ZIKA: AN OLD VIRUS WITH A NEW FACE
ZIKA: STAR VIRUS Z NOVIM OBRAZOM

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Editorial

ABSTRACT

Zika virus is a mosquito-borne flavivirus that represents a public health emergency at the ongoing epidemic. This obscure virus was limited to sporadic cases in Africa and Asia, until the emergence of Zika virus in Brazil in 2015, when it rapidly spread throughout the Americas. Most Zika virus infections are subclinical or characterized by mild febrile illness. However, neurological complications, including Guillain-Barré syndrome in adults, and congenital anomalies, including microcephaly in babies born to infected mothers, raised a grave concern. Currently, there is no specific antiviral treatment or vaccine available for Zika virus infection. Thus, international public health response is primarily focused on preventing infection, particularly in pregnant women, and on providing up-to-date recommendations to reduce the risk of non-vector transmission of Zika virus.

Keywords:
Zika virus, emerging infection, microcephaly, neurological complication, sexual transmission

IZVLEČEK

Zika je virus iz rodu flavivirusov, ki se prenaša s komarjevim pikom, in predstavlja javnozdravstveno grožnjo v trenutni epidemiji. Ta nepoznan virus je bil omejen na sporadične primere v Afriki in Aziji vse do pojava v Braziliji leta 2015, ko se je bliskovito razširil v obeh Amerikah. Večina okužb z virusom Zika je subkliničnih in se kažejo kot blaga bolezen z vročinskim stanjem. Najbolj zaskrbljujoči pa so nevrološki zapleti, vključno s sindromom Guillain-Barré pri odraslih ter prirojene nepravilnosti, kot je mikrocefalija pri novorojenčkih, ki se rodijo okuženim materam. Trenutno ne obstaja specifično protivirusno zdravljenje ali cepivo proti okužbi z virusom Zika. Odziv mednarodnega javnega zdravja se osredotoča na preprečevanje infekcije, predvsem pri nosečih ženskah in podajanju posodobljenih priporočil za zmanjšanje tveganja za nevektorsko prenašanje virusa Zika.

Ključne besede:
virus Zika, porajajoča se okužba, mikrocefalija, nevrološki zapleti, spolni prenos

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1 INTRODUCTION

Zika virus (ZIKV) is an arthropod-borne flavivirus that was first isolated from a febrile Rhesus macaque monkey and from *Aedes africanus* in the Zika forest of Uganda in 1947. The first human infection was reported from Nigeria in 1954, and the evidence of virus circulation was observed in the next few decades within several African and Southeast Asian countries (1). Symptomatic ZIKV infections were limited to sporadic cases only. Thus Zika virus did not attract interest from medical or scientific community until 2007, when the first major outbreak of ZIKV infection appeared in Micronesian island Yap, where nearly 75% of the population were infected. The second large outbreak occurred in 2013-14 in French Polynesia, where ZIKV was implicated in approximately 30,000 symptomatic cases with an unusual increase in the number of Guillain-Barré Syndrome (GBS) cases (2). Subsequently, ZIKV infection has expanded through the Pacific islands, and, in May 2015, initial cases were confirmed in Northeast Brazil. Since then, ZIKV epidemic spread dramatically across the Latin America and Caribbean (3). Shortly after ZIKV emerged in Brazil, frequent reports of microcephaly, foetal brain malformations and other neurological disorder coincided with ZIKV infections (4). Thus, on 1 February 2016, the World Health Organization (WHO) declared that the clusters of cases of microcephaly and neurological disorders occurring in areas with Zika virus transmission represent a public health emergency of international concern (5).

2 TRANSMISSION

Zika virus is primarily transmitted to people through the bite of an infected mosquito from the *Aedes* genus, mainly *Aedes aegypti*. *Aedes* mosquitoes usually aggressively bite during the day, peaking during early morning and late afternoon. The same mosquito species transmits dengue, chikungunya and yellow fever viruses. Other *Aedes* mosquito species, like tiger mosquitoes (*A. albopictus*), can potentially serve as vectors, which indicates a possible threat of ZIKV spread in the United States and/or Southern Europe (1, 2). There is increasing evidence of non-vector-borne transmission, particularly mother-to-child transmission and sexual transmission. Vertical transmission (from mother to foetus) has been most frequently described with adverse outcomes in babies, presenting with congenital brain abnormalities, including microcephaly or foetal death (4). ZIKV can be detected in seminal fluid for up to two months after the onset of clinical symptoms. All but one published cases of sexual transmission have been from the symptomatic male, whose sexual activities may have occurred before, during or after Zika symptom onset, to their partner (6).

1 UVOD

Virus Zika (ZIKV) je virus iz rodu flavivirusov, ki se prenaša s pikom komarjev. Prvič so ga osamili leta 1947 pri opici rezus makaki in komarju ščitarju (*Aedes africanus*) iz gozda Zika v Ugandi. Prvo človeško okužbo so zabeležili v Nigeriji leta 1954, dokazi o prenašanju virusa pa so prisotni v naslednjih nekaj desetletjih znotraj več afriških in južno vzhodnih azijskih državah (1). Simptomatske okužbe ZIKV so bile omejne le na sporadične primere. Šele leta 2007 je virus Zika privabil zanimanje s strani medicinske in znanstvene skupnosti, ko se je pojavil prvi večji izbruh okužbe z ZIKV na mikronezijskem otoku Yap, kjer je bilo okuženih skoraj 75% prebivalstva. Drugi večji izbruh so zabeležili v letih 2013 in 2014 v francoski Polineziji, ker se je ZIKV pojavil v približno 300.000 simptomatskih primerih z nenavadno povišanim številom oseb s sindromom Guillain-Barré (GBS) (2). Posledično se je okužba z ZIKV razširila na pacifiške otoke, v maju 2015 pa so bili potrjeni prvi primeri v severovzhodni Braziliji. Od takrat se je epidemija ZIKV dramatično razširila v Latinski Ameriki in Karibih (3). V zelo kratkem času po pojavu ZIKV v Braziliji so pogosto poročali o mikrocefaliijah, fetusnih možganskih deformacijah in drugih nevroloških motnjah, ki so jih povezovali z okužbo z ZIKV (4). 1. februarja 2016 je Svetovna zdravstvena organizacija (WHO) izjavila, da množični primeri mikrocefalije in nevroloških motenj, ki se pojavljajo na področjih, kjer se prenaša virus Zika, predstavljajo javnozdravstveno grožnjo mednarodnega pomena (5).

2 PRENAŠANJE

Virus Zika se primarno prenaša na ljudi s pikom okuženega komarja iz rodu *Aedes*, predvsem komarja ščitarja, *Aedes aegypti*. Komarji iz rodu *Aedes* običajno pikajo agresivno podnevi, najbolj pa zgodaj zjutraj ali pozno popoldne. Ista vrsta komarjev prenaša tudi viruse denge, čikungunje in rumene mrzlice. Ostali komarji iz rodu *Aedes*, kot je tigrasti komar (*Aedes albopictus*) lahko potencialno delujejo kot vektorji, kar pomeni morebitno grožnjo razširjenosti ZIKV tudi v Združenih državah Amerike in/ali južni Evropi (1, 2). Pojavlja se vedno več dokazov o nevektorskem prenosu virusa Zika, predvsem z matere na otroka in s spolnimi odnosi. Vertikalno prenašanje (z matere na plod) je najbolj pogosto opisano prenašanje s škodljivimi izidi pri novorojenčkih, torej prirojenimi možganskimi nepravilnostmi, vključno z mikrocefalijo in smrtjo otroka (4). ZIKV se lahko nahaja tudi v semenski tekočini do dva meseca po nastopu kliničnih simptomov. Pri vseh, razen pri enem izmed objavljenih primerov spolne prenosljivosti, je prenašalec simptomatski moški, ki je imel spolne odnose pred, med in po nastopu simptomov

Other modes of transmission, such as blood transfusion and solid organ and tissue transplantations, are being investigated (7).

3 CLINICAL PRESENTATION AND COMPLICATION

The epidemiological data suggest that only 20% of ZIKV infections are symptomatic. The incubation period of Zika virus disease is not clear, but it is likely to be a few days. The symptoms are mild and self-limiting, involving fever, arthralgia, maculopapular rash, conjunctivitis, headache, retro-orbital pain and myalgia. These nonspecific symptoms are similar to other arbovirus infections, such as dengue and chikungunya, the diseases that share the same endemic areas and virus vectors as ZIKV (1) . Thus, the diagnosis of ZIKV infection in endemic regions based on clinical presentation alone can be wrong. The other usual differential diagnoses are measles, rubella, parvovirus and enterovirus infections, and malaria (2). However, the main concern is increasing evidence that ZIKV infection results in severe neurological complications – Guillain-Barré syndrome in infected patients, and in congenital abnormalities with microcephaly, spontaneous abortion, and intrauterine growth restriction of babies (4, 8). After a comprehensive review of evidence, there is scientific consensus that Zika virus is a cause of microcephaly and Guillain-Barré syndrome. However, many questions remain, including various spectra of birth defects caused by vertical ZIKV transmission, the degrees of risks of adverse outcomes among foetuses with regard to the ZIKV infection and the foetus gestation ages, and other possible (co)factors that might enhance ZIKV infection (5).

4 TREATMENT

There is no specific antiviral treatment available for Zika virus disease. Treatment is symptomatic and supportive and can include good hydration, and the use of analgesics, antipyretics and anti-histamines for pruritic rash. Due to the similar, nonspecific symptoms and geographic distribution, patients with suspected ZIKV infections should be evaluated and managed for possible dengue or chikungunya virus infection (4). Acetylsalicylic acid (Aspirin) and other non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided until dengue can be ruled out, in order to reduce the risk of haemorrhage (1). People infected with Zika should be protected from further mosquito exposure during the first week of illness, so as to decrease the risk for human-to-mosquito-to-human transmission, and thus minimize the risk of local transmission (9).

okužbe z virusom Zika (6). Ostali načini prenašanja, kot so transfuzija krvi in presaditev organov in tkiva, se še preiskujejo (7).

3 KLINIČNA PREDSTAVITEV IN ZAPLETI

Epidemiološki podatki nakazujejo, da je le 20% okužb z ZIKV simptomatskih. Inkubacijska doba okužbe z virusom Zika ni jasno določena, verjetno pa traja le nekaj dni. Simptomi so milejši in so običajno samoomejujoči, vključujejo pa vročino, bolečino v sklepih, makulopapulozni izpuščaj, vnetje očesne veznice, glavobol, retro-orbitano bolečino in bolečine v mišicah. Ti nespecifični simptomi so podobni drugim okužbam z arbovirusi, kot sta denga in čikungunja, bolezni, ki si z ZIKV delita endemska področja in virusne prenašalce (1).

Diagnoza okužbe z ZIKV v endemskih področjih na podlagi izključno klinične predstavitve je lahko napačna. Ostale pogoste diferencialne diagnoze so ošpice, rdečke, parvovirus, okužbe z enterovirusi in malarija (2). Vseeno je zaskrbljujoče vedno večje število dokazov, da okužba z ZIKV pomeni hude nevrološke zaplete: sindrom Guillain-Barré pri okuženih bolnikih in prirojene nepravilnosti, kot je mikrocefalija, spontani splav in znotrajmaternična omejitev rasti pri otrocih (4, 8). Po temeljitem pregledu dokazov obstaja znanstveno splošno strinjanje, da je virus Zika vzrok za mikrocefalijo in sindrom Guillain-Barré. Ostaja pa še veliko nerešenih vprašanj, vključno z raznolikimi spektri prirojenih nepravilnosti, ki jih povzroča vertikalno prenašanje ZIKV, stopnjo tveganja za škodljiv izid glede na okužbo z ZIKV ter gestacijsko doba ploda in ostali morebitni dejavniki, ki bi lahko povečali okužbo z ZIKV (5).

4 ZDRAVLJENJE

Za bolezni, ki jih povzroča virus Zika, ni specifičnega protivirusnega zdravila. Zdravljenje je simptomsko in podporno ter vključuje dobro hidracijo in uporabo analgetikov, antipiretikov in antihistaminikov za pruritične izpuščaje. Zaradi podobnih, nespecifičnih simptomov in enakih endemskih področij, je potrebno bolnike, za katere se sumi, da so okuženi z ZIKV, pregledati tudi za morebitno okužbo z virusom denge ali čikungunje (4). Med zdravljenjem se je potrebno izogibati acetilsalicilni kislini (Aspirin) in ostalim nesteroidnim protivnetnim zdravilom (NSAID), dokler se ne izloči možnosti okužbe z dengo zaradi zmanjšanja tveganja za krvavitev (1). Bolnike, okužene z virusom Zika, je potrebno zaščititi pred nadaljnjimi piki komarjev v prvem tednu bolezni za zmanjšanje tveganja za prenos virusa s človeka na komarja, s tem pa se zmanjša tudi tveganje za prenašanje virusa na ljudi v bližnji okolici (9).

5 PREVENTION, CONTROL AND CURRENT RECOMMENDATIONS

No vaccine or prophylactic treatment is currently available for Zika virus infection. Vaccine projects are at an early stage, but ZIKV vaccine is technologically feasible. However, there are still many unanswered questions about the virus, which need to be solved before a potential vaccine or specific immune prophylaxis (e.g., for pregnant women) is administered to the public (1, 4). Primary prevention is based on the protection against mosquito bites. Personal protection measures, such as applying mosquito repellents and wearing long-sleeved shirts and long trousers to cover as much of the body as possible, especially during mid-morning and late afternoon hours, are necessary. Sleeping in screened or air-conditioned rooms or the use of insecticide-treated mosquito bed nets are recommended. A continuous control of mosquito population by removing their possible breeding sites should be applied around everyone's dwellings (2).

It is recommended that pregnant women and women who are planning to become pregnant should postpone non-essential travel to areas of active ZIKV transmission. Persons with chronic illnesses or immune disorders are requested to consult their doctors before travelling to ZIKV endemic areas (10).

Sexual transmission of Zika virus through semen has been repeatedly documented in several different countries lately. Therefore, to reduce the risk of sexual transmission and potential pregnancy complications related to ZIKV infection, practicing safer sex (including the use of condoms) or abstaining from sexual activity is recommended throughout pregnancy to protect the foetus. In addition, there is also a recommendation for the people returning from ZIKV endemic areas that they should apply safer sexual practices or abstain from sex for at least 8 weeks after their return, even if no symptoms are present. Besides, if men experience Zika virus symptoms, they should practice safe sex or consider abstinence for at least 6 months. Couples that are planning pregnancy should wait at least 8 weeks before trying to conceive if no symptoms of Zika virus infection appear, or 6 months if one or both members of the couple are symptomatic (11).

5 PREPREČEVANJE, NADZOR IN TRENUTNA PRIPOROČILA

Trenutno ni na voljo cepivo ali profilaktično zdravljenje za okužbe z virusom Zika. Projekti s cepivi so v zelo zgodnji fazi, vendar je možnost izdelave cepiva proti virusu Zika tehnološko verjetna. Prav tako ostaja veliko odprtih vprašanj glede poznavanja samega virusa, na katera je potrebno odgovoriti pred splošno uvedbo morebitnega cepiva ali specifične imunske profilakse (npr. za ženske v nosečnosti) (1, 4). Primarno preprečevanje pred okužbo je oblikovano na podlagi zaščite pred piki komarjev. Osebna zaščita vključuje uporabo repelentov proti komarjem in oblačil z dolgimi rokavi in hlačnicami, da zmanjšamo izpostavljene dele kože, predvsem zjutraj in pozno popoldne. Priporoča se spanje v sobah z mrežami za zaščito pred komarji in klimatsko napravo, ali uporaba postelj z mrežami proti komarjem. V vseh bivališčih je potreben nenehen nadzor nad populacijo komarjev z doslednim odstranjevanjem njihovih morebitnih razmnoževalnih okolij (2).

Nosečnicam in ženskam, ki načrtujejo nosečnost, se priporoča, da prestavijo vsa potovanja, ki niso nujna, na področja, kjer je aktivno prenašanje ZIKV. Osebe s kroničnimi boleznimi ali imunsko pomanjkljivostjo se morajo pred potovanjem v endemska področja ZIKV posvetovati z osebnim zdravnikom (10).

V zadnjem času se vse pogosteje objavljajo pisni dokazi o spolnm prenosu virusa Zika. Torej, za zmanjšanje tveganja spolne prenosljivosti in morebitnih zapletov v nosečnosti zaradi okužbe z ZIKV, se priporočajo varni spolni odnosi (vključno z uporabo kondomov) ali spolna abstinenca med nosečnostjo zaradi zaščite ploda. Prav tako obstaja priporočilo za osebe, ki se vračajo iz endemskih področij z ZIKV, da uporabljajo varne spolne odnose ali abstinirajo vsaj osem tednov po vrnitvi, četudi se simptomi ne pojavijo. Če imajo moški simptome virusa Zika, naj varno spolno občujejo ali abstinirajo vsaj šest mesecev. Osebe, ki načrtujejo nosečnost, naj počakajo vsaj osem tednov preden poskusijo spočeti, če se ne pojavijo simptomi virusa Zika, v primeru, da ima eden ali oba v paru simptome, pa vsaj šest mesecev (11).

CONFLICTS OF INTERESTS

The authors declare that no conflicts of interest exist.

NASPROTJE INTERESOV

Avtorji izjavljajo, da ne obstajajo nasprotja interesov.

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THE ROLE OF NON-GOVERNMENTAL ORGANIZATIONS IN THE MENTAL HEALTH AREA: DIFFERENCES IN UNDERSTANDING

VLOGA NEVLADNIH ORGANIZACIJ NA PODROČJU DUŠEVNEGA ZDRAVJA: RAZLIKE V RAZUMEVANJU

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ABSTRACT

Introduction. The contribution's aim is highlighting the differences in understanding non-governmental organizations' (NGOs) role in the mental health area within the public support network for patients with mental health problems from various viewpoints, in order to achieve progress in supporting patients with mental health problems in local communities.

Methods. Qualitative data gathered as a part of a cross-sectional study of NGOs in the support network for patients with mental health problems in two Slovenian health regions (56 local communities), carried out in 2013 and 2014, were used. Qualitative analysis of interviews, focus groups and answers to an open survey question was performed.

Results. There are differences in understanding NGOs' role in the support network for patients with mental health problems, which stem from the roles of stakeholders (local community officials, experts, care providers, and patients) within this system and their experience.

Discussion and conclusion. The actual differences need to be addressed and overcome in order to provide integrated community care. The importance of knowing the current state of NGOs in their life cycle and the socio-chronological context of the local community support network is evident.

Keywords:
mental health, non-governmental organizations, community approach, integrated care, collaboration, local communities

IZVLEČEK

***Uvod**. Namen prispevka je predstaviti razumevanje vloge nevladnih organizacij v podporni mreži na področju duševnega zdravja z različnih zornih kotov, da bi bil dosežen napredek pri podpori pacientom z težavami v duševnem zdravju v lokalnih skupnostih. Cilj raziskave je bil ugotoviti, katere so vloge nevladnih organizacij, ki jih priznavajo zainteresirane strani v podporni mreži za paciente s težavami v duševnem zdravju, da bi bile prepoznane priložnosti za izboljšanje kakovosti dela in sodelovanje ljudi, ki delujejo v tej mreži. Temeljno raziskovalno vprašanje je bilo: Kakšne so razlike v razumevanju vloge nevladnih organizacij na področju duševnega zdravja v okviru javne podporne mreže za paciente s težavami v duševnem zdravju v Sloveniji z vidika različnih udeležencev?*

***Metode**. Uporabljeni so bili kvalitativni podatki, zbrani kot del presečne raziskave nevladnih organizacij v podporni mreži za paciente s težavami v duševnem zdravju v dveh slovenskih zdravstvenih regijah (56 lokalnih skupnosti) v letih 2013 in 2014, ki je potekala fazno s kombinacijo kvantitativnih in kvalitativnih metod ter z razvitimi instrumenti za zajemanje podatkov s perspektive več skupin udeležencev: uslužbencev v javni upravi, strokovnjakov s področja duševnega zdravja, neposrednih izvajalcev ter pacientov. Za potrebe tega članka je bil oblikovan analitični model kvalitativne analize intervjujev, fokusnih skupin in odgovorov udeležencev na odprta anketna vprašanja, ki je temeljil na tem, koliko so odgovori udeležencev upoštevali znanstveno in politično teorijo o vlogi nevladnih organizacij v podporni mreži za duševno zdravje.*

***Rezultati**. Obstajajo razlike v razumevanju vloge nevladnih organizacij v podporni mreži za paciente s težavami v duševnem zdravju, ki izhajajo iz vloge deležnikov v okviru tega sistema in iz njihovih izkušenj. Sistematično se kažejo v večji ali manjši kritičnosti do nevladnih organizacij z vidika pomembnosti za pacienta ali možnih tveganj. Udeleženci so v skupnem pogledu sintetizirali idealni tip vloge nevladne organizacije, kot je formulirana v znanstveni in socialnopolitični teoriji, vendar pa je razumevanje posameznih interesnih skupin omejeno.*

***Razprava in zaključek**. Treba je obravnavati dejanske razlike in jih premagati, da bi zagotovili celovito skupnostno skrb na področju duševnega zdravja. Pomen poznavanja trenutnega stanja nevladnih organizacij in družbenega kronološkega okvira podporne mreže lokalnih skupnosti je očiten. Obstajajo možnosti za razvoj razumevanja vloge nevladnih organizacij v okviru podporne mreže izvajalcev in storitev na področju duševnega zdravja. Izboljšano vzajemno poznavanje, stalna komunikacija in objektivno ocenjevanje vlog vseh zainteresiranih strani v skupnostni skrbi so priložnosti za sodelovanje med izvajalci, uporabniki storitev in lokalnimi skupnostmi. Prispevek je treba razumeti kot delno analizo neposredne prakse, ki jo je treba preveriti z nadaljnjimi raziskavami.*

Ključne besede:
duševno zdravje, nevladne organizacije, skupnostni pristop, holistična obravnava, sodelovanje, lokalna skupnost

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1 INTRODUCTION

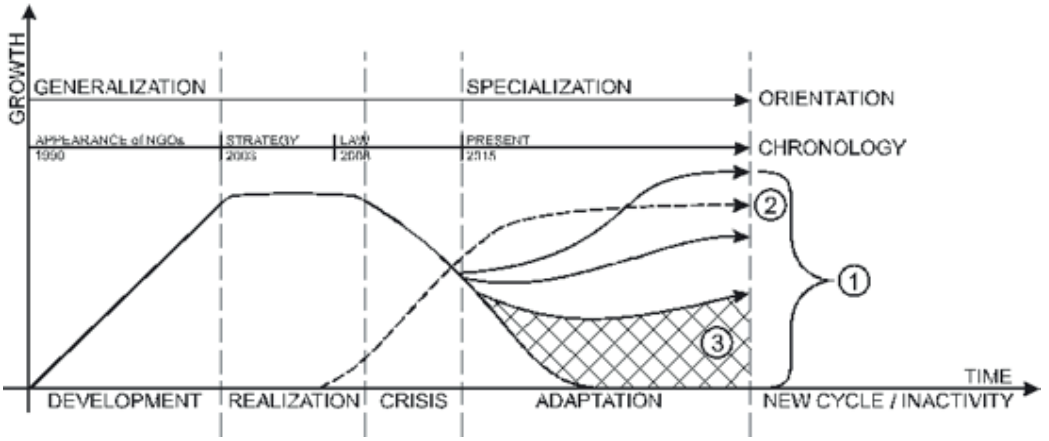
Findings of the Atlas project (1) show that the system of ensuring mental health of the population and care of people with mental health disorders varies from country to country. In accordance with the 'Health 2020', the European health care policy (2), there are increased efforts to develop a harmonized system of coordinated and integrated services (3). Different models have been developed to increase collaboration between stakeholders in the network of providers of care, ensuring (mental) health of a country's (of a region or local community) population, and for a comprehensive support for patient groups (3–5). In this context, the role of non-governmental organizations within the development of community care in the mental health area needs closer attention.

Non-governmental organizations (NGOs) are formally organized, private, non-profit organizations. Their role within the health care system is not always recognized. NGOs mostly differ from public organizations in their vision and mission (aims and objectives), management (professional staff, board members and volunteers), resources (fund raising), reach (public relations, raising awareness in communities, and cooperation), and treatment outcomes (6). Determining the role of NGOs (why and for whom they operate) in 40 countries, Salamon et al. (7) highlighted five groups of roles, namely: the service role (high quality, increased fairness, lower cost/improved efficiency, specialization), innovation role (increased flexibility, accessibility to everyone, the incubator for new ideas, the source of innovation in resolving social and individual problems), advocacy role (changes in government policies or social conditions, advocacy policy, the inclusion of service users), expressive and development role (promotion of cooperation, voluntary work advocate, protecting the interests of various groups, enabling the expression of personal potential, influencing markets by ensuring plurality), community and democracy building role (diversity and pluralism, promotion of mutual trust, belonging and social obligations). Karlsson in Markström (8, 9) demonstrate (using the case of Sweden) the changes in NGOs' roles through the years: from peer support, influencing the official policy, to dedication to the patient's family in order to develop a different view of the ailing family member. They identify the importance of understanding NGOs' roles in the country in order to understand their role within the network of community treatment providers. They emphasize their importance in the planning and decision-making within the health and social care, and in the development of cooperation within care providers' networks (10). Some research confirms that cooperation between public and non-governmental organizations at the primary health care level takes place routinely (11), while others highlights the issue of the lack of knowledge by care providers about NGOs in local communities, and the lack of time to facilitate patients' access to them (12).

1.1 NGOs in Slovenia and Their Activities in the Mental Health Area

NGO activity in Slovenia is below the average of comparable countries; Slovenian NGOs are characterized by low levels of professionalization, weak infrastructure, unawareness of the benefits of networking and cooperation, and unsuccessful dialogue with the state and local authorities (13). The John Hopkins' University research comparing NGO activities in 32 countries in 2008 used three indicators: the NGO income compared to gross domestic product (average 5.1%, Slovenia 2.3%), the share of revenues from public sources in the structure of total NGO revenues (average 42%, Slovenia 27.8%), and the share of NGO employees (average 4.9%, Slovenia 0.74%) (14). Data gathered by the United States Agency for International Development (USAID) depict a similar picture (15). There is no data on the actual awareness of people about NGOs, e.g. in the mental health area.

NGOs in the mental health area are community care providers (16), operating at the private level and in the public sphere, as interest groups trying to influence public policy and its implementation (17). Their role within the system is complementary. Research on the organization and operation of the public health service and NGOs in the mental health area in Slovenia has shown an uneven territorial distribution of psychiatric services and health care workers within the network and, consequently, uneven accessibility. It also highlighted inadequate cooperation between governmental and non-governmental institutions (18). An attempt was carried out to create a database of NGOs in the mental health area (19). The chronology of the development of NGOs in the mental health area in Slovenia also shows a significant delay in the development of this sector (9, 20). Figure 1 shows a schematic representation of the development cycle of an NGO in the area of mental health in Slovenia from 1990 onwards.



Legend:
1 – The NGO development cycle
2 – The cycle of an NGO program transfer into the public sector
3 – Basal NGO program, which is non-transferrable to the public sector

Figure 1. The life cycle of NGOs in the mental health area in Slovenia (21).

The life cycle of an NGO in the area of mental health includes the following phases: development, establishing/functioning, crisis and adaptation, which may be followed by a new cycle. The role of mental health NGOs in Slovenia was mainly increasing from 2003 onwards, when the Strategy of Cooperation of the Government of the Republic of Slovenia with Non-Governmental Organizations (22) was adopted, up to 2008 and the adoption of the Mental Health Act (16). Formally, NGOs have become a part of the public support network, but continuous financing of their activities was not specified (23). At the same time, new professional profiles in the community care for patients with a mental health disorder (the community care coordinator, community psychiatric care teams) have been established in local community service systems, and some NGO activities have been transferred to them. On the one hand, this is a success of NGOs, but on the other hand, the role of NGOs in the support network began to decrease with the establishment and increased operation of community care coordinators and community psychiatric care teams. For NGOs, the time from 2008 to 2010 was a period of crisis, which may have led to processes of adaptation, preservation of basic programs, realization of new ideas, specialization, inactivity, or reduced cooperation. This is a part of an NGO's normal life cycle, as it has fulfilled its function in accordance with its status as the third sector in the society with its complementary role. The recent period (2010–2015) has seen a new dynamic division of work, which, in its transitional phase, according to Hannigan and Davina (24), includes competition between various professional groups and the emphasis on the professional role and public identity. A characteristic uncertainty in recognizing the roles of various providers, particularly NGOs, is occurring, which affects integration processes. For a more effective complementarity, it is important to know how various stakeholders within the network of providers view the importance of NGOs. According to Mesec (25), the main characteristics of NGOs are flexibility, relative independence, clear activities in the public interest, and close connectedness to communities and groups for whom they advocate and are easily accessible. One of the disadvantages she sees is the lack of transparency of their operation, inadequate mutual informing, and financial issues. The expected positive outcomes of their activities within the network of mental health care providers can be estimated from their mission and objectives (the placement of the mental health area among priority areas in the local community, normalization of mental health, improved acceptance and adaptation to people with mental health disorders, empowerment, improved social inclusion, and mutual support among NGO service users). The criteria for monitoring the quality of NGO operations within the framework of the Social Protection Institute (the indicators) include: service user satisfaction, social network expansion, quality leisure time, the empowerment of service users to take care of themselves, resolution of distress and problems, users' safety, informedness on rights, the participation in decision-making by service users, the reduction of hospitalization numbers, the access to services, promotion and destigmatization, the recognition of the program in the local community (26). NGOs may obtain the NGO quality standard based on ISO 9001, including the following elements: transparency, financial transparency and efficiency, effective internal and external communication, equal treatment of

volunteers and employees, effective management and project implementation, well-thought out building of partnerships and networks (27).

1.2 The Aim, Objectives, and Research Question

The aim of the research was to highlight the differences in the understanding of the role of NGOs in the mental health area within the public support network for patients with mental health problems, from the viewpoint of various stakeholders. The findings may help us understand some obstacles in the collaboration between care providers in the support network for people with mental health problems (28–31). The objective of the study was to find out which roles of NGOs are recognized by stakeholders in the support network for people with mental health problems, in order to identify the opportunities for improving the quality of work for people employed in this network and cooperation in developing community care. The basic research question was: 'What are the differences in the understanding of the role of NGOs in the mental health area within the public support network for patients with mental health problems in Slovenia, from the viewpoint of various participants?'

2 METHODS

In order to answer the research question, the data from a case study of 56 local communities in two out of nine Slovenian health regions in 2013 and 2014 were used. The cross-sectional study was carried out in phases by combining quantitative and qualitative methods and using specially developed instruments for data collection from various groups of participants: public officials, mental health experts, care providers, and patients and their relatives. Table 1 below presents the research methodology by defining the purposive sample and the methods used.

This article presents the results of the qualitative part of the research, which was based on recognizing people's subjective experience (how they think, what they feel, and how they understand the meaning of various activities for NGOs' operation within the support network for people with depression). We developed an analytical model based on scientific (7) and policy (26, 27) definition of the NGOs' role in mental health. To collect data, semi-structured interviews and focus groups were used. Semi-structured interviews were used in the parts of the research where the sample included individual people. Focus groups were used due to the possibility of a varying number of people being included (from one to more organizations), according to their readiness to take part and the value of cumulative data collection methods (32). Answers to the open survey question about the role of NGOs were also included.

2.1 Data Analysis

The NVivo 10 program was used. We transcribed the recorded interviews, focus groups, and answers to the open question in the survey on the role of NGOs for people with mental health problems. The texts were read

Table 1. The presentation of the research methodology.

The sample (within the case study of Novo Mesto and Ljubljana health regions)		**The method used**
Public officials	N=2 (employees from two key ministries)	A semi-structured interview
	N=56 (employees of administrative entities in the local communities; one from each local community or according to assigned tasks in the mental health area)	Quantitative method, an online questionnaire via 1KA web interface (including an open survey question)
Mental health experts	N=5 (experts in the mental health area, not working directly with patients)	A semi-structured interview
Providers	N=94 (quota sample: 1–3 providers from each health care or social assistance organization, acting in a network of mental health programs and services in Novo Mesto (35,8%) and Ljubljana (64,2%) health regions). 62% are from the health care area, 34% from the social assistance area, and 4% from other areas)	Quantitative method, an online questionnaire via 1KA web interface (including an open survey question)
Service users	N=82 (men and women with mental health problems, aged 18–70, who accepted the invitation of 4 NGOs or a personal invitation, if they are not NGO members).	Semi-structured interviews and focus groups

several times and open coded in order to identify the main themes (33, 34). The statements were categorized and anonymised. From both data collection methods, the sources for analysis were mainly statements by various stakeholders highlighting the understanding of NGOs' role. Statements by providers working in NGOs (20%) were analysed separately from statements by providers from other organizations in the support network (80%), and those of the patients, according to whether they were using NGO services (74 patients) or not (8 patients).

2.2 Ethical Considerations

All respondents participated in the survey on a voluntary basis, giving an informed consent. Consent for experts and providers taking part in interviews and surveys, respectively, was given by their management; while medical directors, heads of community mental health centres and users' councils agreed for interviews to be carried out with patients at NGOs. Data are presented in a manner that conceals the participants' identities.

3 RESULTS

The opinions of various stakeholders on the role of NGOs within the support network for people with depression are presented in Table 2 below.

Table 2. A schematic presentation of stakeholders' opinions on the role of NGOs in the mental health area within the support network for people with mental health problems.

Stakeholders	The summary of opinions on the definition of NGOs' role (categories)
Public officials for mental health (ministry and local community administration employees)	An innovator and initiator for change, a promoter of health and prevention, an initiator and provider of measures for the quality of life and treatment, an important player for the local community, a user of financial and material resources, the author of a self-evaluation report, the player towards which administrative entities have normatively defined duties, an applicant to tenders.
Experts in the mental health area	Quality provider, a partner with a specific standing in the support network; the voice of service users and the strongest influencer of people; the contractor with specific (very different) staffing professionals and colleagues.
Service providers at NGOs in the mental health area	A provider of supplementary services, preventive and community activities, based on the networking and integration of volunteers, offering assistance with no waiting period, a provider of expert individual approach, cooperation in ensuring the continuity of treatment, a provider with above-average ethical potential of providers.
Providers in other organizations within the mental health support network	A creator of the support network for people with depression and their relatives, the conscience of society, the informer of the public, a provider of proven successful approaches to improving mental health of patients with depression, enables accessibility without stigmatization and reduces stigmatization in the society, the actor whose quality of work depends on the employees, sometimes acting only on paper, their quality varies.
Patients - users of services of NGOs in the mental health area	Acts towards improved quality of life, resolution of complex issues, a provider of psychosocial and employment rehabilitation, a provider of opportunities for enhancing knowledge, exchanging experiences, social inclusion and quality leisure time activities, an outreach motivator, having the know-how of, and experience in successful methods of working with people with depression, a provider with fast-changing staff members.
Patients - users of other services in the mental health area	A provider of assistance at home, a provider of free assistance, the organization requires a better promotion of its own work; a provider of assistance only adequate for some patients with depression; organizations the work of which is insufficiently supervised.

The summary of findings led to the identification of the following NGOs' roles:

- **A provider**: supplementary, voluntary, free services aimed at a particular population group;
- **A supporter**: support for patients with depression and their relatives in terms of advocacy and influence on people;
- **A contractor**: innovative approaches to treatment in the community, psychosocial and employment rehabilitation, help at home, outreach motivation, their activity depends on contractors' relationship and work results, which must be monitored due to the fluctuation of staff;
- **An operator**: linking contractors, patients and experts to improve the quality of life and care for patients with depression by using know-how of, and experience in successful working methods, accessibility without stigmatization, and informing the public to reduce stigmatization;
- **A recipient of support** from administrative entities and local communities in accordance with the normative definition, personal engagement by NGO contractors by participating in tenders, according to a self-evaluating report and public reputation.

There are substantive differences in the understanding of NGOs' role by various interest groups, which are linked to their own involvement in NGO activities. The main differences are seen in their descriptions of the importance of NGO activities for patients. Experts, NGO providers, and NGO service users highlighted the great importance of NGOs for patients, and mostly gave positive descriptions of NGOs' role: 'in NGOs, everything is free, the environment in an NGO is safer than in a bar'. Public administration employees, other providers and patients who are not NGO service users were more critical of the actual importance of NGOs for patients, commenting, for example, that NGOs 'only operate on paper', or that they are a 'provider with frequent personnel changes'. They did not refer to nationally determined criteria for evaluating mental health NGOs' activities in their descriptions and evaluations of the role (26, 27). None of the interest groups showed an understanding of the role of NGOs in their complexity and wholeness (7).

4 DISCUSSION

The analysis highlighted a variety of different descriptions forming the picture of the important role of NGOs for patients with mental health problems. There is a characteristic confusion when identifying the roles of various providers. Various interest groups see the role of NGOs in a less generalized way than that cited by Salamon et al. (7). Mainly positive descriptions of the role of NGOs were given by experts and NGO providers. Partly positive and partly critical descriptions were given by municipality employees, other providers and other patients. The range from mainly positive descriptions through neutral to negative ones shows common ground, but also differences between interest groups in understanding the role and importance of NGOs for patients. This gives rise to concerns regarding the potential bias of providers in NGOs and the question of patients' objectivity, them being either users or non-users of NGO services. It is unclear whether these differences are due to the unfamiliarity or actual experience, and whether providers are afraid for 'their territory'. The comparison of the descriptions of stakeholders' roles on one side, with elements of the NGO quality standard, mission and objectives, and criteria for monitoring the quality of NGO operations in the area of mental health on the other side show that stakeholders' descriptions were drawn from their own roles within the mental health support network, and not from the expected role of NGOs in the country.

Previous research shows the importance of understanding the role of NGOs in the country and in the mental health care system (8–10), as well as the practical ways to improve the understanding of individual providers' roles and cooperation. Grayer et al. (11) found a positive response to information on NGOs in the mental health area by patients with mental health disorders and psychosocial problems in medical treatment at the primary health care level. Increased inclusion into NGOs has reduced the number of consultations for these patients due to psychosocial distress.

Inadequate understanding of the role NGOs are playing in the mental health support network can function as an obstacle to the efforts for a connected, harmonized care for patients with mental health problems, including depression, in the community, and for the implementation of patients' right to choose and decide.

Research showed that the sum of stakeholders' understandings of NGOs' role was indeed covering a whole range of their missions, but looking separately, each stakeholder's view was limited in one way or another. We suppose that such differences derive from various separate experiences, maybe even stereotypes, or just ignorance. It is necessary to improve the awareness of stakeholders on all dimensions of NGOs' role within the network of mental health program and service providers, while excluding the presence of stereotypical views (35). Further opportunities to spread information on the role of NGOs for patients include the Support in dealing with depression workshops in community health centres across Slovenia (36). The next opportunity to increase informedness is to upgrade the existing model for publication, entitled Where to seek help for mental

distress (37), which is available for providers and users, with an added description and the expected effects of various support groups. A practical implementation of the NGOs' complementary role should be considered, for example, in terms of support for relatives. NGOs can be an important partner in the area of work with relatives, as medical staff often struggles to meet the needs of relatives and friends when treating patients (38-40).

The findings show that stakeholders mainly see NGOs' role in a positive light; however, they also mention some risks when including a patient into an NGO. The inclusion requires the knowledge of the current status of an NGO in its life cycle, and in the context of the local community support network, as well as the level of service specialization. Mental health problems involve a specific clinical picture of social isolation, various forms of self-destructive behaviour, and the need for intensive motivation at a person's home, which requires a specific approach and immediate action; however, this concern was not at the forefront. The need for NGOs specialized for people with specific mental health problems was confirmed. But it appears that the identified differences have an inhibitory impact on integration processes of NGOs in the community care approach. If qualitative differences between various stakeholders are recognized and taken into account (the understanding of roles and justification of an individual's contribution/needs), there is an opportunity for improved collaboration between providers in the network of programs and services in the area of mental health and the development of community care. NGOs in Slovenia cannot substitute mental health care system; they are, however, an integral part of it, and complement it in a unique and important way.

4.1 Limitations

The contribution is an analysis of practice, which needs to be verified by further research. Some findings have been established that may be of value in the development of community care for people with depression. The study limitations are due to the sample selection and cross-sectional design, which to a certain extent, limit the findings' generalizability.

5 CONCLUSION

There are many opportunities for developing awareness and understanding of NGOs' role in the network of mental health care providers and services. With improved mutual awareness, constant communication and objective evaluation of all stakeholders' roles in community care, opportunities arise for the collaboration between providers, service users and local communities.

CONFLICTS OF INTERESTS

There is no financial, personal, or academic conflict of interest.

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ETHICAL APPROVAL

Ethical approval for this research was not required. Questions for patients were formulated in such a manner that they did not allow an invasion of privacy or recollection of unpleasant events.

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THE PREVALENCE OF AND RISK FACTORS FOR HEALTHCARE-ASSOCIATED INFECTIONS IN SLOVENIA: RESULTS OF THE SECOND NATIONAL SURVEY

PREVALENCA IN DEJAVNIKI TVEGANJA ZA BOLNIŠNIČNE OKUŽBE V SLOVENIJI: REZULTATI DRUGE NACIONALNE PRESEČNE RAZISKAVE

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ABSTRACT

Introduction. In the second Slovenian national healthcare-associated infections (HAIs) prevalence survey, conducted within the European point prevalence survey of HAIs and antimicrobial use in acute-care hospitals, we estimated the prevalence of all types of HAIs and identified risk factors.

Methods. Patients from acute-care hospitals were enrolled into a one-day cross-sectional study in October 2011. Descriptive analyses were performed to describe the characteristics of patients, their exposure to invasive procedures and the prevalence of different types of HAIs. Univariate and multivariate analyses of association of having at least one HAI with possible risk factors were performed to identify risk factors.

Results. Among 5628 patients, 3.8% had at least one HAI and additional 2.6% were still being treated for HAIs on the day of the survey; the prevalence of HAIs was 6.4%. The prevalence of urinary tract infections was the highest (1.4%), followed by pneumoniae (1.3%) and surgical site infections (1.2%). In intensive care units (ICUs), the prevalence of patients with at least one HAI was 35.7%. Risk factors for HAIs included central vascular catheter (adjusted odds ratio (aOR) 4.0; 95% confidence intervals (CI): 2.9-5.7), peripheral vascular catheter (aOR 2.0; 95% CI: 1.5-2.6), intubation (aOR 2.3; 95% CI: 1.4-3.5) and rapidly fatal underlying condition (aOR 2.1; 95% CI: 1.4-3.3).

Conclusions. The prevalence of HAIs in Slovenian acute-care hospitals in 2011 was substantial, especially in ICUs. HAIs prevention and control is an important public health priority. National surveillance of HAIs in ICUs should be developed to support evidence-based prevention and control.

Keywords:
healthcare-associated infections, prevalence, survey, risk factors, Slovenia

IZVLEČEK

***Izhodišča**. Druga slovenska nacionalna presečna raziskava bolnišničnih okužb (BO) je potekala v okviru evropske presečne raziskave okužb, povezanih z zdravstvom, in uporabe protimikrobnih zdravil v bolnišnicah za akutno oskrbo. Naši cilji so bili oceniti prevalenco vseh vrst BO in opredeliti dejavnike tveganja za BO.*

***Metode**. V enodnevno presečno raziskavo smo vključili vse bolnike, ki so bili na izbrani dan v oktobru 2011 zdravljeni v slovenskih bolnišnicah za akutno oskrbo. Z deskriptivnimi analizami smo opisali značilnosti bolnikov, izpostavljenost invazivnim posegom in ocenili prevalenco različnih vrst BO. Z univariatnimi in multivariatnimi analizami povezanosti BO z možnimi dejavniki tveganja smo opredelili dejavnike tveganja.*

***Rezultati**. Na dan raziskave je imelo BO 3,8% (95-odstotni interval zaupanja: 3,3%-4,4%) bolnikov in dodatnih 2,6% (95-odstotni interval zaupanja: 2,1%-3,0%) bolnikov je bilo še vedno zdravljenih zaradi BO, torej je imelo BO 6,4% (95-odstotni interval zaupanja: 5,7%-7,0%) bolnikov oziroma je bila prevalenca BO 6,4%. Na 100 bolnikov je bilo 7,0 epizod BO, ker so nekateri bolniki imeli več kot eno epizodo. Najvišja je bila prevalenca okužb sečil (1,4%), sledile so pljučnice (1,3%) in okužbe kirurških ran (1,2%). Delež bolnikov z vsaj eno BO je bil najvišji v enotah za intenzivno zdravljenje (35,7%). Na 100 bolnikov v enotah za intenzivno zdravljenje je bilo 42,5 epizod BO. V primerjavi z bolniki brez različnih invazivnih posegov so imeli bolniki s centralnim žilnim katetrom 4,0-krat višji obet za nastanek BO (prilagojeno razmerje obetov (pRO) 4,0; 95-odstotni interval zaupanja: 2,9-5,7), bolniki s perifernim žilnim katetrom 2,0-krat višji obet za nastanek BO (pRO 2,0; 95-odstotni interval zaupanja: 1,5-2,6), intubirani bolniki 2,3-krat višji obet za nastanek BO (pRO 2,3; 95-odstotni interval zaupanja: 1,4-3,5) in bolniki s hitro smrtno boleznijo 2,1-krat višji obet za nastanek BO (pRO 2,1; 95-odstotni interval zaupanja: 1,4-3,3).*

***Zaključki**. Prevalenca BO v slovenskih bolnišnicah za akutno oskrbo je bila v letu 2011 precejšnja. Predvsem je bila visoka v enotah za intenzivno zdravljenje. Preprečevanje in obvladovanje BO je pomembna javnozdravstvena prednostna naloga. Za preprečevanje in obvladovanje BO, ki temelji na dokazih, je treba vzpostaviti nacionalno epidemiološko spremljanje BO tudi v enotah za intenzivno zdravljenje.*

***Ključne besede**:*
okužbe, povezane z zdravstvom, prevalenca, presečna raziskava, dejavniki tveganja, Slovenija

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1 INTRODUCTION

In the first Slovenian national one-day survey of HAIs in acute-care hospitals conducted in October 2001, we estimated that 4.6% of patients had at least one HAI on the day of the survey (1). The second Slovenian national HAIs prevalence survey (SNHPS) was conducted in 2011, within the European point prevalence survey of HAIs and antimicrobial use in European acute-care hospitals (EU PPS), coordinated by the European Centre for Disease Prevention and Control (ECDC).

The objective of this paper is to describe the characteristics of patients, their exposure to invasive procedures, and to report the estimated prevalence of different types of HAIs and identified risk factors for HAIs in Slovenian acute-care hospitals in 2011.

2 METHODS

2.1 Survey Design and Data Collection

A cross-sectional study (one-day prevalence survey) was conducted in all Slovenian acute-care hospitals during three weeks in October 2011. The SNHPS protocol had been adapted from the ECDC point prevalence survey protocol (EU PPS Protocol) (2) to ensure comparability of our results with other European member states participating in the EU PPS, and also with the results of the first Slovenian national one-day survey of HAIs in acute-care hospitals conducted in 2001. We included patients from all acute-care wards, including one acute psychiatric ward and neonatal ICUs. We excluded patients from long-term care wards and accident and emergency departments. Patients were included, if they were admitted to the ward before or at 8:00 am and not yet discharged from the ward at the time of the survey. Neonates on maternity and paediatric wards, if born before or at 8:00 am on the day of the survey, were also included. We excluded patients undergoing same-day treatment or surgery, those seen at outpatient departments and outpatient dialysis patients.
Standard information was collected for all eligible patients by trained teams led by SNHPS coordinators for data collection in hospitals. It included age, sex, admission date, date of data collection (survey date), and ward specialty. As proposed by McCabe, patients were classified according to the severity of their underlying condition into three categories: non-fatal disease (expected survival >5 years), ultimately fatal disease (expected survival 1-4 years), and rapidly fatal disease (expected death within 1 year) (3). Exposures to indwelling devices (central vascular catheter, peripheral vascular catheter, urinary catheter and intubation) on the day of the survey, surgical procedures within 30 days prior to the survey, and insertion of implants within 12 months prior to the survey were recorded. All types of HAIs were identified by reviewing all medical records available at the time of the survey and through consultations with physicians and nurses. We used European standard surveillance definitions for different types of HAIs (2). The prevalence of HAIs was defined as the number of patients with at least one HAI present on the day of the survey (signs and/or symptoms) or still receiving treatment for HAIs on the day of the survey (previously present signs and/or symptoms). In contrast to the ECDC EU PPS Protocol, we have collected the data so that we were able to distinguish between patients with HAIs present on the day of the survey and those still receiving treatment for previous HAIs on the day of the survey. The onset of the signs and/or symptoms suggestive of a HAI was on day 3 of the current admission or later (day 1 was the day of admission). Infections present at admission or occurring on day 1 or day 2, or still being treated on day 1 or day 2, were also counted as HAIs, if fulfilling the HAIs surveillance definitions and additional criteria. These were: (a) If the respective patient has been discharged from acute-care hospital less than two days before re-admission; (b) when the patient had surgical site infection and surgery within 30 days before the survey (deep or organ/space surgical site infection and implant within a year before the survey); (c) in case of a *Clostridium difficile* infection, when the patient had been discharged from acute-care hospital less than 28 days before the current admission; and (d) if an invasive device was placed on day 1 or day 2 and that resulted in a HAI.

2.2 Data Management and Analysis

Completed data collection forms were checked for possible errors, missing information and inconsistencies. SNHPS hospital coordinators were approached for clarifications and to obtain missing information. Data were double-entered using Epi Info (Epi Info, version 3.5.4, CDC, Atlanta, GA, USA). Code range and filter checks were built in. Discrepancies due to entry mistakes were checked against the information on data collection forms and corrected.

Descriptive analyses were performed using the statistical software Stata (Version 11.2, StataCorp, College Station, Texas, USA). Characteristics of patients and their exposure to invasive procedures, including surgery, were described. The proportion of patients with at least one HAI (overall prevalence) and the prevalence of different types of HAIs were computed (overall and according to ward specialties). Univariate and multivariate analyses of association of having any HAI acquired during current hospitalization with selected risk factors studied were performed. Univariate analyses were first performed using the classical method for analyses of 2×k contingency tables and then repeated using logistic regression. Maximum likelihood estimates of odds ratios

(ORs) together with 95% CIs and results of likelihood ratio tests for significance were computed. Risk factors that were found to be significantly associated with any HAI ($p<0.05$) were fitted into a series of multivariate models adding one at a time. They were kept in the multivariate model, if they remained significantly associated with any HAI after the adjustment for other risk factors in the model, except for age (borderline significance, $p=0.05$), which was identified *a priori* as explanatory variable of interest or confounder. Maximum likelihood estimates of aORs together with 95% CIs and results of likelihood ratio tests for significance were computed for all risk factors remaining in the final model.

3 RESULTS

3.1 Participating Hospitals and Numbers of Patients Surveyed

All 21 Slovenian acute-care hospitals participated. 5628 patients were surveyed. Over half of them (56.8%) were hospitalized in three hospitals with over 650 beds, and only 10.0% in nine hospitals with fewer than 200 beds. The number of patients, overall and according to specialties of wards for each participating hospital, is shown in Table 1.

Table 1. A distribution of surveyed patients between acute-care hospitals and different ward specialties, Slovenian national healthcare-associated infections prevalence survey, 2011.

	The number of patients						
Acute-care hospitals	General medicine	Surgery	Gynaecology & obstetrics	Paediatrics	Intensive care	Other/ mixed	All
University Medical Centre Ljubljana	629	707	175	143	88	0	1742
University Medical Centre Maribor	295	388	45	38	24	201	991
General Hospital Celje	146	177	89	28	13	11	464
General Hospital Novo mesto	124	143	43	18	14	0	342
General Hospital Nova Gorica	92	103	38	16	9	22	280
General Hospital Murska Sobota	126	84	37	19	8	0	274
General Hospital Izola	82	57	28	11	8	0	186
General Hospital Slovenj Gradec	68	69	0	22	3	21	183
Oncology Institute Ljubljana	139	35	0	0	8	0	182
General Hospital Jesenice	53	62	0	26	4	19	164
Orthopaedic Hospital Valdoltra	0	149	0	0	0	0	149
Clinic Golnik	130	0	0	0	6	0	136
General Hospital Ptuj	47	41	9	18	7	0	122
General Hospital Trbovlje	33	25	28	6	3	0	95
General Hospital Brežice	36	23	0	2	4	22	87
Hospital Topolšica	70	0	0	0	4	0	74
Gynaecology & Obstetrics Hospital Postojna	0	0	35	16	0	0	51
Gynaecology & Obstetrics Hospital Kranj	0	0	30	12	0	0	42
Diagnostic Centre Bled	35	0	0	0	0	0	35
Surgical Centre Rožna dolina	0	18	0	0	0	0	18
Medicor	0	1	0	0	4	6	11
All	2105	2082	557	375	207	302	5628
Proportion (%)	37.4%	37.0%	9.9%	6.7%	3.7%	5.4%	100%

3.2 Patient Characteristics and Exposure to Invasive Procedures

The mean age of patients was 54.8 years (range from 0 to 102, median 60.7 years), 34.1% were less than 50 years old, 50.9% were from 50 to 79 years old, and 15.0% were aged 80 years or more. There were fewer males (47.8%) than females. Of 5602 patients (99.5% of all surveyed) who were categorized according to McCabe index, 5.1% had rapidly fatal diseases and 16.4% had an ultimately fatal disease. The average length of hospital stay from the admission to the survey day was 11.4 days (median five days). The length of stay was 1-3 days for 33.4% of patients, 4-7 days for 33.4%, 8-14 days for 16.2% and ≥15 days for 17.0% of patients. 30.5% of patients had undergone surgery since admission, 31.6% during the month before the survey, and 9.5% of patients had an implant inserted in the year before the survey. On the day of the survey, 46.8% had a peripheral vascular catheter, 7.3% a central vascular catheter, 16.2% a urinary catheter, and 3.0% were intubated. Exposures to indwelling devices were most common in ICUs. The prevalence of exposures to different indwelling devices, overall and according to the ward specialty, is shown in Table 2.

3.3 The Prevalence of Healthcare-Associated Infections

On the day of the survey, 3.8% (95% CI: 3.3%-4.4%) of patients had at least one HAI, and additional 2.6% (95% CI: 2.1%-3.0%) were still in treatment because of at least one HAI (not present on the day of the survey), corresponding to the overall prevalence of 6.4% (95% CI: 5.7%-7.0%). The prevalence of HAIs ranged from 0.0% to 8.5% in different hospitals. The prevalence was higher among patients hospitalized in large hospitals with more than 650 beds (7.3%), and lower among those hospitalized in small hospitals with less than 200 beds (3.7%). Overall, the prevalence of urinary tract infections was the highest (1.4%), followed by pneumoniae (1.3%) and surgical site infections (1.2%). Excluding HAIs that were not present on the day of the survey, but for which patients were still being treated, the corresponding prevalence estimates were 0.7%, 0.8% and 0.8%. The proportion of patients with at least one HAI or still treated for at least one HAI was the highest in ICUs (35.7%), followed by surgical wards (6.4%), general medical (5.9%), paediatric (2.4%), and gynaecology and obstetrics wards (2.2%). Excluding HAIs that were no longer present on the day of the survey, but for which patients were still being treated, the corresponding prevalence estimates were 26.6%, 3.7%, 3.1%, 2.1%, and 1.3%. The numbers of patients with different types of HAIs and their respective prevalence, overall and according to different ward specialties, are shown in Table 3.

Table 2. The prevalence of exposures to indwelling devices on the day of the survey, Slovenian national healthcare-associated infection prevalence survey, 2011.

	Intensive care	General medicine	Surgery	Gynaecology & obstetrics	Paediatrics	Other/ mixed	All
Peripheral vascular catheter	77.8%	50.3%	50.7%	21.2%	50.1%	18.2%	46.8%
Central vascular catheter	72.5%	5.7%	5.7%	0.5%	5.1%	0.3%	7.3%
Urinary catheter	82.1%	15.1%	17.8%	7.4%	0.0%	4.3%	16.2%
Intubation	53.1%	0.6%	2.0%	0.9%	0.0%	0.3%	3.0%
Number of patients (100%)	207	2105	2082	557	375	302	5628

Table 3. The number (N) and prevalence of different types of healthcare-associated infections (HAIs) overall and according to ward specialties, Slovenian national healthcare-associated infections prevalence survey, 2011.

	Intensive care	General medicine	Surgery	Gynaecology & obstetrics	Paediatrics	Other/ mixed	All
	N (prevalence)	N (prevalence)	N (prevalence)	N (prevalence)	N (prevalence)	N (prevalence)	N (prevalence)
Urinary tract infections	8 (3.9%)	35 (1.7%)	28 (1.3%)	4 (0.7%)	1 (0.3%)	1 (0.3%)	77 (1.4%)
Pneumoniae	30 (14.5%)	25 (1.2%)	19 (0.9%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	75 (1.3%)
Surgical site infections	9 (4.3%)	5 (0.2%)	48 (2.3%)	3 (0.5%)	0 (0.0%)	1 (0.3%)	66 (1.2%)
Systemic infections	12 (5.8%)	22 (1.0%)	13 (0.6%)	1 (0.2%)	6 (1.6%)	1 (0.3%)	55 (1.0%)
Bloodstream infections (BSIs)	12 (5.8%)	14 (0.7%)	7 (0.3%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	34 (0.6%)
Gastro-intestinal system infections	6 (2.9%)	11 (0.5%)	5 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	22 (0.4%)
Other lower respiratory tract infections	10 (4.8%)	5 (0.2%)	6 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	21 (0.4%)
Bone and joint infections	0 (0.0%)	1 (0.0%)	14 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	15 (0.3%)
Skin and soft tissue infections	1 (0.5%)	6 (0.3%)	6 (0.3%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	14 (0.2%)
Eye, Ear, Nose or Mouth infections	0 (0.0%)	6 (0.3%)	0 (0.0%)	0 (0.0%)	1 (0.3%)	0 (0.0%)	7 (0.1%)
Cardiovascular system infections	0 (0.0%)	3 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.1%)
Catheter-related infections w/o BSIs	0 (0.0%)	2 (0.1%)	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.1%)
Reproductive tract infections	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.5%)	0 (0.0%)	0 (0.0%)	3 (0.1%)
Patients with at least one HAI[a]	74 (35.7%)	125 (5.9%)	134 (6.4%)	12 (2.2%)	9 (2.4%)	4 (1.3%)	358 (6.4 %)

[a] Patients can have several HAIs, thus the numbers in columns do not necessarily add up to the number of patients with at least one HAI.
Not a single central nervous system infection was detected.
BSIs: bloodstream infections; w/o: without.

396 episodes of HAIs occurred in 358 patients (322 had one, 34 two and 2 had three episodes). 335 episodes (84.6%) started during current hospitalization, of which all were attributed to current hospitalization. 15.4% of all HAIs were present at admission, of which 59.0% were associated with a previous stay in the same hospital, and 23.0% were surgical site infections. The median duration of hospital stay until the onset of HAIs acquired during current hospitalization was 10 days (mean 15.6 days).

Among 396 episodes of HAIs, urinary tract infections were most common (19.4%), followed by pneumoniae (18.7%) and surgical site infections (16.7%). The mean number of HAI episodes per infected patient was 1.1. There were 7.0 episodes of HAIs per 100 patients. The corresponding ratio was the highest in ICUs (42.5/100), followed by surgery (7.1/100), general medicine (6.5/100), paediatrics (2.4/100), and gynaecology and obstetrics (2.2/100).

3.4 Risk Factors

The prevalence of HAIs acquired during current hospitalization, according to patient characteristics, ward specialties, exposure to extrinsic risks and the length of hospital stay is shown in Table 4, along with the results of univariate analysis of association.

The results of multivariate analysis of association of different risk factors with any HAI acquired during current hospitalization, together with the relevant results of univariate analyses, are shown in Table 5. Patients aged 80 years or more had 2.2 times higher odds for any HAI than those less than 50 years old (adjusted OR (aOR) 2.2; 95% CI: 1.4–3.4). In comparison to patients without fatal diseases, those with rapidly fatal diseases had 2.1 times higher odds for any HAI (aOR 2.1; 95% CI: 1.4–3.3). The presence of at least one HAI was further independently associated with surgery during current hospitalization (aOR 1.9; 95% CI: 1.5-2.5), the presence of a central vascular catheter (aOR 4.0; 95% CI: 2.9–5.7), the presence of a peripheral vascular catheter (aOR 2.0; 95% CI: 1.5–2.6), the presence of intubation (aOR 2.3; 95% CI: 1.4-3.5), and the presence of a urinary catheter (aOR 1.8; 95% CI: 1.3–2.4).

Table 4. The prevalence of healthcare-associated infections (HAIs) acquired during current hospitalization according to patients' characteristics, ward specialties, and exposure to extrinsic risks and results of univariate analysis of association, Slovenian national healthcare-associated infections prevalence survey, 2011.

	The prevalence of patients with HAIs	The number of patients (base)	Odds ratio	P-value (95% CI)
Sex				
Male	6.5%	2692	1	P<0.001
Female	4.2%	2936	0.6	(0.5-0.8)
Age				
<50 years	2.2%	1919	1	P<0.001
50–79 years	6.8%	2866	3.2	(2.3-4.5)
≥80 years	7.5%	843	3.6	(2.4-5.4)
McCabe index				
Non-fatal disease	3.5%	4394	1	P<0.001
Ultimately fatal disease	10.9%	921	3.4	(2.6-4.4)
Rapidly fatal disease	15.0%	287	4.9	(3.4-7.0)
Specialities				
General medicine	5.1%	2105	1	P<0.001
Surgery	4.9%	2082	1.0	(0.7-1.3)
Gynaecology & obstetrics	2.0%	557	0.4	(0.2-0.7)
Paediatrics	1.6%	375	0.3	(0.1-0.7)
Intensive care	33.8%	207	9.5	(6.7-13.5)
Other	1.0%	302	0.2	(0.1-0.6)
Surgery - current hospitalization				
No	3.4%	3908	1	P<0.001
Yes	9.7%	1719	3.1	(2.4-3.9)
Implant during the last 12 months				
No	4.7%	4893	1	P<0.001
Yes	9.2%	535	2.1	(1.5-2.8)
Intubation				
No	4.4%	5457	1	P<0.001
Yes	35.9%	170	12.3	(8.7-17.2)
Central vascular catheter				
No	3.5%	5216	1	P<0.001
Yes	28.5%	410	11.0.	(8.5-14.3)
Peripheral vascular catheter				
No	3.4%	2992	1	P<0.001
Yes	7.5%	2635	2.3	(1.8-2.9)
Urinary catheter				
No	3.0%	4715	1	P<0.001
Yes	17.1%	911	6.6	(5.2-8.4)
Length of hospital stay[a]				
≤ 3 days	1.4%	1899	1	P<0.001
4-7 days	4.8%	1630	3.5	(2.2-5.4)
8-14 days	7.2%	1112	5.4	(3.5-8.4)
≥15 days	11.6%	987	9.1	(5.9-13.9)

Maximum likelihood estimates for odds ratios together with 95% confidence intervals (CI) and likelihood ratio tests for significance of association (P-value) were computed using logistic regression.

[a] The length of hospital stay was computed until the day of the survey for patients without HAIs acquired during the current hospitalization and for those with HAIs acquired during the current hospitalization until the day of occurrence of HAIs (first HAI, if several).

Table 5. Risk factors for healthcare-associated infections (HAIs) acquired during current hospitalization, results of multivariate and relevant univariate analysis of association, Slovenian national healthcare-associated infections prevalence survey, 2011.

			Unadjusted		Adjusted[a]	
	The prevalence of patients with HAIs	The number of patients (bases)	Odds ratio	*P-value* (95% CI)	Odds ratio	*P-value* (95% CI)
Patient characteristics						
Age						
<50	2.2%	1913	1	P<0.001	1	P=0.001
50-79	6.7%	2849	3.2	(2.3-4.5)	1.8	(1.2-2.6)
≥80	7.5%	836	3.6	(2.4-5.4)	2.2	(1.4-3.4)
McCabe index						
Nonfatal disease	3.5%	4392	1	P<0.001	1	P=0.001
Ultimately fatal disease	10.9%	919	3.4	(2.6-4.4)	1.4	(1.0-1.9)
Rapidly fatal disease	15.0	287	4.8	(3.4-7.0)	2.1	(1.4-3.3)
Exogenous risk factors						
Surgery - current hospitalization						
No	3.4%	3886	1	P<0.001	1	P<0.001
Yes	9.6%	1712	3.0	(2.4-3.8)	1.9	(1.5-2.5)
Intubation						
No	4.4%	5428	1	P<0.001	1	P<0.001
Yes	35.9%	170	12.3	(8.8-17.3)	2.3	(1.4-3.5)
Central vascular catheter						
No	3.5%	5191	1	P<0.001	1	P<0.001
Yes	28.5%	407	11.0	(8.5-14.3)	4.0	(2.9-5.7)
Peripheral vascular catheter						
No	3.4%	2981	1	P<0.001	1	P<0.001
Yes	7.5%	2617	2.3	(1.7-2.9)	2.0	(1.5-2.6)
Urinary catheter						
No	3.0%	4690	1	P<0.001	1	P<0.001
Yes	17.1%	908	6.6	(5.2-8.4)	1.8	(1.3-2.4)
Hospital stayb						
≤ 3 days	0.3%	1862	1	P<0.001	1	P<0.001
4-7 days	2.2%	1873	3.4	(2.2-5.3)	2.8	(1.7-4.4)
8-14 days	7.5%	909	5.4	(3.4-8.3)	3.8	(2.4-6.0)
≥15 days	19.1%	954	9.0	(5.9-13.8)	5.3	(3.3-8.3)

Maximum likelihood estimates for odds ratios together with 95% confidence intervals (CI) and likelihood ratio tests for significance of association (P-values) were computed using logistic regression. 5598 individuals with information on all risk factors in the table were included in analyses (98.5% of all individuals surveyed).

[a] Adjusted for all other risk factors shown in table.

[b] The length of hospital stay was computed until the day of the survey for patients without HAIs acquired during current hospitalization and for those with HAIs acquired during current hospitalization until the day of occurrence of HAIs (first HAI if several).

4 DISCUSSION

Ten years after the first Slovenian national HAI prevalence survey, we obtained the second national estimate of the overall prevalence of HAIs in Slovenian acute-care hospitals. It was substantial and rather high in ICUs. Three most frequently reported HAIs were urinary tract infections, pneumoniae, and surgical site infections, together accounting for more than half of all HAI episodes. Risk factors associated with HAIs, in addition to fatal underlying conditions, included central and peripheral vascular catheters, urinary catheter, intubation and surgery. Exposures to these invasive procedures were substantial.

Since we used standardised European methods and European HAIs surveillance definitions, our results are comparable to the overall European results. It is reassuring that our estimated prevalence of HAIs (6.4%) was very similar to the overall estimated prevalence of HAI in the European point prevalence survey (6.0%; country range: from 2.3% in Latvia to 10.8% in Portugal) (4). However, our estimated prevalence of HAIs among patients in ICUs (35.7%) was much higher than the corresponding European estimate (19.5%). Similar to our results, the three most frequently reported HAIs in Europe as a whole were urinary tract infection (Slovenia: 19.4%; Europe: 19.0%) pneumonia (Slovenia: 18.9%; Europe: 19.4%), and surgical site infection (Slovenia: 16.7%; Europe: 19.6%). Exposures to indwelling devices (urinary catheter and intubation), surgery, the presence of a rapidly fatal disease, and a prolonged hospital stay (≥15 days) were also associated with HAIs in the European survey. Finally, our exposure rates to indwelling devices on the day of the survey were very similar to overall European exposure rates (peripheral vascular catheter: in Slovenia 46.8% and in Europe 46.7%; central vascular catheter: in Slovenia 7.3% and in Europe 7.5%; urinary catheter: in Slovenia 16.2% and in Europe 17.2%; intubation: in Slovenia 3.0% and in Europe 2.3%).

In comparison to the 2001 Slovenian national HAIs prevalence survey, the SNHPS in 2011 estimate of the proportion of patients with at least one HAI on the day of the survey was lower (4.6% and 3.8%) (1). In contrast, the proportion of patients in ICUs with at least one HAI on the day of the survey was almost the same in 2001 as in 2011 (26.9% and 26.6%). However, we should be cautious with comparisons, as the methods used to ascertain HAIs in both surveys differed (including the slightly different HAI surveillance definitions used in 2001), and may have had different sensitivity and specificity. In 2011, we identified the same risk factors associated with HAIs as in 2001. These were: older age, having a fatal disease, being exposed to indwelling devices (central vascular catheter, peripheral vascular catheter, urinary catheter, intubation with or without ventilation), and having a prolonged hospital stay. In addition, in 2011, surgery was also associated with HAIs. It should be noted that factors associated with higher odds of HAIs do not necessarily precede HAIs. For example, a peripheral vascular catheter can be inserted because of antimicrobial parenteral treatment of a HAI. In 2011, we collected information on indwelling devices on the day of the survey only, while in 2001, we collected information on indwelling devices on the day of the survey and/or during the week before the survey. In 2011, 7.3% of patients had a central vascular catheter and 46.8% of patients had a peripheral vascular catheter on the day of the survey, while in 2001, 6.3% and 45.5% of patients had a central vascular catheter and a peripheral vascular catheter on the day of the survey and/or during the week preceding the survey, respectively. In 2011, 16.2% of patients had a urinary catheter on the day of the survey, while in 2001, 16.3% had a urinary catheter on the day of the survey and/or during the week preceding the survey. These results suggest that, on average, the exposure of patients to indwelling devices may have increased during the last decade. Lower point estimate of prevalence of HAIs on the day of the survey in 2011 (3.8%), in comparison to 2001 (4.6%), together with some indication for higher exposure rates to risk factors associated with HAIs, suggest that there may have been some improvement in HAIs prevention and control in Slovenian acute-care hospitals during the last decade.

The strength of our survey was the use of standardised European methods piloted in 66 hospitals from 23 countries before the main survey, including both University Medical Centres from Slovenia (5). However, there were also some limitations. It is possible that the sensitivity and specificity of approaches to ascertain HAIs in some of participating hospitals in the SNHPS were less than optimal. This could have resulted in under- or over-estimation of the overall prevalence of HAIs and misclassification of some HAIs. During the SNHPS, we did not have resources needed for the concurrent validation of data collection methods within the European point prevalence survey of healthcare-associated infections and antimicrobial use in Europe in 2011 validation study performed in 10 EU Member States in 20 acute hospitals. The sensitivity of 83% (95% CI: 79%–87%) and specificity of 98% (95% CI: 98%–99%) were found for HAIs (6). The level of agreement between the primary survey data collection and validation of results were very good for HAIs overall (Cohen's kappa (κ): 0.81), and across all the types of HAIs (the range: from 0.83 for bloodstream infections to 1.00 for lower respiratory tract infections). The authors concluded that valid and reliable methods for HAIs ascertainment were used. In Slovenia, we have assessed the sensitivity and specificity of the method used in the SNHPS for the ascertainment of six selected types of HAIs in the largest Slovenian teaching hospital, the University Medical Centre Ljubljana. We used a retrospective medical chart review. The estimated

overall sensitivity and specificity of our data collection methods for ascertaining HAIs were relatively high, and the level of agreement between the primary survey data collection and validation of results was very good for HAIs overall (7). This is reassuring with respect to the validity and reliability of our SNHPS results.

5 CONCLUSIONS

Our results indicate that the prevalence of HAIs in Slovenian acute-care hospitals in 2011 was substantial. Lower estimated prevalence of HAIs on the day of the survey in 2011, in comparison to 2001, together with some indication for higher exposure rates to invasive procedures associated with HAIs, suggest that there may have been some improvement in HAIs prevention and control in Slovenian acute-care hospitals during the last decade. An unacceptably high estimated prevalence of HAIs in ICUs requires the development of a national HAIs surveillance system in ICUs to support the intensification of their evidence-based prevention and control.

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CONFLICT OF INTEREST

No conflicts of interest exist.

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ETHICAL APROVAL

The Medical Ethics Committee of the Republic Slovenia consented to the development and implementation of the National Network for the Surveillance of HAIs, with one of its components, repeated Slovenian national healthcare-associated infections prevalence surveys (consent number: 68/04/08).

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SENSITIVITY AND SPECIFICITY OF THE METHOD USED FOR ASCERTAINMENT OF HEALTHCARE-ASSOCIATED INFECTIONS IN THE SECOND SLOVENIAN NATIONAL PREVALENCE SURVEY

OBČUTLJIVOST IN SPECIFIČNOST METODE PREPOZNAVANJA BOLNIŠNIČNIH OKUŽB V DRUGI SLOVENSKI NACIONALNI PRESEČNI RAZISKAVI

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ABSTRACT

Introduction. The second Slovenian national healthcare-associated infections (HAIs) prevalence survey (SNHPS) was conducted in acute-care hospitals in 2011. The objective was to assess the sensitivity and specificity of the method used for the ascertainment of six types of HAIs (bloodstream infections, catheter-associated infections, lower respiratory tract infections, pneumoniae, surgical site infections, and urinary tract infections) in the University Medical Centre Ljubljana (UMCL).

Methods. A cross-sectional study was conducted in patients surveyed in the SNHPS in the UMCL using a retrospective medical chart review (RMCR) and European HAIs surveillance definitions. Sensitivity and specificity of the method used in the SNHPS using RMCR as a reference was computed for ascertainment of patients with any of the six selected types of HAIs and for individual types of HAIs. Agreement between the SNHPS and RMCR results was analyzed using Cohen's kappa coefficient.

Results. 1474 of 1742 (84.6%) patients surveyed in the SNHPS were included in RMCR. The sensitivity of the SNHPS method for detecting any of six HAIs was 90% (95% confidence interval (CI): 81%-95%) and specificity 99% (95% CI: 98%-99%). The sensitivity by type of HAI ranged from 63% (lower respiratory tract infections) to 92% (bloodstream infections). Specificity was at least 99% for all types of HAIs. Agreement between the two data collection approaches for HAIs overall was very good (κ=0.83).

Conclusions. The overall sensitivity of SNHPS collection method for ascertaining HAIs overall was high and the specificity was very high. This suggests that the estimated prevalence of HAIs in the SNHPS was credible.

Keywords:
healthcare-associated infections, prevalence, retrospective medical chart reviews, sensitivity, specificity, cross-sectional study, Slovenia

IZVLEČEK

***Uvod**. Druga slovenska nacionalna presečna raziskava bolnišničnih okužb (SNPRBO) je potekala leta 2011 v slovenskih bolnišnicah za akutno oskrbo v okviru evropske presečne raziskave okužb, povezanih z zdravstvom, in uporabe protimikrobnih zdravil v bolnišnicah za akutno oskrbo. Cilj naše raziskave je bil oceniti občutljivost in specifičnost metode za prepoznavanje šestih pomembnih vrst bolnišničnih okužb (BO): okužb kirurške rane, okužb krvi, okužb, povezanih z žilnimi katetri, okužb sečil, okužb spodnjih dihal brez pljučnic in pljučnic (ki predstavljajo približno tri četrtine vseh BO) v Univerzitetnem kliničnem centru Ljubljana (UKCL).*

***Metode**. Izvedli smo presečno raziskavo med bolniki UKCL, ki so bili vključeni v SNPRBO. Uporabili smo metodo retrospektivnega pregleda medicinske dokumentacije (RPMD) in evropske standardne definicije za namene epidemiološkega spremljanja BO. Izračunali smo občutljivost in specifičnost metode za prepoznavanje bolnikov z vsaj eno izmed šestih izbranih BO v SNPRBO v primerjavi z referenčno metodo RPMD in za posamezne vrste BO. Skladnost rezultatov SNHPS in RMCR smo ugotavljali s koeficientom kappa po Cohenu.*

***Rezultati**. Od 1742 bolnikov, ki so bili vključeni v SNPRBO, smo v RPMD vključili 1474 (84,6%) bolnikov. Občutljivost SNPRBO metode za prepoznavanje bolnikov z vsaj eno od šestih izbranih vrst BO je bila 90% (95-odstotni interval zaupanja: 81%-95%). Specifičnost je bila 99% (95-odstotni interval zaupanja: 98%-99%). Ocenjena občutljivost za posamezne vrste BO je bila najnižja za okužbe spodnjih dihal brez pljučnic (63%) in najvišja za okužbe krvi (92%). Specifičnost za vse vrste BO je bila 99% ali višja. Skladnost rezultatov SNPRBO in RPMD glede prepoznanih BO je bila zelo dobra (κ=0,83). Najpogostejši vzrok za neprepoznavanje BO v SNPRBO je bil nepravilna uporaba definicij BO za namene epidemiološkega spremljanja oziroma njihovo slabo poznavanje. Pomanjkljiva medicinska dokumentacija v času RPMD pa bi bila lahko vzrok za neprepoznavanje nekaterih BO z RPMD.*

***Zaključki**. Občutljivost metode, uporabljene za prepoznavanje BO v SNPRBO, je bila visoka in specifičnost zelo visoka. Skladnost pristopov prepoznavanja BO v SNPRBO in RPMD je bila zelo dobra. Zaključimo lahko, da je bila ocena prevalence BO v SNPRBO verodostojna. Temeljito usposabljanje zbiralcev podatkov za pravilno uporabo definicij BO za namene epidemiološkega spremljanja in zagotavljanje čim bolj popolnega beleženja podatkov, ki so pomembni za prepoznavanje BO v medicinski dokumentaciji, sta pomembni za izboljšanje občutljivosti metod prepoznavanja vseh vrst BO v bodočih nacionalnih presečnih raziskavah.*

Ključne besede:
bolnišnične okužbe, prevalenca, retrospektivni pregledi medicinske dokumentacije, občutljivost, specifičnost, presečna raziskava, Slovenija

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1 INTRODUCTION

Surveillance is an essential part of effective infection control programs (1). A cost-effective alternative to more resource-demanding prospective healthcare-associated infection (HAI) surveillance systems are point prevalence surveys of HAIs (2, 3).

To estimate the prevalence of all types of HAIs in all acute-care hospitals in Slovenia, the first national prevalence survey was conducted in 2001 (4). On the day of the survey, 4.6% patients had at least one HAI. Among the limitations of the survey, the researchers noted no piloting or validation of the data collection methods and a possibility that the sensitivity and specificity of approaches to ascertain HAIs in some participating hospitals were less than optimal. Ten years later, in 2011, the second Slovenian national HAIs prevalence survey (SNHPS) was conducted (5). The agreed standard methodology for the European point prevalence survey of HAIs and antimicrobial use in European acute-care hospitals (EUPPS) coordinated by the European Centre for Disease Prevention and Control (ECDC) was used (6). The estimated proportion of patients with at least one HAI on the day of the survey or still treated for any HAI on the day of the survey was 6.4% (5).

Data validity is a major issue in the surveillance of HAIs and the accuracy with which HAIs are ascertained varies considerably due to differences in experience, qualifications, training and awareness of surveillance staff, and consistency in the application of surveillance definitions for HAIs (7, 8). In order to contribute to the accuracy of results of future surveys, sensitivity and specificity of methods used should be determined regularly (9, 10). Recently, the results of the ECDC pilot validation of the EUPPS in 10 European Union (EU) Member States conducted in 2011 were published (11). The overall sensitivity and specificity of the method used for ascertainment of HAIs were estimated to be 83% and 98%, respectively. The sensitivity by type of HAIs ranged from 83% for bloodstream infections to 100% for lower respiratory tract infections, and specificity was higher than 99% for all types of HAIs. Due to limited resources at the time of the SNHPS, Slovenia did not participate.

The objective of our study was to estimate the sensitivity and specificity of the method used for the ascertainment of patients with any of the selected six types of HAIs (excluding neonatal infections) overall and for individual types of HAIs in the SNHPS conducted in 2011 in the largest Slovenian teaching hospital (the University Medical Centre Ljubljana - UMCL), in comparison to the reference method based on retrospective medical chart review (RMCR). The six selected HAIs were bloodstream infections (including microbiologically proven catheter related infections), catheter-related infections without bloodstream infections, lower respiratory tract infections (other than pneumonia), pneumoniae, surgical site infections, and urinary tract infections (asymptomatic bacteriuria excluded). These account for approximately three quarters of all HAIs. Our secondary objectives were to determine the level of agreement between the two HAI ascertainment methods, the SNHPS and RCMR, and to explore the reasons for discrepancies.

2 METHODS

2.1 The Methods Used in the Slovenian National HAI Prevalence Survey

The methods were described elsewhere (5). In brief, a one-day cross-sectional study was conducted in all Slovenian acute-care hospitals in 2011. Before the start of the data collection, the national SNHPS coordination expert team trained all SNHPS co-ordinators for data collection in individual hospitals, who, except for one, were infection prevention and control physicians. The national SNHPS coordination expert team, together with the SNHPS hospital coordinators, trained hospital teams of SNHPS data collectors. Special attention was dedicated to good understanding of the method used for ascertainment of HAIs and European standard surveillance definitions for different types of HAIs (6). During the period of three weeks in October 2011, SNHPS data collectors collected standard information for all patients according to the SNHPS protocol. The presence of different types of HAIs, or ongoing treatment for these HAIs on the day of the SNHPS, was ascertained by reviewing all medical records available at the time of the survey and through consultations with attending physicians and nurses. The SNHPS data collectors ascertained HAIs by judging whether the criteria were fulfilled according to the SNHPS protocol and the surveillance definitions. They recorded the following information about each ascertained HAI: the code of the type of HAI; the exposure to relevant indwelling devices for pneumonia and bloodstream infection within 48 hours before the onset, and for urinary tract infection within seven days before the onset; the source for bloodstream infection (catheter related, secondary to another site (e.g. surgical site infection), other/unknown); the date of onset; presence at admission; and the source of HAI (current hospital, other hospital, other/unknown). The information about the presence of individual criteria for fulfilment of the European HAI surveillance definitions was not recorded.

2.2 Data Collection with Retrospective Medical Chart Review

We conducted a cross-sectional study. All patients enrolled into the SNHPS in the UMCL in 2011, with the exception of neonates, were eligible for RMCR. The RMCR team

consisted of the primary data collector (microbiologist), infectious disease specialist (infection control physician) and epidemiologist, all with expertise in HAI surveillance. During the period from December 2012 to July 2013, more than a year after the SNHPS data collection, the primary data collector, blinded with respect to the HAI status of patients as ascertained in the SNHPS, reviewed all available medical documentation of all eligible patients. The data sources used, either paper forms or different electronic hospital information systems, included clinical information (medical charts, nursing care reports, antibiotics use records, temperature lists), laboratory and radiology reports. Extracted information was recorded on RMCR data collection forms. The data that had also been collected during the SNHPS included: patient's hospital registration number, age, sex, hospital admission date, and SNHPS date. Patients were classified according to the McCabe severity of illness index, at the time of admission, into three categories: non-fatal diseases, ultimately fatal diseases (expected survival between one and five years), and rapidly fatal diseases (expected survival less than one year) (12). Exposures to indwelling devices (central vascular catheter, peripheral vascular catheter, urinary catheter), intubation during hospitalisation, and surgical procedures during a month preceding the survey, or, for insertion of implants, during 12 months preceding the survey, were recorded. Additional information not collected during the SNHPS included all individual criteria for the ascertainment of selected six types of HAIs according to the SNHPS protocol and European HAI surveillance definitions (6). For example, to be able to ascertain lower respiratory tract infection (other than pneumonia), recorded information included the presence of clinical or radiographic evidence of pneumonia and following signs or symptoms (with no other recognized cause): fever (>38 C), cough, new or increased sputum production, rhonchi, wheezing. In addition, the following information was recorded: positive culture obtained by deep tracheal aspirate or bronchoscopy; positive antigen test on respiratory secretions; organisms seen on smear or cultured from lung tissue or fluid, including pleural fluid; a lung abscess or empyema seen during a surgical operation or histopathologic examination; an abscess cavity seen on radiographic examination of lung.

2.3 Data Management and Analysis

The primary data collector checked the RMCR completed data collection forms for errors, missing information and internal inconsistencies. The data were double entered using Epi Info (Epi Info, version 7, CDC, Atlanta, GA, USA). Code range, filter, and some internal consistency checks were built-in. Discrepancies due to entry mistakes were checked against information recorded on RMCR data collection forms, and corrected. The data collected during the SNHPS for all patients surveyed by RMCR, including the data about the six types of HAIs, was added to the merged RMCR and SNHPS dataset. The records of individual patients were matched by using patients' hospital registration numbers.

Data analysis was performed using SPSS (Statistical Package for the Social Sciences, version 21.0, Chicago, IL, USA). The overall proportion of patients with at least one of the six types of HAIs, or still treated for any of these on the day of the SNHPS, as ascertained by the RMCR among all patients included into RMCR (RMCR HAIs prevalence) and of patients with at least one of the six types of HAIs, or still being treated for any of these on the day of the SNHPS, as ascertained during the SNHPS among all patients included into the RMCR (SNHPS HAIs prevalence), was calculated. Respective prevalence estimates for individual types of HAIs were also calculated. The extrapolation of the RMCR results to the 1655 eligible patients (UMCL patients included into the SNHPS without neonates and duplicates) was performed. We used the same approach as described in Reilly et al. (11). The positive predictive value (PPV) and negative predictive value (NPV) were calculated from combined RMCR and SNHPS datasets. PPV was calculated as the percentage of patients with true HAI (as ascertained by RMCR – the "reference") among all positive patients with at least one of the respective six types of HAIs as ascertained in the SNHPS, and NPV as the percentage of the true negative cases (as ascertained by RMCR – the "reference") among all patients identified as negative as ascertained in SNHPS. We estimated the number of true positive patients with at least one of the six types of HAIs by multiplying the number of all positive cases in SNHPS with the PPV. The same procedure was performed for negative cases with the NPV (11). Using the RMCR ascertainment of HAIs as the ''reference'', the sensitivity and specificity of the method used during the SNHPS (SNHPS method) for the ascertainment of patients with any of the selected six types of HAIs overall, and for individual types of HAIs were determined. The sensitivity of the SNHPS method refers to the ability of the method to correctly identify patients with HAIs. It was estimated by dividing the number of patients with any of the selected six types of HAIs detected with both methods by the number of patients with any of the selected six types of HAIs detected by RMCR, together with its 95% confidence interval (CI) (13). The specificity of the SNHPS method refers to the ability of the method to correctly identify those patients without HAIs. It was estimated by dividing the number of cases with no HAIs, as ascertained by both methods, by the number of cases with no HAIs by RCMR and its 95% CI (13). The same procedure was performed for calculating of the sensitivity and specificity of SNHPS method for the identification of individual types of HAIs. We used kappa (κ) statistics to analyse agreement between the two different HAIs ascertainment approaches. Kappa coefficient values between 0.81-1.00 were interpreted as

very good agreement, values 0.61-0.80 as good, values 0.41-0.60 as moderate, values 0.21-0.40 as fair/marginal, and values below 0.2 as poor agreement. Negative values are possible and also denote poor agreement) (14, 15). 95% CIs were calculated. All discrepant cases with respect to HAIs, as ascertained during the SNHPS and by the primary RMCR data collector, were reviewed by the RMCR team, in order to explore the reason for discordance.

3 RESULTS

1742 patients were surveyed in the UMCL, in the SNHPS. After excluding 9 duplicates and 78 neonates, 1655 patients remained eligible for RMCR. Of those, records were not available for 162 (9.3%) patients during the RMCR period and were insufficient for the ascertainment of possible HAIs for additional 19 (1.1%) patients. Thus, 1474 patients (84.6% of all surveyed in the SNHPS and 89.1% of all eligible for RMCR) were included in the RMCR. Characteristics of these 1474 patients and of 1655 patients surveyed during the SNHPS and eligible for RMCR are presented in Table 1. Both groups are very similar with respect to sex, age and McCabe index at admission, length of hospital stay and proportions with operation during the preceding month.

Table 1. Characteristics of patients surveyed in the University Medical Centre Ljubljana, during the Slovenian national healthcare-associated infections survey (SNHPS) in 2011, eligible for the retrospective medical chart review (RMCR), and of those included into the RMCR.

		SNHPS population eligible for RMCR	RMCR population
The number of patients		1655	1474
Sex			
	Women	809 (48.9%)	738 (50.1%)
	Men	846 (51.1%)	736 (49.9%)
Age (at the time of admission)			
	Median	60	60
	Range	0-98	0-98
	Mean	55	55
	≤49 years	589 (35.6%)	508 (34.5%)
	50-79 years	807 (48.8%)	715 (48.5%)
	≥80 years	259 (15.6%)	251 (17.0%)
McCabe index (at the time of admission)			
	nonfatal disease	1298 (78.4%)	1183 (80.3%)
	ultimately fatal disease	280 (16.9%)	239 (16.2%)
	rapidly fatal disease	66 (4.0)%	52 (3.5%)
	unknown	11 (0.7%)	0 (0.00%)
The length of hospital stay (until SNHPS day)			
	Median	6	6
	Range	0 - 367	0 - 323
	Mean	13	12
	0-3 days	594 (35.9%)	533 (36.1%)
	4-7 days	396 (23.9%)	369 (25.0%)
	8-14 days	267 (16.1%)	230 (15.6%)
	≥15 days	398 (24.0%)	342 (23.2%)
Operations last month (until SNHPS day)			
	Surgery	571 (34.5%)	574 (38.9%)
	No surgery	1084 (65.5%)	900 (61.1%)

[a] in the case of implant, operations during 12 months, preceding the SNHPS

A primary prevalence, the proportion of the 1655 eligible patients with at least one of the six types of HAIs estimated in the UMCL in SNHPS, was 5.8% (95% CI: 4.8%-7.0%). The estimated prevalence of patients with at least one of the six types of HAIs ascertained during the SNHPS (SNHPS HAIs prevalence), among 1474 patients included into RMCR, was 5.4% (82 HAIs in 79 patients). The estimated prevalence of patients with at least one of the six types of HAIs on the day of SNHPS, ascertained by RMCR (RMCR HAIs prevalence) among these 1474 patients, was 4.8% (75 HAIs in 71 patients).

In comparison to the RMCR, the overall sensitivity of the data collection method used during the SNHPS for ascertaining at least one of the six types of HAIs among 1474 UMCL patients included into RMCR was 88.7% (95% CI: 79.0%-95.0%) and specificity 98.9% (95% CI: 98.2%-99.4%) (Table 2). Extrapolating these RMCR results to the 1655 patients eligible for RMCR, the overall sensitivity of the data collection method used during the SNHPS for ascertaining of at least one of the six types of HAIs among UMCL patients was 89.5% (95% CI: 81.1%-95.1%) and specificity 98.8% (95% CI: 98.1%-99.2%) (Table 3). The respective sensitivity by type of HAI ranged from 62.5% for lower respiratory tract infections (excluding pneumoniae) to 91.7% for bloodstream infections, while specificity was higher than 99.0% for all types of HAIs (Table 4).

Table 2. Sensitivity, specificity, positive predictive value and negative predictive value of the method used for ascertaining any of the six types of healthcare-associated infections (HAIs) among 1474 patients enrolled at the University Medical Centre Ljubljana in the Slovenian national HAI prevalence survey in 2011, in comparison to the retrospective medical chart review.

		Retrospective medical chart review		
		HAI	No HAI	Total
Slovenian national HAI prevalence survey	HAI	63	16	79
	No HAI	8	1387	1395
	Total	71	1403	1474

Sensitivity: 63/71x100=88.7% (95% CI: 79.0%-95.0%)
Specificity: 1387/1403x100=98.9% (95% CI: 98.2%-99.4%)
Positive predictive value (PPV): 63/79x100=79.7% (95% CI: 64.9%-84.4%)
Negative predictive value (NPV): 1387/1395x100=99.4% (95% CI: 98.4%-99.5%)

Table 3. Sensitivity, specificity of the method used for ascertaining any of the six types of healthcare-associated infections (HAIs) among 1655 eligible patients enrolled at the University Medical Centre Ljubljana in the Slovenian national HAI prevalence survey in 2011, in comparison to the retrospective medical chart review estimated by extrapolation of the results of the retrospective medical chart review conducted among 1474 patients.

		Retrospective medical chart review		
		HAI	No HAI	Total
Slovenian national HAI prevalence survey	HAI	77[a]	19	96
	No HAI	9	1550[b]	1559
	Total	86	1569	1655

Sensitivity: 77/86x100=89.5% (95% CI: 81.1%-95.1%)
Specificity: 1550/1569x100=98.8% (95% CI: 98.1%-99.2%)
[a]77=PPVx96
[b]1550=NPVx1559

The sensitivity by type of HAI ranged from 62.5% for lower respiratory tract infections (excluding pneumoniae) to 91.7% for bloodstream infections, while specificity was higher than 99.0% for all types of HAIs (Table 4).

Table 4. Sensitivity and specificity of the method used for ascertaining six different types of healthcare-associated infections (HAIs) among 1474 patients enrolled at the University Medical Centre Ljubljana in the Slovenian national HAI prevalence survey in 2011, in comparison to the retrospective medical chart review and respective kappa coefficients by type of HAIs.

Surveillance method	SSI	UTI	PN	LRI	BSI	CRI
RMCR (reference)						
Number of HAIs	15	21	19	8	12	0
Prevalence of HAI episodes* (%) 95% CI	1.0 (0.6-1.7)	1.4 (0.9-2.2)	1.3 (0.8-2.0)	0.5 (0.3-1.1)	0.8 (0.5-1.4)	0 (0.0-0.3)
SNHPS						
Number of HAIs	15	20	26	7	13	0
Prevalence of HAI episodes* (%) 95% CI	1.0 (0.6-1.7)	1.4 (0.9-2.1)	1.8 (1.2-2.6)	0.5 (0.2-1.0)	0.9 (0.5-1.5)	0 (0.0-0.3)
Sensitivity (%) 95% CI	86.7 (59.5-98.3)	76.2 (52.8-91.8)	89.5 (66.9-98.7)	62.5 (24.5-91.5)	91.7 (61.5-99.8)	/
Specificity (%) 95% CI	99.9 (99.5-100)	99.7 (99.3-99.9)	99.4 (98.8-99.7)	99.9 (99.5-100)	99.9 (99.4-100)	100 (99.8-100)
Kappa coefficient 95% CI	0.87 (0.74-1.00)	0.78 (0.64-0.92)	0.75 (0.61-0.89)	0.67 (0.39-0.94)	0.88 (0.74-1.00)	/

* on the day of SNHPS

SSI: surgical site infections. UTI: urinary tract infections. PN: pneumoniae. LRI: lower respiratory tract infections, excluding pneumoniae. BSI: bloodstream infections (including microbiologically proven catheter related infections). CRI: catheter-related infections without bloodstream infections. 95% CI: 95% confidence interval

The agreement between HAI ascertainment during the SNHPS and the RMCR for any of the six HAIs was very good (κ=0.83). The level of agreement across different types of HAIs was ranging from good for lower respiratory infections (excluding pneumoniae) (κ=0.67) to very good for bloodstream infections (κ=0.88).

13 episodes of HAIs (five urinary tract infection, three lower respiratory infections (other than pneumonia), two pneumoniae, two surgical site infections and one bloodstream infection) ascertained during the RMCR had not been ascertained during SNHPS, although all criteria for respective HAI surveillance definitions were fulfilled at the time of SNHPS data collection. This presumably resulted from difficulties with application of HAI surveillance definitions by SNHPS data collection teams.

20 episodes of HAIs had been ascertained during the SNHPS, but not during the RMCR. Among these, there were 9 pneumoniae, four urinary tract infections, three bloodstream infections, two surgical site infections and two lower respiratory tract infections. For most of these episodes, it was clear that they were false positive HAIs, since the criteria for ascertainment of HAIs had not been fulfilled. For example, four HAIs (two pneumoniae, one bloodstream infection, and one surgical site infection) occurred during current hospitalisation; however, sings and/or symptoms were no longer present and patients were no longer treated for them on the day of the SNHPS. One example involved a community-acquired urinary tract infection that was present on admission. Another example involved a bloodstream infection for which there was no evidence (none of the criteria for bloodstream infection surveillance definition fulfilled) in the medical documentation during RMCR. In contrast, in some cases of discrepancies between the SNHPS and RMCR results, HAIs might have been accurately ascertained during the SNHPS, while missed by the RMCR. It seemed possible that the documentation available to the SNHPS data collection teams (on signs and symptoms of HAIs and/or results of examinations) at the time of the SNHPS was no longer available to the RMCR team. For example, among 9 cases of pneumonia ascertained during the SNHPS, there were six cases in which all other criteria according to the surveillance definition were fulfilled during the RMCR, except for radiology evidence. Since in 2011 not all wards at the UMCL had started with electronic archiving of radiology reports, it is possible that radiology reports had been available to the SNHPS data collection teams at the time of the SNHPS, while they were no longer available to the RMCR team.

4 DISCUSSION

The overall sensitivity of SNHPS collection method for ascertaining HAIs in the UMCL in 2011 was high, and specificity was very high. The level of agreement between the two data collection methods for ascertainment of these HAIs was very good overall. Although these results were obtained in only one hospital, where conditions may be different to those in other Slovenian hospitals, this may indicate that data collection methods used in the SHNPS were reliable in identifying HAIs, which is also reassuring with respect to credibility of overall SNHPS results (5). Sensitivity of the SNHPS method varied according to the type of HAI, which indicated greater difficulties in application of some surveillance definitions, and suggests that reliability of HAIs prevalence surveys' data can be improved by better training data collectors in accurate implementation of HAI surveillance definitions. Some under-ascertainment of HAIs during the SNHPS, as well as during the RMCR, may have resulted from insufficient medical documentation. Good quality and completeness of medical documentation are crucial for accurate ascertainment of HAIs for surveillance purposes.

Slovenia did not participate in the ECDC pilot validation study of the EUPPS that enrolled 1950 patients from 20 acute-care hospitals from 10 EU Member States (11). The overall sensitivity and specificity of the method used for the ascertainment of patients with any of the selected six types of HAIs overall, in the SNHPS in the UMCL, as estimated by our RMCR (90%; 95% CI: 81%-95% and 99%; 95% CI: 98%-99%), were higher than the corresponding estimates in the EUPPS validation study (83%; 95% CI: 79%-87% and 98%; 95% CI: 98%-99%). In addition, the levels of agreement between our SNHPS and RMCR results and the EUPPS and EUPPS validation study results for HAIs overall were very similar (κ=0.83 and κ=0.81). Finally, in both validation studies, estimates for the sensitivity of primary data collection methods (SNHPS and EUPPS) varied by the type of HAI. In the SNHPS, it ranged from 63% for lower respiratory tract infections (excluding pneumoniae) to 92% for bloodstream infections, and in the EUPPS, from 83% for bloodstream infections to 100% for lower respiratory tract infections. Reilly et al. also emphasized the importance of the training of data collectors for accurate implementation of HAI surveillance definitions (11).

We should be cautious in comparing these results, since we used a blind RMCR data collection approach, while the countries participating in the ECDC pilot validation study of the EUPPS used a variety of methodological approaches, which included retrospective, simultaneous same day, simultaneous same time, blind and un-blind data collection. It should also be noted that the EUPPS validation study was conducted on the same day as the EUPPS. Thus, the availability of the data to both data collecting teams was very similar, while in our case, it is possible that some data available to the SNHPS team were no longer available to the RMCR team. Reilly et al. also emphasized the importance of good quality of medical documentation for accurate ascertainment of HAIs in prevalence surveys (11).

Relatively high estimated sensitivity for bloodstream infections (92%) and pneumoniae (90%) in the SNHPS may have resulted from a good knowledge and comprehension of respective surveillance definitions. Ascertainment of bloodstream infection requires a positive blood culture, and ascertainment of pneumonia a positive radiology result, in addition to the evidence of signs and symptoms, which is relatively straightforward. Good sensitivity for surgical site infections (87%) may have resulted from a good system for ascertainment of these infections in the UMCL and a high likelihood that surgeons note surgical site infections in the medical documentation. Our relatively low sensitivity for lower respiratory tract infections (63%) and urinary tract infections (76%) may have resulted from the non-recording of signs and symptoms of these infections in the medical documentation.

Our study allowed for a comprehensive RMCR review and ascertainment of the selected six types of HAIs when complete medical documentation was available. The strengths of our study included the high proportion of eligible individuals surveyed during the SNHPS enrolled into our RMCR (89%), and very similar characteristics of eligible patients to those surveyed during the RMCR. We tried to limit the measurement bias by blinding the primary data collector to the HAI ascertainment status of patients during the SNHPS. The major limitation of our RMCR may have been occasional non-availability and poor quality and incompleteness of some of the medical documentation available to the RMCR team more than a year after the SNHPS had been conducted. If the RMCR was conducted shortly after the data collection during the SNHPS, the availability of the data to both data collection teams would be more similar. However, it was clear, that signs and symptoms of patients, diagnostic procedures and results, treatment and care procedures are not always documented in such a way that it would be possible to ascertain all HAIs. To better estimate the sensitivity and specificity of the SNHPS method used during any future SNHPS, the RMCR should be conducted in several hospitals for better representativeness, and on the same day as SNHPS or shortly after, so as to avoid the unavailability of some of the data available during the SNHPS to the RMCR team. The results of our RMCR would be also more reliable if data were collected by two separate investigator teams, and if any discrepant result was examined before the final ascertainment of HAIs.

Finally, recent increase in the use of electronic healthcare information systems in Slovenian acute-care hospitals may make it possible to electronically harvest data for the purpose of HAI surveillance. Structured recording of information with respect to the criteria for the ascertainment of at least the most important types of HAIs according to the European surveillance definitions should be incorporated into healthcare information systems.

5 CONCLUSIONS

The overall sensitivity of SNHPS collection method for ascertaining HAIs in the UMCL in 2011 was high, and specificity was very high. Although these results were obtained in the UMCL, this indicates that the data collection methods used in the SHNPS are reliable in identifying HAIs, which is reassuring with respect to credibility of SNHPS published results (5). Reliability of HAIs prevalence surveys' data can be improved by a better training of data collectors in accurate implementation of HAI surveillance definitions. Good quality and completeness of medical documentation are crucial in the accurate ascertainment of HAIs for surveillance purposes. Development and increasing use of electronic healthcare data systems is an opportunity for the development of less work-intensive electronic surveillance of HAIs, as an alternative to the traditional surveillance of HAIs.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

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ETHICAL APROVAL

The Republic Slovenia Medical Ethics Committee consented to the SNHPS protocol (consent number: 68/04/08). A study protocol of RMCR was approved by Republic of Slovenia National Medical Ethics Committee (consent number: 195/10/12).

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A METHODOLOGICAL APPROACH TO THE ANALYSIS OF EGOCENTRIC SOCIAL NETWORKS IN PUBLIC HEALTH RESEARCH: A PRACTICAL EXAMPLE

METODOLOŠKI PRISTOP K ANALIZI EGOCENTRIČNIH SOCIALNIH OMREŽIJ PRI RAZISKOVANJU V JAVNEM ZDRAVJU: PRIKAZ PRIMERA

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ABSTRACT

Introduction. Research on social networks in public health focuses on how social structures and relationships influence health and health-related behaviour. While the sociocentric approach is used to study complete social networks, the egocentric approach is gaining popularity because of its focus on individuals, groups and communities.

Methods. One of the participants of the healthy lifestyle health education workshop 'I'm moving', included in the study of social support for exercise was randomly selected. The participant was denoted as the ego and members of her/his social network as the alteri. Data were collected by personal interviews using a self-made questionnaire. Numerical methods and computer programmes for the analysis of social networks were used for the demonstration of analysis.

Results. The size, composition and structure of the egocentric social network were obtained by a numerical analysis. The analysis of composition included homophily and homogeneity. Moreover, the analysis of the structure included the degree of the egocentric network, the strength of the ego-alter ties and the average strength of ties. Visualisation of the network was performed by three freely available computer programmes, namely: Egonet.QF, E-net and Pajek. The computer programmes were described and compared by their usefulness.

Conclusion. Both numerical analysis and visualisation have their benefits. The decision what approach to use is depending on the purpose of the social network analysis. While the numerical analysis can be used in large-scale population-based studies, visualisation of personal networks can help health professionals at creating, performing and evaluation of preventive programmes, especially if focused on behaviour change.

Keywords:
social network analysis, qualitative research, social environment, social support

IZVLEČEK

***Izhodišče**. Analiza omrežij je raziskovalni pristop, ki je posebej primeren za opis, raziskovanje in razumevanje strukturnih in relacijskih vidikov zdravja. Analiza socialnih omrežij se v javnem zdravju uporablja med drugim za proučevanja vloge socialne opore in socialnega kapitala ter vpliva osebnih in širših socialnih omrežij na vedenje, povezano z zdravjem. Osebne povezave in omrežja, kot so družina ali prijatelji, so bistveni za socialno vključenost. Raziskave egocentričnih socialnih omrežij imajo dolgo zgodovino v sociologiji, v javnozdravstvenih raziskavah pa se uporabljajo redko.*

***Metode**. V zdravstvenovzgojnih delavnicah Gibam se, ki potekajo v okviru Nacionalnega programa primarne preventive srčno-žilnih bolezni, vključenih v raziskavo o socialni opori za telesno dejavnost, je bil naključno izbran eden od udeležencev. Podatki so bili zbrani s pomočjo vprašalnika, oblikovanega za potrebe raziskave, in so primerni za izdelavo sociograma s podatki o opazovancu – egu in osebah, ki jih imenuje v svoje omrežje – alterjih. Intervjuje je v celotni skupini udeležencev osebno izvedel raziskovalec. Za analizo egocentričnega omrežja udeleženca so bile uporabljene numerične metode analize in računalniški programi za analizo socialnih omrežij.*

***Rezultati**. Z numerično analizo so bili dobljeni podatki o velikosti, sestavi (homofilnost, homogenost) in strukturi (stopnja, jakost in povprečna jakost povezav) egocentričnega omrežja. Velikost omrežja predstavlja število imenovanih alterjev. Homofilnost in homogenost sta bili izračunani na osnovi podatkov o egu in alterju (spol, starost, odnos med egom in alterjem). Stopnja egocentričnega omrežja je izračunana kot razmerje med številom alterjev, ki so povezani z egom, in številom vseh navedenih alterjev. Jakost posamezne vezi je izračunana kot vsota jakosti posameznih komponent povezave ego-alter. Izračunana je bila tudi povprečna jakost vezi v omrežju. Opisani in ovrednoteni so trije programi za analizo socialnih omrežij. Programa Egonet.QF in E-net sta primarno namenjena analizi egocentričnih socialnih omrežij, medtem ko je program Pajek v osnovi namenjen analizi velikih, popolnih omrežij. Vsi trije programi imajo možnost slikovnega prikaza omrežja, razlikujejo pa se po obsegu informacij o akterjih v omrežju in njihovih povezah, ki so prikazane v sliki.*

***Zaključek**. Predstavljeni sta numerična analiza in slikovni prikaz egocentričnih socialnih omrežij. Rezultati kažejo, da ima vsak od pristopov svoje prednosti, uporaba pa je odvisna od namena analize egocentričnega omrežja. Medtem ko je numerična analiza primerna predvsem za raziskave na populacijski ravni, lahko slikovni prikaz socialnih omrežij pomaga zdravstvenim delavcem pri razvijanju, izvajanju in vrednotenju preventivnih programov, zlasti če so ti usmerjeni v spreminjanje vedenja, povezanega z zdravjem.*

Ključne besede:
analiza socialnih omrežij, kvalitativno raziskovanje, socialno okolje, socialna opora

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1 INTRODUCTION

Qualitative research is not a new paradigm in public health. It has been recognized decades ago that public health problems result from complex social, economic, political, genetic and environmental causes, and that there different methods that need to address them (1). Many of these methods evolved in social sciences and offer effective tools for dealing with health challenges that public health research is focused on (1-3). Disease prevention and health promotion is only one of the topics where more individually based and contextualized knowledge is required (3).

In Slovenia, the use of qualitative research in medicine increased significantly in the last years. Studies were performed either with qualitative methods only (4-9), or by means of an integrated approach, together with quantitative measures (9, 11).

The social network analysis (SNA) is defined as a set of methods used for mapping, measuring and analysing social relationships between people, groups and organisations (12). It is a research approach uniquely suited to describing, exploring and understanding structural and relational aspects of health (13, 14). It incorporates the social context to explain individual or group outcomes (15). Historically, the SNA has been used mainly in social sciences, but its use has grown rapidly in recent years into many other areas, including public health (12, 14). Research on social networks in public health focuses less on the transmission of specific tangible elements and more on how social structures and relationships influence health and health-related behaviours (16). Much of what is studied in public health is relational by itself. The SNA has been used primarily to study the transmission of diseases and information, diffusion of innovations, the role of social support and social capital, the influence of personal and social networks on health behaviours and the inter-organisational structure of health systems (13). There have been discussions whether the SNA is a quantitative or qualitative method. Authors describe the evolution from the qualitative approach in the early beginnings of the SNA, to the development of advanced mathematical methods and computer programs that led to a predominance of quantitative approaches, and finally, the mixed approach which combines both (17-19). Quantitative approaches map and measure networks by simplifying social relations into numerical data, where ties are either absent or present. Qualitative approaches, on the other hand, enable to consider issues relating to characteristics of social ties (19).

There are two types of social networks, namely: complete and egocentric social networks. Complete networks consist of a group of units (people, organisations, etc.) and relationships between them. In egocentric social networks (ESN), the person of interest is referred to as the ego. The people he/she is appointing to his/her network – relatives, friends, advisors, etc., are referred to as alteri (15, 20, 21). While the sociocentric approach is used to study complete social networks, the egocentric approach is gaining popularity because of its focus on individuals, groups and communities (15). Personal relationships and networks, like family relations, friendships, or neighbourhoodrelationships, are essential for social integration. Although the ESN studies have a long history in sociology, their use in health studies is rare (22).

With the present study, we aimed to contribute to the consolidation of the SNA in public health research. Our goal was to demonstrate the analysis and use of computer programmes for the ESN analysis on a practical example.

2 METHODS

The present study is part of a larger study on social networks and social support for exercise among participants of healthy lifestyle education workshops 'I'm moving', in the frame of the National Program of Primary Prevention of Cardiovascular Disease.

2.1 The Numerical Analysis of the ESN

The size (N) of a network is defined as the number of contacts – the alteri – the ego has.

The network's composition depends on the attributes of the alteri. In our case, those attributes include age, gender and one's relationship to the ego. Homo-/heterophily (the similarity or dissimilarity between the ego and alteri) and homo-/heterogeneity (the similarity or dissimilarity between alteri) of the network can be defined and calculated (23). Homophily of the ESN was calculated as the proportion of ego-to-alter ties sharing the same attribute among all ego-to-alter ties. Homogeneity of the ESN was calculated as the proportion of alteri sharing the same attribute among all alteri.

If the ego has ties with all of the named alteri homophily and homogeneity have the same value.

Structural attributes include measures like degree, strength, closeness, density, brokerage, etc. (23). In the present case, regarding the observed ties and the aim of the study, only degree, strength and average strength were considered.

Degree (D) of ESN is the number of nodes- alteri adjacent to the ego (20, 22). The degree is a count that ranges from a minimum of zero to the maximum number of adjacent alteri (n_a), if a given alter is adjacent to all alteri (20, 22). As the measure depends on the number of alteri,

a standardisation of the measure is proposed (20). The degree is the proportion of alteri that are adjacent to the ego (na) (Equation 1).

Equation 1.

$$D=n_a/N$$

Strength (s) of each ego-to-alter tie can either be named by the ego it self (based on the interview question and its scale) (22), or calculated, as in our case of the variable "overall support".

The measure average strength (S) has been introduced by the authors, as the separate elements of ties between ego and alteri can have different values of strength. It is calculated as the proportion of summary of separate strengths (Equation 2).

Equation 2.

$$S=s/n_a$$

2.2 The Visualisation of the ESN

Three computer programs for the SNA were analysed. The document analysis approach was used for the qualitative analysis of programs' characteristics. Document analysis is a qualitative approach where documents are interpreted by the researcher. Analysing documents, or in the present example, computer programs, incorporates the coding content into themes, similar to focus groups or interview analyses (24, 25).

The programs Egonet.QF (26) and E-net (27) were primary designed for the analysis of the ESN. The primary purpose of the tool Pajek (28) is the analysis of large social networks, but the analysis of the ESN is possible as well. The following themes, or in the present study, program characteristics, were used for the analysis: the availability of the program and manuals or instructions, preparation of input data, display of different strengths and elements of ties, calculation of numerical measures, and the export of network figures.

2.2.1 Egonet.QF

In Egonet.QF, no preparation of data is needed, as the data about the ego and alteri are entered into the program directly in order to create a network card. A network card is created by adding alteri to the ego. First, the number of circles is selected. The circles represent the closeness of alteri to the ego. In our example, we used the circles as a measure for the strength of ties. In the analysis of the overall support, the closest circle means the highest value of strength - 4. In the analysis of separate ties, where the value is only 0 and 1, we used only one circle. As it is not possible to show different elements of ties in one network card, we created five different cards: four for each different element and one for the overall support. Different sectors of the network card can be selected. The sectors can be specified by different means. In our example, we divided the sectors according to the ties of alteri to the ego (family, relatives, friends, workshop members or others). The nodes – alteri- are placed manually into the specified sector and circle. Additionally, information about alteri can be added: the ID, label, role and sex. As a result, the ego is presented as the centre of the network card with its alteri in different circles and sectors. All attributes of the ego and alteri can be seen in a separate window. Figures of the networks can be exported as digital image files (JPEG).

2.2.2 E-net

In the program E-net, data can be imported in two formats, row-wise as a single text in a raster image file (VNA) format, or column-wise as an Excell sheet. According to the way we organised our data, the row-wise format has been more convenient. The rows represent the collected egos and alteri, while the columns represent their attributes. The VNA file can be created by copying-and-pasting Excell matrices into a text editor and saving the document in the VNA format. In the VNA file, two kinds of data must be identified by an asterisk and matrix title (*ego data and *alter data) (Figure 1). After importing the VNA file in E-net, the data about ego and alteri are shown in a table. The visualisation of the network shows the ego in the centre, connected with the alteri. The lines between the ego and alteri do not convey any information about the type or strength of the connection. Information about each alter (age, sex, relationship, strength of all different elements) is shown by clicking on the respective alter in the network. Figures of the networks cannot be exported.

```
*ego data
ID      age     gender
1       48      female

*alter data
from    to      age     gender  relation        exercise        sup.exe bar.exe sup.ws  overall.sup
1       1_01    43      male    family  1       1       1       1       4
1       1_02    12      male    family  1       1       1       1       4
1       1_03    36      female  family  0       1       1       1       3
1       1_04    53      female  friend  1       1       1       1       4
```

Figure 1. Data on the ego and alteri organized for entering social network analysis in the program E-net.

2.2.3 Pajek

The program Pajek works with specific plain text files, called Pajek files. They can be created from text files by using the program txt2Pajek (29). For demonstration, we used only the connection 'overall support'. Figure 2 shows how data are entered into a text file. The label 'from' presents the ego, the label 'to' different alteri, and the label 'weight' the strength of the tie, in our case the variable 'overall support'. In the next step, the text file is imported in txt2Pajek. The Pajek file is created and saved automatically in the same folder as the text file. By choosing the option 'drawing network', the network is shown with the ego and its connections to alteri. The strength of the connections is demonstrated by different sizes of the lines. Figures of the networks can be exported as JPEG files.

```
from    to      weight
1       1_01    4
1       1_02    4
1       1_03    3
1       1_04    4
```

Figure 2. Data on the egocentric social network, organized in a text file for entering the transformation in the program Text2pajek.

2.3 The Sample for Demonstration

One of the participants of the healthy lifestyle health education workshop 'I'm moving' was randomly selected. The participant was denoted as the ego and members of her/his social network as alteri.

2.4 Input Data

Data were collected by personal interviews, using a questionnaire, which is self-made, based on the 'Social support for exercise survey' (30). The interview was performed in the entire workshop group by the researcher giving the participants detailed oral instructions and individual support for filling in the questionnaire, which was designed with the purpose to create a sociogram (20). Data about the ego included the ID, age, gender, and fitness status.

As a name generator of alteri (21), the following instruction, given orally and in the written form, was used: *'Please think about people who are very close to you. These are the people who mean a lot to you, whom you are asking for advice on important matters, and with whom you are in most frequent contact. Please consider family members, other relatives, friends, neighbours, co-workers, workshop members, etc.'*

Data about alteri included basic data (age, gender and one's relation to the ego) and answers to the following questions to explore elements of social support for exercise, namely: 1. Does the person exercise or do sports with you? 2. Does the person support or encourage you to be physically active? 3. Does the person hinder you in any way at being physically active? 4. Does the person support or encourage you at attending the workshop 'I'm moving'?

2.5 The Preparation of the Data for the Analysis

Each of the elements of the tie has the value 0 or 1, considering the answer to the question. In questions 1, 2 and 4, the answer 'yes' has the value 1 and the answer 'no' has the value 0. In question 3, the answer 'no' has the value 1 and the answer 'yes' has the value 0. Each of the four elements can be analysed and visualized separately. For an overall view on the strength of social support, the variable 'overall support' was created, being a summary of separate elements' values, and had values from 0 to 4. Figure 3 shows how to properly organize data on the ego and alteri for entering the SNA.

ego data

ID	age	gender
1	48	female

alter data

from	to	age	gender	relation	exercise	sup.exe	bar.exe	sup.ws	overall.sup
1	1_01	43	male	family	1	1	1	1	4
1	1_02	12	male	family	1	1	1	1	4
1	1_03	36	female	family	0	1	1	1	3
1	1_04	53	female	friend	1	1	1	1	4

Figure 3. Data on the ego and alteri organized for entering the social network analysis.

3 RESULTS

3.1 Numerical Analysis Results

3.1.1 The Size

The size of the demonstrated ESN was 4.

3.1.2 The Composition

The ESN had homophily value 0.75 for the ego's relationships to alteri, value 0.5 for gender, and value 0.5 for age (two alteri were ofthe same age as the ego, +/- 5 years).

As the ego had ties with all alteri, homogeneity showed the same values.

3.1.3 Structure

The degree of the network was 4, as the ego was connected to all 4 alteri, regardless of the element of the tie.

Three connections had strength values 4 and one connection had the value 3.

The average strength of the network was 3.75.

3.2 Visualisation Results

All three computer programs for the SNA had the option to visualize the ESN.

3.2.1 Egonet.QF

The ESN figure visualized in Egonet.QF in Figure 4 shows the overall support, while Figure 5 shows different network cards for each different element of the tie.

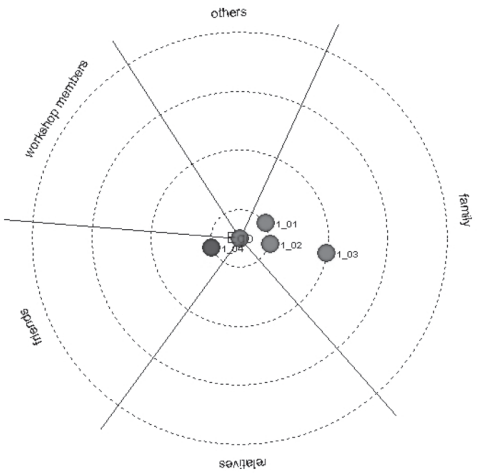

Figure 4. The ESN visualized in the program Egonet QF, showing the overall support.

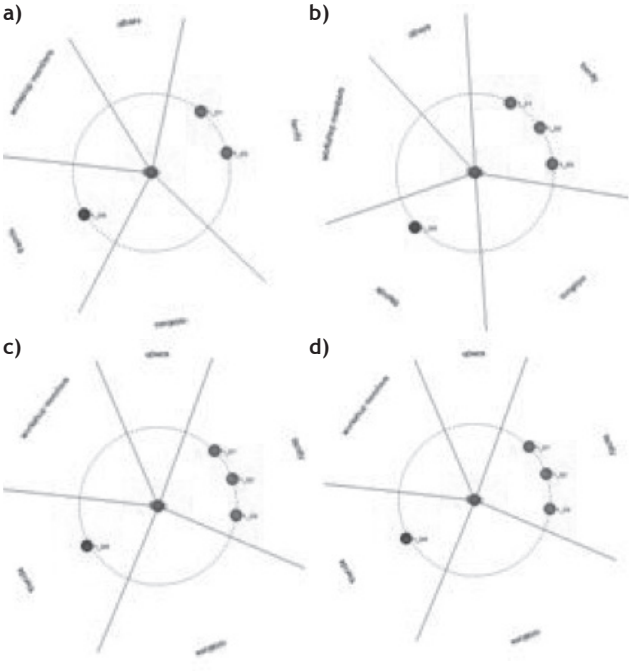

Figure 5. The egocentric social network visualized in the program Egonet QF, showing the following separate elements of the tie: a) exercise with the ego, b) support exercise, c) barrier exercise and d) support attending the workshop.

3.2.1 E-net

Figure 6 shows the ESN figure visualized in E-net. It presents the ties between ego and alteri, with information about the respective alter and the ego-to-alter tie displayed in the window left in the figure.

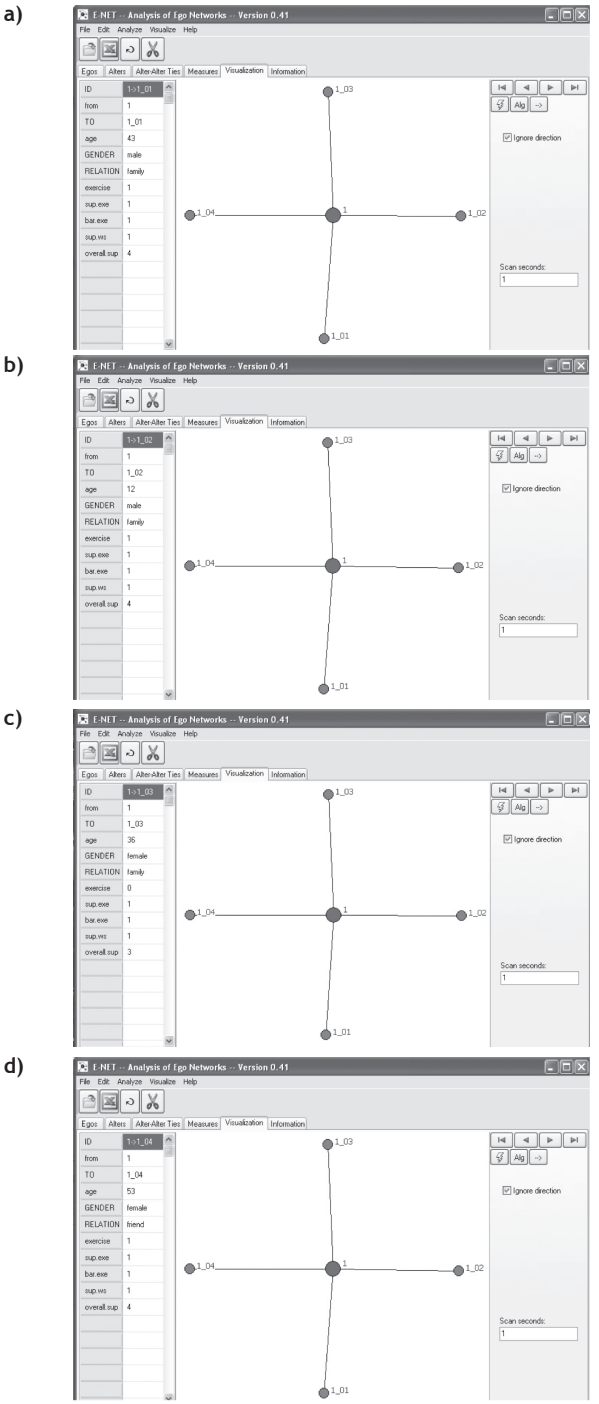

Figure 6. The egocentric social network visualized in the program E-net, displaying information about the alteri and alter-to-ego relationships: a) alter 1_01, b) alter 1_02, c) alter 1_03 and d) alter 1_04.

3.2.1 Pajek

Figure 7 shows the ESN visualized in the program Pajek.

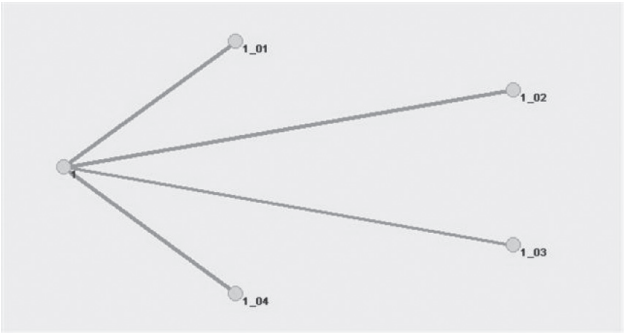

Figure 7. The egocentric social network visualized in the program Pajek.

3.3 The Qualitative Analysis of Programs for the Analysis of Egocentric Social Networks

Table 1 shows the main characteristics of the demonstrated tools.

Table 1. The main characteristics of the demonstrated tools for the visualization of egocentric social networks.

	Tools		
Characteristics	**Egonet.QF**	**E-net**	**Pajek**
Availability	Free download	Free download	Free download
Preparation of input data	No preparation of specific file formats needed	Depending on the desired format, transformation into VNA file is needed.	First, the creation of a text file, then the transformation into the Pajek file.
Display of different strengths of ties	Different strengths can be demonstrated by using circles with different distances to the ego.	Strengths of ties are not shown in the network picture, but are displayed in a separate window.	Different strengths of ties are shown in the network picture by different sizes of the lines between the ego and alteri.
Display of different elements of ties	Different elements can be demonstrated by using different sectors in the network.	Elements of ties are not shown in the network picture, but are displayed in a separate window.	Different elements of ties are not shown in the network picture.
Export of the figure	Export as JPEG file	No export of figures	Export as JPEG file
Calculation of numerical measures	No	Homophily and homogeneity	No
Manual freely available on-line	Yes	Yes	Yes

4 DISCUSSION

Results of the numerical analysis of the ESN give an insight into the network's main characteristics regarding the structure and content. We are able to obtain quantitative and qualitative data about the ESN's size, composition and structure (23). Degree is a measure very easy to compute, but informative in many applications (20). It gives the first overview of the individual's social network. Regardless of the element or strength of the ties, it shows how many people are connected to the ego, or in our example, how many people support the individual. The average strength of ties has an added value because it summarizes information on the strength of separate ties. The 'gap' between the degree and average strength is valuable information, especially in exploring social support. Together with the strength of separate ties, it shows the eventual potential for increasing the support in a very detailed way. The network's composition shows the characteristics of people within the ESN. It tells what are the preferences or possibilities of the individual at choosing persons into her/his network.

The program Egonet.QF is suitable for creating network diagrams, which make use of concentric circles (26). The use of circles is an excellent tool to present the strength of ego-to-alter ties. We used different sectors of the network to present different relationships between the ego and alteri. The division based on other attributes is possible too, so users can choose the option that is best suited to the purpose of their study. The visualization with different circles and sectors is attractive and gives a good overview on the ties between the egos and different alters. E-net is a program designed specifically for the analysis of personal networks (27). The VNA file needed for the import of data is easy to create and allows importing data of more than one ego and her/his alters in one file. This is useful when analysing more ESNs. The visualization is very basic and shows only the ego, alteri and connection

between them. Attributes of the actors are shown in the window beside the picture, by clicking on the respective node. The attributes, in our case, included strengths of separate elements of support by every alter, therefore this option gives a good overview of the source of support for the individual. The attributes can be displayed only separately for each actor. Pajek is a program for analysis and visualization of large social networks (28). Despite that, a visualisation of an ESN is possible too. Two steps are required in the preparation of data, including the use of an additional program for the transformation of data (29). The visualization is very basic and shows only the ego, alteri and connections between them. The only information about the ties is their strength, shown in different sizes of the lines. The analysis of ESNs could be performed in Pajek as well, but only if the ESN is analysed within an analysis of a complete social network.

Despite offering a selection of numerical analysis tools, none of the programs calculates the degree or average strength of the network, and only E-net calculates homophily and homogeneity. This is not considered as an important disadvantage, as the numerical analysis of the ESN is easily performed in other widely accessible programmes, such as Excell.

The analysis of the ESN provides a feasible way of obtaining network information, but it has several limitations. Demonstration of one single case limits representativeness. Relying on a single case is considered acceptable for a study as ours, as the purpose was to demonstrate the use of a particular methodology (17). Another limitation is related to the bias of recall. Respondents are often asked to recall behaviours that took place over a broad period of time. Recent contacts are more likely reported into the network, and forgetting to name people is another potentially significant problem (14, 15). In the analysis of the ESN, the example relies on the accuracy of reports from the focal actor, the ego. As we do not observe the status of relationships from the perspective of alteri, the perceptions of alteri could be different (17, 22). In our study, we focused only on ties between the ego and alteri, and did not explore the ties between alteri. Those ties can potentially affect the ego. As the purpose of our study is to demonstrate the use of the ESN analysis with social support, we limited our example only on ego-to-alter relationships.

With the analysis of different methodological approaches to the analysis of ESNs, we contributed significantly to public health research. We pointed out or introduced measures most suitable for the analysis of the ESN related to public health issues. The approaches are applicable to a wide range of ESN types and questions related to ESN research, including personal networks and social support, professional networks atthe personal level or networks between organizations.

Using the ESN analysis helps us learn about how individuals correspond with their social networks (31). Data obtained from the numerical network analysis, at the population level, can give an overview of social networks and social support in populations of interest. Data can serve for the monitoring and evaluation of programs, where social networks and social support present important components for program success. Especially health promotion or health education programs, where the focus lies on behaviour change, depend highly on the social support of participants. It is important to keep in mind that individuals are involved in a social environment and in a series of social relationships. Improvement and maintenance of health is influenced not only by the individual's behaviour, but also by the behaviours of others in the network (16). The methodological approaches demonstrated in the present study can be used for assessing for any kind of behaviour change. Public health experts working in those programs can benefit from information on their participants' social networks. A network card obtained with one of the visualization tools can not only serve as a presentation of results, but can also help the individual as cognitive support in network exploration, to help keeping the overview of relationships (32). The existing and potential sources of support or barriers can be identified, and can help maintaining or improving social support. Besides social support, many other relations can be explored at the individual level, such as seeking advice or information from a professional. Studies on the ESN can be performed autonomously, when the focus is on a small sample or specific environment. When gathering personal network information on large scale, ESN studies can be embedded within population surveys to enable population-representative data (22). When performing the ESN analysis at the population level, the numerical analysis is preferred, as it is more suitable for handling large amounts of units, and as the data can be further analysed by using statistical methods (eg. a comparison between egos or ego-alter relations, time dynamics, etc.).

5 CONCLUSION

We demonstrated the analysis of ESNs, including measures and visualization, and compared three different computer programs for the analysis of ESNs. Results show that both numerical analysis and visualization have their benefits. The decision as to which approach to use is dependent on the purpose of the ESN analysis. While the numerical analysis can be used in large scale population-based studies, visualization of personal networks can help health professionals at creating, performing and evaluating preventive programs, especially if focused on behaviour

change. The analysis of social networks, including ESNs, is used widely in the area of public health, and there is an enormous potential in the use of it.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

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Ethical approval has been received by the Committee of the Republic of Slovenia for medical ethics on April 11, 2011.

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