AJUR

American Journal of
Undergraduate Research

Volume 18 | Issue 4 | March 2022

www.ajuronline.org

Print Edition ISSN 1536-4585
Online Edition ISSN 2375-8732

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Undergraduate Research

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American Journal of Undergraduate Research (AJUR) *is a national, independent, peer-reviewed, open-source, quarterly, multidisciplinary student research journal. Each manuscript of AJUR receives a DOI number. AJUR is archived by the US Library of Congress. AJUR was established in 2002, incorporated as a cheritable not-for-profit organization in 2018. AJUR is indexed internationally by EBSCO and Crossref with ISSNs of 1536-4585 (print) and 2375-8732 (web).*

The Effects of the NBA COVID Bubble on the NBA Playoffs: A Case Study for Home-Court Advantage

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https://doi.org/10.33697/ajur.2022.051

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ABSTRACT
The 2020 NBA playoffs were played inside of a bubble at Disney World because of the COVID-19 pandemic. This meant that there were no fans in attendance, games were played on neutral courts and no traveling for teams. In theory, these conditions should remove home-court advantage from the games. This setting generated discussion and concern, as analysts and fans debated the possible effects it may have on the outcome of games. Home-court advantage has historically played an influential role in NBA playoff series outcomes. The 2020 playoffs provided a unique opportunity to study the effects of the bubble and home-court advantage by comparing the 2020 season with the seasons in the past. While many factors contribute to the outcome of games, points scored is the deciding factor of who wins. Thus, scoring is the primary focus of this study. The specific measures of interest are team scoring totals and team shooting percentage on two-pointers, three-pointers, and free throws. Comparing these measures for home teams and away teams in 2020 vs. 2017-2019 shows that the 2020 playoffs favored away teams more than usual, particularly with two-point shooting and total scoring.

KEYWORDS
NBA; NBA Covid; NBA Bubble; HomeCourt Advantage

INTRODUCTION

Home-court advantage is often discussed in sports circles as a contributing factor to the outcome of games. It is well-known that the home team typically benefits from some competitive edge while playing at their home court, resulting in a better chance of winning. Thus, the NBA playing the 2020 playoffs in a bubble due to the COVID-19 pandemic brought a great deal of concern for fans, teams, journalists, and others. The bubble environment would not be able to replicate many of the factors that normal home-court advantage relies on. Among the biggest is the effect from the crowd. The home crowd has the ability to energize home teams, help control momentum in favor of the home team and create a chaotic and stressful environment for away teams to play in. There is no way to replicate these effects in the bubble conditions. Also, there are geographic factors that are lost, like altitude and time-zone effects. There's evidence across all sports that teams in high altitude regions can rely on away teams coming in and struggling with the lower oxygen levels at a higher altitude, which the home teams are accustomed to playing with Lopez et al.[1]. Examples of high altitude teams in the NBA would be the Utah Jazz and Denver Nuggets, both of whom participated in the 2020 NBA bubble. Also, referees are known to be subject to favoring home teams. This is due in large part to pressure from fans, which is no longer in play in the bubble. Refs may still have biases, but there's nothing to sway that bias towards the home team like normal. Any positive effects of the home team playing in the arena they're most comfortable in and living in the comfort of their own home are also lost. Travel is also normally discussed as a factor hurting away teams, but in the context of the playoffs being played in the bubble, losing this may not be significant. In the playoffs,

many times (aside from the first game of the series when the away team travels), both teams often travel at the same time, since they're both going back and forth between the two cities to complete the series.

Aschburner[2] discusses the anticipated effects, sharing concerns from former players, coaches and other experts about the potential effects of removing home-court advantage. Aschburner notes that the NBA did make attempts to recreate the effects by putting the "home" team logo on the court and allowing the "home" team to play crowd noise and music, but most people doubted these small attempts would recreate a true playoff atmosphere. During the 2020 NBA playoffs, home teams only won about 48.2% of the games. This is lower than normal, which Aschburner claims usually floats around 60%. This shift in the home team winning percentage surely indicates the opportunity for thorough investigation.

So, what happened? Did the home teams fail to perform up to normal standards without the help of home-court advantage? Were away teams able to rise to the occasion and perform better not having to deal with the headache of going on the road? We seek to answer the questions using scoring totals and shooting percentages as indicators of team performance. This will deepen understanding of how home-court advantage affects home and away teams in the NBA.

Our study is quite different from earlier NBA home-court advantage studies. By using the neutral site games of 2020, we will get to compare home and away performance to a control. Typically, studies just compare home vs away performance. These studies do not separate the effects of home-court advantage into the specific effect on the home team and the specific effect on the away team. They show that home teams outperform away teams, but not if this is a result of home teams overperforming or away teams underperforming because of home-court advantage. Some of these studies are reviewed in greater detail in Section 2.

We will compare home team performance in 2020 at a neutral site with no fans vs. 2017–19 playoffs with fans. Likewise, away team performance in 2020 at a neutral site with no fans vs. 2017–19 playoffs with fans. By comparing home teams in 2020 to home teams in 2017–19 and away teams in 2020 to away teams in 2017–19, we add a new perspective to the field of research. This will allow for a more accurate understanding of the effects of home-court advantage on home and away teams in the NBA. We will not only see that home-court advantage helps home teams outperform away teams, but also separate the effects of home-court advantage on home teams' and away teams' performance individually.

Nine hypotheses were tested to understand the differences in 2020 vs. earlier years. First, whether or not the difference between home win percentage in 2020 and 2017–19 is zero. This difference is found to be statistically significant from zero. Then we assess for differences in home scoring in 2020 vs 2017-2019. Similarly, we can do the same test, but for differences in away scoring in 2020 vs 2017-2019. Also, differences in team shooting (for two-pointers, three-pointers, and free throws) from 2020 vs 2017-2019 for both home and away teams. The results from these tests bring a new perspective to the understanding of how home-court advantage impacts games by altering the performance of the home and away teams.

There is voluminous literature on the effects of home-court advantage. Many NBA home-court advantage studies analyze the effects by studying shooting percentages. Kotecki[3] reported significant evidence of home-court advantage by comparing field goal percentage, free throw percentage and points scored in home vs. away teams. He found all of these measures showed evidence that home-court advantage helps home teams play better. Cao et al.[4] studied the effects of pressure on performance in the NBA. Using free throws as their measure of interest, they tested whether home fans could distract and put pressure on opposing players to make free throws. However, they did not find significant evidence that home status has a substantial impact on missing from the free throw line. Harris and Roebber[5] used two-point shots, three-point shots and free throws as measures of interest to study home-court advantage. Two-point shots were found to be the strongest predictor of home-court advantage. They suggested that home teams should try to shoot more two-point shots and force their opponent to take more two-point shot attempts. This help home teams

have a greater control of the game play and help maximize the benefits home-court advantage.

Some studies focus less on shooting and more on other metrics. For example, Greer[6] focused on the influence of spectator booing on home-court advantage in basketball. The three methods of performance used in this study were scoring, violations, and turnovers. This study was conducted using the men's basketball programs at two large universities. The study finds that social support, like booing, is an important contributor to home-court advantage. Greer explains, whether the influence is greater on visiting team performance or referee calls is less clear. However, the data does seem to lean slightly in favor of affecting visiting team performance. Another study focused on scoring was conducted by Jones[7], he analyzes scoring patterns across each of the 4 quarters to analyze the effects of home-court advantage over the course of a game. He found that typically 2/3 of the benefits of home-court advantage are received in the first quarter with the remaining 1/3 slowly accumulating over the final 3 quarters. This implies home-court advantage is most effective when teams use it to build a lead early and maintain it for the remainder of the game. If they are losing after the first quarter, there is a sharp drop in win probability.

There are also surveys on the factors contributing to home-court advantage. Courneya and Carron[8] gave four main game location factors for home and away teams, namely, the crowd factor, which is the impact of fans cheering; learning factors, which is an advantage from home teams from playing at a familiar venue; travel factors, the idea that away teams may face fatigue and jet lag from traveling; and, rule factors, which says that home teams may benefit from some advantages in rules and officiating. They acknowledge that these factors would all be removed if games were played at a neutral site, even if one team was designated as "home team". This study was reviewed a decade later by Carron et al.[9]. The 2005 review goes over the new findings from studies about the significance of these four game location factors. Since 1992, they have found that results on these four factors are mixed. However, there is some evidence supporting crowd and travel factors impact games across all major sports. There is less evidence suggesting learning and rule factors impact across the various collegiate and professional sports. The NBA is not a league which has rules that may favor the home team, like batting last in the MLB, but these rule factors also account for referee bias which may impact the NBA. One interesting finding cited by Carron et al.[9] is that the absence of crowds results in overall performance increases. Another study by Price et al.[10] is able to find some evidence of referee bias. They focus on two measures, DTOs and NTOs. DTOs, discretionary turnovers, are defined as turnovers always caused by the ref blowing the whistle while the ball is in play. NTOs, non-discretionary turnovers, are determined directly by players with no ref whistle, or the ball going out of bounds. The use these to test ref bias by checking how variables, like home vs. away team, affect DTOs relative to NTOs. They found evidence that a home bias does exist. In fact, home bias increases both during the playoffs and in games with higher attendance. This is crucial to the NBA bubble, which consists of playoff games with no attendance. Lastly, as discussed in the introduction, Lopez et al.[1] find evidence that geographic factors like altitude may influence and strengthen home-court advantage for teams in high altitude regions.

There are a few examples of natural experiments in basketball. Harville and Smith[11] studied the effect of home-court advantage using the 1991-1992 college basketball season. Unlike the NBA, it is not uncommon to have a few games played at neutral sites during the college basketball season. This allowed them to construct two samples, one of home teams and one of neutral teams. They formulated their study in a regression predicting the expected difference in score for home teams. They set up their study to find if the home teams won games by more points when they had home-court advantage vs. when playing on a neutral court. This study concluded with evidence supporting home-court advantage. Also, Boudreaux et al.[12] is able to construct a natural experiment using the Los Angeles Lakers and Los Angeles Clippers. Since these two teams share a home stadium, many factors like travel and familiarity are nullified. However, the designated home team has larger crowd support due to attendance from their season ticket holders. By comparing Lakers–Clippers matchups, they single out the effect of having a sympathetic crowd and Boudreaux et al.[12] estimate crowd effects increase the chance of winning 21–22.8 percentage points.

METHODS AND PROCEDURES

Data were collected from the official NBA website. The main variables of interest are whether or not the home team won, scoring totals for home and away teams, and shooting percentages for home and away teams on two-pointers, three-pointers, and free throws. These variables were very popular and frequently used in the related literature discussed earlier. While many other measures could be used for examining the outcome of the game and team performance, scoring seemed to be the most important because the winner of a game is determined by who scores more points. Furthermore, the three types of shots are a natural discussion point in basketball, as they're all important and directly impact scoring totals. Free throws can often determine the winner of close games, especially when losing teams are forced to foul the winning team to stop the clock and hope for some missed free throws. The three point shot has grown very prominent in basketball. The entire NBA has increased their volume of three-point shot attempts in response to the recent success of the Golden State Warriors and Stephen Curry. Due to this fact, there is a growing consensus that the three-point shot is crucial because of the efficient scoring and floor spacing it provides offenses. However, two-point shots are not to be overlooked and may actually be most important, especially for home teams, according to Harris and Roebber[5]. In fact, the 2020 NBA champion Los Angeles Lakers actually led the league in two-point shooting percentage throughout the playoffs and were bottom five in three-point shooting percentage.

The data was collected on a game by game basis. This gave us two observations for each variable per game played, one observation for each team(home and away). There were 83 games played in the 2020 playoffs, giving 83 observations for each variable in 2020 for both the home and away teams (166 observations total). Likewise, there were 243 games played over 2017-2019, giving 243 observations of each variable for both home and away teams over 2017-2020 (486 observations total). There can only be one winner and one loser, making the outcome a binary variable, with one indicating a win and zero indicating a loss.

Home-court advantage is the basic idea that the home team is more likely to win given they benefit from positive effects of a few factors we discussed earlier. So laying a foundation of typical home-court advantage is crucial. Before focusing on the 2017 to 2020 playoffs, we can take a quick look at home team win percentages since 2010. Notice in Figure 1, the 10 years before 2020, the home team winning percentage ranged from around 0.56 to 0.7 and never dipped below 0.5. The 2020 bubble broke this historic pattern, dipping down below 0.5. Foreshadowing the confirmation of the expectation that the effect of home-court advantage was removed in the 2020 playoffs.

Moving on to the main focus of the study, comparing 2020 to 2017-2019. Figure 2 shows the histograms of the home (green) and away scoring (red) for 2020 vs. 2017-2019. All histograms are fairly bell shaped, which is important for statistical tests designed for normally distributed data. There appears to be little difference between the 2020 and 2017-2019 for home scoring. For away scoring, a more pronounced shift to the right in 2020 is observed compared to 2017-2019.

Our second target of inference is shooting percentage for home and away teams. Figure 3 shows home shooting for two-pointers, three-pointers and free throws for 2020 (top) vs. 2017–19 (bottom). The histograms appear to be fairly similarly distributed between 2020 and 2017–19. Likewise, Figure 4, shows the same percentages except for away teams. It appears that the two-point shooting percentage for away teams has a small shift to the right in 2020 relative to 2017-2019.

The 2020 bubble provides a new and exciting opportunity to study home-court advantage for the NBA. Unlike college basketball, aside from a few exhibition/preseason games, the NBA always has a home and away team. So, for the first time in NBA history, the bubble allows NBA home and away performance to be compared against a control/neutral field. The NBA bubble removed many, if not all, factors impacting home-court advantage. The NBA bubble featured 8 seeding games for each team, then a standard playoff format. The focus of this study was on the play during the playoff games, since it followed the standard playoff format and could be compared back to other playoffs. For this study, the

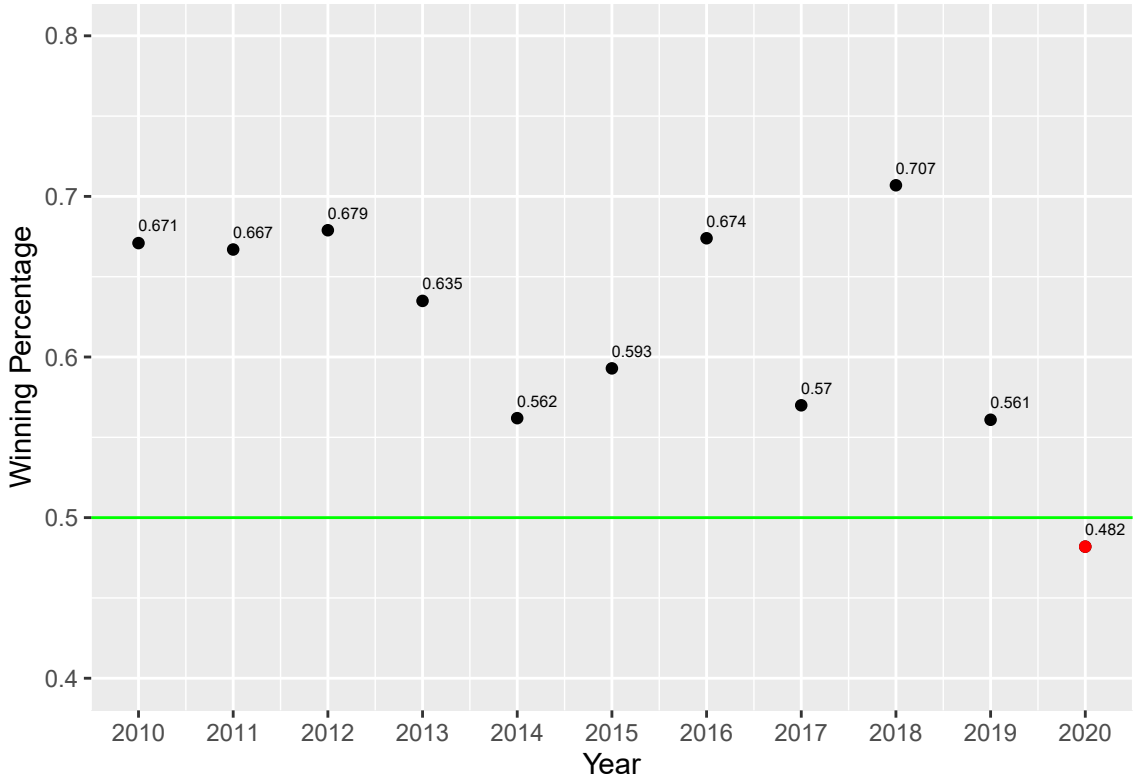

Figure 1. Winning percentage of NBA home teams in the playoffs since 2010, the green line denotes .500.

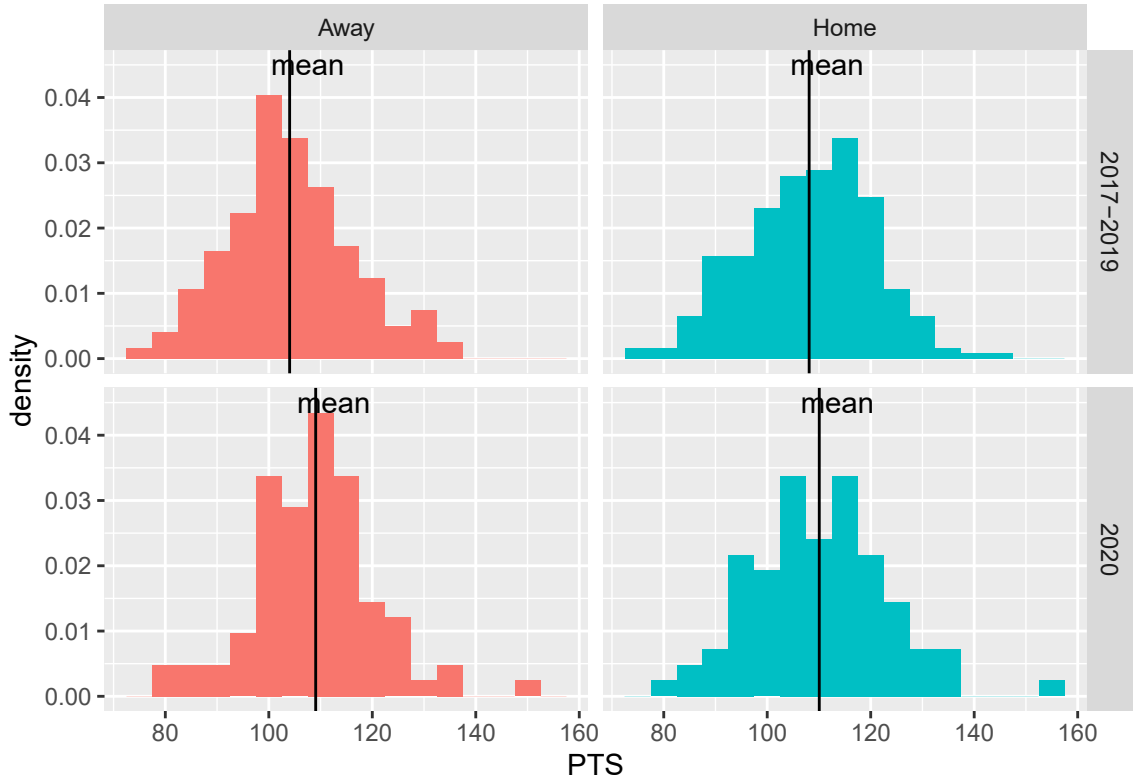

Figure 2. Histograms of home (blue) and away (red) scoring for 2020 (bottom) and 2017-2019 (top).

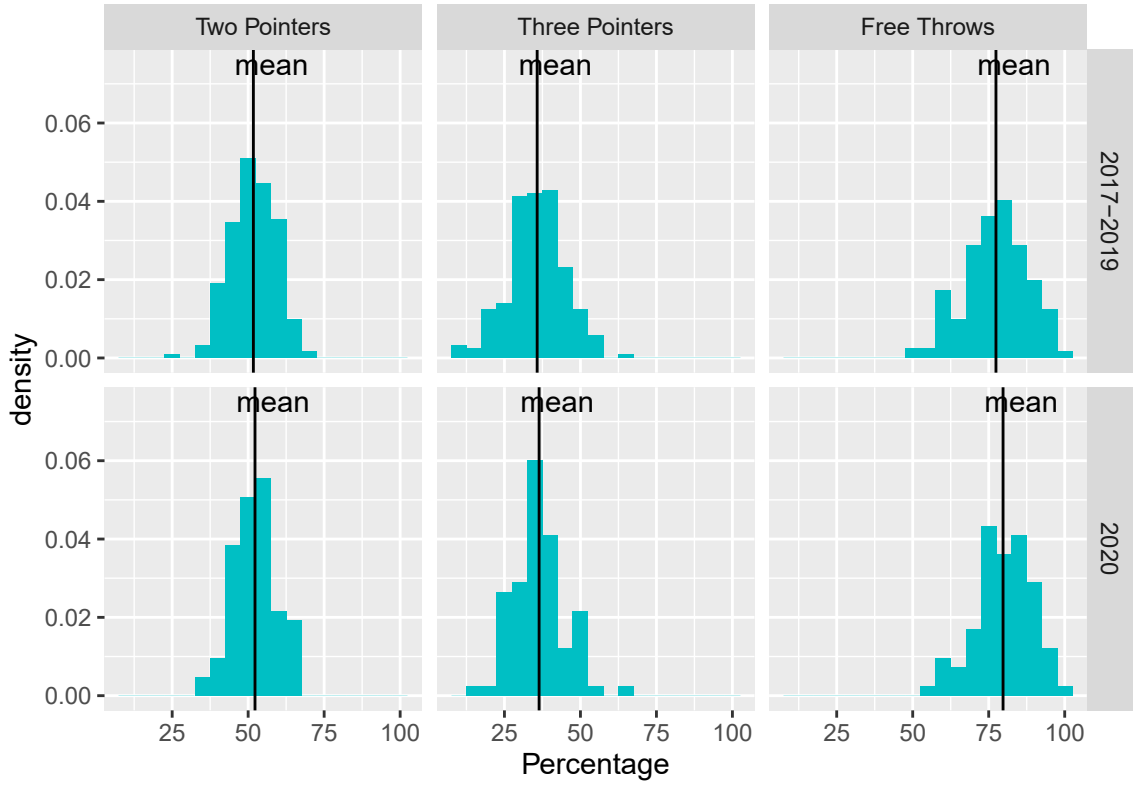

Figure 3. Histograms of home shooting percentages for two- pointers, three-pointers and free throws for 2020 (top) vs. 2017–19 (bottom).

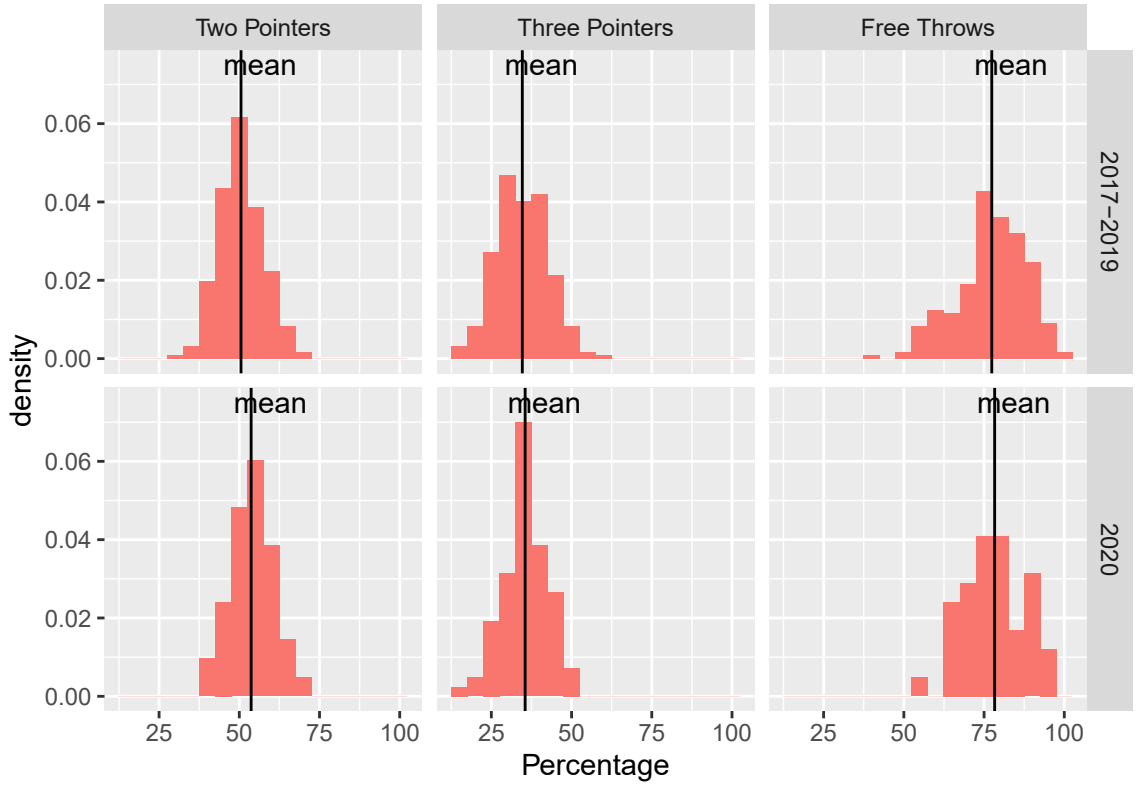

Figure 4. Histograms of away shooting percentages for two-pointers, three-pointers and free throws for 2020 (top) vs. 2017–19 (bottom).

2020 playoffs were compared against the three previous playoffs collectively. To control for the changing play style of the NBA, we limit the study to 2020 vs 2017-2019 due to the faster pace of play and more common use of the three-point shot in modern basketball. If we used data from say 10 years ago, or earlier, observed differences may not be from effects of the NBA bubble, but rather from the effects of drastic changes in the style of play between the seasons. However, basketball evolves slow enough that we can reasonably assume 2017-2019 are at least very close in pace and playing style to 2020.

Comparisons between 2020 and 2017–19 home and away teams were made on home team winning percentage, total team scoring and two-point, three-point and free throw shooting. Comparing the differences in these metrics for home and away teams in 2020 vs previous years will provide valuable insights to the understanding of home-court advantage. We can see how going on the road may negatively impact away performance and how playing at home may positively impact home performance. If there are differences in scoring for home or away teams, the differences can be used to show how home-court advantage affects the overall performance of home and away teams. While testing for differences in shooting will provide added context for how home-court advantage specifically affects performance. Shooting percentages are not the only possible metrics affected by home-court advantage, but they are the most obvious and likely most important one.

We formulate the following nine specific research questions to test the effects of the COVID bubble on the 2020 NBA playoffs:

1. Is the home team winning percentage in 2020 different than that it was in 2017-2019?
2. Is the average home team scoring different in 2020 than it was over 2017-2019?
3. Is the average away team scoring different in 2020 than it was over 2017-2019?
4. Are home teams making two-pointers at the same rate in 2020 as 2017-2019?
5. Are home teams making three-pointers at the same rate in 2020 as 2017-2019?
6. Are home teams making freethrows at the same rate in 2020 as 2017-2019?
7. Are away teams making two-pointers at the same rate in 2020 as 2017-2019?
8. Are away teams making three-pointers at the same rate in 2020 as 2017-2019?
9. Are away teams making free throws at the same rate in 2020 as 2017-2019?

All nine questions can be approached by a standard two-sample comparison with the z-test. The z-test statistic follows a standard normal distribution, which is a good approximation based on the central limit theorem given the sample size in this application.

We also conducted nonparametric tests that are distribution free to confirm the results from the z-test. For question 1, we used Fisher's exact test for a contingency table which summarizes the wins and losses of the home team in the 83 games in 2020 and the 243 games in 2017-2019. For all other eight questions, the data are the scores or shooting percentages from the 83 games in 2020 and the 243 games in 2017-2019. We used Wilcoxan's rank-sum test.

All three tests, namely the z-test, Fisher's exact test, and Wilcoxan's rank-sum test, were performed using R [13].

Regression was also considered, but it did not seem to add any additional useful insight to answering the questions presented. Regression is a popular tool in home-court advantage studies, but as mentioned previously, this study is very

Table 1. The results from the 9 tests(* denotes significant p-value at alpha=0.05)
Note: Home and Away scoring totals are divided by 100

	2020	2017–19	P-value		Adjusted P-value	
			Z-test	Wilcoxon	*Z*-test	Wilcoxon
Home Win	0.482	0.613	0.0497*	0.0400*	0.4473	0.3598
Home Scoring	1.101	1.081	0.2321	0.2985	1.0000	1.0000
Away Scoring	1.091	1.040	0.0008*	0.0004*	0.0075*	0.0035*
Home 2P	0.523	0.515	0.4335	0.5719	1.0000	1.0000
Home 3P	0.363	0.357	0.5733	0.8852	1.0000	1.0000
Home FT	0.793	0.774	0.0692	0.0496*	0.6228	0.4464
Away 2P	0.536	0.504	0.0003*	0.0003*	0.0030	0.0023
Away 3P	0.357	0.346	0.3256	0.3081	1.0000	1.0000
Away FT	0.783	0.777	0.6601	0.8370	1.0000	1.0000

different from past studies. Rather than trying to prove the existence of home-court advantage, like many previous studies, this paper was more interested in generating a clearer understanding of how home-court advantage affects each team. The most effective way to do that is hypothesis testing to compare performance in the neutral bubble to previous years with normal game conditions for both the home and away teams. Another potential benefit of regression would have been the ability to control for factors like the strength of opponent. However, we felt that the strength of team was already well enough controlled for by the fact that we focused on the playoffs. The playoffs only include the strongest 16 of 30 teams, then continue to remove the less competitive teams, so that the talent disparity between teams is much smaller than regular season play, where controlling for opponent strength is more likely to be important.

RESULTS

Starting from the top, Table 1 summarizes p-values of the nine hypotheses for both z-tests and Wilcoxon tests. The p-values are all fairly similar for both tests giving strong confidence in the conclusions drawn. Additionally, the adjusted p-values, calculated using a Bonferroni correction, and point estimates for each sample are provided.

First, we see a statistically significant change in home win percentage in 2020 from 2017–19, with a p-value of 0.0497 for the z-test and 0.0400 for Fisher's exact test. The 95% confidence interval (CI) of $(-0.255, -0.008)$ confirms our belief that home-court advantage was lost in the 2020 NBA playoffs. However, after accounting for multiple tests using the Bonferroni correction, the p-values for both tests are no longer significant. So, we may only cautiously say there is evidence that home-court advantage was not a factor in 2020.

Home team performance did not seem to be negatively impacted by losing home-court advantage like expected. Home scoring, two-point and three-point shooting all show no significant difference, on average, between 2020 vs. 2017–19 based on p-values from both tests. However, the Wilcoxon test and z-test have conflicting results for free throws. The z-test p-value of 0.0692 indicates no significant difference, while the Wilcoxon test p-value of 0.0469 indicates a difference at the 5% significance level. Since the p-value of the Wilcoxon test is so close to significance level and neither p-value is significant after a Bonferonni correction for multiple tests, this difference is likely not very meaningful. There appears to be no strong evidence suggesting home teams played at a lower level in 2020 than they did in previous years when they had home-court advantage.

Away teams saw more of an impact than home teams. For starters, there is a significant increase in mean points per

game, indicated by p-value of 0.0008 for z-test and 0.0004 for Wilcoxon. It is important to note both p-values also remain significant after a Bonferonni correction giving strong indication of significance. The average difference in points was estimated to be about 5 points, with 95% CI $(2.083, 7.988)$. Likewise, the away team two-point shooting efficiency increased significantly based on p-value of 0.0003 for both the z-test and Wilcoxon test. Again, both p-values remain significant after Bonferroni correction. The average difference was estimated to be about 0.03, with 95% CI $(0.015, 0.050)$. However, unlike two-point shooting, away teams did not see a statistically significant difference in three-point and free throw shooting. Overall, away teams have evidence of change in performance in the bubble. The away teams seemed to perform better than they would under normal conditions as a visiting team.

DISCUSSION

Generally, it seemed that away teams fared better in the 2020 NBA playoff bubble than previous years on the road. Starting from the dip in home winning percentage to below 0.482, it is clear that something was different. Although the difference was not significant after a Bonferroni correction, it is still informative to consider and understand that home teams seemed to struggle to win compared to normal conditions. Compared to Kotecki[3], who finds home teams consistently have a significantly better record than away teams, boasting about a 60.5% win percentage in his sample, the 48.2% home winning percentage of 2020 home teams is quite a shift. In this study, home teams did not appear to benefit from the usual advantages provided by being the home team.

Away team average scoring did increase by a statistically significant amount. This goes hand in hand with our intuition and conclusion about the home winning percentage decreasing. If away teams are scoring significantly more and home teams are not, then we expect to see away teams winning a larger number of games. This may give more reason to believe the conclusion that there was a significant decrease in home winning percentage in 2020, despite failing to be significant after the Bonferroni correction. Only away team scoring being significantly impacted by playing on a neutral court and not the home scoring indicates that home-court advantage stems mainly from adverse effects on the visiting team.

At least some of that improvement from away teams came from significantly higher two-point efficiency. This corresponds with the conclusion from Harris and Roebber[5], where they found home teams are best suited to capitalize on advantages from two-point shots. Normally, by shooting more two-pointers themselves and forcing away teams to shoot more two-pointers, the home team benefits most from effects of home-court advantage. However, with away teams significantly improving two-point shooting in the bubble, this strategy was no longer viable and home-court advantage disappeared.

To get a bit more detailed, we saw an estimated 3% increase in away two-point shooting percentage. Likewise, NBA teams shot an average of about 53 two-point shots per game, in our data, leading to a three-point increase in total scoring. Even this small swing in scoring for away teams can make a big difference in outcome of games. Around 1/3 of NBA games end by a decision of six points or less, these are the games where the three points matter most. Suppose there are 30 seconds left and the away team is losing. If the away team has the ball, only down three, they can take their time finding a good shot which can still either be a two or three given the score and remaining time. In the context of the NBA bubble, this crucial possession also has the benefit of the away team getting to work in silence without the jeers from enemy fans. However, in the same situation, while being down six, the offense must rush to get a quick shot off which probably has to be a three-pointer. The three point swing creates a much more desperate circumstance that is less likely to have a positive outcome. Even in the positive outcome case you're still going to be down three and likely have to foul the opposing team after you score. Alternatively, if the away team is playing defense with 30 seconds left, only down three, you can play regular defense without fouling, get a stop, then draw up a play to score a three-pointer with the remaining six seconds. In the same scenario, down six, you have no choice, but to foul. The free throws will likely put you down seven or eight points, but the alternative is letting the opponent run the 24 second shot clock down wasting time. Similarly, the away team may even be in a situation where they're leading by the three

additional points, which for the same logic as explained above puts them in far greater control of the game. Clearly, the three point swing can drastically change probability of winning for a team down the stretch of a game. Since, home teams picked up an additional two-points per game on average vs. five for away teams, the three additional points from two-point shooting appear to be the driving factor of away teams closing the gap with home teams.

There are a few possibilities that might create this increase in two-point shooting percentage. One could be the possible removal of officiating bias in favor of the home team during the bubble. As we saw in Price et al.[10], home bias is normally stronger in high attendance games. Thus, with no attendance at games, it's reasonable to say officiating bias was smaller than normal. Away teams in the bubble may have benefited from more fouls called on drives to the basket. On drives to the basket there can often be a lot of contact with no clear foul, these calls are then up to the ref's discretion. Typically, refs may be more reluctant to blow the whistle against the home team, in front of their crowd, on this type of play. The NBA only records an attempted shot when a foul is called on the shot if the shot is made. So, when away teams are fouled, but it is not called because it's often at the ref's discretion to make the call, they'll likely miss and be credited the miss. However, in the bubble, if fouls are called more fairly, the missed shots from uncalled fouls are removed and two-point shooting would increase. This wouldn't affect three-point shooting because those fouls are clearer and less up to the ref's discretion. Another possibility, without the crowd noise inhibiting their offense, away teams were able to more easily run their offensive sets that generate easy two-point looks at the rim. Also, away teams being generally more confident without opposing fans present, may have been more inclined to attack the basket and get an easy look close to the rim. It's hard to say for sure what causes the increase in away two-point shooting, but these are all possibilities. It may also be a combination of all of these.

Separating the effects of the home-court advantage into home effects and away effects allowed for some interesting new insights. Previously, we knew that on average home teams outperformed away teams. It was less clear whether it was from positive effects on the home team or negative effects on the road team or perhaps a bit of both. The biggest takeaway from this study is the main source of home-court-advantage is the negative effects playing on the road away teams face. In 2020 there wasn't any evidence of regression for home team performance, based on the performance measures used, despite being stripped of home-court advantage. Yet, home teams lost about 12% more of games in the 2020 playoffs than the typical average. This was because of the improvement of away teams. No longer having to face the struggle of traveling, pressure from opposing fans, or playing on an unfamiliar court, teams saw an improvement in their play and an increase in winning. The improvement of away teams confirms a proposition from Greer[6] that the positive social impact of crowds benefiting home teams may be a result of inhibiting away teams.

It's worth noting that much of this paper discusses the effects from an offensive point of view, focusing on a team's ability to score. However, one of the main factors that affects an offense's ability to score is the opposing defense. It's possible that home-court advantage mainly functions as an extra defender for home teams, which is how it negatively impacts away scoring. There is not much home fans can do to help their team on offense, except being quiet so players can easily communicate and focus. However, when on defense, fans can act as a ""sixth defender"" supporting their team by cheering loudly and making it harder on the offense. Also, as seen in the study Price et al.[10], fans can create turnovers by pressuring officials to make calls in their favor. This would explain how away teams were able to improve offensively in the bubble. Home teams did not have the regular help from the noise of fans that hinders the away team's offensive efforts. This would also explain why home team offense didn't show significant change in the bubble, the in-game offensive environment was largely unaltered for home teams since the bubble provided the same quiet environment they're used to at home while on offense. I still believe home-court advantage is better categorized as a negative effect on away team offense, since it's more likely noise from fans lowers level of play of away offense rather than raises the level of play of home defense. This will be further discussed below. An interesting finding is all shooting and scoring numbers for both home and away teams did make at least small increases. Although, these increases were not all significant these increases are exactly what is reported in Carron et al.[9] when they explain how evidence suggests that teams perform better with the absence of fans. This is important because it coincides with our conclusion

that home-court advantage mostly plays into games by negatively impacting away teams by acting as an extra defender. If fans cause overall performance to drop, then home-court advantage must come from a bigger drop in away performance than the drop in home performance. This is why away teams were able to close the gap with home teams with home-court advantage removed. Future studies may want to use the 2020 NBA bubble and compare vs previous years using other performance measures. For example, turnovers, steals, assist, rebounds, and many more game statistics. There are plenty of other possibilities besides just shooting efficiency to pick through looking for more possible sources of added points for away teams. This will further help explain what is lost in the performance of away teams when they travel to opposing arenas. This study is only the beginning of possibilities for studies using the 2020 NBA bubble as a case study for home-court advantage. Although, the study is limited by a one time sample, it seems unlikely that these conditions will ever be repeated. It may not be possible to have a follow-up study using the same measures with a different sample. Otherwise, that type of study could help strengthen the conclusion in this paper. Also, you could answer more questions with a larger sample size. For example, testing the strength of home-court advantage relative to specific teams, like the Denver Nuggets and Utah Jazz who we know from other literature may have a stronger home-court advantage. The sample size of home games for the individual teams in the bubble was far too small to try and address this question, the Jazz and Nuggets only had 3 and 9 home games, respectively.

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PRESS SUMMARY

The purpose of this study was to examine the 2020 NBA playoffs, which were played inside of a bubble in Disney World because of the COVID-19 pandemic. The hope was to generate new insights about the effects of home-court advantage because the bubble created an unprecedented neutral playing field for the NBA. For the first time the effects of home-court advantage on home and away teams could be easily separated and studied individually, typically studies can only compare them relative to each other. This study is focused on team scoring totals and team shooting percentage on two-pointers, three-pointers, and free throws. Comparing these measures for home teams and away teams in 2020 vs. 2017–2019 shows that the 2020 playoffs favored away teams more than usual, particularly with two-point shooting and total scoring. The implication of these findings is home-court advantage seems to be the result of negative effects on away team, not positive effects on home-team.

Internalizing Symptoms in Children Exposed to Adversity: Examining Associations with Resilience, Social Support, and Community Cohesion

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https://doi.org/10.33697/ajur.2022.052

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ABSTRACT
Exposure to adverse childhood experiences (ACEs) contributes to increased rates of psychopathology in youth. Specific environmental factors have been linked to improved functioning following adversity, but few studies have taken a social-ecological approach to examine how resilience, social support, and community cohesion may be associated with internalizing problems (*i.e.*, anxiety, depression) in young children. The current study included 49 children between the ages of 8 and 13 (M_{age} = 10.43, SD = 1.57; 55.1% male; 95.8% Black or African American) who were recruited from four community programs in the Midsouth, United States that serve families experiencing adversity. Regarding income, 77.3% of youth's caregivers reported an annual household income under $15,000. Almost all children reported experiencing at least one ACE (92.6%). Two linear regression models were run to assess how resilience, social support, and community cohesion were related to youth's depression and anxiety symptoms while controlling for ACEs and family income. The model examining depression was significant, (F (*5, 48*) = 4.16, $p < .01$, $R^2 = .33$) with fewer reported ACEs ($\beta = 1.55$, $p < .02$) and higher resilience ($\beta = -.73$, $p = .01$) associated with lower depressive symptoms. The model assessing anxiety was not significant. Results indicate that personal resilience may be a key target for intervention in children exposed to ACEs as efforts to strengthen individual resources (*e.g.*, self-efficacy, emotion regulation skills) could be linked to reduced psychopathology.

KEYWORDS
Adverse Childhood Experiences; Social Ecology; Resilience; Social Support; Community Cohesion; Internalizing Symptoms; Anxiety; Depression

INTRODUCTION

Adverse childhood experiences (ACEs) are regrettably common and impact a large percentage of children in the United States annually.[1] The Center for Disease Control (CDC) reports that more than 60% of adults endorse at least one ACE in their childhood, with 16% experiencing four or more ACEs.[1] Childhood adversities can encompass a myriad of events including child abuse or neglect, exposure to intimate partner violence (IPV), substance use in the home, familial mental illness, parental incarceration, and community violence.[2] Felitti and colleagues were among the first to examine the relation between ACEs and adult functioning, with their work indicating that ACEs are associated with an increased risk of health problems in adulthood.[3] More recent research has shown that ACEs are related to higher levels of posttraumatic stress disorder (PTSD),[4] depression,[4,5] and anxiety in adults.[6] The available literature has primarily studied the effects of ACEs on adult outcomes, with less work examining the impact of ACEs on childhood functioning.[7] Further, ACEs research in child samples has traditionally focused on mental health associated with exposure to specific types of adversity rather than the effects of cumulative adverse exposure.[8] Moreover, most empirical work on ACEs and childhood mental health has examined factors that increase risk for psychopathology rather than exploring social ecological strengths that could be linked with improved child outcomes.[7] Thus, the present study aimed to assess how factors across the social ecology were associated with the internalizing domains of depression and anxiety following childhood exposure to adversity.

ACEs & Children's Internalizing Symptoms

Previous research has focused on the impact of ACEs on children's mental health, connecting ACEs to children's emotion regulation abilities and subsequent internalizing symptoms (*e.g.*, anxiety and depression). Emotion regulation refers to the psychological processes that influence which emotions are felt, when they are felt, and how frequently they are experienced.[10] Negative environmental factors (*e.g.*, living below the poverty line, IPV exposure in the home) can hinder the typical development of emotion regulation skills in children,[10,11] which is associated with heightened emotional internalization.[12] Thus, children exposed

to ACEs are at a higher risk for the development of internalizing symptoms.[13] Internalizing symptoms are often separated into two categories: anxiety and depression. Research shows that experiencing more ACEs is associated with increased reports of both anxiety and depression.[14,15] In children, anxiety symptoms are evidenced by excessive worry about one's school performance, personal and familial safety, or events in the future; children may also have difficulty (*e.g.*, excessive worry or nervousness) when separated from their caregivers.[16] Research shows that exposure to four or more ACEs is associated with heightened levels of anxiety.[14, 17] Depressive symptoms in children can be more challenging to identify. Young children experiencing depression often lose interest in activities that they previously enjoyed, display high levels of irritability, or increases in temper tantrums, and they may socially withdraw from others.[18,19] In addition to these symptoms, youth with depression may exhibit fatigue, feelings of worthlessness, and difficulties concentrating.[20] Recent research suggests a strong, positive correlation between levels of ACEs and the severity of depressive symptoms in middle childhood.[15] Despite differences in symptomology between anxiety and depression, studies indicate that exposure to violence in one's home or community, family dysfunction, and child maltreatment were linked to increased levels of depression and anxiety in children between the ages of six and eleven.[6] Although a robust literature has indicated that ACEs are associated with depression and anxiety across development and into adulthood, few studies have focused on how the presence of social-ecological strengths in a child's environment may be associated with fewer internalizing symptoms.

Social-Ecological Theory

Bronfenbrenner's social-ecological model provides a useful framework for conceptualizing how various environmental factors may be related to internalizing symptoms in children exposed to ACEs.[21] The social ecology is comprised of five expanding systems that surround the child: the microsystem, the mesosystem, the exosystem, the macrosystem, and the chronosystem.[21] Changes in relationships or resources within each system may affect a child's development. The microsystem, mesosystem, and exosystem are most proximal to a child's immediate environment, and therefore these systems have the strongest associations with children's internalizing symptoms.[22] The microsystem directly surrounds the child and consists of parents or caregivers, siblings, or any childcare providers or teachers.[21,23] The mesosystem represents the settings that a child is directly involved in, such as one's school, neighborhood, and religious communities.[21,23] Finally, the exosystem is categorized by events that happen in the child's life, but don't directly happen to the child, such as a parent losing their job, a new park placed in the neighborhood, or new changes in local government policies (*e.g.*, access to community services, affordable housing, or food assistance).[21,23]

Adverse experiences occurring within various levels of the social ecology have previously been associated with an increased risk for children's internalizing symptoms. Specifically, stressful experiences in the home, or in the microsystem (*e.g.*, witnessing IPV, child abuse and neglect, divorce) have been linked with heightened levels of anxiety and depression in adolescents.[17,23] Adversities experienced in the mesosystem, such as bullying, peer victimization, or violence also have a significant impact on internalizing symptoms in youth.[25,26] Within the exosystem, children exposed to community level adversity, such as reduced access to safe spaces, community violence, and/or neighborhood disorder report higher levels of depression and PTSD compared to children who experience less communal adversity.[27,28] Most research has focused on risk factors associated with child psychopathology rather than examining strengths across the social ecology.

Social-Ecological Strengths

Social-ecological strengths can be conceptualized as factors within an individual, a family, or a community that may be related to improved functioning.[28] The CDC highlights the utility of implementing a social-ecological framework that explores manifest strengths as these factors may be integral in preventing violence against children and youth.[29] Within this model, there are three primary systems outlined (individual, relational and communal) that map onto Bronfenbrenner's micro-, meso- and exosystems. Individual-level factors include variables that bolster self-efficacy (*e.g.*, emotion regulation, positive reinforcement, resilience) which have been linked with improved functioning following exposure to adversity.[29] Social support is a key factor of the relational system, which includes the presence of stable, supportive individuals who promote safety and sustained support.[29] Strengths within the communal system include variables such as strong neighborhood connections and consistent access to community resources and specialized care.[29] The current study aimed to examine relations between internalizing symptoms and socioecological strengths including resilience (individual system), social support (relational system), and community cohesion (community system).

Resilience

Resilience has become an increasingly studied construct in child development research and is defined as "the amount of adaptability that occurs in the face of stress, trauma, tragedy, or threats."[30] Definitions of resilience vary, with some researchers defining it as one's personal ability to overcome adversity and others defining it as normative levels of functioning despite exposure to adversity.[31,32] One prominent definition considers resilience to be one's access to resources that allow individuals to flourish despite exposure to adversity;[33] this is the conceptualization of resilience used in the current study. Across the empirical literature, resilience, regardless of definition or measurement, is associated with improved outcomes for individuals who have experienced adversity. Studies examining resilience in adults exposed to ACEs demonstrate that individuals who report higher

resilience have fewer mental health diagnoses (*e.g.*, depression and PTSD).[34,35] In relation to children, research indicates that resilience is associated with lower levels of anxiety and depression in clinical samples.[36,37] Further, self-reported resilience in the aftermath of ACEs has been linked with a delayed onset of anxiety and depressive disorders in youth.[38,39] Taken together, studies demonstrate that higher levels of resilience may be linked with fewer internalizing symptoms in children exposed to ACEs. However, few studies have examined resilience in younger and more diverse, community-based samples of children. Moreover, most research has relied on parental reports of children's resilience rather than using children's self-reported data, which the present study sought to address.

Social Support

Social support, including support from family and friends, is one relational factor associated with improved mental health.[39] Strong family relationships are characterized by secure caregiver-child attachments and the presence of at least one caring, supportive adult in the child's life.[40] Friend support refers to positive, emotional connections to peers in one's school or neighborhood.[41] One study found that youth with strong parental social support reported more frequent engagement in adaptive coping strategies (*e.g.*, expressing one's feelings, tackling a problem head on).[42] Children with parents who were emotionally available and implemented positive, trauma informed parenting strategies in the home were better able to manage stress and reported higher engagement in adaptive coping skills following adversity.[43,44] In addition to parent support, research has demonstrated that strong support from friends is linked to an increased sense of self-acceptance and a decrease in depression and anxiety symptoms in youth.[41,45] Yet, little research has examined the direct relation between social support and internalizing symptoms for children exposed to multiple ACEs. Thus, the current study contributed to the limited literature by examining how multiple social-ecological factors, including social support, differentially related to anxiety and depressive symptoms while accounting for ACEs.

Community Cohesion

Community cohesion is a valuable community-level construct that may be associated with children's well-being. Community cohesion refers to the integration of a family into their community and the mutual levels of support shared between neighbors.[46] One study examined the relation between neighborhood support and internalizing symptoms in children exposed to parent-child violence. Results showed that children residing in close-knit neighborhoods reported lower internalizing symptoms than those from more disconnected neighborhoods.[47] Other studies indicate that higher levels of community cohesion have been associated with lower rates of anxiety and depression in youth following exposure to community violence.[45,48] Although there is some evidence to suggest that community cohesion is associated with children's internalizing symptoms, to the authors knowledge, the present study was the first to examine the association between community cohesion and internalizing symptoms in a sample of youth exposed to multiple ACEs.

THE CURRENT STUDY

Previous literature provides strong evidence for the relation between ACEs and adulthood psychopathology, as well as the importance of identifying social-ecological strengths associated with children's mental health. Further, past research demonstrates that exposure to more ACEs is linked with heightened internalizing symptoms (*i.e.*, anxiety, depression) in children. However, there is a dearth of literature regarding the relation between social-ecological strengths and internalizing symptoms in children exposed to ACEs. The current study aimed to address this research gap by simultaneously examining several strengths within different levels of the social ecology and assessing how they related to children's anxiety and depressive symptoms. Guided by Bronfenbrenner's social-ecological theory,[28] the current study examined three factors: resilience (the individual level), social support (the relational level), and community cohesion (the community level) and their relation to children's internalizing symptoms while accounting for ACEs. Additionally, the present study controlled for annual family income, as living below the poverty line is reportedly linked with higher internalizing symptoms in children and reduced levels of social support.[49,50] While accounting for income, it was hypothesized that 1) exposure to more ACEs would be associated with heightened anxiety and depressive symptoms and 2) higher levels of resilience, social support, and community cohesion would be associated with lower levels of children's self-reported anxiety and depressive symptoms.

METHODS AND PROCEDURES

Participants

Participants included 49 children between the ages of 8 and 13 years old (M_{age} = 10.43, *SD* = 1.57; 55.1% male) with 92.6% of participants reporting at least one ACE. The sample was predominantly Black or African American (95.8%) with 2.1% identifying as White or European American and 2.1% identifying as American Indian or Alaskan Native. Most of the sample reported having a lower income, with 77.3% of youth's caregivers reporting an annual household income under $15,000.

Procedure

Following institutional review board (IRB; PRO-FY2018-688) approval, participants were recruited from four community programs in the Midsouth, United States. Caregivers and children separately completed a 60-90 minute interview with trained study staff. Prior to beginning the interview, parents completed an informed consent and parent permission form while youth completed a child assent form. Participants were informed that their data would be kept confidential and that their responses would not be linked to their identifying information. This was a grant funded project, with funds available for participant compensation. The caregiver and child each received a $30 gift card for their participation. A list of local and national mental health, counseling, and support resources was provided to all families at the end of the survey. The contact information for the principal investigator was also given to participants.

MEASURES

Demographics

Child participants were asked basic demographic information including their relationship to the caregiver participating in the study, their age, gender, and current grade in school. Caregivers reported on the family's annual income with response options ranging from less than $5,000 to more than $50,000.

Coddington life events scales (CLES)

The CLES is a 35-item measure that was completed by child participants. It is designed to identify how specific life events affect a child's wellbeing including stressful, traumatic, or celebratory events.[51] The current study utilized responses to the 17 CLES items that represent adverse life events (*e.g.*, the death of a family member, being hospitalized for illness or injury, a parent going to prison). Questions were answered dichotomously (1 = Yes, this has happened to me; 0 = No, that has not happened to me). Items were summed to create a total childhood adversity score, which had a possible range of 0-17. Higher scores indicated more adverse experiences during childhood. The CLES is a reliable and valid measure for examining children's life events.[51] Internal reliability was not calculated in the current study because children could experience one of the adversities listed in the CLES without necessarily experiencing another.

Behavior assessment system for children- third edition (BASC-3)

The BASC-3 is a standardized measure used to assess children's thoughts, feelings, attitudes, and internal reactions.[52] In this study, two validated versions of the BASC-3 were administered: one for children ages 8 to 11 years old (child version) and one for youth 12 years and older (adolescent version). The child version contained 137 items and the first 42 items were "True" or "False" questions. The remaining items were answered on a four-point Likert scale from 1 (Never) to 4 (Always). The adolescent version contained 189 items with the first 59 items answered as "True" or "False," and the Likert scale for the remaining items was from 1 (Never) to 4 (Always). Both versions contained items related to anxiety (*e.g.*, "I worry about making mistakes"), and depression (*e.g.*, "Your mood changes easily"). Overall composite scale scores for the BASC-3 demonstrate strong psychometric reliability, with alpha coefficients for anxiety at .85 for 8 to 11-year-olds and .87 for 12 to 14 years-old and for depression .83 and .86 respectively.[52] Q-global, an online scoring software program, was used to generate a norm-referenced, standardized t-score for both anxiety and depression across all respondents with higher scores reflecting greater symptomology.

Child and youth resilience measure-revised (CYRM-R)

The Child and Youth Resilience Measure-Revised is a 17-item self-report questionnaire used to identify resources that may foster resilience.[53, 54] The CYRM-R is comprised of two primary subscales: personal resilience and caregiver resilience. Personal resilience refers to children's perceptions of their own intrapersonal skills and behaviors that foster a sense of belonging and self-efficacy. Caregiver resilience encompasses the caring supervision and perceived support that characterize the child-caregiver relationship. Only the personal resilience subscale was used in this study, and it included seven items (*e.g.*, "I cooperate with people around me"; "I know how to behave in different social situations"). The CYRM-R utilizes a 5-point Likert scale from 1 (Not at all) to 5 (A lot) with total personal resilience scores ranging from 7 to 35. Higher scores on this subscale indicate higher levels of resilience. The personal resilience subscale has demonstrated strong internal reliability in previous studies (α = .82).[53] Internal reliability for the current sample was .79.

Social support scale

The Social Support Scale is a 10-item self-report inventory adapted from the Multidimensional Scale of Perceived Social Support,[56] which measures perceived social support from friends and family.[55] Items included "My friends really try to help me" and "My family lets me know that they care about me". The Social Support Scale uses a 4-point Likert scale from 1 (Not true about me) to 4 (Mostly true about me). All 10 items were summed to obtain a total score, which ranged from 19 to 40 in the current sample, with higher scores representing higher levels of perceived social support. The Social Support Scale has demonstrated good internal reliability in past studies (α = .88 to .90).[56,55] The alpha coefficient for this sample was .77.

Community cohesion scale (CCS)

The Community Cohesion Scale is a six-item self-report questionnaire adapted from the Social Cohesion and Trust Scale.[57] The CCS measures community characteristics, such as shared values and levels of trust and reliance among neighbors. Sample items include: "In your community, people are willing to help their neighbors" and "You live in a close-knit neighborhood." Participants were asked how much they agreed or disagreed with these statements on a 4-point Likert scale ranging from 1 (Strongly disagree) to 4 (Strongly agree). After reverse coding, items were summed to create a total community cohesion score. Higher scores indicated that participants felt a greater sense of connectedness and trust in their community. The CCS has demonstrated strong internal reliability with alpha values ranging from .80 to .91 in previous samples.[57] However, in the current study the alpha value was rather low ($\alpha = .56$). To improve the measure's reliability, one item was removed from the scale ("People in your neighborhood do not share the same values."). The alpha value improved to an acceptable level of .61 and the adjusted total score ranged from 8 to 20 in this sample.

DATA ANALYTIC PLAN

Linear regression modeling was conducted in SPSS version 27 to assess relations between the independent variables (*i.e.*, resilience, social support, community cohesion, reported ACEs, annual income) and the outcomes of children's anxiety and depressive symptoms. Separate regression analyses were conducted for each outcome. Prior to running the regressions, data were screened for missingness, skewness, kurtosis, and multicollinearity. A missing data analysis revealed that 2.7% of the data were missing. This was addressed using mean substitution, which is acceptable for studies with small amounts of missingness.[58] Skewness and kurtosis values were in the normal range and there was no evidence of multicollinearity (VIF < 2).

RESULTS

Children reported an average of three adverse events in their lifetime ($M = 3.35$, $SD = 1.90$), with the death of a family member (83.3%) being the most frequently endorsed ACE. Additionally, 52.1% had been hospitalized for an illness or injury, 43.8% experienced parental divorce or separation, 37.5% had a parent who was incarcerated, 31.3% had been in a bad accident or fall, 18.8% had seen someone beaten up or shot at, 12.5% had been personally beaten up or shot at, 10.4% reported parental drug use in the home, 9.8% endorsed childhood abuse, 6.3% reported witnessing IPV in the home, and 4.1% endorsed another adverse or traumatic experience (*e.g.*, seeing a parent's gunshot wound, being in a vehicle when the brakes failed). Income was not correlated with any of the study variables. See **Table 1** for means, standard deviations, and correlations among study variables.

		1	2	3	4	5	6	7
1.	**Household Income**	-						
2.	**ACEs**	.02	-					
3.	**Resilience**	-.17	-.08	-				
4.	**Social Support**	-.05	.02	.59**	-			
5.	**Community Cohesion**	-.05	.03	.34*	.44**	-		
6.	**Depressive Symptoms**	.05	.35*	-.47**	-.26	-.09	-	
7.	**Anxiety Symptoms**	.01	.26*	-.04	.04	.15	.61**	-
	M	3.10	3.35	43.67	34.67	15.10	51.85	54.20
	SD	1.95	1.90	5.97	5.29	3.20	9.53	10.53

Table 1. Means, Standard Deviations, and Correlations Among Study Variables. $N = 49$; *$p < .05$, **$p < .01$.

Findings from both regression models are reported in **Table 2**. The linear regression model that examined factors associated with depressive symptoms was significant ($F\ (5, 48) = 4.16$, $p < .01$, $R^2 = .33$). In this model, experiencing fewer ACEs ($\beta = 1.55$, $p = .02$) and exhibiting higher personal resilience ($\beta = -.73$, $p = .01$) were associated with fewer depressive symptoms. Household income, social support, and community cohesion were not significantly related to youth's self-reported depression levels. The model for anxiety was not significant.

Regarding depressive symptoms, results partially supported the first hypothesis as children who experienced a higher number of ACEs reported more depressive symptoms. Regarding hypothesis two, personal resilience was the only social-ecological strength associated with lower levels of depressive symptoms. No social-ecological factors were significantly associated with anxiety

symptoms. These findings partially support the second hypothesis, indicating that higher levels of personal resilience may be linked with fewer internalizing symptoms, specifically in the context of depression.

	Depression			
	β	*t*	R^2	*F*
Model Summary			.33	4.16**
Household Income	-.14	-.23		
ACEs	1.55	2.45*		
Resilience	-.73	-2.89**		
Social Support	-.06	-.21		
Community Cohesion	.22	.52		
	Anxiety			
	β	*t*	R^2	*F*
Model Summary			.10	.90
Household Income	.03	.03		
ACEs	1.40	1.72		
Resilience	-.13	-.40		
Social Support	-.002	-.004		
Community Cohesion	.56	1.04		

Table 2. Linear Regression Models Examining Factors Associated with Depression and Anxiety. *Note.* $N = 49$; $*p < .05$, $**p < .01$.

DISCUSSION

Seminal research has explored the impact of ACEs on child development and mental health in adulthood; however, few studies have investigated the relations between social-ecological strengths and youth's internalizing symptoms following exposure to adversity. Specifically, the present study investigated how the social-ecological strengths of resilience, social support, and community cohesion were associated with depression and anxiety symptoms in a sample of youth who had experienced ACEs. It was hypothesized that higher exposure to ACEs would be associated with heightened anxiety and depressive symptoms, and that higher levels of resilience, social support, and community cohesion would be associated with lower levels of children's self-reported anxiety and depressive symptoms, all while accounting for family income.

In line with the first hypothesis, children who experienced more ACEs reported higher levels of depressive symptoms. Notably, youth in this study endorsed high exposure to ACEs (*i.e.*, more than three adversities on average). Given the young age of the study population, this places youth at an increased likelihood for experiencing more than four ACEs before the age of 18, which has been linked to poorer mental health functioning. Specifically, the current sample is at a heightened risk for negative health outcomes as past literature suggests that adults who experience four or more ACES may be particularly vulnerable.[1] Accordingly, given the high rates of ACEs in this sample, higher rates of self-reported depression symptoms are not surprising. This finding aligns with previous studies indicating exposure to stress and adversity are linked to psychopathology in childhood.[7,59,60] Results from the current study trend with Bronfenbrenner's social-ecological theory,[21] which states that adverse experiences or events in a child's most proximal relationships negatively affect their mental health. In this study, the most frequently endorsed ACEs occurred in the microsystem (*e.g.*, parental divorce, IPV or violence exposure in the home, a parent being hospitalized) constituting significant interpersonal events. Past research indicates that children who experience interpersonal adversity report elevated symptoms of both anxiety and depression.[14,24,26]

Unexpectedly, anxiety was not associated with ACEs in this study. On average, children's reports of depression and anxiety were in the normal range for youth in this age group (See Table 1). Perhaps depression represents a mood disorder that may be uniquely impacted by trauma exposure. It may be that young children who have experienced multiple ACEs are more likely to shut down in response to adversity rather than engage in continuous worry or rumination about the stressor. Additionally, it could be that types of anxiety (*e.g.*, hypervigilance, persistent worrying, fear of social interactions) are differentially affected by ACEs, which was not captured when using a cumulative anxiety symptom score. Further, differences in anxiety symptoms were not examined in relation to specific types of ACEs, which could represent a key next step for future work. Nonetheless, the present

study underscores previous literature indicating that heightened exposure to adversity has negative mental health outcomes for youth, particularly depression, and highlights the value of early intervention with children exposed to ACEs.[17,24]

Regarding social-ecological factors, hypothesis two was partially supported. Specifically, youth who endorsed higher personal resilience reported fewer depressive symptoms, suggesting that children's positive self-concept and increased access to resources (*e.g.*, equitable education, behavioral control, opportunities to learn new skills) are central to understanding psychopathology. This finding lends support to a small body of literature indicating that youth's resilience may be linked with lower reports of depression over time.[38, 39] One study found that children who have more "positive childhood experiences" (*e.g.*, stronger parental bonds, stable home environment) report higher levels of resilience and lower depressive symptoms in comparison to their peers with equal adversity exposure.[38] These results indicate resilience may represent a novel social-ecological strength that could be targeted for intervention and may be uniquely related to the etiology of depression in children ages 8-13. It may be that this developmental stage lends itself to more accurately reporting egocentric information rather than external information about one's friends or community, suggesting that personal resilience could be critical for youth in this age bracket. Resilience, as measured in this study, captures variables that are central to mental health (*e.g.*, recognizing personal strengths, cooperating with others, finishing what one starts) and reflects constructs such as tenacity and determination. These personal facets of resilience may be essential in helping children thrive amidst adversity and maintain adaptive functioning.

Neither social support nor community cohesion were associated with either of the internalizing outcomes in the current sample. It may be that children's ability to accurately report on their social support or community cohesion was limited due to child age, developmental stage, or the instruments used to capture these constructs. Regarding social support specifically, research indicates that children often report more inflated perceptions of their relationships with others, particularly peers, that may not adequately reflect the quality or quantity of their available support.[62] Notably, while the total scores yielded from the social support measure showed appropriate variability, there was a slight negative skew suggesting that youth endorsed somewhat higher levels of perceived social support than would be expected. Further, it may be that conducting interviews in a face-to-face format amplified social desirability bias. While an interview format is valuable as it often increases response rates, improves item comprehension, and reduces the amount of missing data, perhaps children responded to questions in a way that made them seem more socially liked or desirable, rather than providing answers that were the "truest" for themselves.[63] Future studies should attempt to reduce social desirability bias when collecting data regarding perceived social support by keeping questions neutral when asking about supportive relationships (*i.e.*, "I have people I can count on")[64] and use a mixture of both closed- and open-ended questions to assess the quality of support.[65]

To the authors knowledge, this was the first study to examine community cohesion in youth exposed to adversity. Although community cohesion was not associated with internalizing problems, the null findings warrant discussion to guide future research. First, items assessed on the community cohesion measure may have been too broad for children in this age range. For example, children may not know how to answer a question asking, "I live in a close-knit neighborhood." Children may have only lived in one neighborhood for their whole life and might not be able to identify what constitutes a "close-knit" community. Second, it may be hard for children to identify community and cultural values in their neighborhood, and they may overestimate their community connectedness. Indeed, while the range of total scores was appropriate, participants endorsed relatively high levels of community cohesion, leading to a slight negative skew for this scale. Moreover, if community values are challenging to identify, it may be even more difficult to accurately report if other neighbors can be trusted or if they share similar values. Some research suggests that the type of abstract thought needed to comprehend concepts like a "close-knit" or "trustworthy" group is not developed until middle childhood (12 years or older).[66] It could be that assessing both internal and external resources available in one's community, such as perceptions of safety and the number of people they know in their neighborhood, are better proxies of community cohesion for young children.[67,68] Future work should implement multiple methods of measurement to operationalize the concept of community cohesion for young children. For example, including items that are intentionally child-focused, such as asking how safe the child feels in their neighborhood or assessing how many community opportunities (*e.g.*, sports, arts, employment) are available for them, may be one strategy to enhance the accurate reporting of community cohesion among youth.

Strengths

The present study boasts several strengths. Participants were recruited from the broader community and were predominantly Black or African American; representing a population that is typically underrepresented and understudied in the literature. Further, this study took a strengths-based approach to examining internalizing symptoms by exploring which social-ecological factors (*i.e.*, resilience, social support, community cohesion) were most salient for children exposed to ACEs. Rather than focusing on the cumulative risks associated with negative outcomes following trauma, this study explored what positive resources were available to children and how these resources that may be associated with internalizing problems. Finally, the majority of the interviews were conducted in-person and the surveys were read aloud to participants, which is a research strategy that is reported to improve data quality by reducing the amount of random responding and missing data.[69]

Limitations

Though this study has notable strengths, several limitations should also be acknowledged. Data were cross-sectional, which limits the interpretation of directionality and temporality. Additionally, power was likely limited due to the relatively small sample size. Further, the families participating in this study were actively seeking services, so the generalizability of the findings may not extend to all families, as the intentional act of reaching out for help may engender adaptive functioning in the family system. Lastly, the nuances in assessing social-ecological factors such as social support and community cohesion may have been reduced in this study due to the developmental age range of the sample and limitations of the measures.

Clinical implications

Research highlights the need for intervention efforts to address psychopathology in children exposed to ACEs. Children should be given opportunities to process trauma exposure in safe and supportive environments through trauma informed interventions such as Trauma-Focused Cognitive Behavioral Therapy (TF-CBT).[70] Given study findings, interventions should also implement strategies to bolster resilience such as increasing self-efficacy and positive self-talk, teaching emotion identification and regulation skills, and practicing mindfulness, which could mitigate the onset of depressive symptoms. Importantly, these techniques aimed at increasing resilience could be implemented at different levels across the social ecology. Psychoeducation could be provided to parents who, in turn, could practice these strategies at home. Children could attend individual sessions with a school counselor or mental health provider. Further, these techniques could be shared in a group-based format as a part of broader community-focused programming.[71,72] Implementing these strategies in the child's home or microsystem following adversity could be a critical preventative measure against the development of internalizing symptoms.

CONCLUSIONS

The current study took a social-ecological approach to examine the associations between resilience, social support, community cohesion and internalizing symptoms *(i.e.*, anxiety, depression) in young children who had been exposed to ACEs. Linear regression modeling revealed that fewer ACEs and higher levels of resilience were linked to fewer depressive symptoms. These findings extend the ACEs literature and provide insight to guide future intervention methods for youth exposed to adversity.

ACKNOWLEDGMENTS

The authors thank the Midsouth community organizations for their partnership and collaboration, as well as The Urban Child Institute (UCI) for their funding support (PI: Howell). Additionally, the authors thank research assistants from the University of Memphis and the participants who gave their time and energy.

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PRESS SUMMARY

Adverse childhood experiences (ACEs) are reported by a majority of children in the United States. Research indicates that ACEs are associated with increased reports of anxiety and depression in children. Limited work has examined how social-ecological strengths may be associated with anxiety and depression symptoms in youth following ACEs. The current study explored how factors across the social ecology, including resilience, social support, and community cohesion were associated with mental health symptoms in a sample of racially diverse youth exposed to adversity. Results showed that experiencing more ACEs was associated with endorsing more depressive symptoms, and higher levels of personal resilience were linked with lower levels of depression. Thus, mental health professionals and community stakeholders working with ACE-exposed youth should implement strategies that foster resilience (*i.e.*, learning self-efficacy and positive self-talk, teaching emotion identification and regulation skills), as building personal resilience could lessen symptoms of depression among youth experiencing adversity.

Print Edition ISSN 1536-4585
Online Edition ISSN 2375-8732