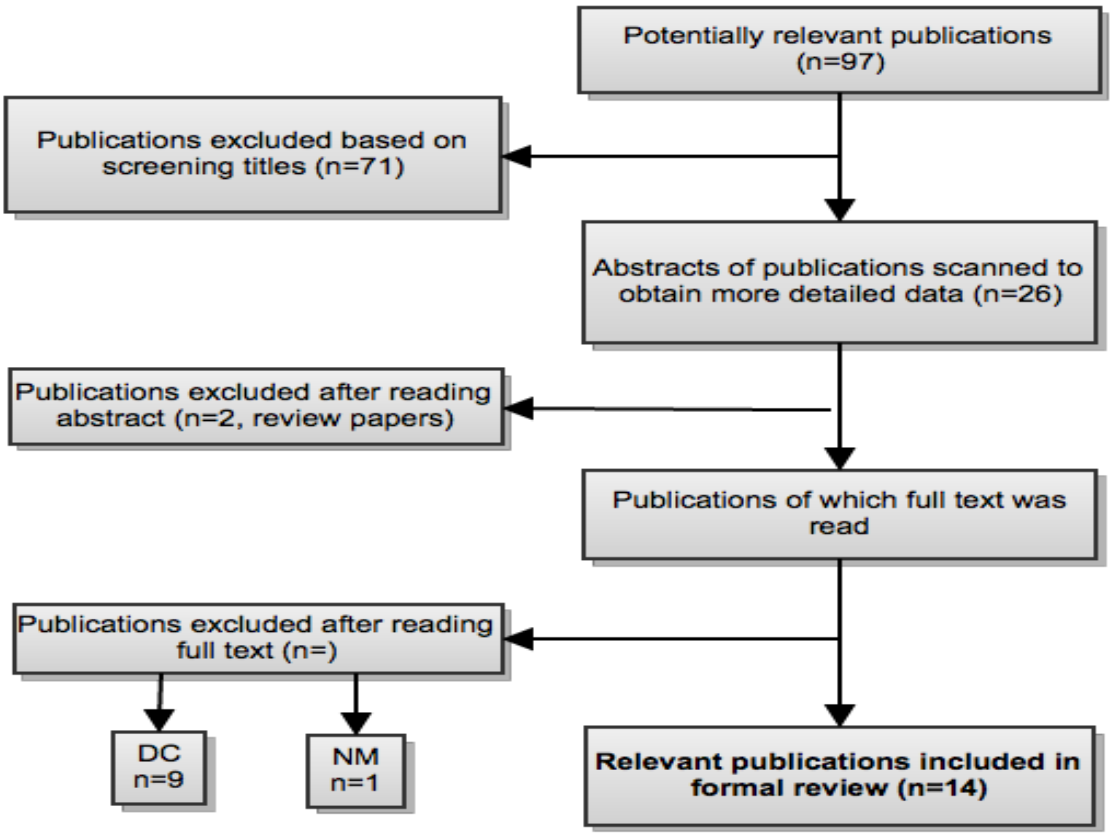
3. Results

3.1 Literature review

The search yielded 97 potential papers in the database Pubmed, of which 26 fit the defined inclusion criteria on a title and abstract reading. Out of these, eight papers were excluded because data had been collected in developed countries. One paper was excluded because no information about the method was presented. Furthermore, three review papers were excluded. Therefore, the final literature list for further analysis consists of 14 papers (see figure 5).

Figure 5:

Flowchart of review selection procedure. DC= developing countries, NM= methods not sufficiently reported.



3.1.1 Characteristics of included papers (table 1)

Seven studies took place in the United States of America (1,8,9,10,11,12,13), two in Germany (4,5), one in France (2), one in Spain (3), one in Australia (6), one in Sweden (7), and one in Switzerland (14). Seven paper evaluated the effects of precaution measurements on nUTI incidence (1,2,4,9,13,14), whereas eight studies focussed on identifying nUTI-related risk factors (3,5,6,7,8,10,11,12). Within those which evaluated precaution measurements, three papers used prospective, non-randomised designs (1,2,13), one retrospective analysis of patient folders (4), and two a randomised control trial (9,14). Out of those which investigated nUTI-related risk factors, four used a prospective design using patient documentation (3,7,10,12) and four used a retrospective analysis of patient data (5,6,8,11). Outcome measures were clearly addressed in six papers (1,2,4,9,10,13,14), whereas the others did not report outcomes, as they did not evaluate an intervention but analysed patient data for epidemiology.

The settings varied between academic teaching hospitals (1,2,7,9,10,14), general medical hospitals (3,4,5,6,12,13) and acute care hospitals (8,11).

With regards to UTI-related risk factors, three broad risk-factor categories have been identified in this review: general risk factors, risk behaviours and staff awareness. For an overview based on PRECEED mapping see figure 6. The figure shows which factors contribute to the outcome of nUTI incidence, moving backwards through the causalities at different stages. For example *lack of surveillance* is seen as an enabling factor for a lack of awareness, which reinforces the observable behaviour of insufficient hygiene precautions that leads to nUTI incidences.

3.1.2 General risk factors (table 2)

The most frequently reported nUTI-related risk factor refers to the use of urinary catheters (1,2,9,10,11), stating that catheter-associated nUTI are the most common with about 80% in the German health-care system (5). Thus, having an indwelling urinary catheter increases the likelihood

for a nUTI incidence significantly for the patient. The type of the catheter used influences this relationship significantly (9), as well as the duration a catheter stays in place (3,11). Different catheter types have different durations they can stay in place before the risk of infection increases (9).

The type of hospital ward has been reported to be an additional risk factor (4). This is consistent with the finding that the elderly and patients with diabetes are on average higher at risk (7,8). Furthermore, the relative risk increases in those care units where patients are not able to communicate their perceived symptoms, such as in paediatric intensive care units (3) or care of the elderly (8).

Another risk factor refers to the transition between health-care facilities, especially from long-term care to acute care (6). Documentation of the patient's status is often not transferred properly during admission, which leads to the problem that catheters which were inserted at the prior facility are forgotten and thus not removed on time.

Patients with diabetics mellitus are more at risk, as well as the female gender (7,8).

3.1.3 Risk behaviours

The most frequently mentioned risk behaviour refers to physicians who do not remove catheters on time (1,2,11,12). Furthermore, inappropriate catheterising use has been reported frequently (9,12,), which is defined as using catheters when it is not urgent/necessary, or a lack of proper maintenance using hygiene precautions.

3.1.4 Staff awareness

Risk awareness and the consequences of urinary tract infections are underestimated within the German care sector (4.). Those who are responsible lack the awareness that UTIs produce relevant costs and are associated with sepsis and mortality.

Furthermore, physicians are frequently not aware that indwelling urinary tract catheters are in place during medical consulting, which is associated with a lack of proper catheter documentation in patient charts, especially in post-operative follow-up treatments (1,2,11,).

3.1.5 Suggested precautions (table 2)

There is common agreement between the studies that catheter duration should be kept as short as possible (1,2,3,5,6,7,8,10,11,12,13). Furthermore, catheter maintenance should be performed according to standardised guidelines (9,12). Hand-sanitisers should be available in every patient room (7).

According to two studies, nUTI should be included in every intensive care unit surveillance system in order to increase the staff's general risk awareness (1,13), which would enable feedback on performance and keep the stakeholders involved. In both interventions, computerised patient-centred care logistics were used that prompt physicians for catheter removal, combined with staff education and nurse empowerment. It has been demonstrated that this approach is significantly effective in reducing catheter duration and overall device-days (1,13) (P=.002, r=.301; P<.001, device-days decreased by 42%) and reducing the overall incidence of catheter-associated nUTI (13) (P=.054). That surveillance is effective in decreasing nUTI incidence has been further confirmed by one study, yielding a significant reduction in the relative risk ratio for nosocomial infections (4) (P<.05, 55% reduction).

Another study evaluated an intervention in which nurses placed additional reminders in patient folders to trigger physicians to action (2). Associated results show that the frequency of nUTI among catheterised patients decreased from 10.6 to 1.1per 100 patients (P=.003).
The incidence of catheter-associated nUTI decreased from 12.3 to 1.8 per 1000 catheter-days (P=.03), as well a reduction in antibiotic use before or during catheterising (P<0,001, r=.99).

According to one study, standardised guidelines should be combined with effective policy

implementation and the integration of electronic systems to identify catheter use (12).

One study suggests the use of antibiotic prophylaxis when catheters are removed to prevent complications (14).

Another study suggests that the information management between health-care facilities should be improved in order to avoid catheters being forgotten during transition, especially from long-term care to acute care (6).

3.1.6 Stakeholder mapping

Only broad professional categories of stakeholders have been reported. The literature refers to the role of nurses and physicians (1,2), but this issue is frequently not addressed explicitly. From those papers that evaluated nUTI-related interventions, two broad perspectives on the role of both stakeholder categories with regards to the emergence of nUTI can be distinguished between. The issue of delayed removal is associated with physicians' neglect and unawareness (1,2), whereas issues of guideline compliance is more associated with nursing staff (1,2,7).

Figure 6:

Mapping of review results according to PRECEED.

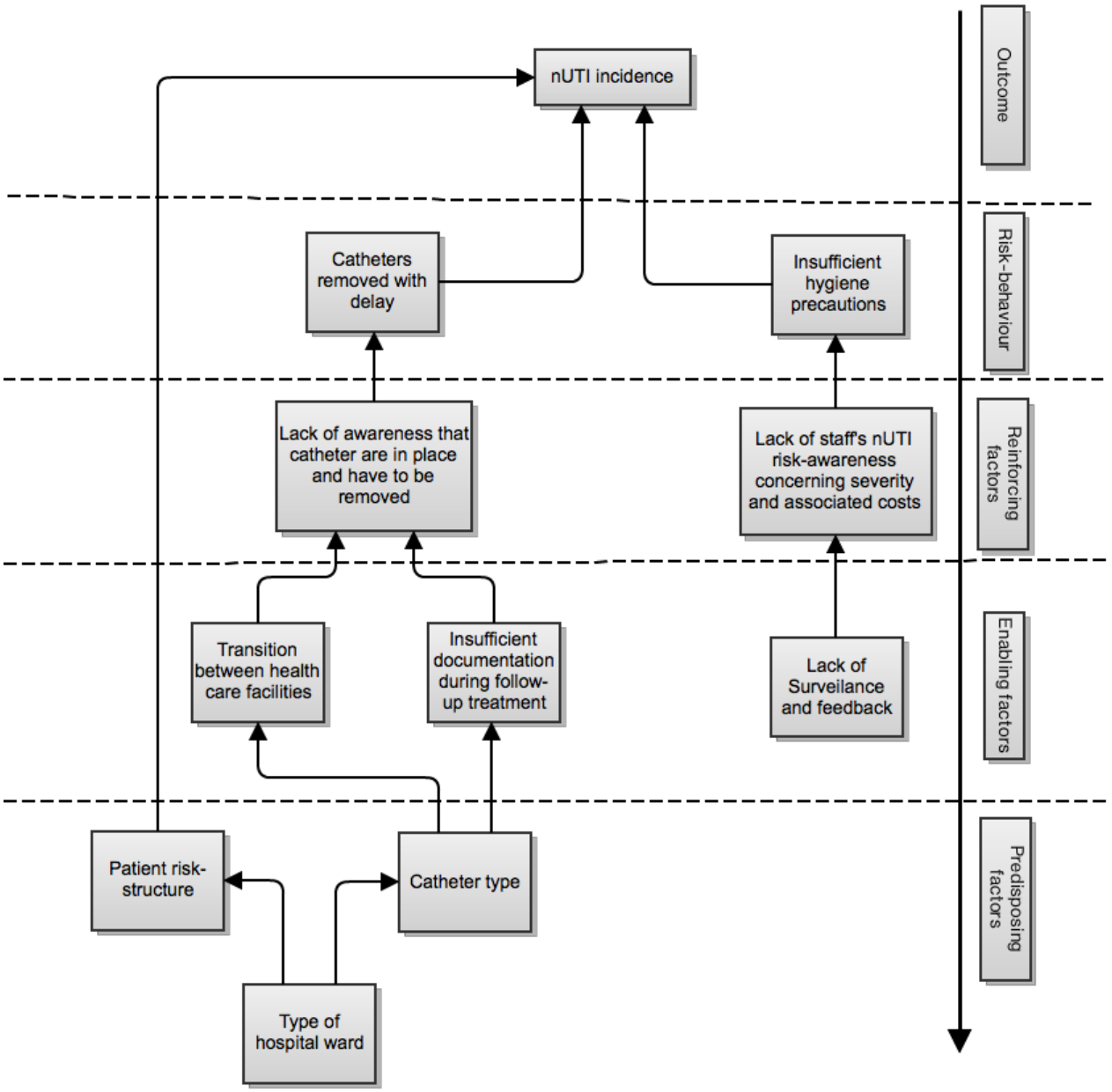


Table 1:

Characteristics of papers included.

Author, year & country	Goal study	Care setting & stakeholders	Study design, sample size	Outcome measures
1.) Andreessen et al., 2012. United States	Evaluation of a UTI control & prevention bundle, based on computerised templates for patient documentation.	167-bed academic teaching hospital. Medical/surgical care units. Physicians, nurses.	Prospective study. Non-randomised comparison of 3 weeks pre-intervention and 3 weeks post-intervention data. N= 114.	Reduction in catheter duration (P=.002): 71% decrease in catheter days, from 505 to 148.
2.) Crouzet et al., 2007. France	Evaluation of the impact of daily reminders on removing unnecessary catheters within 4 days after insertion.	1205-bed university-affiliated hospital. Neurosurgery, cardiovascular surgery, orthopaedic surgery, neurology and geriatrics. Nurses & physicians.	Prospective study. Non-randomised comparison of 3 months pre-intervention and 3 months post-intervention from computerised infection control data and medical charts. Executed in different departments.	The frequency of nUTI among catheterised patients decreased from 10.6 to 1.1 per 100 patients (P=.003). The incidence of catheter-associated nUTI decreased from 12.3 to 1.8 per 1000 catheter-days (P=.03). Reduction of antibiotic use before or during catheterising (P<0.001, r=.99).

Author, year & country	Goal study	Care setting & stakeholders	Study design, sample size	Outcome measures
3.) Flores- Gonzales et al., 2011. Spain	Epidemiology. Incidence and risk factors of nosocomial UTI.	Second-level Paediatric Intensive Care Unit (PICU).	Prospective correlation study, analysing urine sample from all patients staying longer than 48 hours of N= 100 children.	Not reported.
4.) Gastmeiner et al., 2011. Germany	Evaluation if active surveillance leads to reduction in CAUTI.	418 hospitals, 614 ICUs.	Retrospective correlation study , analysing patient documentation data from the German Krankenhaus Infektions Surveillance System (KISS) after active surveillance has been implemented.	Significant reduction in the relative risk ratio for nosocomial infections ($p<.001$).
5.) Geffers et al., 2011. Germany	Epidemiology of device-associated infections and relationship with multi-resistant organisms.	800 hospitals, 586 ICUs.	Retrospective correlation study, analysing data from the German Krankenhaus Infektions Surveillance System (KISS) within 1 year periode.	Not reported.
6.) Graves et al., 2007. Australia	Epidemiology: identifying a comprehensive set of nUTI-related risk factors.	712-bed tertiary referral hospital and a 312-bed district hospital.	Retrospective correlation study. 4157 UTI cases were included.	Not reported.

Author, year & country	Goal study	Care setting & stakeholders	Study design, sample size	Outcome measures
7.) Hälleberg et al., 2011. Sweden.	Epidemiology. Risk factors and consequences of nUTI	Orthopaedic university hospital.	Prospective observational study with a descriptive and comparative design. N=86 hip-fracture patients.	Not reported.
8.) Hazelett et al., 2006. USA	Investigating the relationship between the use of indwelling urinary catheters and nUTI.	Acute care hospital.	Retrospective correlation study. Elderly with indwelling urinary catheter. N= 277.	Not reported.
9.) Karchmer et al., 2000. USA	Assessing the efficacy of a silver-alloy, hydrogel-coated latex urinary catheter for the prevention of nosocomial catheter-associated UTIs.	600-bed university hospital	Randomised crossover trial. Comparison of the rates of nosocomial catheter-associated UTI in patients with silver-coated and uncoated catheters.	Silver-coated catheter cause significantly less nUTI (P=.001).
10.) Milan et al., 2009. USA	Evaluating pathogen resistance between CAUTI / NAUTI and empirical therapy adequacy.	University hospital. Urology.	Correlation study. N= 589.	Resistance of pathogens in patients with urinary catheter was significantly higher (P = .001).

Author, year & country	Goal study	Care setting & stakeholders	Study design, sample size	Outcome measures
11.) Wald et al., 2008. USA	Epidemiology. Frequency and duration of perioperative catheter use and to determine the relationship between catheter use and postoperative outcomes.	2965 acute care hospitals	Retrospective cohort study. Patient undergoing a major surgery. N=35904.	Not reported.
12.) Tiwari et al., 2012. USA	Epidemiology. Risk factors associated with UTI.	General medical-surgical hospital	Prospective correlation study of medical patient records. N= 436.	Not reported.
13.) Topal et al., 2005. USA	Evaluation of an computerised patient-centred care-logistic intervention based on prompts in computerised entry/order system combined with staff education and nurse empowerment.	4 general medical units (120 beds).	Prospective cohort study. 3 levels of measurements: preintervention (N=164), postintervention (N=81), postintervention2 (N= 58).	Device-days decreased by 42% and the device utilisation ratio de-creased about 37% (P <.001). Catheter-associated nUTI incidence decreased about 47% (P=.054).

Author, year & country	Goal study	Care setting & stakeholders	Study design, sample size	Outcome measures
14.) Pfefferkorn et al., 2009. Switzerland	Evaluating the impact of antibiotic treatment at catheter-removal on UTI incidence.	Academic teaching hospital. Department of surgery	Prospective randomised study. N=239. Urinary cultures were obtained before and 3 days after catheter removal for both experimental and control condition.	Patients who received antibiotic prophylaxis showed significantly fewer urinary tract infections (P<0.001).

Table 2

nUTI-associated risk factors and suggested prevention/control precautions

Reference	nUTI-associated risk factors as stated by the authors	Advice for prevention/control precautions as suggested by the authors
1.)	Physicians are not always aware of catheter being in use.	Routinely prompt nurses and physicians to remove unnecessary urinary tract catheters. Evidence-based practice guidelines for catheter use. Careful implementation of computerised templates as digital patient folders. Should be embedded in educational training. Feedback on performance as critical element to keep stakeholders involved.

Reference	nUTI-associated risk factors as stated by the authors	Advice for prevention/control precautions as suggested by the authors
2.)	Physicians are not always aware of catheter being in use.	Daily reminders from nurses to physicians to remove unnecessary catheters leads to reduced nUTI incidence.
3.)	Patient's length of stay in PICU with catheter in place.	n/a
4.)	Lack of UTI-related risk awareness among health care workers. ICU patients are frequently not able to communicate perceived symptoms. Only 25% of ICUs performed routine microbiology screening of catheterised patients.	Active surveillance reduces nUTI incidence (14% for CAUTI reported).
5.)	The infection rates for nosocomial infections differ strongly between different types of ICU. This can be attributed to different risk structures of the patients.	Not reported.
6.)	Transition between hospitals.	Improved information management.

Reference	nUTI-associated risk factors as stated by the authors	Advice for prevention/control precautions as suggested by the authors
	Assistance required prior to admission.	
	Patient admitted with fracture or dislocation.	
	Urinary catheter in place before admission.	
7.)	All participants with diabetes acquired nUTI.	Using a closed urinary drainage system.
		Alcohol hand sanitisers should be available in all patient rooms.
		Keep the duration of catheter use as short as possible.
8.)	Pre-existing UTI.	Reduce unnecessary urinary catheter use.
	Inappropriately placed indwelling urinary catheters.	Eliminate pre-existing UTIs.
	Female elderly patients received inappropriate indwelling urinary catheters more frequently.	

Reference	nUTI-associated risk factors as stated by the authors	Advice for prevention/control precautions as suggested by the authors
9.)	Uncoated catheter use.	Using silver-coated catheters.
10.)	Urinary catheter.	Patients with nUTI should not be empirically treated unless a clinical emergency requires it.
11.)	Postoperative urinary catheter duration. Indwelling urinary catheter that are in place for more than 2 days. Operation type: Orthopaedic, Cardiac, Gastrointestinal, Vascular. (increased risk). Catheter removal is underreported in medical documentation.	Surveillance and feedback.
12.)	Inappropriate use of catheters (34%). Prolonged hospital stay.	Use of standardised guidelines combined with effective policy implementation. Use of electronic systems to identify catheter use.

Reference	nUTI-associated risk factors as stated by the authors	Advice for prevention/control precautions as suggested by the authors
13.)	Inappropriate use of indwelling urinary catheters.	Computerised physician order system as prompt for catheter removal if not necessary anymore, combined with patient-centred care logistics to convey information to follow-up departments. Nurse-driven protocol integrated in computerised system to prompt physicians if patients do not fit the criteria for catheter use anymore. Mobile bladder scans to assess urinary retention non-invasively.
14.)	N/a	Antibiotic prophylaxis at urinary catheter removal to prevent a common, in most cases inconvenient but potentially harmful, complication.

3.2 Focus-group

The inter-rater reliability was found to be Kappa = 0.84 (p <.0.001), thus resulting in a very good agreement. For an overview about the findings related to the process that leads to nUTI incidence see figure 7.

3.2.1 General nUTI-related risk awareness

With regards to the problem dimension of relative importance of nUTI within the German care sector, the participants stated that nUTI is underestimated, thus resulting in low levels of general risk awareness.

> "*Although international literature shows that nUTI is one of the most frequent nosocomial infections, little concern exists within the German care sector*"
>
> (Consultant clinical microbiology)

Furthermore, nUTI-related risk awareness varies between health-care units within a hospital, which can be explained by different patient risk structures and associated focus of care.

> *"I observed during active surveillance that urinary catheters receive less attention in in intensive care units, where it is not in the focus of care and diagnostic. My view is supported by feedback that I receive from colleagues"* (Link nurse)

Determinants for this lack of risk awareness are reported to be multifaceted. One major determinant refers to cost ambiguities within the German insurance policies concerning nUTI, which make it difficult to calculate costs deriving from nUTI incidences. Consequently, the impact of nUTI is underestimated from the financial perspective.

> *"It can happen that a urinary tract infection is profitable and that even prolonged lay time is beneficial from a financial point of view. It is a very complex system and therefore difficult to put nUTI incidence in relationship to associated costs."*
>
> (Consultant clinical microbiology)

Another determinant refers to a lack of systematic surveillance. Without surveillance,

feedback on performance is not possible and the overall incidence of nUTI hard to measure. However, the relationship between surveillance and feedback will be reported in a separate section (*factors that are specific to the German context*).

Besides organisational characteristics as mentioned above, the participants reported arguments that are supposed to increase risk awareness on the individual level via conscious-raising. The first refers to the quality of care and associated trust between caregiver and patient.

> *"Having a nUTI additional to other complaints does not increase the mood of the patient and can become a burden for the patient–caregiver trust relationship and lowers the quality of care." (Link nurse)*

The second refers to the relationship between cost reduction and maintaining jobs.

> *"Most of us do understand that a hospital works within a business environment and that the reduction of nUTI-related administration and associated cost reduction is important for the company to be efficient. Only this way are our jobs safe in the long-term perspective." (Link nurse)*

The third argument refers to the relationship of UTI-related antibiotic use and MRSA.

> *"Reducing nUTI means less use of antibiotics, which is an important issue with regards to prevention of multi-resistant pathogens." (Consultant of clinical microbiology)*

3.2.2 Factors that are specific to the German context

If confronted with a patient who may have an nUTI, the nursing staff acts as an information gatherer. They filter the information before consulting a decision-maker, who are in general physicians. Nurses focus on wound control, checking patient documentation and talking with the patient about his/her complaints. A slight difference in this procedure exists between nurses and link nurses, who would check for catheters which may have been forgotten in the peripheries.

> *"First I would check if the catheter has been maintained properly and how*

long it is in place. Furthermore, I would talk with the patient about his complaints. I think that is an important thing to do." (Nurse manager of urology)

"Additionally to what I said earlier, I would also check the periphery for forgotten catheters. This is frequently forgotten by others." (Link nurse)

Physicians then use the data that is provided by the nurse to make his/her decision on how to proceed. Additionally he/she gathers information about medicine intake and may initiate further diagnostic procedures such as bladder scans or checking the liver status.

It has been clearly addressed that in the modern fast-paced hospital environment, nurses are a major source of information about particular patients. Frequently, physicians cannot keep track of the fast-changing patient structures and rely on nurses' information to form a picture about the individual patient.

"I experienced that physicians are frequently not completely informed about their patients, especially if they had a day off. The patients change on a daily basis and after a day off, the patient structure may have changed completely. The demand for high adaptability to changing patient structures can only be supplied by relying more on information provided by nursing staff." (Consultant clinical microbiology)

Taking the importance of collaboration into account, it seems problematic that remarks about patients, when formulated by nurses, are often not taken seriously.

"Conflict arises when physicians neglect information provided by nursing staff. If the information is simply attenuated or not taken seriously." (Manager of nursing)

Furthermore, a clearly addressed risk behaviour refers to insufficient hygiene measurements that can be specific to the context and profession.

"The behaviour that is most responsible for nUTI is definitely insufficient hygiene during maintenance and insertion." (Link nurse)

"No operating surgeon would ever touch a wound without complying to sterile precautions. However, if they exit the operating theatre they neglect the precautions

and sometimes behave carelessly." (Link nurse)

Additionally, the participants reported that catheters are frequently removed with delay.

"We have checklists that state what has to be done and when. Unfortunately, they are little controlled and catheters stay longer in place than recommended." (Link nurse)

Feedback on performance has been reported as a major instrument to change behaviour within the hospital settings. Only if professionals see the relationship between their behaviour and undesired outcomes will problem awareness that urinary catheters are a major source of nosocomial infections increase. Therefore, the lack of systematic surveillance is considered to be a major problem.

"A urological surgeon wants to save lives. He fights cancer in surgery. How important can a tiny catheter be compared to that? It is a question of awareness that this tiny catheter can ruin his OP result. This has to be visualised via statistics to provide feedback." (Consultant of clinical microbiology)

Another problem refers to ambiguous responsibilities and associated allocations of blame. This conflict can arise between different health-care professions as well as between the patient and the nurse/physician in charge. In the case of a nUTI incidence, it frequently remains unclear who is responsible, which gives room for speculation and unjustified allocations of blame, resulting in tension between health-care professionals and even between caregivers and the patients.

"Once we have an infection and someone asks why it happened, people tend to formulate accusations, whether they are justified or not." (Link nurse)

The main reason for ambiguous responsibilities refers to a lack of standardisation. A general guideline exists but differs in scope between different departments, for example with regards to peripheral catheterisation. The general guideline states what has to be done, but not necessarily when and under which conditions. Thus, it is not clearly defined when catheters have to be controlled and removed.

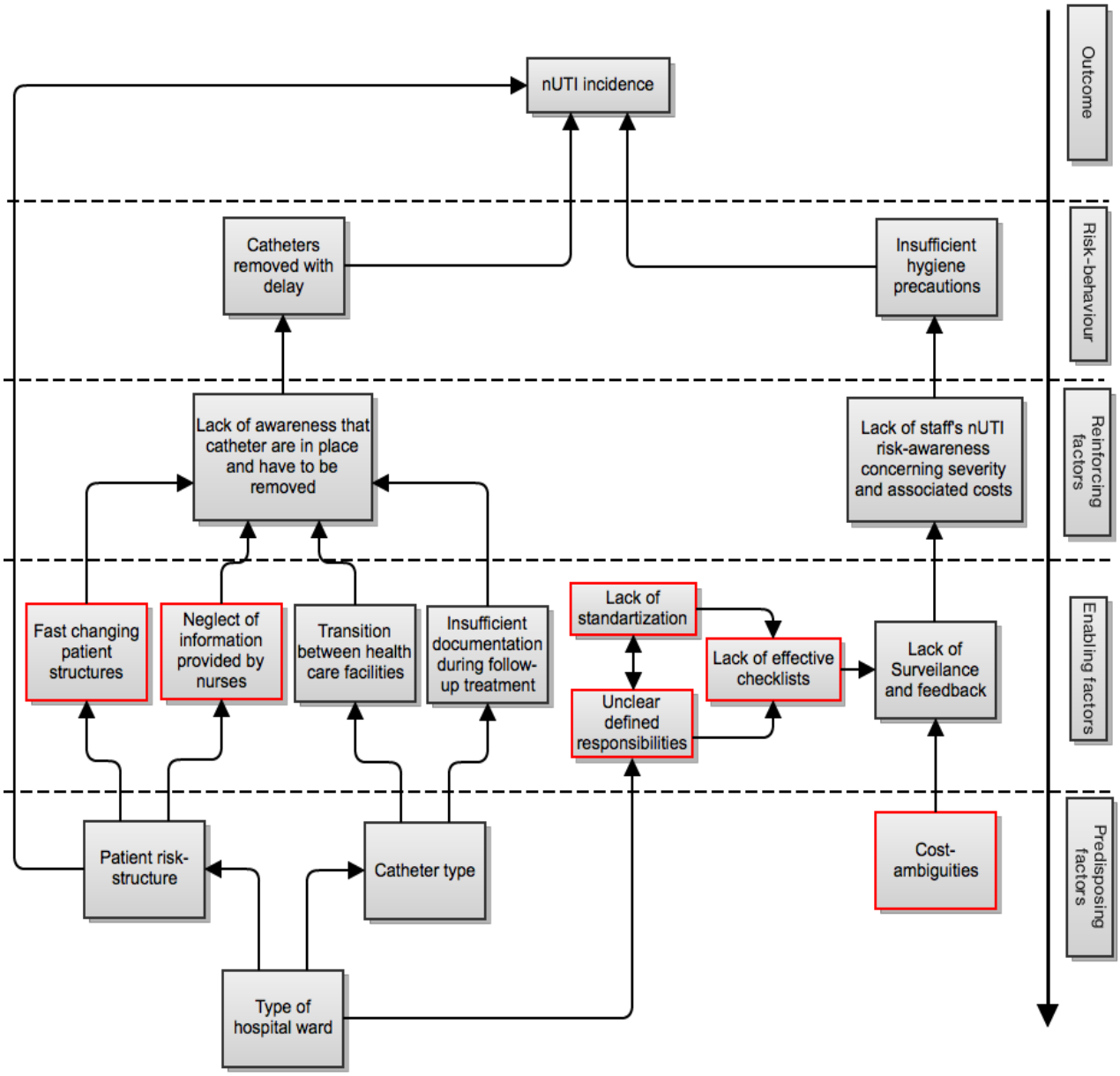
"Every care unit has its own guidelines that are elaborated and signed by the head

physicians and directors of nursing. They consist of tasks that have to be done in the postoperative care process, for example removing the catheter after hip replacement surgery on the physician's demand. The problem is that it has to be documented somewhere!" (Manager of nursing)

"The guidelines do not provide a clear instruction about what has to be done at which point of time. They do not provide a schedule that clearly states when a catheter has to be removed." (Consultant of clinical microbiology)

Figure 7:

Mapping of risk factors according to PRECEED, incorporating the German context as derived from focus-group results (marked red).



3.2.3 Solution need: surveillance, feedback and integrated checklists

As mentioned above, systematic surveillance has been reported to be useful in increasing risk awareness, reducing catheter use and avoiding prolonged catheterising. According to the implications of issues of accountability and associated standardisation, a system for surveillance should incorporate sets of checklists that link tasks that have to be done to the persons responsible. However, there are a couple of reasons why this has not been implemented yet (see tables 3 & 4).

First of all, highly trained professionals would be needed to conduct the data for systematic surveillance. According to the participants there is a shortage of qualified staff.

> *"The main issue concerning the implementation of systematic surveillance is the lack of qualified professionals available for this task. We have enough staff to conduct surveillance in single care units and let the system rotate, but we lack resources to do it in every care unit where catheters are in use."* (Consultant of clinical microbiology)

Second, the existing staff has a high workload and lack resources to do additional tasks.

> *"We have on average two caregivers in each shift. They are responsible for 26 patients, yielding a rotation of 1/13."* (Manager of nursing)
>
> *"It is without question that surveillance makes a lot of sense. However, it makes no sense to add additional workload to those who are already at their limits."* (Link nurse)

Another barrier to surveillance refers to the lack of standardisation between evaluation criteria.

> *"It is a general problem of infection control that everyone is formulating criteria for evaluation. However, in the daily work practice, they are applied differently. Some are sitting in front of the PC and use routine data, whereas others go to the care units, talking to the patients and the caregiver and derive different data. That is a fundamental problem!"* (Consultant of clinical microbiology)

The nUTI-associated cost ambiguities are a strong barrier by creating a vicious circle: without systematic surveillance, the real costs of nUTI cannot be calculated, and without financial motivation, surveillance will not be implemented.

> *"The question is basically what has to be invested and what is the expected return. Without clarity, there is a lack of financial motivation."* (Consultant clinical microbiology)

Furthermore, digital patient folders are not available in every department. Therefore, data collection becomes more time-consuming for those without.

> *"There are three departments with digital patient folders. The hospital slowly implements them. However, it can take a while until we have one."* (Manager of nursing)

Another issue refers to non-compliance to checklists embedded in patient documentation. Some stakeholders neglect the system and therefore cause frustration among those who comply, which undermines the system's success.

> *"We have a similar system for antibiotic therapy. It is a good approach. It visualises what has to be done and who is responsible for decision making. Unfortunately, it does not work because one professional group does not comply, which leads to frustration among those who did."* (Consultant clinical microbiology)

Consequently, the above-mentioned barrier can become a strong facilitator for the implementation of surveillance once the vicious circle is penetrated.

> *"Essentially, we should be aware of the costs caused by nUTI in order to calculate how much could be saved by nUTI reduction. Only if the savings overweigh the costs for nUTI reduction could a new approach be created."* (Consultant clinical microbiology)

3.2.4 Solution need: educational staff training

Mutual agreement about the importance of further staff education exists. The stakeholders agree that there is an urgent need for increasing the quality of care consciousness with regards to nUTI, but some barriers limit extensive training. However, there are ways this approach can be realised (see table 5)

> *"It is without question that improved staff education is favourable."* (Consultant clinical microbiology)
>
> *"Staff education should emphasise nUTI-related awareness. In my opinion, quality of care-related awareness does not have the relative importance it should have."* (Manager of nursing)

The first main barriers refer to the time available for further education.

> *"The main barrier is definitely the time available for education. Where do I get the time to do proper education?" (*Consultant of clinical microbiology)

The second refers to a lack of staff motivation to actively participate in educational sessions.

> *"How can we motivate the staff to participate in educational training, not only physically but actively, with interest?"* (Consultant of clinical microbiology)
>
> *"In my opinion, the lack of interest and insufficient awareness of the problem are a big issue."* (Manager of nursing)

Furthermore, the concern has been formulated that adding educational training to a nurse's/physician's heavy workload may be inappropriate.

> *"We keep on realising, especially because we are from the hygiene background, that staff are torpedoed with educational programs. They should be trained in hygiene precautions, in fire control and prevention, and in issues specific to their particular profession. The pressure of educational training is strong for the average staff member. The question is which rate of training is appropriate, and which issues are of relative importance for each particular professional group."* (Consultant

clinical microbiology)

With regards to eLearning, the lack of availability of computers in every department may be a barrier.

> *"If eLearning systems are used, it depends on the availability of computers. For the average care-giver, it is frequently not possible to access a computer at the ward."* (Link nurse)

Further educational training could be integrated in team sessions to reduce the problem of missing time capacity.

> *"In my opinion, educational training should be integrated in team sessions, which are obligatory for the ward staff. Those who fail to participate must inform themselves and sign that they understood the information."* (Manager of nursing)

Additionally, the training should be tailored to the specific needs of different departments/functions to be more effective.

> *"The educational training should be tailored to the field of each profession, so that the staff can identify with the content; otherwise, the information will be neglected."* (Link nurse)

3.2.5 Values concerning a possible solution

It has been reported explicitly that a solution, however it is actually designed, should be embedded in daily work routines and become part of the health-care worker's working life in order to stimulate commitment.

> *"The most important thing about a solution is that it is lived by every stakeholder."* (Manager of nursing)

Table 3:

Solution need: Systematic surveillance of nUTI in every health-care department: Barriers and facilitators.

Barriers	Facilitators
Shortage of qualified staff to conduct data. High workload for existing staff. Lack of standardisation between evaluation criteria. Cost ambiguities. Lack of digital patient folders.	Hypothetically: removing cost ambiguities to motivate financial approaches for nUTI surveillance.

Table 4:

Solution need: Integration of checklists in patient documentation: Barriers and facilitators

Barriers	Facilitators
Different guidelines between health-care departments. Checklists that clearly schedule catheter-removal do not exist. Insufficient communication between health-care facilities. Staff does not adhere to checklists.	Would remove undesired allocations of blame.

Table 5:

Solution need: Educational staff training: Barriers and Facilitators.

Barriers	Facilitators
Lack of time.	Educational training could be integrated in team sessions.
Lack of staff motivation.	Training should be tailored to professionals' needs.
Heavy workload.	
Lack of computers (for eLearning).	

4. Discussion

4.1 Literature review

The results show that an amalgam of factors are involved in the emergence of nUTI. According to the review, the most striking cause of nUTI is a lack of staff awareness, which can be differentiated: awareness that is linked to the general perception of nUTI as a less important infection, to underestimated associated costs and severity, and to the monitoring of catheter duration and delayed removal. Another eminent risk factor is the guideline compliance in terms of catheter placement in unnecessary cases or the lack of proper maintenance.

However, it seems to be more a problem of the conscious perception of nUTI risk factors that precedes guideline compliance that leads to a neglect of urinary catheters within HCWs' daily work routines. Referring to the Transtheoretical Model of Behaviour Change (TTM), it can be assumed that the dimensions can be structured in a hierarchical fashion, as awareness has to precede intentional behaviour. Consequently, health-care workers should first be aware that catheters and the associated nUTI require attention, and then they should have enough education/information and motivation to adhere to the guidelines. According to Prochaska et al. (2008), the best way to increase risk awareness is conscious-raising, based on presenting relevant information and feedback

about the causes or consequences, and alternatives for a problem behaviour. An important parameter for use is that raising awareness must be quickly followed by an increase in the problem-solving ability and self-efficacy. According to the literature review, providing feedback on performance via surveillance has been linked to reductions in the lack of awareness (Andreessen et al., 2012), which can be seen as a direct act of conscious-raising and has been proven to be very effective.

The interventions that were included in this review frequently made use of prompts to remind physicians to remove catheters (Andreessen et al., 2012; Crouzet et al., 2007; Topal et al., 2005), which can be seen as triggers embedded in the care process. According to Prochaska et al. (2008), cues to action can facilitate the step from intentional stages to action stages, thus bridging the behaviour–intention gap. Consequently, systematic surveillance combined with cues to action has two advantages: it creates risk awareness through providing feedback on performance, which additionally increases capabilities, and stimulates HCWs to change their behaviour.

Furthermore, it is striking that many risk factors are associated with the storage of patient data. Catheter duration should be documented carefully at different stages of the care process, starting by admission if transferred from another care facility. As Wald et al. (2008) state, catheter use is under-documented in many patient charts. Given that different health-care departments within a hospital treat a single patient, improved information management via easily accessible patient folders is the only reasonable approach. Electronic data storage in the form of management and retrieval systems provide the advantage that information can be processed rapidly and is available wherever needed.

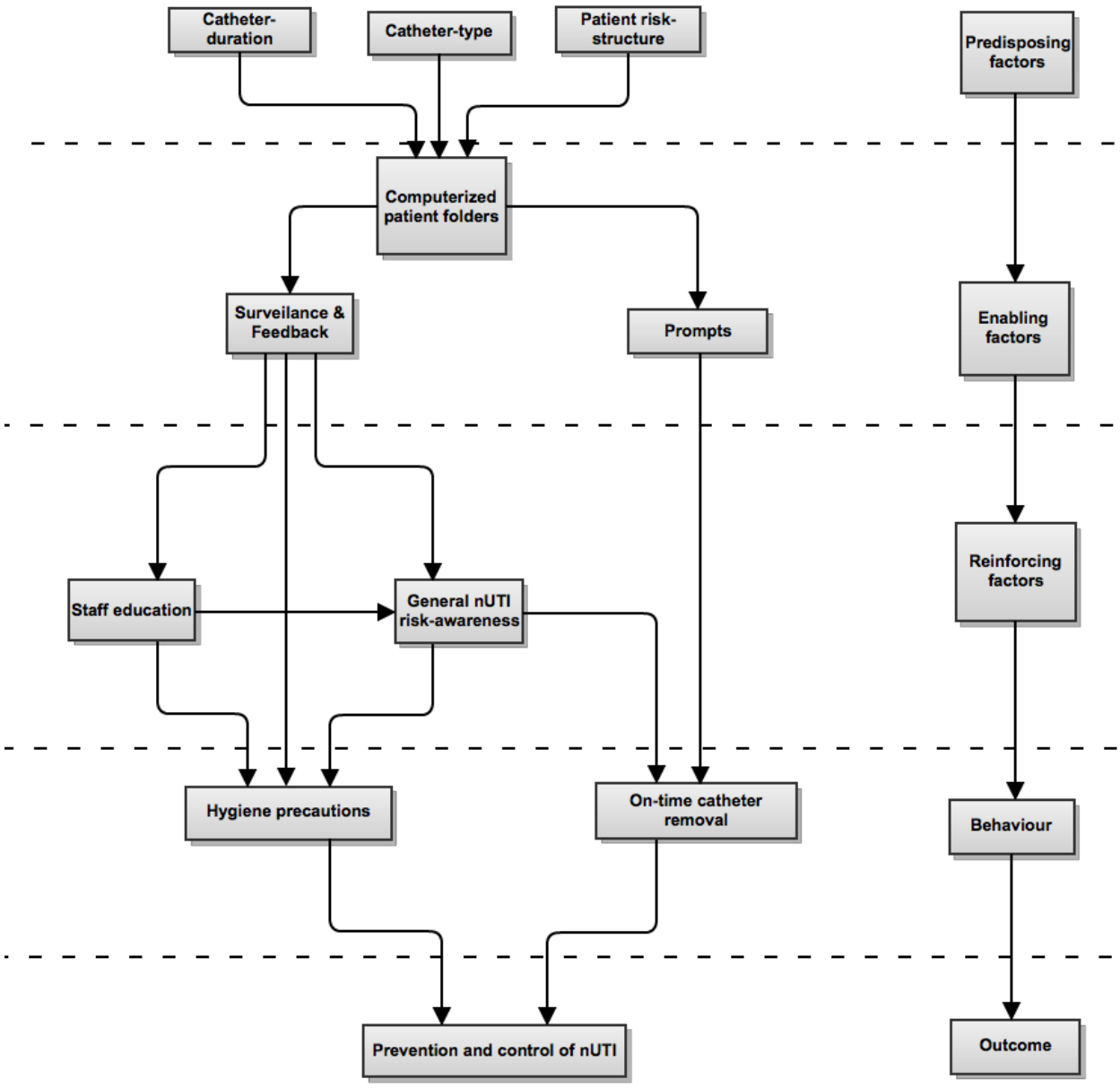
Using the PREECED model combined with implications of the TTM, the solution-related results can be combined according to their relationships and role within nUTI prevention and control into one framework (See figure 8). As the mapping of risk factors (figures 6 & 7) highlighted the hierarchical chain of causality leading to nUTI at different stages, the solution framework uses the same terminology, ranging from predisposing solution mechanisms to the ultimate outcome of nUTI reduction.

Direct behaviours that influence the prevention and controlling of nUTI are supposed to be on-time catheter removal and guideline compliance, which are both influenced by levels of general nUTI risk perception. The most important factor in this hypothetical model refers to the enabling factor of infrastructure in terms of computerised patient folders and templates (Andreessen et al., 2012; Topal et al., 2005), which can be assessed by every HCW, and contains data about a patient's risk structure, the catheter type in use and related duration. The central storage of such information enables the proper surveillance of nUTI incidence and associated risks and provides feedback to those who were involved. Furthermore, catheter duration can be monitored within the system and prompts for catheter removal made, thus creating awareness that catheters are in place. Both the direct monitoring of catheter duration and valid surveillance of nUTI are supposed to increase the general awareness of nUTI by enabling more sophisticated cost calculations and providing direct feedback on performance. The combination of increased risk awareness and constant surveillance and monitoring can be assumed to increase guideline adherence. However, this model has not been validated yet and is based on international literature that may not be applicable to the German context. It serves as a structural framework to think about the problem dimension in terms of an anticipated solution and has to be extended by findings from the focus group.

Identifying relevant stakeholders that are associated with the solutions proposed by the authors mentioned above is only broadly possible based on the literature review. In general, physicians and nurses are mentioned as potential stakeholders but there are many sub-professions and specialisations within the German care context, which differ in their scope of expertise and related daily work routines, for example operative physicians, lung physicians etc. This implies for this research, that stakeholders were invited to the focus group based on expert consultation for stakeholder identification.

Figure 8:

Structural solution framework derived from review results, mapped with PRECEED.



4.2 Focus group

First of all, there is a great extent of convergence between findings from international literature, as reported in the literature review, and the results of the focus group. The general risk factors are comparable: the duration urinary catheters in place, the type of hospital department, the transition between health-care departments and associated issues of documentation were reported.

The two major risk behaviours, delayed removal of urinary catheters and insufficient hygiene guideline compliance, were reported by the focus-group participants, too. In line with literature (Andreessen et al., 2012; Gastmeier et al., 2011), the participants highlighted the importance of surveillance for providing feedback and keeping stakeholders involved. The use of prompts as cues to action only gained second order priority, because without standardised guidelines and effective documentation, this feature seems to be quite useless. Comparable to Tiwari et al. (2012), the stakeholders therefore addressed the lack of standardised guidelines and mandatory scheduling of actions as the main issue. The effective interventions that were included in the review made use of digitalised patient folders and incorporated standardised guidelines and features such as prompts (Andreessen et al, 2012; Crouzet et al, 2007), and are thus grounded in a well-established infrastructure. In contrast, the focus-group results show that this is not entirely established in the German care context and that the change can take several years, depending on available resources. Despite these organisational barriers, convergence exists that nurses are a good source of information about patient status and therefore suitable for reminding physicians of tasks that have to be done, for example removing catheters.

Furthermore, there are factors that are specific to the German care context that differ from international literature and need to be targeted exclusively. The first refers to insurance policies that cause cost ambiguities. If a nUTI can be beneficial from a financial point of view, there is little motivation for key stakeholders in managerial positions to launch new nUTI precautions. On the other hand, without improved surveillance, the real incidence of nUTI in German hospitals will be underestimated, thus yielding little motivation to engage in preventive measurements. This vicious circle has to be penetrated to achieve German-wide change in nUTI-related risk perception and associated preventive measurements. The second factor refers to the lack of inter-departmental standardisation of guidelines, for example in postoperative care, and how they are embedded in patient documentation. Additionally, they are not embedded in daily working schedules and checked for compliance in a systematic way.

The general lack of nUTI-related risk awareness in the German care context, as mentioned by Gastmeier et al (2011), was reported by the focus-group participants as well. Two broad strategies were mentioned to increase risk awareness. The first refers to active, systematic surveillance that helps to monitor the overall incidence of nUTI and follow-up consequences. By visualising the importance of nUTI prevention and control, the stakeholders will recognise the relative importance of this issue. How this can be realised will be discussed more in depth in the section on the proposed eHealth solution framework. The second strategy refers to providing arguments for conscious-raising that are relevant for German health-care workers. Appealing to their sense for quality of care, job preservation and the prevention of multi-resistant pathogens may increase their risk awareness. Although this will not be sufficient as a stand-alone intervention, it can be an additional element of a possible eHealth application as discussed in the next section

The first and most promising solution would be the systematic surveillance of nUTI in every health-care department. Although highly recommended by the participants and international literature, the barriers for implementation overweigh the facilitators (see table 3). Integrating checklists in patient documentation to increase responsibilities and the proper scheduling of catheter removal is promising, too. However, several barriers can limit its implementation (see table 4). Mutual agreement about the importance of further staff education exists, especially with regards to raising consciousness for nUTI and related quality of care (see table 5). However, considerations of overly educating staff exist, especially taking the high workload in relation to time-consuming education into account. Therefore, educational training should be as least time consuming as possible. Although it could be feasible to increase nUTI-related education, it is questionable if such a measure would be effective without an increase in staff motivation to prevent nUTI, which is closely related to a lack of surveillance and associated feedback. If additional education is implemented, it should be emphasised to tailor the content to profession-specific needs.

Although the participants shared consensus on most of the topics and agreed on the major problems, it was important to have multiple stakeholders involved. Especially with regards to the

issues of the neglect of information provided by nurses, the nursing perspective added value to understanding the whole context. The heavy workload as the main barrier to surveillance, education etc. was strongly emphasised by the link nurse and the manager of nursing. In the light of this, a possible solution should target this issue explicitly. Consequently, the participatory approach yielded added value, highlighting the importance of stakeholder involvement in contextual inquiries

4.3 Proposed eHealth solution framework

The solution framework based on implications of international literature reflects the solution needs formulated in the focus group. Due to the strong convergence between literature and focus group, the approach seems to be promising but should be modified to be tailored to the specific context in Germany (see figure 9). In the following section, the solution-related results will be translated into a possible eHealth framework that can be used for further development.

It starts with a data storage, management and retrieval system, where the input for computerised patient folders should be enlarged, including remarks of physicians and nurses concerning the patient's status. This can be realised via a dashboard application for digital patient documentation that incorporates these options. As reported in the focus group, nurses and their closer relationship to the patients are an important source of information for physicians as decision makers in times of fast-changing patient structures. If a nurse is concerned about a patient's status or can provide additional information that is not part of the standard documentation formula, he/she can store the remark within the dashboard application.

In the next step, this information should be embedded in a clinical decision support system. The dashboard application for digital patient documentation could synchronise with an application for clinical decision support, where this information should be linked to standardised guidelines for further procedures. In the case of an indwelling urinary catheter, the system should schedule the appropriate time for removal as a function of catheter type and patient risk structure. Clear responsibilities for each action should additionally be assigned to each profession. Within the

clinical decision support application, integrated checklists should monitor which actions have been performed by each profession. This is easy to realise via the dashboard, as every user can get his/her own, personalised account. Consequently, the system can distinguish between users and their professions. This way, the system reduces the lack of clear responsibilities and associated allocations of blame. If the system realises that a catheter has not been removed, it can send prompts to the responsible profession that appear on their dashboard account.

If patient information is stored digitally and combined with the clinical decision support, computer-based surveillance is possible without additional workload for each department's staff, thus bridging the main barrier. Systematic surveillance enables the visualisation of nUTi-related consequences, which will lead to increased overall risk awareness. Additionally, a direct link should be established between non-compliance to standardised guidelines and nUTI incidence, yielding direct feedback on one's performance and visualising related consequences. The output of surveillance and checklist compliance should be integrated in short educational staff training sessions during team sessions and combined with arguments for conscious-raising to have the best possible impact on staff risk awareness, as well as their compliance to hygiene precautions. The arguments for conscious-raising, for example higher quality of care, are intended to increase the motivation of health-care workers to follow the training/feedback session more consciously, thus additionally facilitating its success. The feature of educational training could be realised as a dashboard application, too. The advantage would be that the content, and thus the link between surveillance and checklist compliance, could be tailored to the specific situation of a health-care department, thus increasing the relevance by avoiding too much time consumption. If, for example, the department of urology has to be prompted for catheter removal frequently, this and the related consequences can be visualised during team sessions. This way, education can be delivered as efficiently as possible without consuming large amounts of time, thus bridging the main barrier for staff education. Consequently, increased risk awareness and educational training will reinforce the success of the presented model.

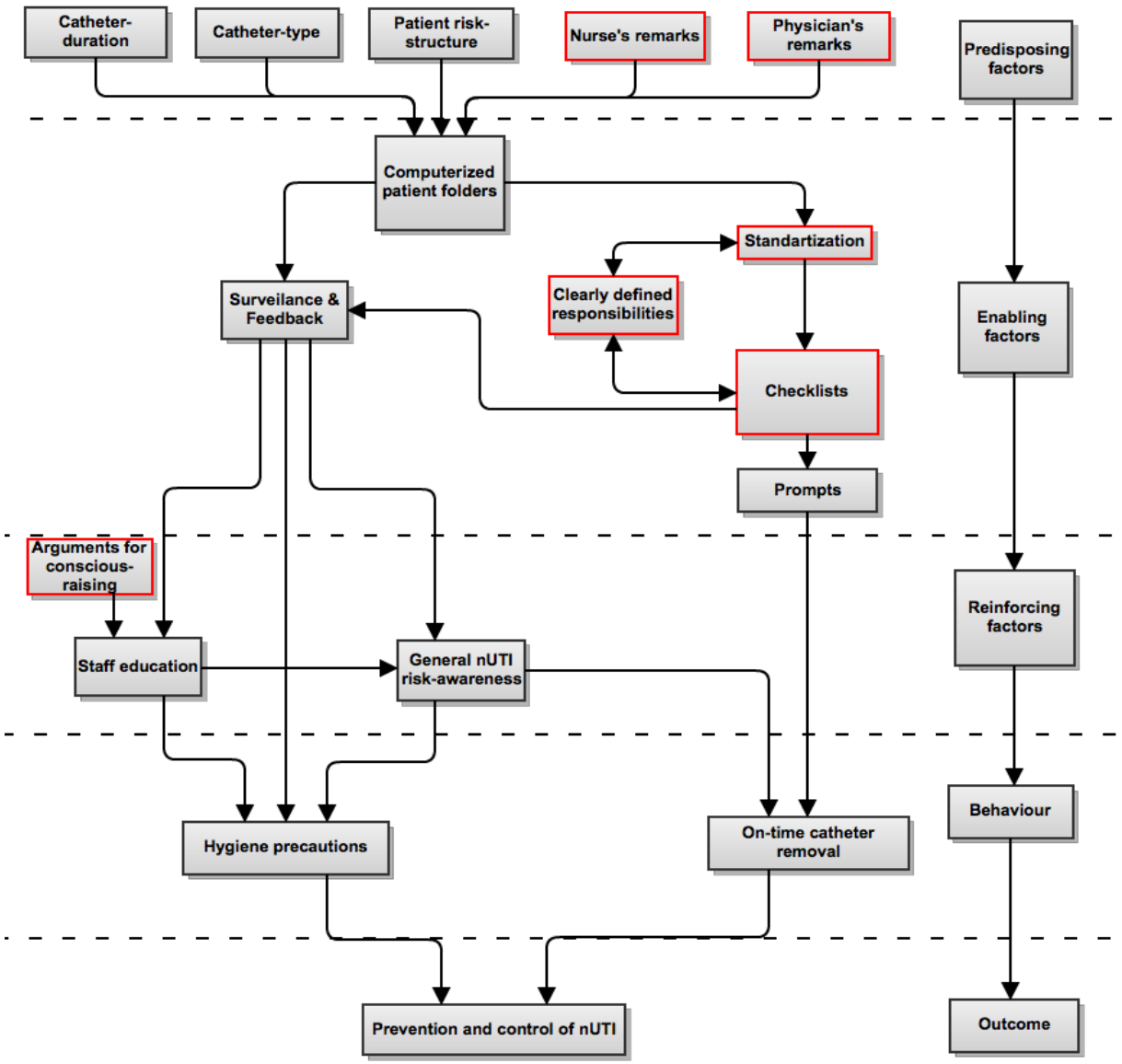
As the focus group showed, the most important value for this solution is that it is embedded in daily working life routines. The rise of new technologies enables a direct link between central data storage and devices in the close patient environment, for example through mobile tablet PCs. This way, the interface between digitalised patient information and health-care workers can be optimised. According to implications of the TTM, a tablet that uses this information to give feedback on performance would increase motivation and provide suggestions for the next step, thus increasing ability. Through prompts to action, the desired behaviour can be triggered. Consequently, this system would have two advantages. First, it increases quality of care through standardisation, clear responsibilities and feedback on performance. Second, it enables the systematic surveillance of nUTI without demanding more expenditure on additional staff and by using the same evaluation criteria.

The major barrier for strategic implementation is thought to be the nUTI-related cost ambiguity on the organisational level. However, a review of handheld computer adoption in health-care settings found that this approach is supposed to be cost-efficient in terms of reducing costs for paper-based documentation and associated time restraints for administration (Lu, Xiao, Sears, & Jacko, 2005). A PDA may cost €300 but is a one-time expenditure, whereas paper-based documentation is an on-going expenditure with an estimated cost of €60 for each document when integrating costs for administration and storage. Therefore, replacing the paper-based system with tablets is less expensive in the long-term perspective. After five patients, the costs would break even. Taking into account that every nUTI costs about €1000, and there is reason to assume that the real costs are underestimated, avoiding nUTI by implementing the suggested system would be an additional benefit. Therefore, financial decision makers should consider this approach as cost-efficient. For those who are not financially motivated, such as physicians and nurses, the increased quality of care should be the main argument. However, it must be mentioned that this calculation is based on calculations within the Dutch health-care system and thus may vary in the German context.

As the proposed eHealth solution shows, there are many ways eHealth technology can support clinical decision making and help improve quality of care. The biggest advantage is simply that digitally stored patient data enables many additional features, such as surveillance and integrated checklists. Furthermore, it highlights the importance of stakeholder involvement. Without a holistic understanding of the problem dimension, the eHealth technology may miss its purpose. With regards to the proposed framework, it would be ineffective without being integrated in the daily work routines via tablets, a consideration that was highlighted by the focus group.

Figure 9:

Suggested solution framework adapted to the German context, mapped with PRECEED



4.4 Implications for EurSafety Health-Net

The eHealth solution as suggested above would be in line with the goals of EurSafety Health-Net by increasing quality of care and patient safety when implemented successfully. Furthermore, it would enable improved epidemiology of nUTI. According to laws governing data protection and data security, the dashboard version must run on German servers without being directly synchronised with the Dutch servers. Only this way can the protection of patient information be guaranteed. Nevertheless, the evaluation results can be embedded in the overall dashboard database to provide insight into nUTI epidemiology in the cross-border region, which would increase quality of care indirectly, too.

Although the proposed approach would be promising in reducing nUTI in the German care sector, it must be mentioned that related cost ambiguities may seriously hinder its implementation. Therefore, the insurance policies should additionally be tackled on higher ecological levels next to the development of this eHealth technology. From the viewpoint of an insurance company, redesigning the cost structure of nUTI may increase their profits, as they have to pay for less nUTI. The EurSafety Health-Net, as a platform with many network relationships within the health-care system, could use its resources to vindicate this approach effectively by convincing the insurance companies' decision makers to reconsider their cost structure. Although this may result in a loss of money for the hospitals in the short-term perspective, as some nUTI are not beneficial from a financial point of view anymore, it is in line with the overall health-care goal of quality of care. Although this research focusses on nUTI, it is reasonable that the suggested eHealth technology could be extended to other nosocomial infections. This may reduce the overall infection incidence and therefore reduce costs.

4.5 Implications for further research based on the CeHRes roadmap

As the context is now sufficiently understood, the next step should elaborate on standardising nUTI-related guidelines, as this is central to embedding checklists in the eHealth

system. Again, relevant stakeholders should be involved in this process. Furthermore, the proposed technology should be explained to the stakeholders and associated values should be ranked with critical decision-making systems, in order to formulate stakeholders' functional and technical requirements. Then, the research should focus on the design process based on these requirements by developing a prototypical version in cooperation with prospective users and other stakeholders. Afterwards, operationalisation should take place, incorporating the development of marketing plans, and planning the integration into work procedures. As the legal aspect of implementation may be more complex than anticipated in this paper, research in the field of German law should target this issue explicitly.

Finally, summative evaluation should be conducted to evaluate how the proposed eHealth solution is used and what the effects on nUTI incidence are. This whole research should be considered as an iterative cycle, as the results of evaluation could be used to redesign the technology when necessary.

4.6 Limitations

As a literature review has been used as a starting point for this research, associated sources of bias may have confounded the validity of this study. The tendency that research yielding significantly positive results is more frequently published may have resulted in publication bias. However, the great convergence between review and focus group suggests successful triangulation, thus minimising this concern.

One of the invited stakeholders did not participate due to her high work schedule. This may have resulted in a missing stakeholder perspective, which may have changed the results. However, the consultant clinical microbiology was able to fill this gap based on his own experience in this field. Therefore, it is likely that this source of bias has been minimised.

Furthermore, the participants were from the field of urology, and thus familiar with and sensitised to nUTI. One may argue that their opinion does not reflect other hospital departments

because they are specialists in this field. On the other hand, the link nurse and the consultant clinical microbiology work closely together with other departments and thus made useful observations. Consequently, their perspective provided in-depth insight into the problem dimension.

5. Conclusion

The determinants that lead to nUTI incidence are similar compared to the international context. Given that urinary tract infections are the most common nosocomial infection across various countries and care settings (Tenke et al., 2008), explaining about 40% of infection variance, it can be concluded that there is an urgent need within the German care setting to find a suitable prevention strategy. The system as it is in place now is not sufficient for reducing nUTI incidence and too many barriers hinder its extension. The vicious circle of surveillance and cost ambiguities cannot be penetrated by the existing system, so a new approach is necessary. The suggested eHealth technology is a promising approach that can serve the purpose of EurSafety Health-Net to increase patient safety.

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APPENDIX

Focus-group design.

Zeit	Wer	Was	Bemerkung
1min	Ron/Alex	Begrüßung	
5min		Team vorstellen	- Wer sind wir? - Warum arbeiten wir zusammen? - Center for eHealth Research and Disease Management (IBR) & Institute for Social Sciences and Technology - EurSafety Health - 'Roadmap' fur Health Entwicklung
5min		Das Ziel dieser Fokus-Gruppe	-Schaffen einer wissenschaftlichen Grundlage für die Kontrolle und Prävention von nosocomialen Harnwegsinfektionen im deutschen Gesundheitssektor via einer online Anwendung (z.B. eLearning, eCoaching) -Steigerung des **Risikobewusstseins** im Bezug auf nosocomiale Harnwegsinfektionen. Sowohl hinsichtlich der damit in Verbindung stehenden Kosten als auch der medizinischen Konsequenzen, motiviert durch die Divergenz zwischen deutscher Einschätzung und internationalem Vergleich. ⅄Wie schätzen die jeweiligen beteiligten Berufsgruppen das Risiko ein ? ⅄Wie kann diese Einschätzung effektiv erhöht werden? -Welche Ursachen werden mit nosocomialen Harnwegsinfektionen in Verbindung gebracht? ⅄Welche Rolle spielen dabei die jeweiligen Berufsgruppen? ⅄Wie welche Lösungsansaetze sind sinnvoll? ⅄Wie koennen die Lösungsansaetze im deutschen Krankenhausalltag umgesetzt werden? ⅄Welche Anforderungen stellt die jeweilige Berufsgruppe an die Lösung? Im Rahmen dieser Fokus-Gruppe werden wir zunächst auf das Harnwegsinfektion bezogene Risiko eingehen und anschliessen anhand von Fallbeispielen die jeweiligen Ursachen zusammen analysieren. Es ist wäre wünschenswert wenn sie ihre **Profession-spezifischen Erfahrungen** in den folgenden Diskurs mit einfliessen lassen würden.

			Zögern sie nicht i**hre Meinung** einzubringen!
2min		Ankündigung der audio-visuellen Aufzeichnung	Nachdruck auf wissenschaftlichen Zweck. Material wird nach Analyse sofort vernichtet
5min		Unterschreiben der **Einwilligungserklärung**	Formular liegt der Mappe bei.
In der Zwischenzeit		Kamera und Audio-Rekorder **anschalten**!	
5min		Kurze Vorstellrunde	Name, Berufsgruppe
15min		Divergenz zwischen deutscher Einschätzung und internationalem Vergleich.	„Welchen Stellenwert haben nosocomiale Harnwegsinfektionen ihrer Meinung nach innerhalb dieses Krankenhauses?“ **Flipover** Aus dem Gespräch mit Herrn Hermann ging hervor das Harnwegsinfektionen relativ wenig Bedeutung beigemessen wird. Diese Annahme wird auch durch eine Analyse von KISS Datenbeständen unterstützt. (Gastmeier, Behnke, Schwab, & Geffers 2011). Das Gespräch kann nun zwei Richtungen nehmen: 1.Die Beteiligten halten Harnwegsinfektionen für relativ harmlos und sehen keinen Grund dass die Risikowahrnehmung erhöht werden muss. (Wahrscheinlich) 2.Die Beteiligten teilen die Ansicht dass Harnwegsinfektionen unterschätzt werden. Richtung 1: Diskussion mit RON: Harnwegsinfektionen als eine der häufigsten nosocomialen Infektionen. Verbindung zur Urosepsis, MRSA und Mortalität, sowie damit in Verbindung stehende Kosten. Richtung 2: Direkt weiter zum nächsten Punkt.
15min		Wie kann die Risikowahrnehmung in deutschen Krankenhäusern erhöht werden	1. Empfehlung der KISS Analyse: Harnwegsinfektionen sollten in jedem Krankenhaus internen Überwachungssystem aufgenommen werden. Die Inzidenz Erkennung und Kostenrelevanz würde dadurch erhöht. ⅄Was halten die jeweiligen Stakeholder von diesem

			Ansatz? ⅄Was steht der Umsetzung im Wege? (Barriers) ⅄Wie könnte man es erleichtern? (Faciliators) Die Teilnehmer werden gebeten diese Punkte stichpunktartig auf dem entsprechenden Formular aufzuschreiben. **Flipover** Zusammentragen + Diskussion 2. Risikobewusstsein durch Informationsverbreitung erhöhen (Conscious raising) ⅄Welche Argumente sind für die jeweiligen Berufsgruppen relevant? (stimuliert durch Gespräch mit RON) **FLIPOVER** Beste Argumente für jeweilige Berufsgruppe !
2 min		Überleitung zum nächsten Thema	Bis jetzt haben wir uns damit beschäftigt für wie gefährlich Harnwegsinfektionen von den Beteiligten gesehen werden. Die Logik dahinter: Erst wenn Jemand sich eines Problems bewusst ist und motiviert ist dagegen anzugehen, kann Prävention erfolgreich sein. Im Folgenden geht es um die Prozesse die zur Entstehung von Harnwegsinfektionen führen. Als Anregung werden wir ihnen gleich 2 Fallbeispiele präsentieren.
10 min		Arbeitszettel: **Fallbeispiel 1** Eine 60 jährige Frau mit einer Diabetes Typ 2 Diagnose wurde wegen eines Sturzes in das Krankenhaus aufgenommen. Im Rahmen der Behandlung wurde ihr eine neue Hüfte eingesetzt. Jetzt, 10 Tage später, klagt die Frau über Unwohlsein und Schwindelgefühle. Sie hat seid 2 Tagen	Anweisung: Mitlesen und das Formular in der Arbeitsmappe erst alleine ausfüllen: Stellen sie sich vor, dass sie diesem Patienten gegenüber stehen. 1.Was könnten die Ursachen für diese Symptome sein? 2.Welche Rolle könnte meine Berufsgruppe bei der Entstehung gespielt haben? 3.Fehlt jemand in dieser Runde der von einer solchen Situation betroffen ist? 4.Was ist akut zu unternehmen? 5.Welche Information wird benötigt? 6.Wo sehen sie aus eigener Erfahrung Konfliktpotential?

		nichts mehr gegessen und hat eine gemessene Temperatur von 38,9 Grad. Das Blutbild: Leuco: 12 ; CRP: 150. Die Lungen sind nicht auffällig. Kein Durchfall, kein Erbrechen.	
10 min		Gemeinsamens zusammentragen der Ergebnisse	**„Flipover“** Berufsgruppe: Antwort auf Frage 1-5
15min		Ursache – Lösung Fallbeispiel 1 Umsetzbar?	Das oben genannte Fallbeispiel zielt auf die folgende Probleme ab: ⅄ Fehlerhafte Katheter -wartung ⅄ Zu langer Katheter -einsatz Die internationale Literatur schlägt die folgenden Lösungsansaetze vor. Wir sind daran interessiert, inwiefern sie deren Umsetzbarkeit und Effizienz beurteilen: ⅄ Merksymbole in Patientenakten die vor zu langer Katheter-benutzung warnen. (Bsp. Sticker die Farbe wechseln) ⅄ Bessere Personal -schulung über Richtlinien und Konsequenzen. ⅄ Formular: 1.Was halten die jeweiligen Stakeholder von diesem Ansatz? 2.Wie koennte es umgesetzt werden? 3.Was steht der Umsetzung im Wege? (Barriers) 4.Wie könnte man es erleichtern? (Faciliators) 5.Was wäre für ihre Berufsgruppe die wichtigste Eigenschaft dieser Lösungsstrategie **Flipover (3x)**
10min		Gemeinsamen Zusammentragen der Ergebnisse	Diskussion zu beiden Loesungsansaetzen.
10min		Arbeitszettel: **Fallbeispiel 2** Ein 75 Jahre alter Mann wohnt seid 5 Jahren in einem Pflegeheim und hat einen Harnwegskatheter seid	Anweisung: Mitlesen und das Formular in der Arbeitsmappe erst alleine ausfüllen: Stellen sie sich vor, dass sie diesem Patienten gegenüber stehen. 1.Was könnten die Ursachen für diese Symptome sein? 2.Welche Rolle könnte meine Berufsgruppe bei der

		8 Monaten. Er wird mit einer Sepsis schwer krank im Krankenhaus aufgenommen. Zuvor hat er bereits seid 7 Tagen cotrimoxasol (2x985) eingenommen.	Entstehung gespielt haben? 3.Fehlt jemand in dieser Runde der von einer solchen Situation betroffen ist? 4.Was ist akut zu unternehmen? 5.Welche Information wird benötigt? 6.Wo sehen sie aus eigener Erfahrung Konfliktpotential?
10min		Gemeinsames zusammentragen der Ergebnisse	**„Flipover“** Berufsgruppe: Antwort auf Frage 1-5.
15min		Ursache – Lösung Fallbeispiel 2 Umsetzbar?	Das oben genannte Fallbeispiel zielt auf die folgenden Probleme ab: ⅄ Ineffizienter Antibiotika -einsatz ⅄ Gesetzter Harnwegkatheter vor Aufnahme. Die internationale Literatur schlägt die folgenden Lösungsansaetze vor. Wir sind daran interessiert, inwiefern sie deren Umsetzbarkeit und Effizienz beurteilen: ⅄ Verbesserter Informationsaustausch zwischen Pflegeheimen und Krankenhäusern. ⅄ Mikrobiologische Testverfahren vor Antibiotika-Behandlung Formular Arbeitsmappe: 1.Was halten die jeweiligen Stakeholder von diesem Ansatz? 2.Wie koennte es umgesetzt werden? 3.Was steht der Umsetzung im Wege? (Barriers) 4.Wie könnte man es erleichtern? (Faciliators) 5.Was wäre für ihre Berufsgruppe die wichtigste Eigenschaft dieser Lösungsstrategie
10min		Gemeinsames zusammentragen der Ergebnisse	Diskussion zu beiden Loesungsansaetzen.