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Ohio Cardiovascular and Diabetes Health Collaborative

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Overview of Undiagnosed/ Masked Hypertension

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Objectives

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- Provide an overview of the prevalence and impact of Masked Hypertension (MH) on cardiovascular outcomes
- Summarize the risk factors and diagnostic evaluation for MH
- Recognize treatment implications in patients with MH

Significance of Out of Office Blood Pressure Readings

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- The primary reason for out of office blood pressure (BP) readings is to identify patients not on antihypertensive medication with:
  - White Coat Hypertension (WCH) with elevated office BPs who may not require drug treatment
  - MH with normal office readings who should be considered for drug treatment
- In addition, for patients on antihypertensive medications, to identify
  - White Coat Effect (WCE) – where office BPs are significantly higher than out of office readings
  - Masked Uncontrolled Hypertension (MUCH) – where office readings indicate adequate BP control but out of office readings are elevated

White Coat Hypertension and Masked Hypertension

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- The prevalence of WCH and MH is between 10-30%, each, depending on the study.
- The risk of cardiovascular morbidity and mortality for MH is about the same as adults with sustained hypertension, indicating a benefit to treatment
- While there appears to be an increased risk of cardiovascular morbidity with MH, we do not know if there is a benefit to treating these individuals.

Up to 30% of patients in our practices are either over- or under-treated for hypertension

Hypertension. 2018;71(6):e136-e139.

Characteristics of Masked Hypertension

- MH prevalence averages ~13% and up to 30% in some surveys
- Prevalence increases with higher (normal) office readings
- Increased prevalence of MH also seen in older persons, males, Black patients, and those with obesity, diabetes, chronic kidney disease (CKD), and sleep apnea
- Large longitudinal cohort studies show ***CVD risk similar to that of sustained hypertension***
- Overlap between MH identified by home blood pressure monitoring (HBPM) and ambulatory blood pressure monitoring (ABPM) only 60-75%, though both show same cardiovascular disease (CVD) risk compared to never-treated hypertensives (NTH) and sustained hypertension (HTN)
- Randomized controlled trial (RCT) data evaluating benefit of treatment is not yet available
- Profiles of risk for treated patients showing MUCH parallel that of MH, respectively

CVD and Mortality with Masked Hypertension vs. Normotension

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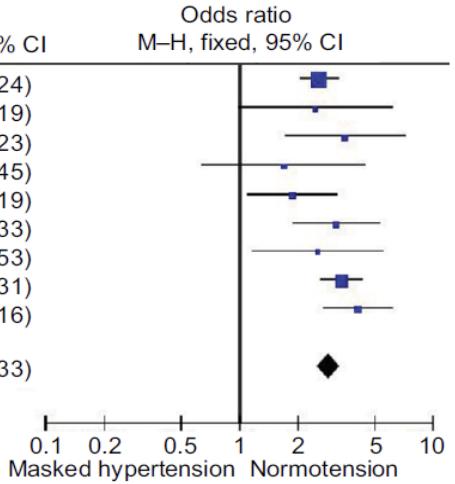
A

Composite cardiovascular events: masked HTN versus normotension

Study or subgroup	Masked hypertension Events	Total	Normotension Events	Total	Weight	Odds ratio M–H, fixed, 95% CI
Asayama et al[32]	149	1612	159	4176	38.1%	2.57 (2.04–3.24)
Björklund et al[27]	10	82	10	188	2.5%	2.47 (0.99–6.19)
Booth et al[7]	35	352	10	329	4.4%	3.52 (1.71–7.23)
Fagard et al[28]	7	31	20	136	2.7%	1.69 (0.64–4.45)
Hansen et al[30]	21	211	48	859	8.1%	1.87 (1.09–3.19)
Mancia et al[29]	25	184	43	909	5.9%	3.17 (1.88–5.33)
Pierdomenico et al[31]	11	120	18	471	3.1%	2.54 (1.17–5.53)
Stergiou et al[16]	119	636	211	3312	26.2%	3.38 (2.65–4.31)
Tientcheu et al[6]	53	256	52	865	8.9%	4.08 (2.70–6.16)
Total (95% CI)		3484		11245	100.0%	2.91 (2.54–3.33)
Total events	430		571			

Heterogeneity: χ^2=9.59, *df*=8 (*P*=0.29); I^2=17%
Test for overall effect: *Z*=15.46 (*P*<0.00001)



B

Mortality: masked HTN versus normotension

Study or subgroup	Masked hypertension Events	Total	Normotension Events	Total	Weight	Odds ratio M–H, fixed, 95% CI
Booth et al[7]	29	385	15	353	14.0%	1.84 (0.97–3.48)
Mancia et al[29]	25	184	43	909	12.1%	3.17 (1.88–5.33)
Stergiou et al[16]	136	636	301	3312	73.9%	2.72 (2.18–3.40)
Total (95% CI)		1205		4574	100.0%	2.65 (2.18–3.23)
Total events	190		359			

Heterogeneity: χ^2=1.76, *df*=2 (*P*=0.41); I^2=0%
Test for overall effect: *Z*=9.67 (*P*<0.00001)

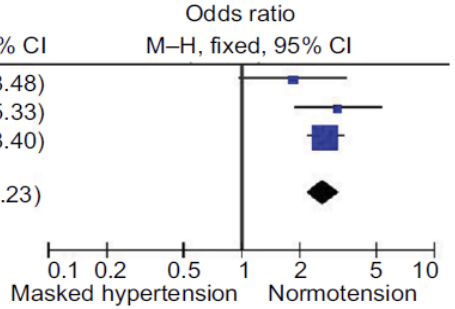


Figure 1 Masked HTN versus normotension – whole cohort.
Notes: (**A**) Composite cardiovascular events. (**B**) All-cause mortality.
Abbreviations: CI, confidence interval; HTN, hypertension; M–H, Mantel–Haenszel.

Palla M et al. Integr BP Control 2018; 11: 11-24.

Comparison of Outcomes in Masked Uncontrolled Hypertension vs. Controlled Hypertension

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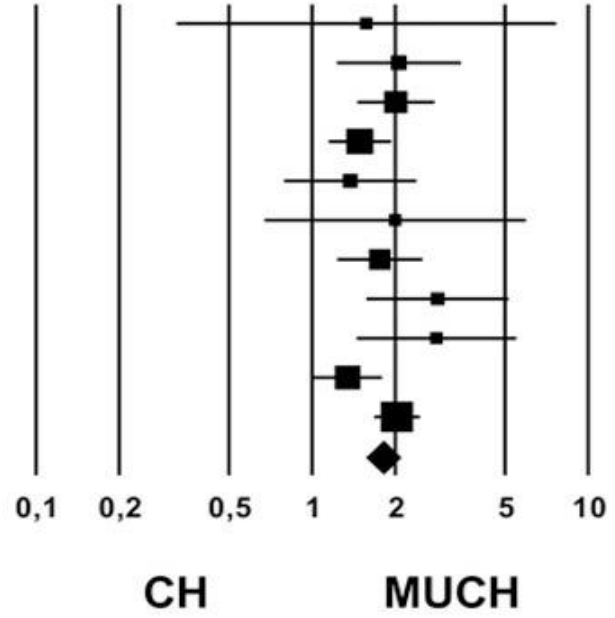
Study name	Hazard ratio	Lower limit	Upper limit	Z-Value	p-Value
OvA Study 2003	1,570	0,321	7,681	0,557	0,578
SHEAF Study 2004	2,060	1,221	3,474	2,710	0,007
Chieti-Pescara Study 2005-2017	2,010	1,449	2,788	4,181	0,000
IDACO Study 2005-2017	1,490	1,142	1,944	2,940	0,003
Hadassah Study 2008	1,375	0,787	2,400	1,120	0,263
J-HEALTH Study 2008	2,000	0,669	5,975	1,241	0,214
IDHOCO Study 2014	1,760	1,227	2,524	3,073	0,002
Dallas Heart Study 2015	2,845	1,566	5,167	3,434	0,001
Jackson Heart Study 2016	2,820	1,443	5,511	3,033	0,002
HONEST Study 2017	1,345	1,005	1,800	1,995	0,046
Spanish Registry Study 2018	2,030	1,669	2,469	7,091	0,000
Overall	1,796	1,566	2,061	8,371	0,000

Statistics for each study

Hazard ratio and 95% CI



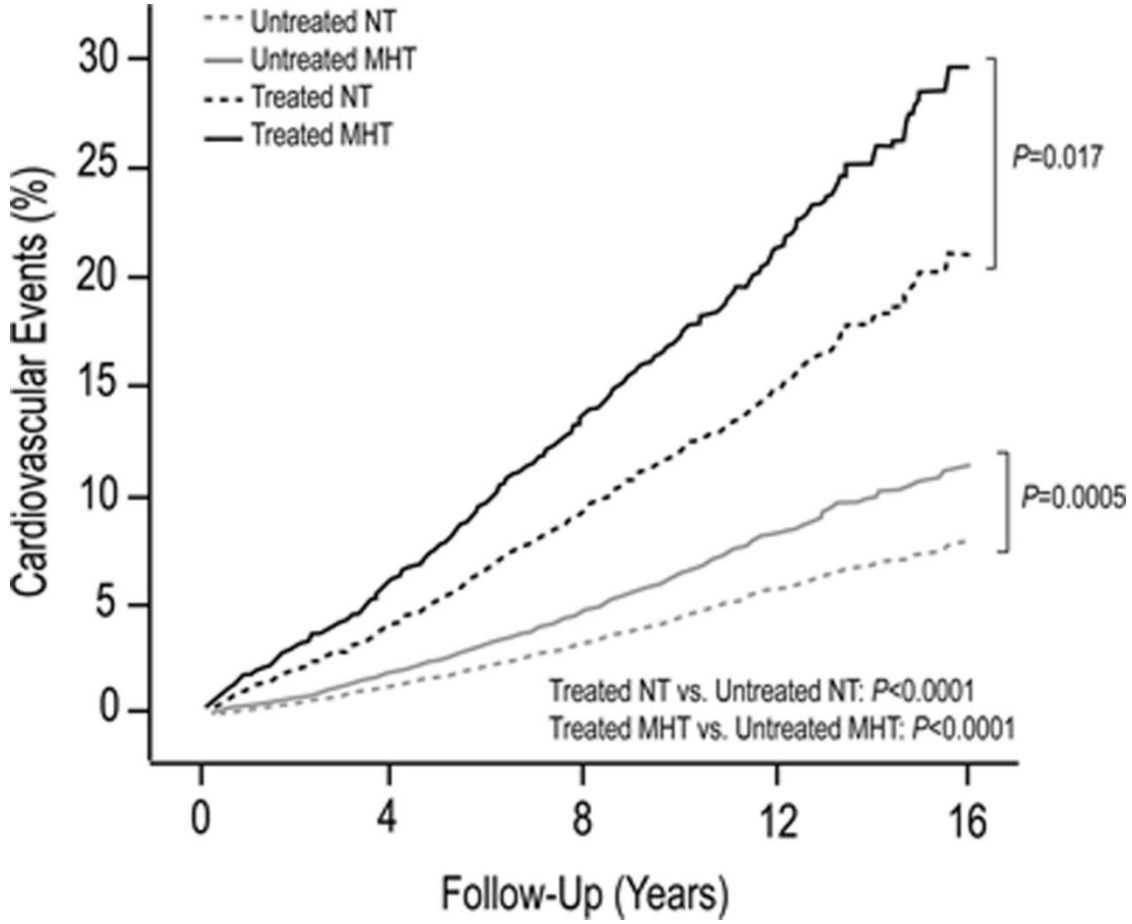
Q = 12,9 P = 0,2
I squared = 22,5
Tau squared = 0,01

Meta Analysis

Pierdomenico SD et al. Hypertens 2018; 72:862-869

Cohort, Sex, and Age-Standardized Incidence of Cardiovascular Events Meta-Analysis from International Database on Ambulatory Blood Pressure in Relation to Cardiovascular Outcomes (IDACO)

- Untreated and treated normotensive (NT) and MH subjects without diabetes
- Significant higher incidence of cardiovascular events in:
  - Treated patients with MUCH versus treated patients with BP controlled
  - Patients with MH versus untreated patients with NT
- Fully adjusted hazard ratios (HR) for treated versus untreated MH are as follows: HR, 2.27 (95% confidence interval, 1.6–3.2; P<0.0001)



Masked Hypertension by Ambulatory Blood Pressure Monitoring and Home Blood Pressure Monitoring

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- ABPM is more sensitive than HBPM in detecting MH
  - ABPM missed the detection of MH between 9-21% as detected by HBPM
  - HBPM missed the detection of MH 48-61% as detected by ABPM

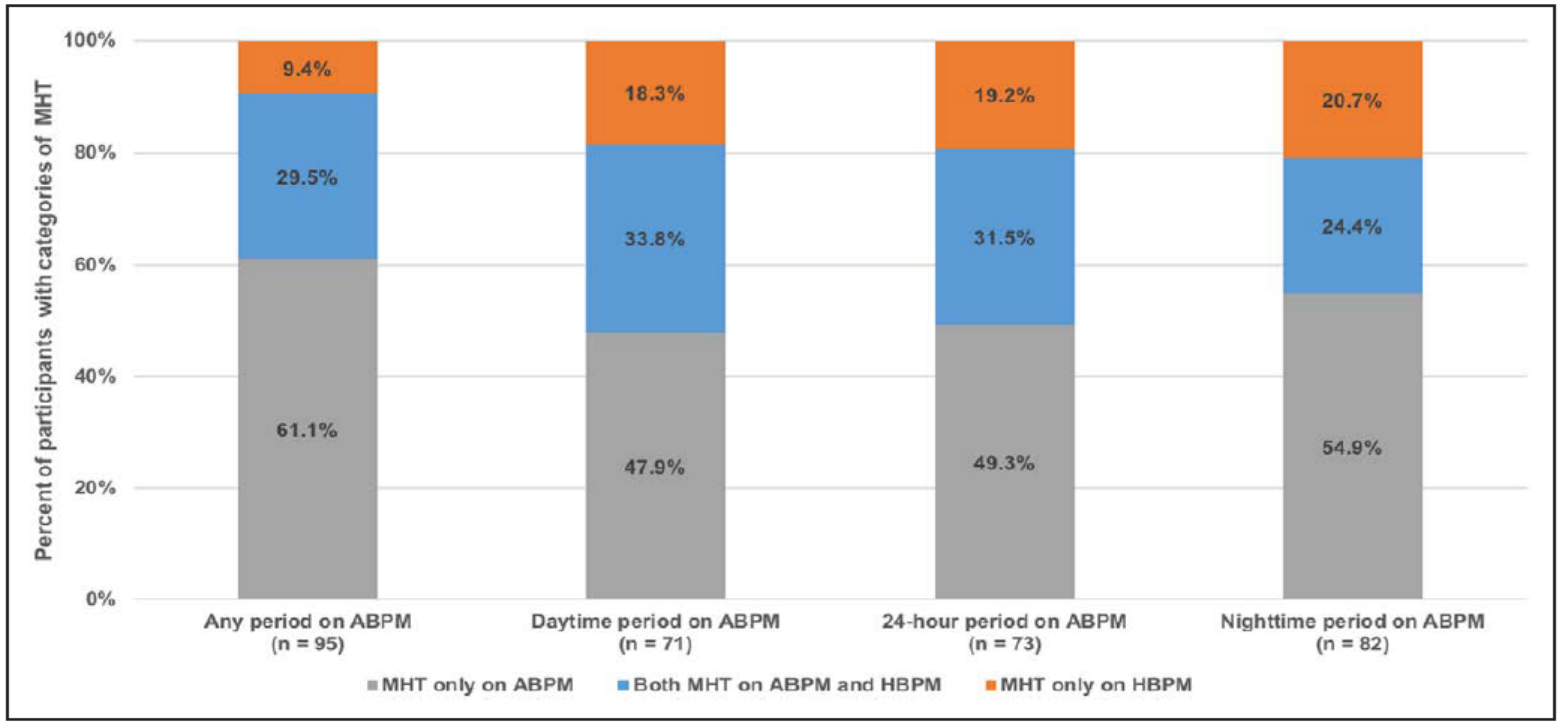

Figure. Distribution of participants into categories based on the absence or presence of masked hypertension (MHT) on ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM).

Anstey DE et al. HTN 2018; 72: 1200-1207

Detection of Masked Hypertension in Patients *not on* Drug Therapy

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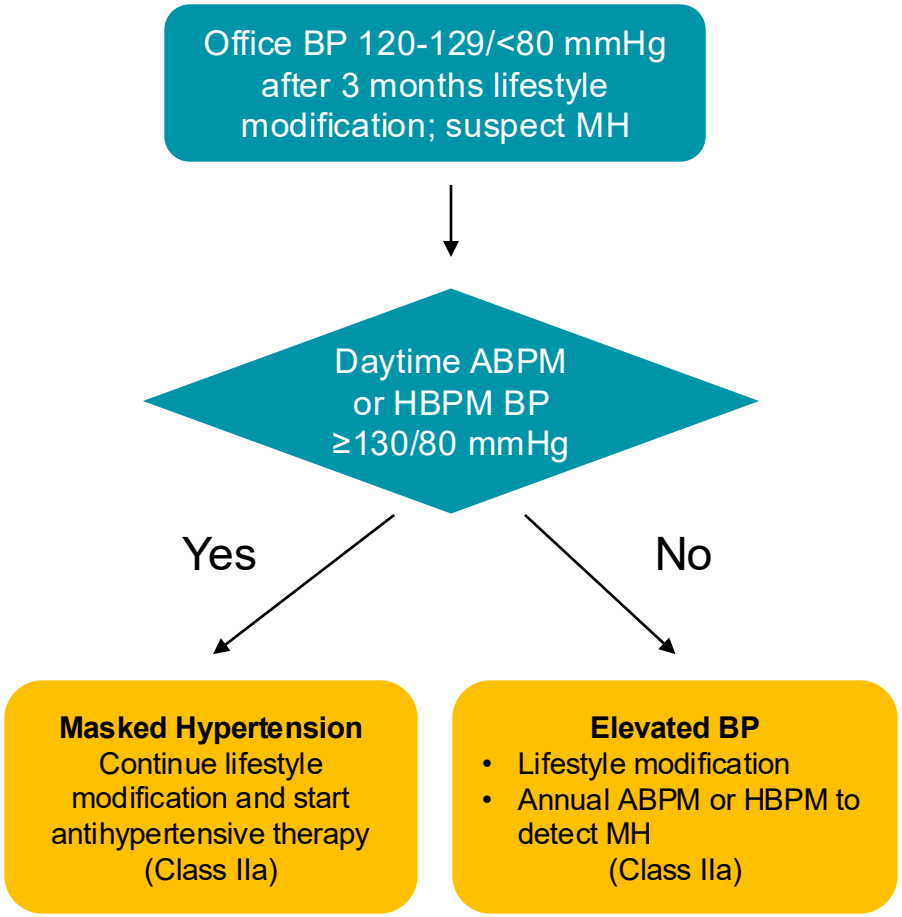
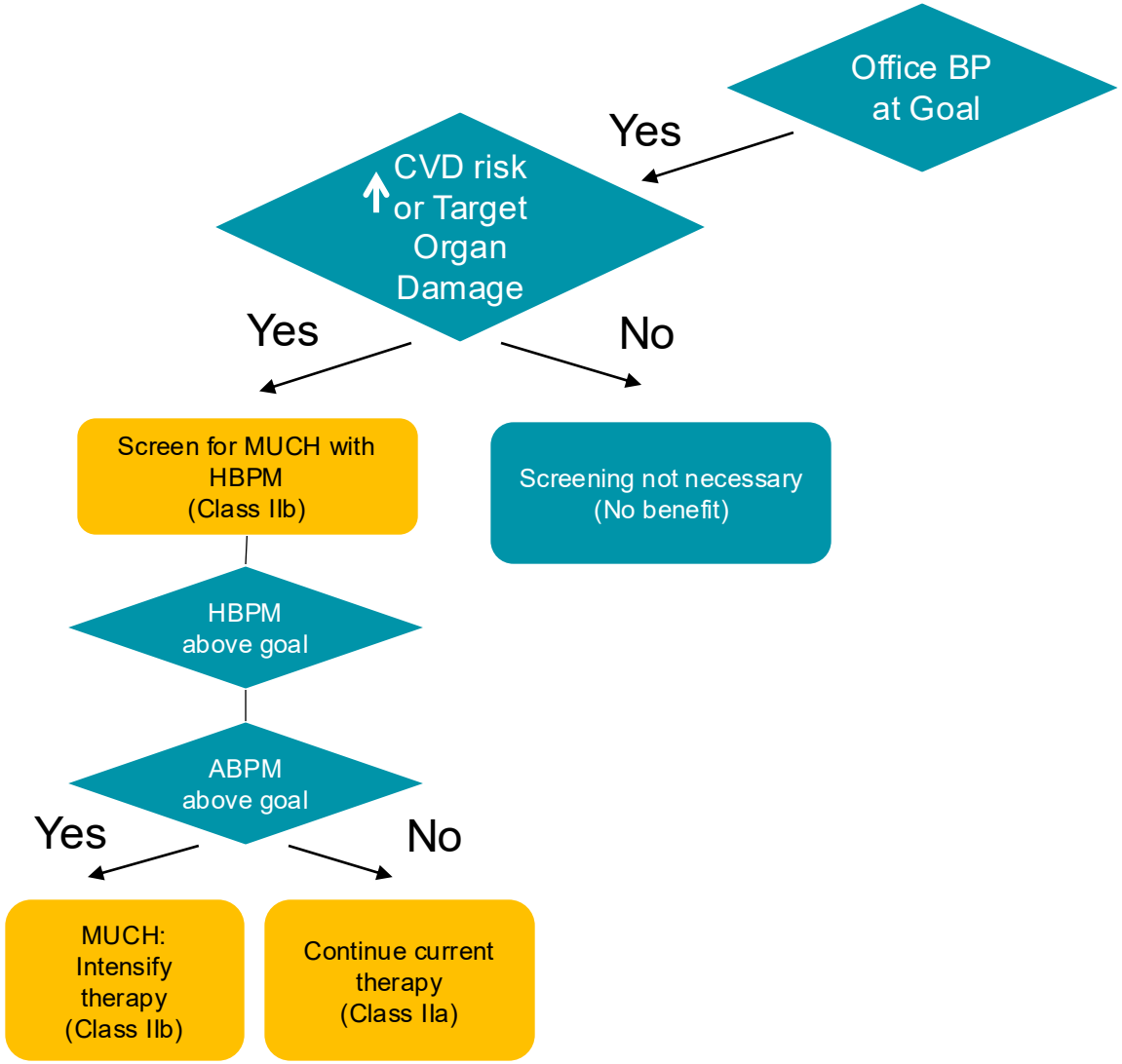


ABPM = ambulatory BP monitoring; HBPM = home BP monitoring

Detection of Masked Uncontrolled Hypertension in Patients *on* Drug Therapy



Summary/Conclusions

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- MH prevalence averages ~13% and up to 30% in some surveys
- Prevalence of MH increases with higher (normal) office readings
- Increased prevalence of MH also seen in older persons, males, Blacks, and those with obesity, diabetes, CKD, and sleep apnea
- Large longitudinal cohort studies show **CVD risk similar to that of sustained hypertension**
- Overlap between MH identified by HBPM and ABPM only 60-75% though both show same CVD risk compared to NTH and sustained HTN
- Likely due to capability for nocturnal BP measurements, ABPM more sensitive than HBPM for detecting MH
- RCT data evaluating benefit of treatment is not yet available
- Profiles of risk for treated patients showing MUCH parallel that of MH, respectively