

Operating Expenses

Sales and Marketing Expense

| | Year Ended December 31, | | Change | |
|---------------------|-------------------------|-----------|-----------|-------|
| | 2019 | 2018 | \$ | % |
| | (dollars in thousands) | | | |
| Sales and marketing | \$ 87,731 | \$ 69,608 | \$ 18,123 | 26.0% |
| % of revenue | 44% | 47% | | |

Sales and marketing expense increased by \$18.1 million in 2019 compared to 2018. The increase was primarily due to a \$15.5 million increase in employee-related costs, which includes stock-based compensation, associated with our increased headcount from 286 employees as of December 31, 2018 to 345 employees as of December 31, 2019. The remaining increase was principally the result of a \$1.2 million increase in trade show and advertising costs and a \$1.0 million increase attributed to office related expenses to support the sales team.

Research and Development Expense

| | Year Ended December 31, | | Change | |
|--------------------------|-------------------------|-----------|----------|-------|
| | 2019 | 2018 | \$ | % |
| | (dollars in thousands) | | | |
| Research and development | \$ 50,024 | \$ 41,305 | \$ 8,719 | 21.1% |
| % of revenue | 25% | 28% | | |

Research and development expense increased by \$8.7 million in 2019 compared to 2018. The increase was primarily due to a \$5.4 million increase in employee-related costs, which includes stock-based compensation, associated with our increased headcount from 229 employees as of December 31, 2018 to 252 employees as of December 31, 2019, a \$1.3 million increase in hosting and software related cost to support research and development activities and an increase of \$0.4 million in office related expenses to support research and development activities. In addition, a total of \$6.5 million of internally-developed software costs during 2019 and \$7.7 million of internally-developed software costs during 2018 were capitalized, resulting in an increase of the expense by \$1.2 million compared to 2018.

General and Administrative Expense

| | Year Ended December 31, | | Change | |
|----------------------------|-------------------------|-----------|-----------|-------|
| | 2019 | 2018 | \$ | % |
| | (dollars in thousands) | | | |
| General and administrative | \$ 46,820 | \$ 31,462 | \$ 15,358 | 48.8% |
| % of revenue | 23% | 21% | | |

General and administrative expense increased by \$15.4 million in 2019 compared to 2018. The increase was primarily due to a \$9.8 million increase in employee-related costs, which includes stock-based compensation, associated with our increased headcount from 89 employees as of December 31, 2018 to 113 employees as of December 31, 2019. There was an additional increase of \$3.7 million in depreciation and amortization, \$0.8 million to support compliance as a public company, a \$0.6 million increase in office related expenses to support the administrative team, and an increase of \$0.2 million in software subscription costs.

Other Income (Expense), Net

| | Year Ended December 31, | | Change | |
|--------------------|-------------------------|----------|---------|--------|
| | 2019 | 2018 | \$ | % |
| | (dollars in thousands) | | | |
| Other expense, net | \$ 4,597 | \$ 4,628 | \$ (31) | (0.7)% |
| % of revenue | 2% | 3% | | |