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Blood Pressure Variation in the Institutionalized Elderly

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ABSTRACT

Ambulatory blood pressure (ABP) monitoring has been used to examine stress responses in a variety of settings and populations, demonstrating that both the environment and activities influence BP. Little is known, however, about the effects of such factors on the BP of elders, particularly those in institutional settings. This paper examines sources of variation in BP among elders living in two long-term care settings. Twenty-seven residents of a nursing home (NH) facility and 29 residents from independent living (IL) facilities wore ABP monitors for approximately 24-hours. Individual pressures were transformed to z-scores and analyzed by ANOVA. Posture, mood and activity were significantly associated with systolic BP among IL while location and activity were significantly associated among NH. Posture and activity were associated with diastolic BP among IL residents. The specific effects of location, posture, and activity did not differ across settings.

***Key words**: aging, nursing home, independent living, stress*

Introduction

Variation in blood pressure (BP) over the course of a day occurs as an adaptive response to the continuously changing internal and external environmental conditions experienced by the individual[1,2]. Many studies among working adults have confirmed that there are marked changes in both systolic and diastolic BP when individuals go from their place of employment to home[3–7]. This variation is often related to differences in the stressfulness of changing environments[8–10]. However, factors such as mood[5,7,11,12], posture, and activity[13–20] also have substantial effects on BP variation.

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Available evidence illustrates the adaptive and clinical impact environmental factors have on diurnal BP variation in young and middle aged adults. However, little data are available on causes of daily BP variation among elders, particularly frail elders residing in long-term care institutions. Ethnographic studies suggest that it can be quite stressful for resident elders[21–24]. No data examining how or even if BP responds to the unique lifestyle stresses that occur within institutionalized settings have been reported. Studies of life stressors and diurnal variation of BP in people over 65 years of age have tended to focus on community residing elders[18] with lifestyles and circumstances very different from long-term care[18,25]. The purpose of the present study is to evaluate and compare factors that may affect daily BP variation of elders residing in two institutional settings: independent living (IL) and nursing home (NH). It was hypothesized that 1) BP vary by location, posture, mood and activity within each setting and that 2) variation in BP associated with these factors differ across settings.

Material and Methods

Sample

Residents from two congregate care retirement communities were recruited to participate in this research. All NH residents were from one facility in Columbus, Ohio, U.S.A. Eleven IL residents were recruited from the same facility and 17 were recruited from an additional facility in Columbus. Both facilities offered multiple levels of care. A total of 27 NH participants and 28 IL residents completed the protocol. Letter, newsletter announcement, phones recruited participants, and follow-up visits. Consent was obtained directly from IL participants following protocols approved by The Ohio State University's Institutional Review Board. Family or legal guardians provided consent for cognitively impaired NH residents. Residents were included if they were over 65 years and had resided at the facility for more than six months. Comatose and bed-bound residents were excluded. Both resident groups were representative of the institutional population in age, functional and health status. NH residents followed general trends expected for »typical« nursing home residents. They were mostly women, had multiple co-morbid diseases, were predominantly of European descent, were dependent on assistance with activities of daily living, and had few social supports[26–28]. IL residents were younger, healthier, took fewer medications and had less functional impairment than NH residents (Table 1). Participants from the two IL facilities were of similar age, health status and functioning level. Because of their similarity, IL residents of both facilities were grouped for analyses. Although some patients were taking antihypertensive medications, they were still included in the study. In general, although antihypertensives have lowering effect on absolute level of pressure, they have little influence on its diurnal variation[29].

Procedures

Between 7:00–8:00 a.m. while still in his or her room, each participant was fitted with a Spacelabs 90202 ambulatory BP monitor, which was then worn for approximately 24 hours. Fittings followed protocols of the Hypertension Center at Cornell University Medical College[30,31]. After fitting and calibration, IL participants were given instructions about the monitor and diary, while observation of NH residents began. BP and heart rate were measured at 20-minute intervals from 8:00 a.m. to 10 p.m. and every 40 minutes from 10 p.m. to 8:00 a.m. the following morning. A total of 2,771 blood pressures were recorded with an average

TABLE 1
SELECTED CHARACTERISTICS OF SAMPLES

Characteristic	Independent living X ± SD	Nursing facility X ± SD	Two-tailed significance
N	29	27	
Age	80.4 ± 6.2	87 ± 7.6	0.001*
% Female	90%	85%	0.70†
Years of education	15.6 ± 2.4	12.7 ± 3.3	0.001*
Diagnoses	2.6 ± 2.0	7 ± 2.6	0.001*
% With hypertension	27.6%	18.5%	0.53†
Medications	2.8 ± 2.4	6.5 ± 3	0.001*
% Cardiovascular medication	27.6%	22.2%	0.76†
% Mood altering medication	6.9%	40.7%	0.004†
% Arm fat‡	28.14 ± 12.4	22.3 ± 11.6	0.09*
BMI	24.2 ± 4.3	25.7 ± 5.4	0.25*
24-hour mean SBP	1367 ± 17	130 ± 19	0.15
24-hour mean DBP	73 ± 9	71 ± 9	0.32
Day-time SBP	138 ± 17	129 ± 19	0.08
Day-time DBP	75 ± 10	71 ± 9	0.14
Night-time SBP	130 ± 18	133 ± 22	0.53
Night-time DBP	67 ± 10	73 ± 12	0.09

‡ Calculated by Mid-arm fat = [arm circumference – (π x triceps skinfold/10)]^2
* t-test, † Fisher's exact test

of 50 (range 19–64) measurements per person.

At each measurement, IL residents recorded the time and their location, mood and activity. Moods reported were happy, sad, angry, or anxious. If participants had a neutral mood, they were instructed to leave the mood section blank. Observers of NH residents recorded location, posture, activity, and observed mood. For NH residents, mood was assessed by outward appearance. Residents were identified as »neutral« if showing no outward expression, »agitated,« following the definition of Cohen-Mansfield and Billig[32] that is displaying »inappropriate verbal, vocal or motor activity that is not explained by the needs or confusion *per se*, »sad« if crying or moaning, and »happy« if smiling or laughing. NH residents were observed for an average of 13 hours, starting at 7:00 a.m. until they went to bed for the night (8:00–10:00 p.m.). No observations were recorded at nighttime.

Analysis

To examine the data, observations and diary entries were grouped into categories. Due to a low variation in recorded mood, mood was grouped into neutral, positive affect (happy) and negative affect (agitated or anxious, angry and sad). Position was either sitting, standing upright, or reclining. Location was coded as personal room (or apartment), dining room, activity rooms, and common areas (including: halls and lobbies for IL and halls, lounges and nurses' station for NH).

In keeping with Gottesman and Bourestom's[33] model, activity was divided into personal care, social and expressive activity, passive activity, eating, and physical activity (walking, exercise, physical therapy or moving in a wheel chair). Personal care included transport, grooming, washing, toileting and medical care in the NH and all self-care activities and housework for IL residents. Social and expressive activities included all conversations, games, physical activity associated with games, programmed activities, church, computer time, correspondence, and visiting. Passive activities included times when residents were waiting, sleeping, doing nothing, fidgeting, and time spent in front of a television. Eating was placed in its own category.

To examine the effects of mood, location, posture and activity on BP, all measurements were converted to z-scores using the resident's overall mean daily pressure: $z_i = (BP_i - X_i)/s_i$, where BP_i = a reading from an individual (i), X_i = individual mean BP, s_i = individuals daily pressure standard deviation[30]. This adjusts all BP measurements to the same scale and removes the between-individual differences in level of BP.

The analysis of z-scores addresses the question of why a particular pressure was located at a particular position within the distribution of all the pressures for an individual. The hypothesis is that the mood, activity, posture or situation of measurement associated with a given pressure determines its place in the distribution of all pressures. If there were no association between the factors and blood pressures, then the average z-score for every activity, posture or situation would be close to zero because the factor-BP combinations would be randomly dispersed throughout the distribution. However, if the average z-scores for different activities, postures or situations were substantially positive or negative, it would suggest that experiencing a particular category (such as standing or being at work) either increased or decreased pressure, respectively, relative to the person's daily ambulatory mean pressure[12].

The effects of location, posture, mood and activity on BP within each sample were examined with ANOVA, with the systolic or diastolic BP z-score as the dependent variable and location, posture, mood and activity as independent variables. Post hoc tests with a Bonferonni adjustment were used to examine the effects of each location, posture, mood and activity. To compare samples, the means of each state within a factor (e.g. negative affect or sitting) were compared across samples using a two-sided Student's t-test.

Results

The two main effects models for variation in SBP and DBP within each sample differed across settings. Where posture, mood and activity were significantly associated with SBP in IL, only location and activity were significantly associated with SBP among NH residents (Table 2). Location, posture and activity were significantly associated with DBP among IL

TABLE 2
MAIN EFFECTS MODELS OF INDEPENDENT LIVING AND NURSING HOME ON SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

	Independent living	Nursing home
Source of variation	p > F	p > F
Systolic	$R^2 = 0.1$	$R^2 = 0.06$
Location	0.42	0.05
Posture	<0.001	0.78
Mood	0.01	0.07
Activity	0.001	<0.001
Diastolic	$R^2 = 0.2$	$R^2 = 0.04$
Location	0.07	0.04
Posture	<0.001	0.45
Mood	0.44	0.34
Activity	<0.001	0.003

residents, while only location and activity was associated with DBP among NH participants (Table 2). These models account for a small amount of variation in standardized BP (Table 2).

To examine the individual effects of states of each factor (location, posture, mood and activity), means were compared within each group. After adjusting for the effects of posture, mood, and activity, standardized SBP among IL residents was significantly higher in the dining room compared to being in one's room or an activity room (Table 3). The common area and dining room was associated with higher standardized DBP compared to being in one's room or apartment in both IL and NH settings. For NH residents, being in the dining room was associated with the highest SBP and being in the activity room was associated with the lowest SBP. The mean effect of each location did not differ across groups for either SBP or DBP.

After controlling for activity, location and mood, neither SBP varied by posture among NH residents (Tables 4). NH residents spent 70% of their time sitting and only 2% of the observations standing. SBP and DBP varied by posture among IL participants. The mean effect of each posture did not significantly differ across groups.

Among IL residents, all activities resulted in a significant rise in SBP and DBP relative to sleeping (Table 5). The

TABLE 3
ASSOCIATION OF LOCATION WITH THE STANDARDIZED BLOOD PRESSURES AMONG THE INDEPENDENT LIVING AND NURSING HOME ELDERS*

Location	Independent living			Nursing home		
	N	X†		N	X†	
		SBP	DBP		SBP	DBP
Room	1031	–0.12[a]	0.10[a]	479	0.23[a]	–0.04[a]
Dining room	45	0.05[b]	0.26[b]	247	0.26[b]	0.09[b]
Common area	117	0.09[a]	0.44[b]	133	0.12[a]	0.15[b]
Activity room	29	0.005[a]	–0.07[a]	162	0.15[a]	–0.30[a]

* None of the means are significantly different between groups (t-test p > 0.05).
† Different letters indicate significantly different means within groups (p <0.05)

TABLE 4
ASSOCIATION OF POSTURE WITH THE STANDARDIZED BLOOD PRESSURES AMONG THE INDEPENDENT LIVING AND NURSING HOME ELDERS*

Posture	Independent living			Nursing home		
	N	Marginal mean†		N	Marginal mean†	
		SBP	DBP		SBP	DBP
Recline	310	–0.12[a]	–0.06[a]	277	0.20[a]	–0.16[a]
Sit	694	0.21[b]	0.10[b]	724	0.12[a]	–0.03[b]
Standing	218	0.27[c]	0.51[b]	20	0.13[a]	0.11[b]

* None of the means are significantly different between groups (t-test p > 0.05).
† Different letters indicate significantly different means within groups (p <0.05)

TABLE 5
ASSOCIATION OF ACTIVITY WITH THE STANDARDIZED BLOOD PRESSURES AMONG THE INDEPENDENT LIVING AND NURSING HOME ELDERS*

Activity	Independent living			Nursing home		
	N	Marginal mean†		N	Marginal mean†	
		SBP	DBP		SBP	DBP
Sleep	249	–0.66[a]	–0.35[a]	212	–0.14[a]	–0.34[a]
Social/expressive activities	271	0.22[a,b]	0.36[b]	116	0.09[a]	0.05[b]
Passive activities	404	0.11[a,b]	–0.02[b,c]	231	0.09[a]	–0.07[b]
Physical activities	96	0.15[a,b,c]	0.10[a,b]	20	0.18[a,b]	–0.01[a]
Eating	87	0.14[c]	0.62[b]	129	0.45[b]	0.17[b]
Care	115	–0.05[b,c]	0.38[b]	107	0.22[b]	0.05[b]

* None of the β coefficients are significantly different between groups (t-test $p > 0.05$).
† Different letters indicate significantly different means within groups ($p < 0.05$)

TABLE 6
ASSOCIATION OF MOOD WITH THE STANDARDIZED BLOOD PRESSURES AMONG THE INDEPENDENT LIVING AND NURSING HOME ELDERS*

Mood	Independent living			Nursing home		
	N	X†		N	X†	
		SBP	DBP		SBP	DBP
Neutral	755	–0.19[a]	0.22[a]	940	–0.06[a]	–0.16[a]
Negative affect	87	0.26[a]	0.11[a]	61	0.28[a]	–0.05[a]
Positive affect	353	0.009[a]	0.08[a]	20	0.18[a]	0.03[a]

* None of the β coefficients are significantly different between groups (t-test $p > 0.05$).
† Different letters indicate significantly different means within groups ($p < 0.05$).

greatest rise in SBP was during social/expressive activities, followed by physical activity, eating, passive activities and personal care. However, these activities were not all significantly different from one another. DBP was highest while IL residents were eating followed by personal care, social and expressive activities, passive activities and physical activities. Among NH residents, eating and care were significantly different from sleeping. Eating resulted in the highest BP among NH residents. All activities except for physical activities were associated with a significantly different DBP. The mean effect of each activity category did not significantly differ across groups.

After adjusting for all other factors, the mean standardized systolic and diastolic BP did not significantly differ across moods, in either group (Table 6). The means associated with each affect did not differ between groups.

Discussion

While the two groups varied greatly in health status, they did not differ in mean BP. Both groups had higher 24-hour mean BP than reported in previous studies of younger, community dwelling older adults[34]. Daytime and nighttime mean BP was also higher than previously reported in older adults[18,34]. NH residents had higher BP at night than during the day.

Main effects models explain only a small amount of the variation in standardized BP, similar to other studies using both similar and more complex models[30,31]. Although there are no models of BP that directly compare to ours, there are some interesting similarities and differences from previous research. Studies on younger adults (under 60 years of age) show an effect of location of measurement[30,31]. Typically, however, these studies contrast more macroenvironmental changes, such as going from the place of employment to home. In the present study, there is an effect of location within the facilities, particularly in the NH group. Diastolic BP was higher in common areas such as lobbies and the nurses' station in both groups, an effect that is hard to explain. IL residents commonly socialize or walk through these areas, while, on the other hand, NH residents most often sit and do little in their common areas. For NH residents, a common stressor is boredom; they spend a great deal of time sitting not doing anything. Lack of anything to do may not be considered stressful since, in general, inactivity decreases BP. However, if residents become frustrated and agitated sitting un-engaged, while staff rush about or the resident has difficulty gaining needed attention from staff, sitting may be a stressful »activity« and result in elevated BP. Unfortunately, we do not have data to test this hypothesis. While in activity rooms, NH residents had lower BP. The social atmosphere in these areas was more festive and residents appeared to enjoy most of the activities that took place there. Activity room activities often involved small to medium groups, where residents commonly participated in social and expressive activities (e.g. group discussion, baking) or residents listened to or played music and sang. The results showed that BP during social and expressive activities did not differ from BP during sleep, whereas other activities such as eating, personal care and passive activities were at least marginally associated with higher BP. Thus, activity and environment may have combined to decreased BP in this location.

Posture had the same effect on BP among IL residents as has been reported in previous studies of younger participants[12,31]. Given the low frequency of standing among NH residents (therefore, low statistical power), it is not surprising that posture was not associated with BP in this group. The effects of activity, however, were similar to those reported previously in younger adults[31]. Previous studies used different categories and the patterns of variation are somewhat different here. Eating was associated with the highest SBP and DBP among NH residents and the highest DBP among IL residents although eating is not the most »physically-active« activity. It may be that eating was the most engaging activity for NH results, creating the greatest arousal as measured by BP response.

Unlike previous studies on younger adults, mood did not have a large effect on BP in either group. One explanation for the lack of effect may be the low frequency with which mood was reported and/or observed. However, IL residents reported negative and positive affects as frequently as has been reported elsewhere[5,12]. Another possibility is that among the high percentage of NH participants who were taking mood-altering medications (40%) emotional responsivity was blunted.

Because data were available from only a small sample from only two facilities, these results are not generalizable. Also, since the two samples differ in age and health as well as environment, the effects of frailty and environment on BP cannot be distinguished. Although this study has limitations, it is clear that BP does vary by location and activity within institutional settings. Also, ambulatory BP monitors appear useful for examining BP variation within long-term care settings.

Future research must separate the effects of frailty/illness from location, perhaps by comparing groups of comparable health and age living in different residential settings – a difficult task since by definition NH residents are frailer than IL residents. In addition, a more detailed ethogram of moods could enhance our understanding of how mood relates to BP. One such mood scale, the Apparent Affect Rating scale developed by Lawton and colleagues, may provide more information[35,36]. Because physical activity adds an additional stressor to several different kinds of activities – eating, social, personal care etc. – an objective measure of physical activity such as measured with an actigraph, may allow a more detailed analysis of how activity relates to BP in institutionalized elders.

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REFERENCES

1. JAMES, G. D., T. G. PICKERING, Am. J. Hypertens., 6 (1993) 170S. — 2. JAMES, G. D., D. E. BROWN, Ann. Rev. Anthropol., 26 (1997) 313. — 3. HARSHFIELD, G. A., T. G. PICKERING, H D. KLEINERT, S. BLANK, J. H. LARAGH, Psychosom. Med., 44 (1982) 237. — 4. VAN EGEREN, L. F., Psychosom. Med., 54 (1992) 337. — 5. SCHWARTZ, J., Ann. Behav. Med., 16 (1994) 210. — 6. YAMASAKI, F., J. E. SCHWARTZ, L. M. GERBER, K. WARREN, T. G. PICKERING, Hypertens., 32 (1998) 417. — 7. BRONDOLO, E., W. KARLIN, K. ALEXANDER, A. BOBROW, J. SCHWARTZ, Psychophysiol., 36 (1999) 86. — 8. SCHNALL, P. L., J. E. SCHWARTZ, P. A. LANDSBERGIS, K. WARREN, T. G. PICKERING, Hypertens., 19 (1992) 488. — 9. JAMES, G. D., Y. R. SCHLUSSEL, T. G. PICKERING, Psychosom. Med., 55 (1993) 55. — 10. JAMISON, R. N., S. A. RAYMOND, J. G. LEVINE, E. A. SLAWSBY, S. S. NEDELJKOVIC, N. P. KATZ, Pain, 91 (2001) 277. — 11. SOUTHARD, D. R., T. J. COATES, K. KOLODNER, F. C. PARKER, N. E. PADGETT, H. L. KENNEDY, Health Psychol., 5 (1986) 469. — 12. JAMES, G. D., L. S. YEE, G. A. HARSHFIELD, S. G. BLANK, T. G. PICKERING, Psychosom. Med., 48 (1986) 502. — 13. CLARK, L. A., L. DENBY, D. PREGIBON, G. A. HARSHFIELD, T. G. PICKERING, S. BLANK, J. H. LARAGH, J. Chronic. Dis., 40 (1987) 671. — 14. VAN EGEREN, L. F., A. W. SPARROW, Psychosom. Med., 51 (1989) 1. — 15. JAMES, G. D., Yearb. Phys. Anthropol., 34 (1991) 189. — 16. GRETLER, D. D., G. F. CARLSON, A. V. MONTANO, M. B. MURPHY, Am. J. Hypertens., 6 (1993) 127. — 17. PIEPER, C., K. WARREN, T. G. PICKERING, J. Hypertens., 11 (1993) 177. — 18. SHAPIRO, D., I. B. GOLDSTEIN, Psychophysiol., 35 (1998) 305. — 19. GERBER, L. M., Am. J. Hum. Biol., 10 (1998) 459. — 20. O'SHEA, J. C., M. B. MURPHY, J. Hum. Hypertens., 14 (2000) 227. — 21. JACOBS, J.: Fun city: An ethnographic study of a retirement community. (Rinehart and Winston, New York, 1974). — 22. GUBRIUM, J.: Living and dying at Murray Manor. (St Martins Press, New Ork, 1975). — 23. SAVISHINSKY, J.: The ends of time: Life and work in a nursing home. (Bergin & Garvey, Westort, CT, 1191). — 24. SHIELD, R., In: SOKOLOVSKY, J. (Ed.): The cultural context of aging. (Bergin & Garvey, Westport, CT, 1997. — 25. KAWAMURA, H., M. JUMABAY, H. MITSUBAYASHI, Y. IZUMI, M. SOMA, Y. OZAWA, D. REHEMUDULA, M. MAHMUT, Y. MU, M. AISA, Z. H. CHENG, S. Z. WANG, Hypertens. Res., 23 (2000) 177. — 26. DWYER, J., A. BARTON, W. VOGEL, J. Gerontol., (1994) S75. — 27. MILLER, B., S. MCFALL, R. CAMPBELL, J. Gerontol., 49 (1994) S14. — 28. MULROW, C., M. GERETY, J. CORNELL, V. LAWRENCE, D. KANTEN, J. Am. Geriatr. Soc., 42 (1994.) 374. — 29. LEMMER, B., In: WHITE, W. (Ed.): Contemporary cardiology: Blood pressure monitoring in cardiovascular medicine and therapeutics. (Humana Press,

Totowa, NJ, 2001). — 30. JAMES, G. D., L. S. YEE, T. G. PICKERING, Soc. Sci. Med., 31 (1990) 1213. — 31. JAMES, G. D., T. G. PICKERING, Am. J. Phys. Anthropol., 84 (1991) 343. — 32. COHEN-MANSFIELD, J., N. BILLIG, J. Am. Geriatr. Soc., 34 (1986) 711. — 33. GOTTESMAN, L., N. BOURESTOM, Gerontologist, 14 (1974) 501. — 34. SEGA, G., C. BRAVI, G. CESANA, F. VALAGUSSA, G. MANCIA, A. ZANCHETTI, J. Cardiovasc. Pharmacol., 23 Suppl. 5 (1994) S12. — 35. LAWTON, M. P., M. H. KLEBAN, J. DEAN, D. RAJAGOPAL, P. A. PARMELEE, J. Gerontol., 47 (1992) P228. — 36. LAWTON, M. P., P. A. PARMELEE, I. R. KATZ, J. NESSELROADE, J. Gerontol., 51 (1996).

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VARIJACIJE KRVNOG TLAKA U OSOBA KOJE ŽIVE U INSTITUCIJAMA ZA NJEGU STARIH OSOBA

S A Ž E T A K

Ambulatorni krvni tlak (ABP) koristi se kako bi se istražio odgovor na stres u različitim mjestima stanovanja i populacijama. U dosadašnjim istraživanjima pokazalo se da i vrsta okoline i tip aktivnosti utječu na krvni tlak. Međutim, malo se zna o učincima takvih čimbenika na krvni tlak starih osoba, posebice onih koje žive u okviru institucija za njegu starih osoba. U ovom radu istražuju se izvori varijacija krvnog tlaka u osoba štićenika dviju institucija za trajnu njegu starih osoba. Ispitivano je 27 osoba korisnika staračkog doma i 29 osoba koje žive samostalno. Ispitivane osobe nosile su ABP uređaj tijekom približno 24 sata. Zabilježeni krvni tlak svake osobe transformiran je u z-vrijednosti i analiziran ANOVA metodom. Položaj tijela, raspoloženje i tip aktivnosti bili su značajno povezani sa sistoličkim krvnim tlakom kod osoba koje žive samostalno, dok su prostorija u kojoj osoba boravi i tip aktivnosti bili značajno povezani s tlakom kod korisnika staračkog doma. Položaj tijela i tip aktivnost bili su povezani s dijastoličkim krvnim tlakom kod osoba koje žive samostalno. Specifičan učinak prostorije, položaja tijela i tipa aktivnosti nije se razlikovao u ove dvije skupine.