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Araştırma Makalesi / Research Article

Santral Venöz Kateter Bakımında Kullanılan Standart Bakım ile Transparan Film Örtülerin Etkinliklerinin Karşılaştırılması: Olgu Kontrol Çalışması

Effectiveness of Transparent Dressing with Chlorhexidine Gluconate for Central Venous Catheter Care in the Intensive Care Unit: A Case Control Study

Merve OZSARAC EYUBOGLU[1] | Ganime Esra SOYSAL[2*]

ÖZET

Bu çalışma, santral venöz kateter (SVK) bakımında kullanılan standart bakım ile klorheksidin glukonat içeren transparan film örtülerin etkinliğinin kateter enfeksiyonu, bakım maliyeti, hemşire memnuniyeti ve verimliliği açısından karşılaştırılması amacıyla gerçekleştirildi. Çalışmanın evrenini, bir devlet hastanesinin Genel Yoğun Bakım Ünitesi'nde yatan hastalar ile bu ünitede çalışan hemşireler oluşturdu. Mart- Aralık 2020 tarihleri arasında olgu kontrol tipinde gerçekleştirilen çalışmada, kontrol grubuna standart SVK bakımı, olgu grubuna klorheksidin içeren transparan film örtüler ile SVK bakımı uygulandı. Veriler, hasta dosyalarından, hemşire gözlem formlarından, hemşireler ile birebir yüzyüze görüşerek ve enfeksiyon kontrol komitesinden sürveyans bilgileri alınarak araştırmacı tarafından toplandı. Verilerin analizi bir istatistik programından yardım alınarak yapıldı. Olgu grubunda SVK kullanım oranı 0,66 kontrol grubunda ise SVK kullanım oranı 0,55 olarak hesaplandı. Olgu grubunda SVK kullanım oranı kontrol grubuna göre fazla ($p<0,05$) olmasına karşın, santral venöz katater ile ilişkili kan dolaşımı enfeksiyonu gelişimi görülmedi. Olgu grubunda 77, kontrol grubunda ise 293 pansuman yapıldı. Kontrol grubunda rutin değişim, kirlilik, gevşeme nedeniyle olgu grubuna göre, olgu grubunda ise ıslaklık nedeniyle kontrol grubuna göre daha fazla pansuman gerçekleştiği görüldü. Buna rağmen, klorheksidin glukonat içeren şeffaf pansumanların maliyet etkinliği daha iyi bulundu. Bununla birlikte, klorheksidin glukonat içeren şeffaf pansumanların kullanılması hemşire memnuniyeti ve verimliliğini artırdığı görüldü. Şeffaf pansumanlar enfeksiyon açısından gazlı bezden önemli ölçüde farklı değildi. Klorheksidin glukonatlı şeffaf pansumanlar sınırlı maliyet etkinliği gösterirken, hemşire memnuniyeti ve verimliliğine olumlu katkıda bulundu.

Anahtar kelimeler: Santral Venöz Kateter, Pansuman, Kateter, Enfeksiyon, Yoğun Bakım, Maliyet

ABSTRACT

The objective of this study was to compare the efficacy of standard care and transparent film dressings containing chlorhexidine gluconate in the management of central venous catheters (CVCs) in terms of catheter-related infection, cost of care, nurse satisfaction and efficiency. The study population comprised patients hospitalised in the General Intensive Care Unit of the State Hospital, and nurses employed in this unit. In the case-control study conducted between March and December 2020, the control group received standard CVC care, while the case group received CVC care with transparent film covers containing chlorhexidine. The data were collected by the researcher from patient files, nurse observation forms, face-to-face interviews with nurses, and surveillance information from the infection control committee. The data were analysed using a statistical software program. The rate of CVC utilisation in the case group was 0.66, while the rate of CVC utilisation in the control group was 0.55. Despite the higher rate of CVC use observed in the case group compared to the control group ($p < 0.05$), there was no evidence of catheter-related bloodstream infection. A total of 77 dressings were performed in the case group, compared to 293 in the control group. It was observed that a greater number of dressings were performed in the control group than in the case group, due to the need for routine changes, the presence of contamination and loosening. Conversely, a greater number of dressings were performed in the case group than in the control group, due to the presence of wetness. However, the cost-effectiveness of transparent dressings containing chlorhexidine gluconate was found to be superior. Nevertheless, the utilisation of transparent dressings containing chlorhexidine gluconate appeared to enhance nurse satisfaction and efficiency. Transparent dressings demonstrated no significant distinction from gauze in terms of infection. While transparent dressings with chlorhexidine gluconate exhibited limited cost-effectiveness, they contributed favourably to nurse satisfaction and efficiency.

Keywords: Central Venous Catheter, Dressings, Catheter, Infection, Intensive Care, Cost

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INTRODUCTION

The diagnosis, management, and provision of care for patients admitted to Intensive Care Units (ICUs) entail a comprehensive range and entail the utilization of numerous interventional therapies. The utilization of a central venous catheter (CVC) stands as the prevailing approach for accessing the intravenous/central line (Smith & Nolan, 2013). While employing a central venous catheter offers advantages, it also presents potential complications, including infection and thrombosis(Çam et al., 2008; Yeşil et al., 2014). Within ICUs, central venous catheter-related bloodstream infection, commonly referred to as central line-associated bloodstream infection (CLABSI), constitutes a significant factor contributing to both mortality and morbidity (Niemann et al., 2022). The demands of nursing practice require healthcare professionals to implement interventions with the best available evidence to make sound clinical decisions (Celebi & Ilce, 2022; Lopez, 2015).

CVCs are inserted by medical practitioners, while the subsequent care is administered by nurses. The majority of infections and associated complications that arise during the CVC procedure, even when implemented under ideal circumstances, can be averted through meticulous nursing care (Corley et al., 2019). Preventing catheter-related infections in patients not only leads to reduced hospitalization durations and early cost savings, but also contributes to alleviating nurses' workload and enhancing their job satisfaction (Kıray et al., 2019; Şanli et al., 2016; Sanlı & Sarıkaya, 2016; Thokala et al., 2016). During the catheter dressing process, nurses are tasked with selecting suitable dressing materials tailored to the patient's needs.(Kıray et al., 2019) Significant catheter-related infections observed in ICUs encompass catheter colonization, phlebitis, exit site infection, port infection, tunnel infection, septic thrombophlebitis, and CLABSI.

In numerous regions, traditional care for central venous catheters (CVCs) involves the use of sterile gauze and non-sterile adhesive tape (Corley et al., 2019). Based on research findings, incorporating transparent dressings in catheter care is expected to offer increased convenience to nurses. This is achieved through fewer dressing changes and the ability to observe the catheter site due to the transparency of the dressing material (Sanlı & Sarıkaya, 2016).

A comprehensive meta-analysis examined nine randomized controlled trials (RCTs) and revealed that the utilization of transparent dressings containing chlorhexidine gluconate has demonstrated a reduction in both catheter colonization and the incidence of CLABSI (Safdar et al., 2014).

The aim of this study is to compare the conventional approach involving sterile gauze for CVC care with the use of transparent dressings containing chlorhexidine gluconate, with a focus on aspects such as infection rates, cost implications, and nurse satisfaction and efficiency.

METHODS

Study Design and participants

This study adopted a non-randomized case-control design with parallel controls. The objective was to compare two approaches for central venous catheter (CVC) care: the standard method involving sterile gauze and the use of transparent dressings with chlorhexidine gluconate. The comparison was made based on the development of catheter infections, cost of care, nurse satisfaction, and cost-efficiency.

Materials and Their Properties

In the case group, sterile transparent dressings with chlorhexidine gluconate (3MTM 1657R TegadermTM CHG) were employed as covers. Additionally, an antiseptic solution consisting of 2% chlorhexidine gluconate and 70% alcohol (Biorad Dermol) was used for skin antisepsis. If the dressing's integrity remained intact, a daily dressing change was conducted.

In the control group, sterilized gauze tailored to size was used. Skin antisepsis employed 10% povidone-iodine (Medisin), and non-sterile adhesive medical tape (Clivex) measuring 10m x 10cm was replaced daily until wetness and contaminants were eliminated.

This research took place in a General Intensive Care Unit at a second-level state hospital from March to December 2020, accommodating 8 beds. The unit provides ICU services at the second level, with patient admissions mainly from the emergency room, and referrals from palliative care, the operating room, and inpatient services. Staffed with 13 nurses, including a nurse practitioner, one general surgeon, and one cardiovascular surgeon, the ICU operates three shifts: 08:00-16:00, 16:00-08:00, and 08:00-08:00, with each shift having four nurses responsible for two patients.

CVCs are typically inserted by two skilled physicians working in the ICU. It's worth noting that some patients admitted to the ICU may already have a CVC in place. However, there is no established protocol for CVC care within the unit. Nurses follow a standard care routine using povidone-iodine, sterile gauze, and non-sterile plaster.

During the CVC insertion process, both physicians and ICU staff practice hand hygiene and employ barrier measures such as masks, sterile gloves, and sterile gowns. All patients receive a similar type of CVC featuring three lumens, with the catheter secured using two or three silk skin sutures fastened to its two clips.

The hospital lacked chlorhexidine gluconate antiseptic solutions and transparent dressings. Yet, for the research, the investigator's resources provided both items.

Population and Study Sample

The study included patients receiving treatment in a specific intensive care unit, where their central venous catheters were inserted by unit medical staff and cared for by unit nurses over 7-10 days. Twelve unit nurses assessed care satisfaction. Sixty patients were initially involved, 30 in each group (case and control), meeting parametric test criteria. However, one patient dropped from each group, leaving 29 patients in each.

Inclusion Criteria: Patients aged 18 or above, not pregnant, with parental consent if applicable, without pre-existing infections, immunosuppressive therapy, or hypersensitivity to chlorhexidine gluconate or povidone-iodine, whose central venous catheters were inserted by unit physicians and monitored for 7-10 days post-insertion.

Exclusion Criteria: Deceased or transferred patients during follow-up, instances of catheter-related interventions or care beyond researcher control leading to discontinuation of monitoring and study exclusion.

Data Collection

The researcher used a daily CVC follow-up form (developed by MO). Infection control nurses' surveillance provided data for CVC cultures and infection-related findings. Nurses' care satisfaction was assessed with a 5-point Likert scale (1-unsatisfied, 5-very satisfied). CVC care effectiveness was evaluated by analyzing nurse satisfaction and dressing procedure duration (Figure 1).

Statistical analysis

The collected data underwent statistical analysis, presented as mean and standard deviation percentages. Prior to comparing mean values between groups, normality of distribution was assessed. The "Independent-Samples T Test" was applied for normally distributed data, and the "Mann–Whitney U Test" for non-normally distributed data. Chi-square test was used for pairwise comparison of categorical variables. Correlation coefficients were determined using the Pearson coefficient for normally distributed variables and the Spearman coefficient for non-normally distributed ones. Significance levels were set at $p<0.05$, $p<0.01$, and $p<0.001$ during results analysis. The incidence rate of central catheter-associated bloodstream infections (CVCI) was calculated as CVCII Rate=CVC-related bloodstream infections Number/CVC Days x 1000, reflecting infections per 1000 catheter days within a fixed catheter use period. A central catheter day is determined by summing the number of days that intensive care unit patients carried one or more central catheters throughout a given period. CVC Usage Rate = CVC Days/ICU Patient Days.(Çetinkaya Şardan et al., 2013)

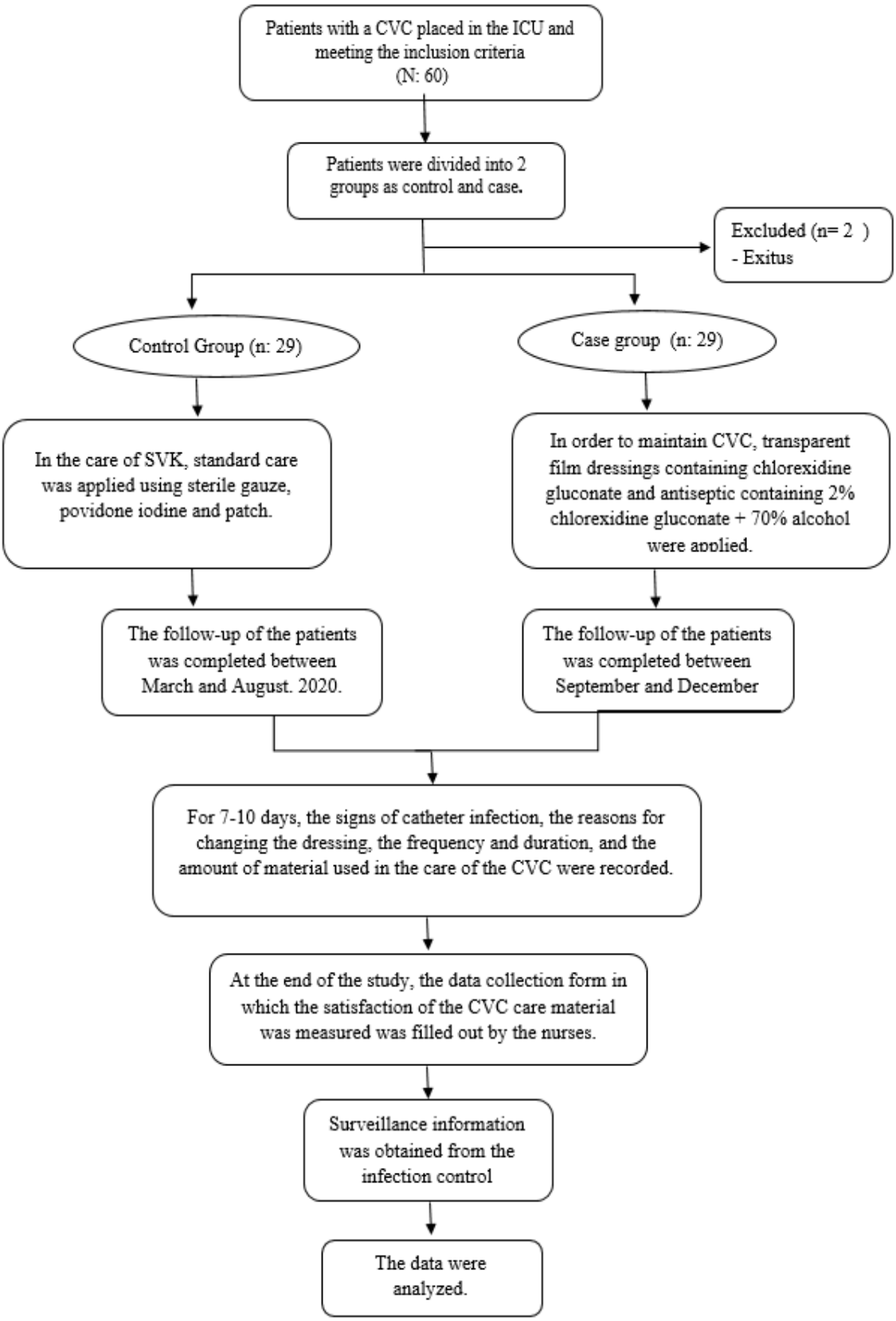

Figure 1. Study Flow diagram

RESULTS

The case group consisted of patients with a mean age of 72.17±14.83, among whom 36.7% (n:11) were female and 63.3% (n:19) were male. In the control group, the average age was 75.03±14.83, with 12.50% being female (n:12) and 60% being male (n:18). The statistical analysis indicated that the two groups exhibited similar age and gender distributions (p>0.05). The most common diagnoses among patients in both groups were cerebrovascular and pulmonary disorders, as well as cancer and trauma.

Regarding the duration of mechanical ventilation and the days of follow-up with Nasogastric Tube (NG) or Percutaneous Endoscopic Gastrostomy (PEG), there was no statistically significant difference between the case and control groups (p>0.05). In terms of central venous catheter (CVC) insertion sites, 73.3% (n:22) of patients in the case group had femoral CVCs, and 26.7% (n:8) had subclavian CVCs. In the control group, 70.0% (n:21) had femoral CVCs, and 30.0% (n:7) had subclavian CVCs. The comparison of insertion sites between the two groups did not yield a statistically significant difference (p>0.05).

Complications

In the case group, 6.7% (n:2) and in the control group, 3.0% (n:1) of patients experienced arterial puncture during CVC insertion (p>0.05). Throughout the study, no CLABSI or catheter infections were observed in the case group, while one patient in the control group had CLABSI (p>0.05). Pseudomonas aeruginosa was identified as the most common gram-negative bacteria in the patient with catheter infection. During the study duration, no occurrences of catheter exit site infection/colonization, pneumothorax, hemothorax, thrombosis, catheter malposition, catheter dysfunction, or air embolism were noted in either cases or controls. No catheter removal was performed for control purposes.

Bleeding was observed in an average of 1.94±0.1 patients in the case group and 1.92±0.10 patients in the control group during the follow-up period, with no statistical difference (p>0.05). Assessment included a total of 945 patient days, 529 in the control group and 416 in the case group. Examining days with a catheter, there were 568 catheter days (292 in the control group and 276 in the case group). The rate of CVC usage was calculated as 0.55 in the control group and 0.66 in the case group. Statistical analysis revealed a significantly higher rate of CVC use in the case group compared to the control group (p<0.05). Regarding infection rates, the control group exhibited 3.4 infections per 1000 catheter days, while the case group had 0 infections per 1000 catheter days. However, the difference in infection rates between the two groups was not statistically significant (p>0.05) (Table 1).

Table 1. CVC usage rate and CVC- related bloodstream infection in the case and control groups

	Group case	Group control	Statistical analaysis
Number of patients (n)	29	29	
Patient days	416	529	
CVC days (n)	276	292	
CVC usage rate	0,66	0,55	U: 312,500 p: 0,042
CVC-related bloodstream infection (n)	0	1	
CVC-related bloodstream infection rate	0/1000	3,4/1000	U: 435,000 p: 0,317

U: Mann Whitney U Tests

In the case group, bleeding at the catheter insertion site occurred in 23.3% (n:7) on the first and second days, and 3.3% (n:1) on the third and fourth days post-CVC placement. Redness was observed in only one patient (3.3% of the group) on the first day of CVC follow-up, with no instances of redness, edema, or compromised skin integrity throughout the follow-up.

In the control group, catheter insertion site bleeding was observed in 36.7% (n:11) on the first and second days, and 3.3% (n:1) on the third day. Redness occurred in a single patient (3.3%) on the first day of CVC follow-up. Similar to the case group, no instances of redness, edema, or compromised skin integrity were noted at the catheter insertion site throughout the follow-up period.

Cost of Care

The control group exhibited a higher frequency of dressing changes and a greater average row gathering compared to the case group (as shown in Table 2). Specifically, there were 77 dressings conducted in the case group, whereas the control group underwent 293 dressings ($p<0.001$).

Upon calculating the cost of materials utilized for each dressing in Table 2, it was observed that the total dressing cost for the case group amounted to 77 dollars, whereas the corresponding cost for the control group was 2.93 dollars ($p<0.001$). Consequently, the utilization of transparent dressing with chlorhexidine gluconate for routine ICU central venous catheter (CVC) care was deemed not to be cost-effective.

Table 2. CVC Cost of care in the case and control groups

Group case			**Group control**		
Material usage	**Mean±sd**	**Unit price**	**Material usage**	**Mean±sd**	**Unit price**
Non-sterile gloves (2 pieces)	5,1±1,8	0,154TL	**Non-sterile gloves** (2 pieces)	19,5±1,2	0,154 TL
%2CHG+%70alcohol antiseptic (4 cc)	9,0±2,6	0,06TL	Povidon iyot antiseptic (3 cc)	31,2±2,7	0,272TL
Sterile gauze (1 piece)	3,13±2,0	0,27TL	Sterile gauze (1 piece)	22,8±2,0	0,27TL
Transparent dressing with CHG	2,5±0,8	61,5TL	Plaster (10cmx10cm)	97,6±6,2	0,074TL
Cost of total (unite price)		62,31 TL	Cost of total (unite price)		1,738TL
Cost of total (77 dressing)		4,798 TL 1 Dollars* 77 Dollars	Cost of total (293 dressing)		509,5TL 10 Dollars* 2.930 Dollars
Statistical analaysis		**U:0,000 Z:-6,962 P:0,0001**			

TL: Turk liras/ local cost , * Calculated over to average dollar rate.

Efficiency- Productivity

The statistical analysis revealed a significant distinction ($p<0.001$) between the two groups in terms of nurse satisfaction scores for catheter insertion site observation ($p<0.001$) and catheter fixation ($p<0.05$), favoring the use of transparent dressing with chlorhexidine gluconate ($p<0.001$).

Furthermore, a significant contrast was observed in favor of sterile gauze in nurse satisfaction scores concerning the ease of dressing insertion ($p<0.001$), removal ($p<0.001$), and absorption of discharge ($p<0.05$) characteristics (as detailed in Table 3).

The time necessary for dressing changes was found to be shorter in the case group ($p<0.001$) in comparison to the control group (as shown in Table 4).

Upon reviewing the graphical representation, it becomes apparent that the control group underwent more dressing changes compared to the case group due to routine change, deterioration/loosening of integrity, and instances involving blood/dirt/contamination. On the other hand, the case group had a higher number of dressing changes than the control group due to issues related to wetness ($p<0.05$).

Table 3. Comparison of nurse satisfaction in the case and control groups

Nurse satisfaction (1-5)	Group case Mean±sd	Group control Mean±sd	Statistical analaysis*
Catheter insertion site observation	4,7±0,4	1,33±0,4	p: 0,001
Dressing insertion ease	2,83±1,1	4,75±0,4	p: 0,001
Dressing removal ease	3,25±0,9	4,67±0,4	p: 0,001
Catheter fixation	4,25±0,6	3,17±1,0	p: 0,005
Absorbing discharge	3,42±0,7	4,17±0,3	p: 0,008
Total	3,52±0,5	3,7±0,3	p: 0,197

*T tests

Table 4. Frequency and duration of the CVC dressing change in the case and control groups

Variable	Group	N	Rank average	Rank collection	U	p
Frequency of change	Grup case	30	15,5	465,0	0,000	0,001
	Grup control	30	45,5	1365,0		
Duration of change *	Grup case	30	18,05	541,5	76,500	0,001
	Grup control	30	42,95	1288,5		

*: Calculated in minutes

U: Mann Whitney U Tests

DISCUSSION

In ICUs, catheter infections can be prevented with effective nursing interventions in CVC care. Nurses' choice of dressing materials and care practices helps avoid complications and reduces initial healthcare budget challenges (Eren et al., 2010; Thokala et al., 2016). Physicians place CVCs, while nurses administer their care. Effective CVC care based on evidence-based practice plays a crucial role in avoiding catheter-related infections and treatment and care costs (Deutsch et al., 2014; Sanlı & Sarıkaya, 2016). While a decrease in infection rates is beneficial to the patient, it also improves the quality of nursing care (Karayavuz, 2006). In this regard, the use of proper dressing materials by nurses in the clinic minimizes the cost burden of health care by minimizing the financial strain that may occur in the early period and preventing the onset of infection. Additionally, it increases nurse satisfaction and work efficiency.

Complications

Not only does a proactive nursing strategy benefit the patient, but it also improves the quality of nursing care provided. Catheter care is considered essential for the prevention of catheter-related bloodstream infections, despite the limitation of epidemiological evidence (Tsuchida et al., 2007). The cost of caring for these infections exceeds one billion dollars annually, placing a significant burden on the healthcare system (Niemann et al., 2022). In this study, although the rate of CVC usage was greater ($p<0.05$) in the case group treated with transparent dressings with chlorhexidine gluconate than in the control group, no cases of CLABSI were detected. One patient in the control group who received conventional care developed CLABSI ($p>0.05$). The pathogenic microorganism growing in the femoral area, *Pseudomonas aeruginosa* is a significant opportunistic pathogen (Dönmez et al., 2021; Yu et al., 2019). In the majority of research studying the consequences of CVC, catheter-related infections have been observed (Akdemir et al., 2018).

According to the CDC Guidelines for the Prevention of Intravascular Catheter-Related Infections (2011); It is recommended to avoid the femoral region for CVC placement in adults (Category IA) and use a subclavian site, rather than a jugular or a femoral site, to minimize infection risk for non-tunneled CVC placement in adult patients (Category IB) (O'grady et al., 2011).

Although there are studies provided that chlorhexidine gluconate impregnated catheter dressings prevent central lineeassociated blood stream infections /colonization, it has been emphasized that additional research is required in large populations for which there is no absolute evidence (Table 1)(Düzkaya et al., 2016; Ho & Litton, 2006; Pedrolo et al., 2018; Safdar et al., 2014; Timsit et al., 2009; Yadigar et al., 2013; Yu et al., 2019). By CDC recommendations, the use of sterile gauze and transparent dressing (Category 1A) is suggested as part of the standards of care (O'grady et al., 2011).

In situations with a high infection rate, it is advised to use transparent dressings with chlorhexidine gluconate (Lorente, 2015; Safdar et al., 2014). In this study, conducted in a second-stage ICU with high-risk patients, there was no significant difference between transparent dressings with chlorhexidine gluconate and standard gauze dressings in terms of infection.

In Ullman et al (2016)'s systematic review, there was no difference between standard gauze dressing, transparent dressing, and transparent dressing with chlorhexidine gluconate in terms of CLABSI. However, the same systematic review found evidence of moderate quality evidence that chlorhexidine gluconate-impregnated dressings lower the incidence of CLABSI per 1000 patient days when compared to transparent dressings (Ullman et al., 2016).

During the insertion of a CVC, an arterial puncture complication occurred in 2 patients (6.7%) in the case group and 1 patient (3%) in the control group; no other complications occurred ($p>0.05$). According to the literature, an arterial puncture is the most common complication (Comerlato et al., 2017; Ergül et al., 2016).

When the complications that occurred at the dressing site in the case and control groups during the care of CVC were examined, in terms of bleeding at the catheter insertion site on the 1st(7 patients), 2nd(7 patients), 3rd(1 patient), and 4th(7 patients), there was no significant difference between the two groups. Concerning redness, complications developed on the first (2 patients) day, but there was no significant difference between groups. ($p>0.05$). In their study, Duzyaka et al. (2016) found that there may be bleeding in the form of leakage at the catheter entry site during the first dressing (Düzkaya et al., 2016). The CDC recommends replacing the catheter site dressing if it gets moist, loose, or obviously soiled (Category IB) and using standard gauze if the patient is sweating or the site is bleeding or leaking (Category II) until the condition resolves. In addition, according to certain sources and the results of this study, it is recommended to use gauze dressings on the first day after catheter insertion, followed by transparent dressings.

Cost of Care

As did Florence Nightingale, the foundation of professional nursing, we must translate care data into statistical and mathematical data and become involved in health policy.(Sherifali, 2020) The service given indeed has a significant impact on the recovery of patients in intensive care units, but the financial impact of all health services offered also has a significant impact on hospital budgets (Eren et al., 2010).

Some studys reported that the use of a transparent dressing with chlorhexidine gluconate in CVC care is cost-effective (Maunoury et al., 2015; Schwebel et al., 2012; Thokala et al., 2016).

Pedrolo et al. compared transparent dressings with chlorhexidine gluconate to sterile gauze dressings, reporting higher costs for unplanned dressing changes before scheduled intervals. In the study, the transparent dressing with chlorhexidine gluconate did not meet the replacement standard of every 7 days; it had to be changed within the first 3 days due to bleeding at the catheter site, dressing wetness, and integrity deterioration (Pedrolo et al., 2018).

Not cost-effective, as 293 dressings were used in the control group compared to 77 in the case group (Table 2). Timsit et al. studied transparent dressings with chlorhexidine gluconate versus those without (changed every 3 days and once in 7 days). The result indicated a reduction in CLABSI ratio from 1.3% to 0.4% (Timsit et al., 2009).

In another study, cost-effective transparent dressings without chlorhexidine gluconate, lasting up to three days, were deemed suitable. While reducing dressing changes, chlorhexidine gluconate transparent dressing did not lower central line-associated bloodstream infection rates but could save nursing time (Yu et al., 2019).

In line with guidelines, dressing change is recommended at IB level for leakage bleeding, dirtiness, looseness, or deterioration. Sterile gauze dressings should be changed every 2 days (Evidence II), while clear dressings should be changed every 7 days (Evidence IB). Using transparent dressings without chlorhexidine gluconate is more convenient for nurses, requiring fewer changes, and enabling better observation of the catheter area (Karadağ, 1999; Sanlı & Sarıkaya, 2016; Yu et al., 2019).

Efficiency- Productivity

Evaluating the satisfaction of nurses who care for patients during long shift hours in ICUs with the dressing materials they use during CVC care is extremely important both for being a patient advocate and for effective and sustainable CVC care (Sanlı, 2017). In some studies, it was reported that nurses were satisfied with the use of transparent dressings with chlorhexidine gluconate in terms of observing the entry site and absorbing discharge, but had difficulty removing them; altogether, satisfaction was rated as high.

In scrutinizing Table 3, a significant distinction ($p<0.001$) favored chlorhexidine gluconate transparent dressings for nurse satisfaction with catheter site observation and fixation compared to the control group. In the control group, parameters like dressing insertion and removal ease, and nurse satisfaction with discharge absorption were statistically significant ($p>0.001$). However, no noticeable difference in overall satisfaction was observed between the groups ($p>0.05$). This may be attributed to the exclusive use of transparent dressings by nurses accustomed to gauze dressings during the study, influencing overall satisfaction assessment.

In the control group, both average and cumulative ranks for dressing change duration were significantly higher than the case group, indicating a notable difference ($p\leq0.001$). Increased dressing change frequency in the control group directly correlated with prolonged duration (Table 4). In contrast, the case group's shift to transparent dressing with chlorhexidine gluconate (as in Table 2) reduced time spent on changes, enhancing nurse productivity, job satisfaction, and concurrently reducing workload.

As per Richardson et al., groups treated with chlorhexidine gluconate-containing transparent

dressings required fewer changes, leading to increased nursing productivity. This reduction not only streamlines nursing workflow but also enhances overall efficiency and effectiveness in patient care.(Richardson et al., 2015)

Limitations

The study in the State Hospital's Intensive Care Unit was affected by factors such as the COVID-19 pandemic during planning, physician involvement in CVC placement potentially affecting barrier measure compliance, and challenges in standardizing measures. The unavailability of 0.5% chlorhexidine gluconate with 70% alcohol and the absence of 70% alcohol-containing gluconate in the country posed limitations. Due to the 4% chlorhexidine gluconate concentration exceeding guidelines, the investigation focused on using a solution with 70% alcohol + 2% chlorhexidine gluconate. These factors collectively influenced the study design and execution, considering prevailing circumstances and resource availability.

CONCLUSION AND RECOMMENDATIONS

It was discovered that transparent dressings with chlorhexidine gluconate, which can remain in CVC care/dressing for up to seven days, did not reduce the CLABSI ratio in comparison to standard care, were not cost-effective, but boosted nurse satisfaction and productivity. The use of transparent dressings devoid of chlorhexidine gluconate in CVC dressings will be more convenient for nurses since they require fewer dressing changes and permit catheter area fixation and inspection.

It was recommended not to use the femoral region in CVC placement, to use long-acting transparent dressings with chlorhexidine only in critically ill patients, and to use gauze pads for standard care since bleeding may occur at the catheter insertion site on the first day of CVC insertion, and to use cost-effective, easy-to-care transparent dressing for subsequent routine care.

Ethics approval and consent to participate

This prospective case-control study adhered to the Helsinki Declaration and Good Clinical Practice Directive, receiving approval from the local ethics committee (Ethical Permission: Bolu Abant Izzet University Clinical Research Ethics Committee, 2020/22). Written informed consent was obtained from participating patients/patient relatives, and nurses involved in the study were informed and gave written consent.

Competing interests

The authors declare that they have no competing interests.

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Araştırma Makalesi / Research Article

Üniversite İç Ortam Uçucu Organik Bileşikleri Etkileyen Faktörlerin İncelenmesi

Investigation of Factors Affecting University Indoor Volatile Organic Compounds

Sanaz LAKESTANI[1*]

ÖZET

Bolu Abant İzzet Baysal Üniversitesi'nin çeşitli binalarından iç hava örnekleri alarak iç ortam hava kalitesini ve kaynaklarını belirlemeyi amaçlayan bir çalışma yapılmıştır. Bu çalışma Bolu'da ilk kez gerçekleştirilmiştir ve uçucu organik bileşiklerin (UOB) konsantrasyonları yaz ve kış mevsimlerinde toplam 35 farklı noktada ölçülmüştür. Örnekler, termal olarak desorbe edilebilen tüpler aracılığıyla pasif örnekleme prensibi kullanılarak toplanmış ve analizi Termal Desorber-Gaz Kromatografi/Kütle Spektrometresi (TD-GC/MS) sistemi ile yapılmıştır. Toplam UOB konsantrasyonu iç mekanda kış mevsiminde 1168,01 µg/m³ ve ikinci dönemde (yaz) 780,70 µg/m³ olarak hesaplanmıştır. İstatistiksel değerlendirmeye göre UOB'leri etkileyen faktörler şunlardır: ana caddeye yakınlık, binanın yeni olup olmaması, binadaki kişi sayısı, kimyasal laboratuvarların varlığı, kafeteryanın olup olmaması, binanın önünde sigara içilmesi, içeride baskı makinesinin bulunması.

Anahtar kelimeler: İç Ortam Hava Kalitesi, Mevsimsel, Uçucu Organik Birleşikler, TD-GC/MS

ABSTRACT

A study was conducted to determine indoor air quality and sources by collecting indoor air samples from various buildings at Bolu Abant İzzet Baysal University. This study, the first of its kind in Bolu, measured volatile organic compounds (VOCs) at 35 different points during both summer and winter. Samples were collected through passive manual inspection using thermally desorbable tubes, and analysis was conducted using the Thermal Desorber-Gas Chromatography/Mass Spectrometry (TD-GC/MS) system. The total VOC concentration was calculated as 1168.01 µg/m³ in the winter season and 780.70 µg/m³ in the summer. Statistical evaluation revealed that factors indicating VOC presence included proximity to the main street, the age of the building, the number of occupants, the presence of chemical laboratories, the existence of a cafeteria, smoking outside the building, and the use of the printing machine.

Keywords: Indoor Air Quality, Seasonal, Volatile Organic Compounds, TD-GC/MS

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Bu çalışma Bilimsel Araştırma Projeleri (2015.31.01.975) tarafından desteklenmiştir.

GİRİŞ

Son yıllarda iç ortam hava kalitesinin insan sağlığı üzerindeki etkilerine olan ilgi giderek artmaktadır. Araştırmalar, ABD'de bireylerin zamanlarının %89'unu iç ortamlarda geçirdiğini, gelişmekte olan ülkelerdeki bireylerin ise %79'unun iç mekanlarda geçirdiğini ortaya koymuştur (Jacobson, 2002; Who Regional, 1988). Sofuoğlu ve diğerleri, Türkiye'de bireylerin gün içerisinde ortalama olarak zamanlarının yaklaşık %79'unu kapalı mekanlarda geçirdiklerini belirlemiştir Bu nedenle iç ortam havasının halk sağlığı üzerinde büyük bir etkisi vardır. Bu konuyla ilgili yapılan çalışmalarda, iç ortam hava kalitesinin bozulmasının çeşitli solunum yolu hastalıklarına (astım vb), alerjik hastalıklara (hipersensitivite pnömonisi gibi), enfeksiyonlara ve kansere neden olabileceği belirtilmektedir(Sofuoğlu and Sofuoğlu, 2011). İç ortam hava kalitesinin iyileştirilmesi, insan sağlığının korunmasına, rahatsızlıklardan kaynaklanan iş kaybının azalmasına ve tıbbi tedaviler nedeniyle ortaya çıkan ekonomik kayıpların önlenmesine yardımcı olacaktır (Bozic et al., 2019). Çeşitli kaynaklardan iç mekan havasına salınan kirleticiler, akut ve kronik sağlık sorunlarına neden olabilir(Lakestani et al., 2013; Lakestani et al., 2022).

Uçucu Organik Bileşikler (UOB'ler), oda sıcaklığında kolayca buharlaşan büyük bir grup karbon bazlı kimyasaldır (Hellén et al., 2002; Ohura et al., 2006). Kanser ve akut ve kronik sağlık patolojilerinin tetiklenmesi dahil olmak üzere çeşitli sağlık sorunlarıyla ilişkilendirilmiştir (Park and Jo, 2004). Havada yüzlerce UOB bulunmaktadır ve bu da iç ortam hava kirliliğinin artmasına neden olmaktadır. BTEKS (benzen, toluen, etilbenzen ve ksilen) iç mekanlarda yaygın olarak bulunan uçucu ve yanıcı bileşikler olduğu bilinmektedir (Isinkaralar et al., 2023). Benzen, toluen ve ksilen gibi maddeler, benzin, yağlar, boyalar, yapıştırıcılar, mürekkepler, plastikler ve kauçuk gibi ürünlerin buharlarında bulunur (Esplugues et al., 2010). Bu üç kirletici aynı zamanda deterjanların, patlayıcıların, ilaçların, köpüklerin ve boyaların bileşiminde kullanılmaktadır (Esplugues et al., 2010).

UOB maruziyetinin sağlık üzerindeki etkileri literatürde detaylı bir şekilde incelenmiştir (Dodson et al., 2007; Soysal et al., 2023). UOB'ler ve diğer kirletici türlerin seviyelerinin belirlenmesi, oluşturdukları sağlık riskleri nedeniyle iç ortam hava kalitesinin değerlendirilmesi açısından öneme sahiptir. UOB seviyeleri iç mekanda genellikle dış ortamda bulunanlardan oldukça yüksektir. UOB'ler boyalarda, verniklerde, yapıştırıcılarda ve inşaat malzemelerinde bulunabilir (Kozicki and Guzik, 2021). İnsan faaliyetleri nedeniyle iç ortamdaki UOB seviyeleri yüksek ölçülmüştür. Parfüm, deodorant, sabun, deterjan, şampuan, oda spreyleri gibi ürünler UOB'lerin seviyesini artırabilir (Yeoman, 2021).

Türkiye'de insanların kapalı ortamda maruz kaldığı kirletici düzeyleri üzerine yapılan çalışmalar biyoaerosol, PM ve UOB'lerin belirlenmesine odaklanmaktadır. Bu çalışmalar genel olarak İstanbul, Ankara, İzmir, Edirne, Kocaeli ve Afyon illerinde yapılmıştır. Bir çalışmada Kocaeli ilinde evlerde, iş yerlerinde ve okullarda ölçülen UOB düzeyleri incelenmiştir (Pekey and Arslanbaş, 2008). Ayrıca Ankara'da evlerde ölçülen formaldehit düzeyleri (Vaizoğlu et al., 2003) ve farklı türde kapalı ortamlarda ölçülen biyoaerosol ve VOC düzeyleri (Aghlara, 2017; Lakestani et al., 2013)üzerinde çalışmalar yapılmıştır. Çevre koruma konusunda uzmanlar, iç ortam havasının kapalı mekanlarda bulunan insanlar üzerinde önemli bir etkiye sahip olduğunu belirlemiştir (Kunt and Dursun, 2018). Ahşap, vernik, boya ve UOB gibi sarf ve inşaat malzemeleri de UOB'lerin önemli bir kaynağıdır (Godısh, 2019). Toplam UOB (TUOB) trafik emisyonları, diğer kaynaklarla karşılaştırıldığında önemli bir katkı sağlar (Godısh, 2019). TUOB'un sera gazı emisyonlarının yaklaşık %35'i taşıtlardan kaynaklanan emisyonlardan veya buharlaşmadan kaynaklanmaktadır (Godısh, 2019; Lakestani, 2015). Ayrıca, UOB'ler hasta bina sendromu tipi semptomlara neden olabilir ve sinerjik bir etki yaratabilir(Godısh, 2019).

Bu çalışma ilk defa Bolu şehrinde, Bolu Abant İzzet Baysal Üniversitesi'nde (BAİBÜ) farklı fakültelerdeki iç ortamda UOB'leri iki dönem, yaz ve kış aylarında, iki yıl

boyunca gerçekleştirilmiştir. Yapılan yeni binalarda ve aynı zamanda kimyasal kullanılan laboratuvar gibi alanlar içeren binalarda hava kalitesinin ve buna etki eden faktörlerin incelenmesi amaçlanmıştır.

GEREÇ VE YÖNTEM

Örnekleme noktaları, BAİBÜ'de farklı fakültelerden seçilmiştir. Proje, iki örnekleme dönemi Yaz ve kış toplam 30 örnek noktasında gerçekleştirilmiştir. Örnekleme noktalarının dağılımı resim 1'de gösterilmiştir. Genel olarak iç ortam hava kalitesini belirlemek için yetişkinlerin nefes yüksekliği olan 1,5 metreden numune alınmıştır. Birinci örnekleme çalışması (Kış) 09- 23 Ocak 2017 tarihleri arasında gerçekleştirilmiş ve ikinci örnekleme (Yaz) 04-8 Ağustos 2017 tarihleri arasında iki hafta boyunca yapılmıştır. Toplamda 30 farklı noktadan pasif ölçümler alınmıştır.

Resim 1. Örnekleme noktaların dağılımı

UOB Örnek Toplanması ve Analizi

Uçucu organik bileşiklerin numune alınması ve analizi sırasında genellikle ABD Çevre Koruma Ajansı (US-EPA) TO-17 yöntemi kullanılmıştır (Isinkaralar, 2023; Isinkaralar and Turkyilmaz, 2022; Lakestani, 2024). Uçucu organik bileşiklerin miktarının belirlenmesi için DWM-550 ve SAK-100-1 aromatikler ve alkanlar içeren standartları kullanılmıştır. Uçucu Organik Bileşiklerin tayini için, hava örnekleri, pasif örnekleme metodu ile 14 gün boyunca, termal olarak desorbe olabilen tüpler içerisine difüzyon yolu ile toplanmıştır. Örnekleme tüpleri 350±10 mg karbograf 4 sorbenti ile doldurulmuş ve paslanmaz çelikten yapılmış tüplerden oluşmuştur.

Toplanan numuneler BAİBÜ Bilimsel Endüstriyel ve Teknolojik Uygulama ve Araştırma Merkezi (BETUM) laboratuvarı'nda Termal desorpsiyon üniteli Gaz Kromatografi- Kütle spektroskopisi (TD-GC-MS) kullanarak SIM modunda analiz edilmiştir.

Tüm noktalardan alınan örnekler organik bileşiklerin konsantrasyonları Formül 1 ve 2 yardımı ile hesaplanmıştır (Lakestani and Milli, 2024; Radiello, 2019).

$$Q_k = Q_{298} (K/298)^{1.5} \quad (1)$$

Qk: Örnekleme Hızı
Q_{298}: 298 Kelvinde Referans miktarı
K: Sıcaklık

$$C = (M / Q_k * t) \times 1{,}000{,}000 \quad (2)$$

C: Konsantrasyon, µg/m³
M: Analitin Kütlesi, µg
t : Zaman, Dakika

BULGULAR VE TARTIŞMA

Bu çalışmada yaz ve kış mevsimlerinde iç mekanlarda ölçülen VOC'lerin dağılım parametreleri (Skewness, Kurtosis, Shapiro-Wilk, P-Değeri ve dağılım türleri) hesaplanmıştır. Bu çalışmadan elde edilen verilere dağılım testi yapılmış ve kış döneminde UOB'lerin heptan, m,p-ksilen ve 1,3,5-tri metilbenzen ve yaz döneminde 1,3,5- tri Metilbenzen hariç diğer UOB'lerin lognormal dağılım gösterdikleri belirlenmiştir.

Tablo 1. İç Ortamda UOB'lerin Konsantrasyonu (Kış) µg/m³

İç Ortam	N*	Min	Mak	Ort ± SD	Med
Hekzan	30	0,17	118,14	23,94 ± 30,61	15,69
Heptan	30	20,45	661,71	257,84 ± 164,25	239,44
Oktan	30	3,86	498,49	116,48 ± 102,52	99,55
Nonan	30	0,35	87,40	13,49 ± 19,43	5,99
Dekan	30	0,06	428,01	67,67 ± 81,50	53,06
Benzen	30	0,57	145,40	51,75 ± 47,64	35,84
Toluen	30	11,53	665,57	212,44 ± 161,89	151,20
Etil benzen	30	5,57	214,34	77,64 ± 54,24	67,85
m,p-ksilen	30	0,67	381,89	101,19 ± 88,47	73,44
Stiren	30	3,04	66,13	23,68 ± 16,16	22,67
o-ksilen	30	0,40	148,82	53,62 ± 42,37	50,33
Isopropilbenzen	30	0,29	72,31	10,63 ± 13,72	6,23
n-Propylbenzen	30	0,27	200,55	21,43 ± 44,20	7,74
1,2,4-tri Metilbenzen	30	0,34	142,64	36,84 ± 33,15	26,68
1,3,5- tri Metilbenzen	30	1,57	123,44	47,82 ± 29,86	47,12
sec-butilbenzen	30	5,09	241,64	33,90 ± 41,81	26,35
4-iso propiltoluen	30	0,02	64,15	11,76 ± 14,07	7,03
n-butilbenzen	30	0,05	12,51	1,88 ± 2,79	0,71
Naftalin	30	0,44	16,01	4,01 ± 4,05	2,26

N*: Örnek sayısı, Min: Minimum, Mak: Maksimum, Ort: Ortalama, SD: Standart sapma, Med: Medyan

Tablo 2'de yaz döneminde belirlenen tüm bölgelerden alınan örneklerde UOB konsantrasyon miktarı belirlenmiştir. İç ortamda heptan 1042,00 µg/m³, oktan 191,82 µg/m³, toluen 385,99 µg/m³, etilbenzen 131,34 µg/m³, m,p-ksilen 376,27 µg/m³ ve o-ksilen 143,73 µg/m³ en maksimum konsantrasyonlara sahiptir (Tablo 2).

Tablo 1 ve 2'de tüm örnekleme noktalarından alınan hava örneklerindeki uçucu organik bileşkelerin konsantrasyon seviyeleri verilmiştir. İç ortamda kış döneminde hekzan 118,14 µg/m³, heptan 661,71 µg/m³, oktan 498,49 µg/m³ benzen 145,40 µg/m³, toluen 665,57 µg/m³, etilbenzen 214,34 µg/m³, m,p-ksilen 381,89 µg/m³, o-ksilen 148,82 µg/m³, sec-butilbenzen 241,64 µg/m³ ve n-propilbenzen 200,55 µg/m³ en yüksek konsantrasyonlara sahiptir (Tablo 1).

Tablo 2. İç Ortamda UOB'lerin Konsantrasyonu (Yaz) µg/m³

İç Ortam	N	Min	Mak	Ort ± SD	Med
Hekzan	30	0,2	40,65	9,99±11,68	4,91
Heptan	30	8,06	1042,00	306,08±226,04	257,85
Oktan	30	7,45	191,82	76,15±53,70	60,60
Nonan	30	0,04	57,83	9,88±14,33	0,33
Dekan	30	2,37	242,78	54,14±58,52	36,02
Benzen	30	0,02	38,82	11,27±9,81	9,54
Toluen	30	29,32	385,99	100,29±86,96	67,02
Etil benzen	30	7,97	131,34	39,22±32,48	28,15
m,p-ksilen	30	8,35	376,27	69,27±93,92	30,29
Stiren	30	0,72	34,93	12,73±10,35	11,88
o-ksilen	30	1,03	143,73	28,11±30,64	19,74
Isopropilbenzen	30	0,33	38,26	6,94±9,03	3,56
n-Propylbenzen	30	0,14	67,69	7,40±14,23	2,44
1,2,4-tri Metilbenzen	30	0,62	60,87	14,62±14,98	10,68
1,3,5- tri Metilbenzen	30	2,25	66,86	30,89±16,84	30,98
Naftalin	30	0,23	20,65	3,72±4,96	1,59

N*: Örnek sayısı, Min: Minimum, Mak: Maksimum, Ort: Ortalama, SD: Standart sapma, Med: Medyan

Kış ve Yaz dönemlerde Toplanan UOB'ler ve Limit Değerler ile Kıyaslama

Kış döneminde ölçümün sonucunda; UOB'lerin en yüksek konsantrasyona sahip bileşikler; toluen İktisadi İdari Bilimleri fakültesinde, heptan rektörlük binasında, oktan, etilbenzen, m+p-ksilen ve isopropilbenzen tıp fakültesinde ölçülmüştür. İkinci örnekleme döneminde Bileşikler içinde en yüksek miktara sahip olan UOB'lar; toluen ve dekan Diş Hekimliği Fakültesi, heptan Rektörlük binasında, oktan Kütüphane binası, etilbenzen, m+p-ksilen ve o-ksilen Tıp Fakültesinde ölçülmüştür.

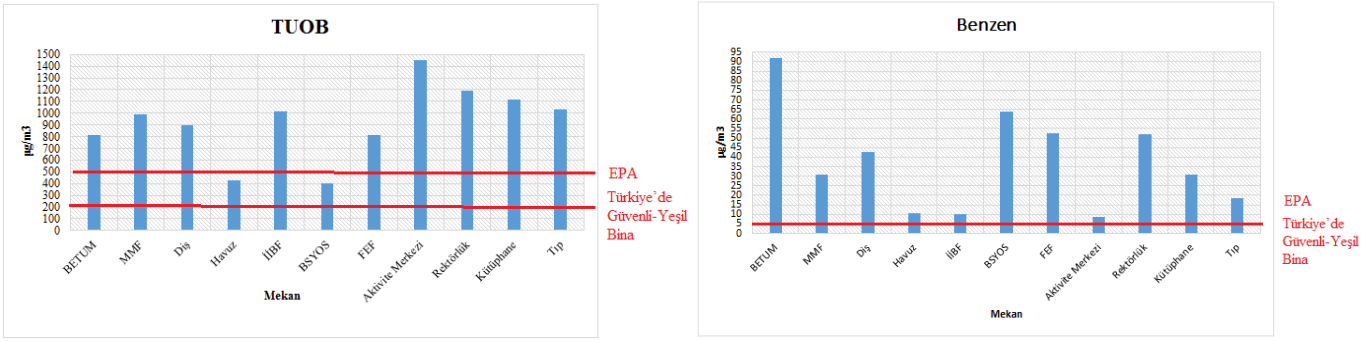
İç ortamda EPA, WHO ve Amerika Isıtma-soğutma ve havalandırma mühendislik Topluluğu (ASHRAE) TUOB'ler için kabul edilen değerler tablo 3'te verilmiştir.

Tablo 3. İç Ortamlarda Sağlanması Gereken TUOB'lein Değeri

TUOB	
Günlük ortalama < 500 µg/m³	Kabul değeri
Günlük ortalama 501-3000 µg/m³	Hassasa grup için önlem alınmalıdır [1]
Günlük ortalama> 3000 µg/m³	Önlem alınması gerekmektedir

[1]Hasas grup: bebekler, hamileler, yaşlılar, astım hastaları, kalp hastaları

TUOB'ler için sağlanması gereken maksimum kriter değeri iç mekanda Türkiye Güvenli-Yeşil binalarda (GYB) 200 µg/m³ ve dış ortam konsantrasyonunun iç ortam konsantrasyonundan büyük (Dış/İç >1) olduğu durumda 400 µg/m³ kabul edilmektedir (TSE yayınlanmamış karar) (Lakestani, 2015). TUOB'Ler konsantrasyonu (µg/m³) BETUM 814,69, MMF 993,57, diş hekimliği 898,06, havuz 425,56, İİBF 1010,65, BSYOS 404,41, FEF 814,99, aktivite merkezi 1453,73, rektörlük 1190,38, kütüphane 1112,21 ve tıp fakültesinde 1028,96 ölçülmüştür. Resim 2'de iç ortamdaki TUOB ve benzenin konsantrasyonları, Birleşik Devletler Çevre Koruma Ajansı ve Türk Standart Enstitüsü (TSE) tarafından belirlenen GYB'ler için gereken maksimum değerlerle karşılaştırılmıştır. TUOB'ler için EPA, ASHRAE ve WHO tarafından kabul edilen değer 500 µg/m³ iken Türkiye GYB'ler için iç ortam havasındaki miktar 200 µg/m³ olarak kabul edilmiştir. EPA ve Türkiye GYB'larda iç ortamda benzenin konsantrasyonunu 5 µg/m³ kabul edilmiştir. Resim 2'de benzenin konsantrasyonunu analiz sonucuna göre değerleri gereken standardın üzerinde görülmüştür.



Resim. 2 TUOB'ler ve Benzen için İç Ortamlarda Sağlanması Gereken Maksimum Kriter Değerleler (MMF: Mühendislik Mimarlık Fakültesi, IIBF: İktisadi İdari Bilimleri Fak., BETUM: Bilimsel Endüstriyel Teknoloji Uygulama Merkezi, BESYO: Beden Eğitim Spor Yüksekokulu)

Mevsimsel karşılaştırılması ve İstatistik Değerlendirilmesi

Birinci ve ikinci dönem iç mekanların UOB konsantrasyonlarının karşılaştırılmasına göre tüm mekanlarda, heptan hariç, en yüksek konsantrasyonlar birinci dönemde (Kış) gözlemlenmiştir. İstatistiksel olarak UOB'lerin miktarı ile iç ortam koşulları arasındaki ilişki ANOVA testi kullanarak incelenmiştir. Sonuçlara göre caddeye yakınlık, binanın yeni olması, birey sayısı, kimya laboratuvarı bulunan binalar, fakültede kafeterya, binanın dışında sigara içilmesi ve baskı makinesinin bulunması UOB düzeyini olumsuz yönde etkileyen faktörlerdir. Binaların konumları dikkate alındığında, bazı kirleticilerin konsantrasyonu dış ortam kaynaklardan etkilenmektedir. Hekzan, nonan, stiren ve 1,3,5-trimetilbenzen konsantrasyonu ile binaların caddeye yakınlığı arasında istatistiksel olarak anlamlı farklılıklar bulunmuştur. Yeni binalarda boya, hekzan ve stiren arasında istatistiksel olarak anlamlı fark olduğu görülmüştür. Bu çalışmada kişi sayısı 20'den fazla ve 20'den az olmak üzere sınıflandırılmıştır. Hekzan, dekan, toluen, m,p-ksilen ve stiren konsantrasyonu ile binada bulunan kişi sayısı arasında istatistiksel olarak anlamlı farklar bulunmuştur. Laboratuvarı olan

fakültelerde özellikle tıp fakültesinde, hekzan, ksilen ve dezenfektan maddeler sürekli kullanılmaktadır. İstatistik analizine göre toluen, etilbenzen ve m,p-ksilen ile laboratuvar olan bölümler arasında anlamlı fark olduğu gösterilmiştir. İstatistiksel değerlendirmeye göre kafeteryalı binalar ile nonan konsantrasyonu arasında anlamlı bir fark olduğu gözlenmiştir. İstatistik analiz sonucuna göre hekzan, nonan, toluen, stiren ve 1,3,5-trimetilbenzen ile bina önünde sigara içilmesi, baskı makinesi bulunan ofislerde heptan, nonan, stiren ve 1,3,5-trimetilbenzen arasında anlamlı fark olduğu gösterilmiştir.

SONUÇ VE ÖNERİLER

Çalışmanın sonucunda, binalarda UOB'lerin konsantrasyonları kış mevsiminde daha yüksek miktarlarda tespit edilmiştir. Örnekleme yapıldığı mekanlarda TUOB'lerin en yüksek seviyesi kış aylarında 1453,73 µg/m^3 aktivite merkezinde kayıt edilmiştir sebebi restoranların olması, ısıtma sistemlerin çalışması ve kişi sayısının fazla olması gibi koşular UOB'lerin konsantrasyonunu etkilemiştir. TUOB'ler ve benzenin sırası ile seviyesi kış aylarında ortalaması 1168,01 µg/m^3, 51,75 µg/m^3 yaz aylarına göre 776,98 µg/m^3, 11,27 µg/m^3 daha yüksek görülmüştür. Bolu şehrinde kış aylarında özellikle sabah ve akşam saatlerinde ısıtma için bazı yerleşkelerde hala kömür ve odun kullanılmaktadır. Bu sebepten dolayı dış ortam hava kalitesini etkilemektedir. Bu kaynaklanan kirleticiler iç ortamı kontamine edebilir ve sağlık etkilerine yol açabilmektedir.

İç ortam hava kalitesi seviyelerinin iyileştirilmesi ve sağlık açısından belirlenen kirleticilerin miktarının azaltılması için öncelikle kirleticilerin kaynakları ve kullanım amaçları gibi koşulların incelenmesi, yöntemler gerekmektedir.

Bu çalışmanın sonucunda belirlenen iç ortam hava kirliliği kaynaklarının ortadan kaldırılması ve emisyonlarının azaltılması için alınabilecek önlemler arasında kirlilik kaynaklarının giderilmesi ve etkin havalandırmanın sağlanması yer almaktadır.

İç ortamda özellikle laboratuvar ortamında kullanılan kimyasallar, temizlik malzemeleri ve böcek öldürücüler, ofislerde bulunan baskı makineleri gibi çeşitli malzemeler nedeniyle, çalışanlar kimyasal maddelere maruz kalabilmektedir. Bu nedenle tüm mekanlar özelikle laboratuvar bulunan binalarda mekanik havalandırma sistemin olması önem arz eder.

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Derleme Makalesi / Review

Antikoagülasyon Tedavisinde Sosyal Belirleyicilerin Kanama Sonuçları Üzerindeki Etkisinin İncelenmesi: Kapsam İncelemesi

Examining The Influence of Social Determinants on Bleeding Outcomes in Anticoagulation Therapy: A Scoping Review

Aykut TURGUT[1*] | Ümmühan YİĞİT[2]
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ÖZET

Giriş: Oral antikoagülasyon (OAK) kontrolü, istenmeyen kanama olasılığını azaltır ve hastanın kanının pıhtılaşmasını geciktirir. Sosyal belirleyiciler, örneğin sosyoekonomik durum, cinsiyet, yaş, ırk/etnik köken, alkol kullanımı gibi faktörler ile oral antikoagülanların reçetelenme alışkanlıkları ve kanama olaylarında farklılıklar gözlemlenmiştir.

Amaç: Çalışmanın amacı, oral antikoagülan kullanan hastalarda sosyal belirleyicilerin kanama üzerindeki etkisini incelemektir.

Sonuç: Düşük sosyoekonomik durum, bu hastalar arasında kanamaya bağlı ölümlerde önemli bir belirleyicidir. Düşük gelirli bireylerin ve siyahi hastaların oral antikoagülan tedaviye erişme olasılığı daha düşüktür. İleri yaş, antikoagülan tedavide kanama riskinin önemli bir sosyal belirleyicisidir ve yaş ilerledikçe kanama riski artar. Cinsiyet değişkeninin, Uluslararası Normalleştirilmiş Oran (INR) kontrolü ve kanama riski açısından anlamlı bir etkisi olmamıştır. Genel alkol kullanımı kanama riskini belirlemede sosyal bir belirleyici olarak görülmemektedir. Ancak kanama riskinin belirlenmesinde hastaların ağır alkol kullanımı ve sosyoekonomik durumları değerlendirilmelidir.

Klinik çıkarımlar: Etnik köken ve sosyoekonomik durum, sağlık profesyonelleri tarafından hasta bakımının yönetilmesinde ve antikoagülan tedavi kullanan hastalarda kanama riskinin değerlendirilmesinde önemli parametrelerdir. Hemşireler, hasta öyküsünü dikkatlice değerlendirmeli ve bu hastalarda daha sık INR izlemesi yapılmalıdır. Literatür, özellikle farklı ırk ve alkol gibi sosyal belirleyicileri olan hastalar arasında oral antikoagülan tedavisindeki eşitsizlikleri ele almak için daha fazla araştırma yapılması gerektiğini belirtmektedir.

Anahtar kelimeler: Antikoagülan, Kanama, Cinsiyet, Tromboz, Etnisite

ABSTRACT

Background: Oral anticoagulation (OAC) control reduces the likelihood of unwanted bleeding and delays the patient's blood clotting. Differences in prescription patterns and bleeding events of oral anticoagulants have already been observed concerning social determinants, such as socioeconomic status, gender, age, race/ethnicity, alcohol use, etc.

Objective: The objective of the study is to examine the effect of social determinants on bleeding in patients using oral anticoagulants.

Conclusions: Low socioeconomic status is a significant determinant in bleeding-related deaths among these patients. Low-income individuals and black patients are less likely to access oral anticoagulant therapy. Older age is a crucial social determinant of bleeding with anticoagulant therapy, and the bleeding risk rises with advancing age. Although the gender variable did not have a significant effect in terms of International Normalized Ratio (INR) control and bleeding risk. General alcohol use is not a social determinant in determining the risk of bleeding. However, the heavy alcohol use and socioeconomic status of the patients should be assessed in determining the risk of bleeding.

Clinical implications: Ethnicity and socioeconomic status are important parameters in the management of patient care by healthcare professionals and in evaluating the risk of bleeding in patients using anticoagulant therapy. Patient history should be carefully evaluated by nurses and more frequent INR monitoring should be done in these patients. The literature indicates that more research is needed to understand underlying factors and develop strategies to address disparities in the use of oral anticoagulant therapy among patients of especially different racial and alcohol social determinants.

Keywords: Anticoagulant, Bleeding, Gender, Thrombosis, Ethnicity

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INTRODUCTION

The risk of thrombosis increases due to common heart diseases and anticoagulant treatment is applied to the patients. These drugs choice for preventing stroke in people with atrial fibrillation, valve replacement, and bypass. Oral anticoagulation (OAC) control reduces the likelihood of unwanted bleeding and delays the patient's blood clotting. OAC can be grouped into two classes of oral anticoagulants to prevent a thromboembolic event: vitamin K antagonists (VKA-coumadin, warfarin) and direct oral anticoagulants (DOAC- dabigatran, rivaroxaban, apixaban, edoxaban, and betrixaban or the novel oral anticoagulants (NOAC). VKAs require frequent monitoring, are effective in preventing strokes, increase the risk of bleeding, can be used in people with any degree of renal impairment, and are less expensive than DOACs. DOACs do not require frequent monitoring, are effective in preventing strokes, and also increase the risk of bleeding, particularly intracranial hemorrhage, although to a lesser extent than VKAs. The cost and follow-up of a particular treatment may affect patient prescription differently depending on certain factors. Prescribing may be influenced by sociodemographic and economic factors unrelated to drug eligibility criteria (Maguire et al., 2007). There are studies examining significant disparities in access to new anticoagulant therapies and disparities in prescribing oral anticoagulants among socioeconomically disadvantaged patients (Essien et al., 2020; Nathan et al., 2019).

Differences in prescription patterns of DOACs have been observed concerning social determinants, such as socioeconomic status (SES), gender, age, race/ethnicity, and alcohol use. One of the most significant adverse effects of anticoagulants are bleeding and bleeding-related death. However, there is currently insufficient information about the impact of social determinants on oral anticoagulant prescribing and their effect on bleeding (Essien et al., 2020).

This scoping review undertakes a comprehensive examination of how social determinants impact bleeding incidents as a result of anticoagulation therapy. Its objective is to examine deeper into the interplay between various social determinants and the bleeding outcomes experienced by individuals undergoing anticoagulation treatment. Considering the rapid increase in oral anticoagulant use in healthcare services due to heart diseases, it is crucial to examine these social determinants to reduce bleeding and bleeding-related deaths, thereby promoting greater equality in healthcare services.

The objective of the study is to examine the effect of social determinants on bleeding in patients using oral anticoagulants and to emphasize the need for a multi-faceted approach that includes not only traditional parameters such as INR and Time in Therapeutic Range (TTR) but also an examination of social determinants impacting the patient's response to anticoagulant therapy.

Design

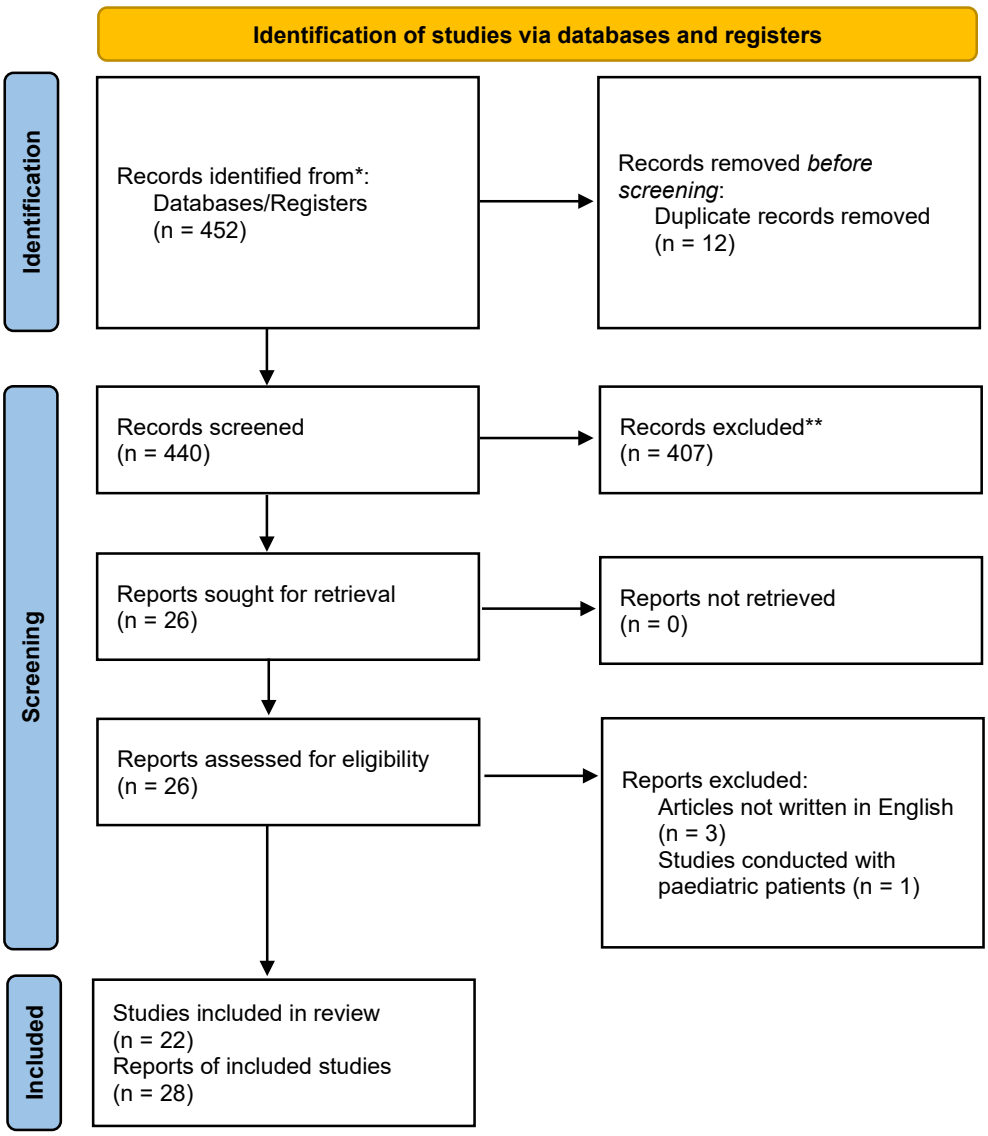
A scoping review was conducted according to Arksey & O'Malley's (2005)(Arksey et al., 2007) methodological framework and further refined by the Joanna Briggs Institute (Peters et al., 2020), to examine existing knowledge about social determinants affecting bleeding in patients using oral anticoagulants obtain a broad and comprehensive view and summarise the evidence and identify gaps in the literature. Preferred Reporting Items for Analyses extension for Scoping Reviews (PRISMA-ScR) were used (Figure 1) to ensure reporting standards (Tricco et al., 2018).

Research questions

We sought to answer the following questions: What can be found in the international literature? Does SES affect bleeding in patients using anticoagulants? Does SES affect the risk of bleeding-related death in patients using anticoagulants? Does gender affect bleeding in patients using anticoagulants? Does age affect bleeding in patients using anticoagulants? Does race/ethnicity affect bleeding in patients using

anticoagulants? Does alcohol affect bleeding in patients using anticoagulants?

Figure 1. PRISMA 2020 flow diagram for systematic reviews



Search methods

The authors designed the review protocol and agreed on its details. A librarian assisted with the definition of the search strategy and database identification. The search was performed in Pubmed, CINAHL, Web of Science, Sciences Direct, Scopus, and Cochrane databases for January 2007-June 2024. The terms used were “anticoagulant”, “social or social determinants: socioeconomic/income/age/race/ethnicity/gender/ sex/tobacco/alcohol/marriedstatus”, “bleeding/hemorrhage” and “VKA/DOAC/NOAC” with their respective synonyms, combined with the Boolean operators “AND” and “OR”. To improve sensitivity and avoid omission of relevant articles, MeSH terms and keywords identified in the existing literature were used. Studies were selected based on the application of the inclusion and exclusion criteria presented in Table 1.

Table 1. Selection criteria

Inclusion criteria	Exclusion criteria
• Adults over 18 years old • Studies in patients with cardiological problems (valve replacement, bypass surgery, Venous Thromboembolism, rhythm disorders (AF, VF,..) who reported bleeding using OAC/ NOAC) • Studies in patients with cerebrovascular disease SVD who reported bleeding using OAC/ NOAC • Clinical/ cohort studies • Qualitative, quantitative, mixed, and grey literature studies • Studies covering the social determinants/factors (social and economic status, alcohol use, age, gender, education, ethnicity, social relations, profession…) in the above headings. • English language studies • 2007-2024 period	• Pediatric studies • In vivo studies • Studies carried out in a laboratory environment • Articles written in languages other than English

Data extraction

Results were collated using reference software (Mendeley Reference Manager 1.19.8) and duplicates were removed. Titles and abstracts were screened for eligibility independently by all team members. The second screening involved a full-text read conducted independently by all team members. Data extraction was conducted by reviewing by all team members. Data extracted were author, year, study type, country, objectives, methodology, sample, social determinants, and main results The extracted data was recorded and summarised using Microsoft Excel and was reviewed by all team members.

Main results of the studies

The results of the comprehensive analysis of the identified studies are presented below. Table 2 shows a representation of the main results of this study.

Table 2. Data extraction table

Author, year, country	Objectives	Methodology	Sample	Social determinant	Main results
Vitry et al. (Vitry et al., 2007) USA	The study aimed to quantify the excess risk of bleeding-related hospitalization when warfarin was co-dispensed with potentially interacting medicines.	Retrospective cohort study	Patients 65 years and older. n= 17,661	Age	The overall incidence rate was lower in the 65–74 age group than in those aged 85yrs or older.
Rohla et.al. (Rohla et al., 2019) Austria, France, Germany, Italy, Spain, Switzerland, and the UK	To determine factors associated with thromboembolic and bleeding events (gastrointestinal bleeding, intracerebral hemorrhage, and other life-threatening bleeding) in two contemporary cohorts of anticoagulated patients with atrial fibrillation (AF), treated with either vitamin K antagonists (VKA) or non-VKA oral anticoagulants (NOACs).	Prospective, multicentre observational study	Patients 18 years and older. n= 7243	Age	A substantial number of thromboembolic and major bleeding events in anticoagulated patients with AF can be attributed to a few modifiable risk factors. For each single point (age ≥ 75 years) decrease on an adjusted modifiable bleeding risk scale, we observed an approximately 30% reduction in both major bleeding and thromboembolic events.
Büchele et al. (Büchele et al., 2020) Germany	The aim of this study was to estimate the incremental risk of a traumatic intracranial haemorrhages associated with OAC in older people.	A cohort study	Patients 65 years and older. n= 1,089,004	Age	Older people exposed to oral anticoagulants containing phenprocoumon, as warfarin, have an almost three times higher risk to sustain traumatic intracranial hemorrhage compared to controls.
Šinigoj et al. (Šinigoj et al., 2020) Slovenia	The aim of this study was to evaluate the safety of direct oral anticoagulants in the oldest old patients with atrial fibrillation and assess the impact of age on major bleeding events.	Prospective clinical study	Patients 65 years and older. n= 2260	Age	The oldest old patients have the highest risk of major bleeding, which is further increased with a patient's history of bleeding.
Erquicia et al. (Domínguez-Erquicia et al., 2021) Spain	To contribute to increasing the knowledge regarding anticoagulation (with vitamin K antagonists (VKAs) and direct oral anticoagulants (DOAC)) in elderly patients by analyzing the incidence, predictors and prognosis of major bleeding in anticoagulated nonagenarian patients with nonvalvular atrial fibrillation (NVAF).	Prospective cohort study	Patients 90 years and older. n= 1216 patient	Age	The results we did not find significant differences regarding the incidence rate of major bleeding between patients treated with VKAs and those treated with DOAC. We found an association between the male sex and the risk of major bleeding in DOAC group.

Author, year, country	Objectives	Methodology	Sample	Social determinant	Main results
Herrera et al. (Adrianzen-Herrera et al., 2024) USA	To assess the incidence of severe (hospitalized) bleeding due to thromboprophylaxis in patients undergoing treatment for multiple myeloma and to identify clinical risk factors for bleeding in this group.	A cohort study	Patients aged 18 to 99 years old. n= 6656	Age	Older age was significantly associated with a higher risk of bleeding, with a hazard ratio of 1.38 per 10-year increase.
Kefale et al. (Kefale et al., 2023) Australia	This study aimed to evaluate the prescription rate of OACs and identify factors associated with their use in patients with AF and a low risk of stroke. Additionally, we investigated bleeding events and their risk factors.	Retrospective cohort study	Patients 18 years and older. n= 61,361	Age, Gender and Socioeconomic status	Age: Increasing age was associated with a higher likelihood of OAC use and an increased risk of bleeding. Gender: Female patients had lower odds of receiving OAC despite a higher stroke risk compared to males. Socioeconomic Status: Better SES was linked to lower odds of receiving OAC.
Nilsson et al. (Nilsson et al., 2014) Netherlands	The objective is to evaluate the sex-dependent effectiveness of (Patient-self-management) PSM of oral anticoagulant therapy in everyday clinical practice.	Case study.	Patients who could self-manage their OAT, as shown by passing the final exam. n= 2068	Gender	Importantly, death, bleeding and thromboembolism were not significantly different between females and males.
Božić et al. (Bozic et al., 2021) Croatia	To investigate the demographic characteristics (sex, age), comorbidities and mortality rate of patients with gastrointestinal bleeding related to anticoagulant (warfarin and NOACs including (apixaban, rivaroxaban, and dabigatran) or antiplatelet therapy.	Retrospective cohort study	Patients 65 years and older. n= 1367	Gender and age	Older age was the main predictors of death, regardless of the drug type (anticoagulant and antiplatelet therapy) or bleeding localization or cause. There was no significant difference in overall mortality according to sex.
Carnicelli et al. (Carnicelli et al., 2022) USA	To determine the effects of age and sex variables on standard-dose DOAC, lower-dose DOAC and warfarin treatments.	Meta-Analyse *(Meta-Analyses of Randomized Clinical Trials)*	Patients 18 years and older. n= 71,683	Gender and age	Younger patients showed a greater benefit from standard-dose DOAC versus warfarin for major bleeding with each 10-year increase in age. No significant interaction for major bleeding by sex was observed for either treatment strategy.

Author, year, country	Objectives	Methodology	Sample	Social determinant	Main results
Khatib, R. et al. (Khatib et al., 2022) USA	Evaluate the impact of between social determinants of health (SDOH) on anticoagulant prescriptions in patients with atrial fibrillation (DOAC).	Systemic review and meta-analysis.	They included 13 studies; 11 were meta-analyzed, covering 9 of the 14 SDOH.	Gender	It has been observed that there exists a disparity in the level of acceptance towards the utilization of anticoagulants between the two genders. There are preconceived concerns about the risk of bleeding in women.
Matsumura et al. (Matsumura et al., 2022) Japan	To investigate sex difference in patient characteristics and clinical outcomes of the (non-valvular atrial fibrillation) NVAF patients treated with DOAC.	Prospective observational study	Women n: 806 Men n= 1410	Gender	Patients treated with DOAC showed that Japanese women experienced comparable bleeding events as compared to men despite the higher bleeding risk estimates.
Essien et al. (Essien et al., 2020) USA	To assess racial/ethnic differences in the use of oral anticoagulants, particularly DOACs, in patients with atrial fibrillation.	Cohort study	Patients 21 years and older. n= 12,417	Race/Ethnicity	Black patients and Hispanic patients were more likely to have a high bleeding risk.
Tedla et al. (Tedla et al., 2020) USA	Our primary aim was to examine racial disparity in the prescription of any OAC in general and NOACs in particular in newly diagnosed AF patients who visited a health care setting. Our secondary aim was to investigate whether race modifies the association between prescription of NOACs (as compared to VKA) and incidence of stroke (a composite of ischemic and hemorrhagic stroke and cerebral embolism) and major bleeding in newly diagnosed AF patients who had at least two visits to a health care setting.	Retrospective cohort study	Patients 30 to 80 years old. n= 11,575	Race/Ethnicity	When stratified by race, crude rates of bleeding were also higher among patients on VKAs than those on NOACs in both whites and blacks. Use of NOACs as compared to VKA significantly lowered the risk of bleeding independent of other risk factors only in whites.
Essien et al. (Essien et al., 2022) USA	To compare OAC use at discharge among different races and ethnicities in the Get With The Guidelines-Atrial Fibrillation registry, and explore trends and postdischarge outcomes like ischemic stroke, major bleeding, and mortality.	Cohort study	Patients 65 years and older. n= 69,553	Race/Ethnicity	Overall, the 1-year cumulative incidence of major bleeding was found to be higher in Black and Hispanic patients compared to White patients. Black patients had a significantly higher bleeding risk than White patients, especially when discharged without any OAC or while taking warfarin or DOAC.

Author, year, country	Objectives	Methodology	Sample	Social determinant	Main results
Abdullah Haddad et al.(Haddad et al., 2021) USA	The objective of the study was to investigate underrepresentation and racial disparities in left atrial appendage occlusion (LAAO) management among black patients.	Comparative Study	Patients 65 years and older. n= 109	Race/Ethnicity and Socioeconomic status	White patients were nearly five times more likely to be discharged on OAC versus dual antiplatelet therapy compared to black patients. Among patients with a history of gastrointestinal bleeding, OAC was more frequently used among White individuals than black individuals. Although there was a substantial disparity in income between White and black individuals, this difference in income was not found to be a significant contributing factor to the association between race and the prescribing of OAC therapy at discharge.
Tse et al. (Tse et al., 2021) New Zealand	The purpose of this study was to determine whether ethnicity and/or socioeconomic status are also independent risk factors for a major bleed among people with a history of cardiovascular disease (CVD) or AF. (Warfarin therapy).	Prospective cohort study	Men aged 45 years or older, women aged 55 years or older. n= 488,107	Ethnicity and socioeconomic status	An increased risk of intracranial bleeds was observed among Chinese and Other Asian people and, in the CVD and no CVD/AF subgroups, among Indian people. Increasing socioeconomic deprivation was also associated with increased risk of a major bleed in all three subgroups, respectively, for each increase in socioeconomic deprivation quintile.
Cressman et al. (Cressman et al., 2015) UK	To examined the extent to which socioeconomic status influences the risk of hemorrhage in older individuals newly commencing warfarin therapy for atrial fibrillation.	Prospective cohort study	Patients 66 years and older. n= 166,742	Socioeconomic status	Among older individuals receiving warfarin therapy for atrial fibrillation, lower socioeconomic status is a risk factor for hemorrhage (GİS) and hemorrhage-related mortality. Socioeconomic status was not associated with intracranial hemorrhage.
Ravvaz et al. (Ravvaz et al., 2021) USA	To evaluate the impact of socioeconomic status (SES), measured by ADI, on patients' risk of stroke and bleeding in newly diagnosed AF patients started on warfarin therapy.	Retrospective cohort study	Patients 18 years and older. n= 7274	Socioeconomic status	Regardless of age, patients in low SES areas are more likely to experience bleeding on warfarin, though age-specific results vary for bleeding and efficacy. Patients in very low socioeconomic status areas required a significantly higher number of INR checks than patients in higher SES areas.

Author, year, country	Objectives	Methodology	Sample	Social determinant	Main results
Dalen et al. (Dalén et al., 2022) Sweden	To examine sought to investigate the impact of patients' socioeconomic status on the risk of bleeding after mechanical aortic valve replacement (AVR). (Warfarin therapy)	Retrospective cohort study	Patients 18 to 70 years old. n= 5974	Socioeconomic status	The socioeconomic status and risk of bleeding in that the risk of bleeding decreased with increasing income level. The risk of death from intracranial hemorrhage was five times higher in the lowest income quartile than the age- and sex-matched general Swedish population.
Roth, J. A. et al. (Roth et al., 2018) USA	Alcohol misuse and the risk of major bleeding in a community sample of patients using warfarin.	Case and control study	Patients 18 years and older. n= 570	Alcohol use	Among 265 cases and 305 controls, AUDIT-C scores indicative of moderate/severe alcohol misuse and heavy episodic drinking were associated with increased risk of major bleeding.
Reddiess et al. (Reddiess et al., 2021) Switzerland	The main aim of the current study was to investigate the associations of regular alcohol intake with incident stroke or systemic embolism in patients with established AF oral anticoagulants.	Prospective cohort studies.	Patients 65 years and older. n= 3852	Alcohol use	There was no significant association between alcohol consumption and bleeding.

Age

Age was evaluated in 7 studies investigating the relationship between age and the incidence of bleeding in patients treated with oral anticoagulants. Bozik et al. (2021) found that older age was a significant predictor of death, regardless of the type of drug used, the location of bleeding, or the cause of bleeding (Bozic et al., 2021). Similarly, Carnicelli et al. (2022) found that the incidence of major bleeding increased with increasing age in a group of patients treated with lower doses of DOACs compared to warfarin (Carnicelli et al., 2022).

Rohla et al. (2019) found that age was associated with a reduction in major bleeding of approximately 30% (Rohla et al., 2019). Büchele et al. (2020) found that older people exposed to oral anticoagulants containing phenprocoumon, such as warfarin, had an almost three times higher risk of sustaining a traumatic intracranial bleeding compared to controls (Büchele et al., 2020). Kefale et al. (2023) in their study also revealed that increasing age was linked to a higher likelihood of receiving OACs. Moreover, older age was associated with an increased risk of bleeding (Kefale et al., 2023).

Sinigoj et al. (2020) found that the oldest old patients (≥ 85 years) had the highest risk of any major bleeding, and intracranial bleeding compared to the group of patients aged 65–74 years, even though the majority of them were treated with reduced doses of DOACs. Significant predictors for major bleeding were age ≥ 85 years and a history of bleeding (Šinigoj et al., 2020). Similarly, a study by Adrianzen-Herrera (2024) found that increasing age is a significant clinical risk factor for bleeding, with the risk increasing by a factor of 1.38 for every 10-year increment in age (Adrianzen-Herrera et al., 2024).

These studies collectively suggest that older age is a significant predictor of bleeding in patients treated with oral anticoagulants and highlight the need for careful monitoring and individualized dosing in this population. Therefore, it is important for healthcare providers to carefully evaluate and closely monitor the potential risks and benefits of oral anticoagulant therapy in elderly patients, particularly those aged 85 years and older and those using DOACs even if the dose is reduced.

Gender

Gender was evaluated in 6 studies conducted on the effects of anticoagulant therapy on bleeding, with a focus on the potential differences between genders. et al. (2007)found a higher risk of atrial fibrillation-related thromboembolism in women not receiving oral anticoagulation, emphasizing the importance of considering gender in treatment strategies. Božić et al. (2021) found that the bleeding caused by these therapies was not affected by the gender variable (Bozic et al., 2021). Similarly, Carnicelli et al. (2022) found no significant differences between standard-dose DOAC, lower-dose DOAC and warfarin treatments in terms of gender (Carnicelli et al., 2022).

A study by Matsumura et al. (2014) showed that Japanese women treated with DOAC experienced comparable bleeding events as men despite the higher bleeding risk estimates. The higher thromboembolic risk estimates in women resulted in higher thromboembolic event rates (Matsumura et al., 2022).

In the study by Kefale et al. (2023), it was observed that female patients had lower odds of being prescribed oral anticoagulants (OAC) compared to males. Despite gender differences in OAC prescription patterns, no significant disparity in bleeding risk between females and males was found, suggesting that gender may not directly impact bleeding outcomes in the context of anticoagulation therapy (Kefale et al., 2023).

A study by Nillson et al. (2015) found that males achieved better TTR control than females but death, bleeding and thromboembolism were not significantly different between females and males. The study also found that oral anticoagulant initiation was lower in women, but Japanese women experienced comparable bleeding events as men (Nilsson et al., 2014). Additionaly, Khatib et al. (2022) noted that there appears to be a marked difference in the level of

acceptance towards the utilization of anticoagulants between male and female populations. The reason for this has been shown to be prejudiced about bleeding risk in women.

Overall, these studies suggest that there is no significant difference in the effects of anticoagulant and antiplatelet therapy on bleeding based on gender, although some differences in TTR control and risk assessment tool performance have been noted.

Race and etnicity

Race and etnicity were evaluated in 5 studies. The studies highlight the disparities in OAC therapy among racial minorities and individuals. Tedla (2020) found that minorities were less likely to receive any OAC, specifically VKAs and DOACs, in comparison to whites, despite accounting for insurance status, income, and stroke risk factors. The study also found that the use of DOACs as compared to VKA therapy was associated with a significantly lower risk of stroke and bleeding in white patients, but not in black patients (Tedla et al., 2020).

A study by Haddad et al. (2021) investigated the association between race and the prescribing of OAC therapy at discharge among individuals with a prior gastrointestinal (GI) bleed. The study found that among those with a prior GI bleed, white patients were nearly five-times more likely to be discharged on OAC therapy than black patients, independent of income. This finding highlights the potential disparities in healthcare access and outcomes for racial and ethnic minorities. Additionally, the study found that although there was a substantial disparity in income between white and black individuals, this difference in income was not found to be a significant contributing factor to the association between race and the prescribing of OAC therapy at discharge. This suggests that other factors, such as systemic biases in healthcare access and treatment, may play a larger role in determining prescribing patterns for OAC therapy (Haddad et al., 2021).

Tse (2021) emphasized the importance of considering ethnicity and socioeconomic status in bleeding risk assessments to guide the use of antithrombotic medication for the management of CVD (Tse et al., 2021).

The study by Essien et al. (2018) found that black individuals were less likely to receive any oral anticoagulant and specifically to receive DOAC therapy compared to white individuals, even after adjusting for clinical features and socioeconomic factors. Furthermore, black and Hispanic individuals treated with DOACs were found to have a higher risk of inappropriate dosing than white individuals. The study also found that black and Hispanic individuals treated with warfarin had a lower median time in TTR compared to white individuals (Essien et al., 2021). Similarly, in a subsequent study, Essien et al. (2022) reported that Black and Hispanic patients were less likely to be prescribed anticoagulation at discharge than White patients, with significant disparities in the prescription of DOACs. This study also revealed that Black patients had higher rates of AF-related adverse outcomes, such as stroke, major bleeding, and mortality (Essien et al., 2022).

These studies indicate that there is a need for further research to understand the underlying factors contributing to these disparities and to develop strategies to address these disparities in the utilization of oral anticoagulant therapy from different racial and ethnic backgrounds. Furthermore, these studies emphasize the importance of considering ethnicity in the assessment of bleeding risk to guide the use of antithrombotic medication for the management of CVD.

Socioeconomic status

Socioeconomic status impacts individual health, even within a universal health care system. This may be partly explained by differences in exposure to risk factors for cardiovascular and other disease, differences in disease severity, inequitable access to health services, and other determinants of health such

as social and physical environments (Addo et al., 2012; Adler, N. E. et al., 1994; Kondo et al., 2009; Mackenbach et al., 2003; Manrique-Garcia et al., 2011)

Socioeconomic status was evaluated in 5 studies. These studies have highlighted the correlation between socioeconomic status and the risk of bleeding among patients undergoing warfarin therapy. A study conducted by Cresman et al. (2015) analyzed the cumulative incidence of bleeding among patients commencing warfarin therapy for atrial fibrillation, stratified by neighborhood-level income quintile. The results showed that the 5-year estimates were 11.5%, 11.2%, 10.6%, 10.3%, and 9.6% for income quintiles 1 (lowest) through 5 (highest), respectively. Additionally, the study identified a similar association between socioeconomic status and risk of fatal bleeding, with patients in the lowest-income quintile 28% more likely to die of warfarin-associated bleeding than those in the highest-income quintile. These findings align with those of a recent study from the United Kingdom, which suggests that social deprivation is associated with an elevated risk of bleeding in anticoagulant recipients (Hippisley-Cox, 2014).

A separate study by Dalen et al. (2022) investigates the association between individual-level socioeconomic status and the risk of bleeding, ischemic stroke/ transient ischemic attack/ embolism, all-cause mortality, and the combined outcome after weighting (Dalén et al., 2022). The results of the study show that the absolute risk of bleeding after 20 years of follow-up was 20% in the lowest income quartile and 16% in the highest income quartile. The study found a significantly higher risk of bleeding in the lowest income quartile than in the highest quartile. Moreover, the risk of death due to intracranial bleeding was strongly related to income level, and the standardized mortality ratio was 5.0 in the lowest income quartile and decreased to 1.3 in the highest income quartile. This implies that the risk of death due to intracranial bleeding was five times higher in patients in the lowest income quartile than in individuals in the age- and gender-matched general Swedish population.

A study by Kefale et al. (2023) shows that higher socioeconomic status was associated with a reduced likelihood of being prescribed OACs. This connection implies that socioeconomic status influenced OAC prescription patterns, which could indirectly affect bleeding risk through factors like medication adherence or access to healthcare resources (Kefale et al., 2023).

The study by Ravvaz (2021) suggests that patients living in very low socioeconomic status areas require more frequent INR checks, particularly beyond 180 days post warfarin initiation, as well as compliance counseling and educational interventions to improve their TTR and decrease the risk of stroke and bleeding. However, these interventions may present additional logistical and financial challenges for these patients (Ravvaz et al., 2021).

Erquicia (2021) conducted a study and found that there were no significant differences in the incidence rate of major bleeding between patients treated with VKAs and those treated with DOACs (Domínguez-Erquicia et al., 2021).

These studies have shown a correlation between socioeconomic status and the risk of bleeding among patients undergoing warfarin therapy. These findings indicate that patients from lower-income backgrounds are at a higher risk of bleeding and bleeding-related death. Furthermore, access to warfarin therapy for stroke prevention varies among those of different social deprivation levels.

Alcohol use

Alcohol use was evaluated in 2 studies. The study conducted by Philip et al. (2021) found that there was no significant association between alcohol consumption and bleeding (Reddiess et al., 2021).

Another study by Roth (2011) found that patients who screened positive for moderate to severe alcohol misuse or heavy drinking had approximately two-fold increased odds of major bleeding. The association between moderate to severe alcohol misuse and major

bleeding was similar for both gastrointestinal and other types of bleeding, while the association between heavy drinking and major bleeding was stronger for gastrointestinal bleeding. The association between moderate to severe alcohol misuse and major bleeding risk was significant in patients on warfarin therapy for one year and those with some genetic variants (Roth et al., 2018).

The findings from these studies indicate that moderate to severe alcohol misuse and heavy drinking is correlated with an elevated risk of major bleeding in individuals who use anticoagulants. However, the data does not demonstrate a significant relationship between general alcohol consumption and bleeding events in anticoagulant recipients.

DISCUSSION

This scoping review has provided a better understanding of the comprehensive examination of the impact that social determinants have on bleeding incidents as a result of anticoagulation therapy. Through this analysis, it was sought to examine deeper into the interplay between various social determinants and the bleeding outcomes experienced by individuals undergoing anticoagulation treatment.

Patients who are older have been reluctant to adhere to recommendations on anticoagulation. This situation, accompanying diseases and the drugs they use may increase the predisposition to bleeding in patients (Bozic et al., 2021). Bozic et al. al, in the study in which they examined the causes of major bleeding and bleeding sites in patients over the age of 65 using anticoagulant and antiplatelet therapy. They stated that aging is an important determinant (Bozic et al., 2021). In another study examining the risk factors of thromboembolic and bleeding events in patients with atrial fibrillation, individuals aged 75 and over were at risk for bleeding (Rohla et al., 2019). Carnicelli et. al. examined at the effect of age on bleeding in the comparison of warfarin and DOAC. In their study, which included patients over the age of 18 using anticoagulants, they reported that being younger is more beneficial in terms of major bleeding (Carnicelli et al., 2022).Older age is a significant determinant of bleeding in patients treated with oral anticoagulants and highlight the need for careful monitoring and individualized dosing in this elderly patients.

In terms of gender, it can be said that there is no difference between men and women in terms of bleeding in patients using anticoagulants. There are studies showing that death, bleeding, and thromboembolism are not significantly different between men and women.(Bozic et al., 2021; Carnicelli et al., 2022; Nilsson et al., 2014) However, Japanese women appear to experience similar bleeding patterns as men, despite having a higher risk of bleeding.(Matsumura et al., 2022) This may be due to higher rates of thromboembolic events in women. It is stated that the prejudice of women about the risk of bleeding increases this risk(Khatib et al., 2022). Although the incidence of stroke is higher in women, it is also known that the probability of receiving oral anticoagulant (OAC) therapy is lower than in men.(Pilcher et al., 2020; Tamirisa et al., 2022a) According to these results the bleeding events of why women are more symptomatic, have a higher risk of side effects with antiarrhythmic drugs is unclear.(Tamirisa et al., 2022b)

Minority populations have persistent disparities in the use of OAC therapy, with minorities less likely to receive OAC therapy, particularly DOACs, compared to white individuals (Essien et al., 2020; Haddad et al., 2021; Tse et al., 2021). The reasons behind this disparity could be due to lack of access to healthcare, lack of knowledge about treatment options, or discrimination based on race or ethnicity. The studies show that white patients are more likely to be prescribed OAC therapy than black patients, even after controlling for income (Tedla et al., 2020). Black individuals are less likely to receive any oral anticoagulant or DOAC therapy compared to white individuals and are at a higher risk of inappropriate dosing. These findings show that there is a need for further examination to address the racial disparities in CVD management. Healthcare providers need to be

aware of these disparities to ensure all individuals have access to effective CVD management.

We review that lower socioeconomic status is a risk factor for bleeding and bleeding-related death. Some studies included within the limitations of the study because they could not distinguish intracranial hemorrhage from fall events (Cressman et al., 2015). As compared with a younger, older patients typically exhibit more risk factors for falls and intracranial hemorrhage (Gage et al., 2005). Up to 80% of older patients have inadequate knowledge of anticoagulant therapy (Nasser et al., 2012), and lower socioeconomic status impacts health literacy, understanding of warfarin therapy, and access to educational and information resources (Hu et al., 2006; Nasser et al., 2012).

We found that alcohol misuse may play a role in increasing the risk of major bleeding, particularly in patients on anticoagulant therapy and those with specific genetic predispositions. However, further research is necessary to fully understand the relationship between alcohol consumption and bleeding risk, as well as the mechanisms underlying this association. These studies highlight the importance of considering alcohol use in bleeding risk assessments and anticoagulant management for patients (Reddiess et al., 2021; Roth et al., 2018).

CONCLUSIONS

The literature review shows that social determinants of health, such as socioeconomic status, race, ethnicity, age, and gender, significantly impact bleeding outcomes in patients undergoing anticoagulant therapy. Specifically, low socioeconomic status is a significant determinant, with low-income individuals and Black patients being less likely to access oral anticoagulant therapy. Notably, there is a lack of comprehensive qualitative studies that explore the systemic barriers to equitable healthcare access, particularly for minority populations, who are less likely to receive OAC despite having similar or higher risks of adverse outcomes compared to individuals of different racial or ethnic backgrounds. This disparity highlights inequalities in access to health services. Additionally, older age is associated with an increased risk of bleeding in patients on anticoagulants and the risk increases with age. While gender does not significantly affect INR control and bleeding risk, variations in the diseases for which anticoagulants are prescribed may influence outcomes. General alcohol use does not appear to be a social determinant of bleeding risk, but moderate to severe alcohol misuse and heavy drinking are correlated with an increased risk of major bleeding and should be considered in patient assessments.

Socioeconomic status and ethnicity are important factors in managing patient care and assessing bleeding risk. For these patients, nurses should take thorough patient histories and monitor INR more frequently. Further research is essential to uncover the underlying factors contributing to disparities in oral anticoagulant therapy and to develop strategies to address these disparities, particularly among different racial and ethnic groups. Individualized dosing, along with close observation, is recommended for elderly patients, particularly those aged 85 years and older, due to the increased risk of bleeding. Additionally, nursing care for elderly patients should include a careful assessment of both the benefits and risks of oral anticoagulant therapy, along with close monitoring for signs of bleeding.

Further research is needed to investigate both the individual and combined effects of social determinants of health on outcomes and processes related to oral anticoagulant therapy. To address these gaps, it is essential to focus on developing targeted educational interventions aimed at improving health literacy and adherence to anticoagulation therapy among socioeconomically disadvantaged populations. Additionally, longitudinal studies that track the long-term outcomes of patients across diverse demographic groups are crucial for better understanding the effectiveness of treatment protocols and informing tailored approaches that consider individual risk factors.

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