Teaching Supplement: Statistics and Lottery Fraud

In 2006, suspicions arose that some lottery ticket retail sellers ("retailers") in the Canadian province of Ontario might be fraudulently obtaining winning tickets that actually belonged to their customers. One case was definitively established, and a retailer was charged with theft and fraud. But were other cases out there too?

This question can be investigated using statistics! It was determined (through a variety of methods: government enquiries, surveys, etc.) that there were a total of 5,713 major (i.e., $50,000 or more) lottery prizes awarded in Ontario in the period 1999–2006, and that retailers had won about 200 of them. It was also estimated that there were about 60,000 retailers in Ontario, out of a total adult population of 8,900,000. Finally, it was found that on average retailers spend approximately 1.5 times as much as the average adult on lottery tickets. For the questions below, assume that all of these figures are precisely correct.

1. Retailers make up approximately what fraction of the Ontario adult population?

2. Retailers spend approximately what fraction of all spending on lottery tickets in Ontario?

3. Of the 5,713 major prizes in this time period, what is the *expected value* of the number that would be won by retailers, in the absence of cheating? (Assume that the expected number of prizes is directly proportional to the amount of money spent on lottery tickets.)

4. Explain why, if we wish to model the number of major prizes won by retailers during this period as a random variable, then the *Poisson* probability distribution should be used.

5. Using the figures and modelling assumption from the previous questions, what is the *probability* that the retailers would win 200 or more major prizes by luck alone?

6. Since the retailers did in fact win 200 of the major prizes, what can we conclude from the results of the previous question? (State your conclusions as precisely as you can.)

In fact, statistical calculations such as the above were indeed used to expose a massive retailer lottery fraud scandal in Ontario, which became major front-page news in Canada and led to numerous consequences including legislative debate, the firing of two CEOs, a number of criminal charges, jail time for several perpetrators, and payouts totalling over twenty million dollars. Related cases were later discovered in various other jurisdictions, including several in the United States. The story stands as a forceful testament to the importance and power of statistical analysis. For more information, see the article "Statistics and the Ontario Lottery Retailer Scandal", by Jeffrey S. Rosenthal, published in CHANCE Magazine.