In 2015, lottery consultant Rylee Robinson was hired to examine Powerball, an interstate-run lottery, for its value, prize structure, complexity, and disappointing ticket sales. Indeed, in 2013, ticket sales had declined in all but four states, and by 2014, Powerball sales had declined across the nation by 19%. Industry insiders attributed the decline to “jackpot fatigue,” which meant casual players would not purchase tickets unless a huge jackpot was up for grabs. With fewer people playing, it took more time to generate jackpots large enough to get folks interested enough to buy tickets. This meant less lottery money was going to state coffers for spending on government programs such as education, economic development, mass transit, or the environment—or whatever beneficiary each state had chosen when Powerball launched.

Robinson was working with the Multi-State Lottery Association (MUSL) to address the falling revenue problems and attract new players to the game. Any rule revisions they made would affect all states that played Powerball. Several members of the MUSL committee working with Robinson believed that increasing ticket buyers’ chances of winning something—not just the jackpot—would encourage ticket sales. A few changes to the rules would result in more prize winners—a jump from 1 in 32 to 1 in 25, but the chances of winning the jackpot would move from 1 in 175 million to 1 in 292 million.\(^1\) The proposed changes would make it more likely that the jackpot size increased—and history showed that the bigger the jackpot, the more tickets were sold.\(^2\) In a simulation run over five years, a study concluded that the chances of accumulating a jackpot worth more than $1 billion increased from 8.5% for the old odds (1 in 175,223,510) to 63.4% for the new odds (1 in 292,201,338).\(^3\)

Before getting behind the suggested rule changes, Robinson wanted to run the numbers again. Would more people really buy Powerball tickets just because the jackpot was larger? Or would the changes actually decrease the popularity of Powerball? And what effect would the new rules have on revenues?

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The Game

Powerball was run through the MUSL, a nonprofit government-benefit association formed in 1987. The organization’s first lottery game was called “Lotto America,” and the first Powerball game was held on April 22, 1992. By 2015, MUSL had an annual budget of $5.5 million, employed 13 staff members, and used statistical analysis, projections, and game-modeling techniques to examine current games and create new ones. The lottery was made available in 44 states. Each state lottery utilized its own central computer system to generate tickets. There was wide variation in each state around bookkeeping and transfer requirements to beneficiaries. Some jurisdictions’ lotteries gave all revenues to their chosen programs, whereas others had predetermined transfer goal amounts that were dependent on ticket sales.

Tickets

Consumers that were at least 18 years old could purchase a $2 ticket from a state lottery sales terminal at licensed retailers—generally convenience stores, gas stations, supermarkets, liquor stores, and drugstores. Ticket sales were open to noncitizens, and Powerball did not limit the number of tickets one person could purchase. Some states, however, limited each transaction to $125.00 or less, but conducting several different purchases meant consumers could buy a large number of different combinations for a single Powerball game. Each ticket required choosing six numbers, and purchasers often picked numbers that held special meaning for them in some way. For example, two winners played their fortune cookie numbers. The alternative “quick pick” method let the computer randomly choose the numbers instead of the purchaser. Roughly 70% to 80% of people buying Powerball tickets used the quick pick method. Some states also allowed the option of “multi-draws,” whereby purchasers chose a selection of numbers for consecutive drawings—5, 10, 25, or 52. An optional add-on feature, the “Power Play,” cost an extra dollar and multiplied all prizes (excluding the jackpot) by a factor. Ticket sales were cut off 59 minutes before the draw, or earlier if a state so ruled. Depending on the state where the ticket was purchased, winners had varying amounts of time to claim their winnings—anywhere from 90 days to one year. That information was displayed on the back of each lottery ticket.

In August 2015, Powerball numbers were drawn twice weekly on Wednesdays and Saturdays at 10:59 p.m. eastern time at Universal Studios in Orlando, Florida. From time to time, the drawing was moved to a different geographic location as a special event. Winning numbers were drawn from two drums. The first drum contained white balls numbered from 1 to 59, and five balls were drawn from it without replacement. From the second drum, which contained 35 red balls, one red ball was drawn. To win the jackpot, all five white balls (in any order) and the one red ball had to be represented on the ticket. Second prize—$1 million paid in cash—was won by matching only the five white balls in any order (also known as “Match 5’’). If the red ball matched, the ticket holder won a prize (see Table 1). If there was more than one winner, the jackpot was divided equally, and if not the money went to the carryover pool (previous days’ unclaimed winnings). Specifically, the Powerball jackpot was reset to $40 million after each win, and increased in each draw by the after-tax carryover pool or at least $10 million. For example, if last week’s jackpot was $50 million and nobody won, the carryover pool was $30 million, and the track take was 50%, then the new jackpot would be the maximum between $50 + $10 million and $50 + $30 million × 50%. In this new example, it would be $65 million.

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7 Some terminals were self-serve, and smartphone apps were being explored.
8 http://www.powerball.com/pb_contact.asp.
9 http://www.powerball.com/pb_contact.asp.
11 Track take was another way of describing the money that game organizers deducted from the winnings.
### Table 1. 2015 Powerball game prizes and proposed rule change.\(^{12}\)

<table>
<thead>
<tr>
<th># Matched Balls</th>
<th>2015 Prize</th>
<th>New Rule Prize</th>
<th>2015 Odds</th>
<th>New Rule Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 + 1</td>
<td>Jackpot</td>
<td>Jackpot</td>
<td>1 in 175,223,510</td>
<td>1 in 292,201,338</td>
</tr>
<tr>
<td>5 + 0</td>
<td>$1 million</td>
<td>$1 million</td>
<td>1 in 5,153,632</td>
<td>1 in 11,688,053</td>
</tr>
<tr>
<td>4 + 1</td>
<td>$10,000</td>
<td>$50,000</td>
<td>1 in 648,975</td>
<td>1 in 913,129</td>
</tr>
<tr>
<td>4 + 0</td>
<td>$100</td>
<td>$100</td>
<td>1 in 19,087</td>
<td>1 in 36,525</td>
</tr>
<tr>
<td>3 + 1</td>
<td>$100</td>
<td>$100</td>
<td>1 in 12,244</td>
<td>1 in 14,494</td>
</tr>
<tr>
<td>3 + 0</td>
<td>$7</td>
<td>$7</td>
<td>1 in 360</td>
<td>1 in 579</td>
</tr>
<tr>
<td>2 + 1</td>
<td>$7</td>
<td>$7</td>
<td>1 in 706</td>
<td>1 in 701</td>
</tr>
<tr>
<td>1 + 1</td>
<td>$4</td>
<td>$4</td>
<td>1 in 110</td>
<td>1 in 92</td>
</tr>
<tr>
<td>0 + 1</td>
<td>$4</td>
<td>$4</td>
<td>1 in 55</td>
<td>1 in 38</td>
</tr>
</tbody>
</table>


### Winning

Winning tickets had to be cashed in the state where they were purchased. The ticket could be redeemed at the retailer from which it was purchased (if the winning amount was under $600) or at state lottery headquarters, either in person or by mail. The ticket holder was required to sign the back of the ticket and present valid government-issued photo identification. Winners could only remain anonymous in Delaware, Kansas, Maryland, North Dakota, or Ohio. Not all revenues generated from Powerball went to the winners. Roughly 5% of lottery ticket sales went to retailers that sold the tickets, 5% went to each state’s lottery administration, the largest percent (50%) went to the winners or was carried over, and the rest (40%) went to state governments (based on their percentage of ticket sales for each drawing).\(^{13}\)

The winner of the jackpot could choose between two forms of payment: either an annuitized prize paid out over 29 years (30 payments), or a cash lump-sum payment. The lump sum was taxed as such, and the remainder was handed to the winner. Some states did not have a state tax on lottery winnings,\(^{14}\) but the majority did, with an average tax of 5.8%. If the annuity was chosen, the winner received an annual payment that increased by 5% each year to account for increases in cost of living. Winners had 60 days to decide how they would like to receive their winnings, and it took the lottery organization roughly two weeks to collect cash from all retailers across the United States in order to have the funds to pay the winners. Lottery jurisdictions retained unclaimed prizes and a share of a state’s jackpot sales. Roughly 50% of states put the money back into the game, and the other 50% gave the money to the state’s general fund. Unclaimed jackpot money was returned to all lotteries proportional to the amount of sales from that state.

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\(^{14}\) States and territories that did not tax lottery winnings included: California, Delaware, Florida, New Hampshire, South Dakota, Tennessee, Texas, Washington, Wyoming, and Puerto Rico.