

**Responsibility Center Management (RCM) and Enrollment,
Graduation, Financial Aid, and Retention: Examining Trends
at Four Public Institutions**

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Responsibility Center Management (RCM) and Enrollment, Graduation, Financial Aid, and Retention: Examining Trends at Four Public Institutions

Abstract:

Responsibility center management (RCM) is a market-based budget model that may benefit certain academic institutions. While there are supporters and opponents of the model, there is a lack of hard evidence about the potential impact of RCM on a variety of institutional variables, hence the need for this study. This study brought together the variables, “fall enrollment,” “graduation rate,” “retention,” and “financial aid,” informed by IPEDS data, to examine quantitatively changes relating to RCM implementation. Data indicates that the implementation of RCM had a positive relationship with these variables. While these outcomes may encourage the implementation of RCM, the individual goals of an institution need to be considered before the decision to use RCM is made.

Introduction

Responsibility center management (RCM) is a decentralized budget model used by some public universities in the United States to transfer central financial authority to individual academic units (Gray 2021; Jaquette, Kramer, and Curs 2018). In a traditional university allocation model, known as Central Administration Management (CAM), tuition revenue and state funds advance to campus central administration where distribution decisions are made for the colleges and departments (Fethke and Policano 2012). Unlike, CAM, RCM employs a market-based model which allows units with the highest stakes in the outcome to generate their revenue, implement cost reduction measures, as well as plan, budget, and develop their areas as they deem appropriate (Deering and Lang 2017). In this article, the acronym RCM will be used, but the model is also known by several other names and acronyms such as responsibility center

budgeting (RCB), resource-centered management, revenue center budgeting, and value center management.

RCM has been discussed since the 1970s as various pressures across the past 40 years have enhanced the need to streamline the allocation of scarce resources (Deering and Lang 2017; McBride, Neiman, and Johnson 2000; McLendon, Mokher, and Doyle 2009). These strains primarily relate to reduced funding from the state (taxpayer dollars), increases in tuition and student debt, evolving technologies, etc. as well as idiosyncratic tensions that affect each academic institution at an individual level (Deering and Lang 2017; Fethke and Policano 2019; Gray 2021). Supporters of RCM tout its ability to promote higher levels of accountability, increase efficiency and fairness, reward faculty labor, and serve as a paradigm for increasing positive student outcomes and campus fiscal responsibility (Dick 1993; Fethke and Policano 2019; Heath 1993; Kosten 2016). Opponents recoil from RCM's corporate overtones and believe that RCM embodies the biggest dilemmas within the contemporary higher education landscape, including foregrounding investment opportunities over academic ones, enhancing strife over shrinking budgets, and leaving only meager provisions for inadequate services (Adams 1997; Carlson 2015; Wilms 1997). While there are arguments on both sides, there is a lack of hard evidence about the potential impact of RCM on a variety of institutional functions, hence the need for this study.

This article uses data retrieved from the Integrated Postsecondary Education Data System (IPEDS) to provide a quantitative analysis of four selected public research universities that implemented RCM between 2008-2010 to better understand how its application may have influenced enrollment, student retention rates, graduation rates, and financial aid packages. This study considers Iowa State University, Kent State University, the University of Cincinnati, and

the University of Florida because these institutions adopted RCM on a similar timeline and, therefore, interference from other, uncontrolled, larger fluctuations is reduced.

Literature Review

While the literature relating to RCM and its implementation spans over four decades, the emphasis in this section is on recent publications, with reference made to foundational works from earlier decades. The context and history subsection explores the backdrop for RCM's development and use, while the praise and critique section foreground the advantages and disadvantages of initiating such a budgetary system. The implementation subsection explains difficulties in applying RCM at the institutional level and an overview of the environments in which RCM is most likely to succeed.

Context and History

The practice of applying a market-based model to higher education has, in some cases, resulted in institutions viewing students as customers, focusing renewed attention on enrollment numbers, and placing significance on rankings (Deering and Sa 2017; Hearn et al. 2006; Hossler 2004; Wilms 1997). Such trends relate to the rise of 20th-century neoliberalist values, wherein it is assumed that a competitive marketplace may solve issues, but it has in many cases increased students' financial burdens (Schraedley et al. 2021). The consequence has been a commodification and marketization of higher education that has allowed for the rise of funding models historically more prevalent in the business world (Hossler 2004). Budget policies are determined by evolving political environments and economic conditions of the region in which the institution is situated, while higher education governance structures are mediated by historical and geographical factors (Knott and Payne 2004; McLendon, Mokher, and Doyle 2009).

During times of financial plentitude, faculty may not have reason to know about or deeply engage with the ways that resources are allocated (Wilms et al. 1997). Periods of relative financial security are followed by eras of cutbacks and reductions. Therefore RCM, which can help facilitate a tightening of the budget, is often applied during times of financial duress (Deering and Lang 2017). These axioms are why transparency is central to RCM; the procedures for allocating resources connect directly to the financial impacts, strategic plan, and a performance-based reward structure that affects faculty (Bouillon, Smith, and Ehoff 2021; McBride, Neiman, and Johnson 2000).

RCM developed from the concept of “every tub standing on its own bottom” quoted from *The Pilgrim’s Progress* by a former president of Harvard University (Carlson 2015). This idea of budgeting, wherein every unit operates and sustains itself, was then extended as a response to increasing accountability measures and to contain administrative bloat. Academic authority and financial responsibility reside under the manager, usually a dean, to promote a more market-based culture wherein the success or failure of the unit is directly related to its ability to meet the target goals (Vonasek 2011).

Within RCM there exist revenue centers and cost centers. True to the nomenclature, the revenue center generates revenue while the cost center provides support and is sustained with taxes paid directly to it by the revenue center to bolster its continued functioning (Palmer 2014). An example of this pairing might be an engineering department serving as the revenue center and the academic library as the cost center (Deering and Sa 2017). The RCM model displays how revenue and costs are shared among responsibility centers, rewarding decision-makers for financial decisions that positively impact their unit and the university at large (Bouillon, Smith, and Ehoff 2021).

Praise and Critique of RCM

Functioning at its zenith, RCM can allow for innovation and creativity on the part of deans and directors who find themselves overseeing their entire budget systems (Heath 1993). At the University of Oregon, for example, the dean of music was able to fund the purchase of music technology equipment because he had increased the number of general education classes offered by his division (Carlson 2015). More students bringing tuition money with them and taking undergraduate-level music courses meant that the dean then had more dollars in the RCM model that he could use in his area to fund new initiatives.

The music instance is an important one as among the main critiques of RCM is that it privileges the programs that bring in the most revenue, which is not usually the strength of arts or humanities programs (Agostino 1993). RCM, by design, emphasizes income-producing programs over arts programs, which are essential to the university experience, culture, and social experience and serve students' needs, but do not fare well within an income-generating model adapted from the business world (Adams 1997; Deering and Sa 2017).

To illustrate this point, a case study of a composite university using actual dollar amounts reported from several universities showed that RCM implementation would theoretically cut the College of Arts and Humanities budget by \$2.04 million below the previous year, which would cripple the division by reducing the funds available to pay faculty and staff salaries and cover operating expenses (Bouillon, Smith, and Ehoff 2021). Further, in a case study from Indiana University at Bloomington, a faculty member discovered that under RCM there were no provisions for replacing equipment in the theatre, telecommunications, or journalism area, and no units designated to provide for the campus newspaper or television station, which tend to cost money of their parent units rather than generate it (Agostino 1993; Linn 2007). To resist

overgeneralizing, is important to note that the individual details of each university matter – RCM implemented at two seemingly “peer” institutions could have very different outcomes on programs. Whereas one institution’s liberal arts program may suffer due to RCM implementation, another institution’s liberal arts program may flourish.

While some disciplines lend themselves to hosting large lecture classes that generate tuition, those areas are not always the obvious ones (Dick 1993). For example, most business schools are considered revenue centers, but they do not usually offer general education classes. This is a disadvantage to business schools under RCM, as they can only count their majors for two years as opposed to other areas that can count, and benefit from, the tuition revenue for four years (Bouillon, Smith, and Ehoff 2021). RCM can also function to price academic programs (Fethke and Policano 2012). There remains a risk that RCM can motivate the creation of programs that generate revenue but do not necessarily serve the greater mission of the institution (Hearn et al. 2006). Furthermore, classes within these programs must be academically rigorous enough that grade inflation is not the method of attracting students, or the mission of the university suffers under this RCM-motivated strategy to attract student tuition dollars (Vonasek 2011).

Returning to the example of the academic library as a cost center under RCM, since the library does not generate degrees and functions as support or a B-unit, allocations of central funds under CAM tend to be the biggest share of their budget (Carlson 2015; Cuillier and Stoffle 2011; Savage and Kahl 2018). Under RCM, the question is not whether to support the library but who should fund that support (Agostino 1993). Fundraising outside the university library is an unlikely option as donors do not relish putting their names or money toward paying for daily operational essentials (Cuillier and Stoffle 2011). In this way, RCM can pit college against

college as they hash out who pays taxes to support which units and create potential infighting among deans as they are pressured to make difficult choices in front of an audience of their peers (Carlson 2015). By 1995, the University of Indiana in Bloomington, which implemented RCM in 1987, rectified this conundrum (and the one plaguing the communication department) by assessing a 10% tax on all units, as the library serves as a common good providing necessary support (Neal and Smith 1995). Services for the common good of the institution, such as the library, need to receive adequate funding (subvention) but at a taxation level that does not remove the underlying revenue-increasing incentives of RCM (Dick 1993; Fethke and Policano 2012; Linn 2007; Stocum and Rooney 1997).

RCM debuted in large private universities and has been adopted by major public universities over the decades; it does not tend to work with smaller institutions or community colleges (Dick 1993; Hillman et al. 2015; Palmer 2014). It has, however, been successfully applied to intercollegiate athletics on campuses and has proven successful (Vonasek 2011). RCM could be useful in increasing revenue for athletics, perhaps more so than reducing the costs of these programs (Deering and Lang 2017; Palmer 2014). Another advantage of RCM is that, unlike CAM, there is no impetus to spend down a unit's budget to close out the fiscal year as RCM does not suggest a use-it-or-lose-it expenditure model (Stocum and Rooney 1997; Zierdt 2009). Further, RCM allows deans to move funds from one spending category to another based on need, with reporting only for the total amount of the bottom line (Stocum and Rooney 1997).

Implementation of RCM

Within the existing body of research on RCM, some recommend that it be implemented entirely in its "pure" form, while others suggest a hybridized form to promote the best usage (Mayer 2011). A hybridized model of RCM can allow for prioritization between goals (outputs)

without the focus being solely on the financial aspects (inputs) (Andrews 2003; Myers 2019). In practice, for example, RCM can be implemented in some departments and not others or used in tandem with CAM or other budget models. Some, like Myers (2019), question why RCM has not been implemented more frequently in its distilled form when it has been around for as long as it has and would provide strategic alignment of incentives with faculty output and revenue levels. Andrews and Hill (2003) argue that for successful implementation of RCM, it needs to entirely replace the budget model in use or risk the previous model dominating the new one. Others believe that RCM may not have a pure form since it must vary with every implementation while taking into consideration the vagaries of each institution (Agostino 1993). Fundamentally, universities must select a budget model that best addresses their needs and goals (Maciariello and Enteman 1974; Rutherford and Rabovsky 2018; Zierdt 2009).

A hybrid approach recognizes that the market-based model offered by RCM does not allow for the complexities of the budget inherent to the higher education context such as the ability of some programs to generate excess revenue while others simply cannot (Adams 1997; Fethke and Policano 2019; Zierdt 2009). While this hybrid approach assumes CAM and RCM, others have suggested blending RCM with an outcomes-based funding style wherein the states allocate funding to higher education institutions based on assessments of student outcomes to ensure that deans are making resource decisions about their areas that relate directly to recruitment, retention, degree completion, and student success (Hillman, Tandberg, and Fryar 2015; Kosten 2016; Savage and Kahl 2018). Some institutions only employ RCM to allocate 10-50% of their budgets (Deering and Lang 2017).

Methodology

In their 2018 article, Jaquette, Kramer, and Curs studied 4 public research universities that were “RCM adopters from the period 2008-2010” (p. 637). Those institutions are Iowa State University, Kent State University, the University of Cincinnati, and the University of Florida. The article provides robust data on the background for each of these institutions and should be referenced for specific details on each institution’s previous budget model and ways in which RCM was operationalized at each. Pertinent to this study, in the discussion section of their article, the authors call for future research on undergraduate enrollment as it is impacted by RCM. They recommended examining enrollment, 6-year graduation rates, retention, and financial aid packages following the implementation of RCM at these institutions.

This article answers that call for additional research. Not only does this afford the benefit of using institutions that implemented RCM within a few years of each other for purposes of congruent data collection in IPEDS, but it also will help align the discoveries of this study to findings in the initial study to create a larger compendium of data on RCM implementation across a broader set of variables. The research includes data between the years 2003-2015 to capture data 5 years before and 5 years after RCM implementation, to provide the opportunity for each RCM adopter to have an adequate period of study both before and after RCM implementation. To do this evenly for each institution, the years are examined in groups of 2003-2007 and 2011-2015.

This article will use a combination of descriptive and inferential statistics to answer the following research questions:

1. Is there a statistically significant difference before and after the implementation of RCM regarding a) graduation rates, b) retention rates, and c) the amount of financial aid awarded?

2. Is there a statistically significant relationship between the amount of financial aid awarded and undergraduate enrollment between 2003-2015?

Variables

IPEDS nomenclature, including “fall enrollment,” is defined as first-time, full-time, undergraduate student enrollment in total. Although provided, this study did not consider the individual breakdown of demographics (age, race, gender identity, etc.) of the students represented in the enrollment count, as that would represent an entirely different study with a focus outside the scope of this one. Another variable, “graduation rate,” (noted as “graduation”) contains 6-year (150%) normal time completion for 4-year and 2-year institutions, including a collated total of all gender and demographics as listed in IPEDS. “Retention” is defined as the full-time retention for the years examined in this study, understood as a percentage. “Financial aid” encapsulates all financial aid awarded, represented in current dollar amounts for the year (not adjusted for inflation), to full-time, first-time degree and certificate-seeking undergraduate students. While the original study also called for an examination of the effects of RCM on the development of additional programs and academic offerings, IPEDS data did not include information that could be parsed beyond a “yes” or “no” answer for the creation of new programs; therefore, it was not featured as a variable in this study.

All data downloaded in comma-separated value (.csv) files from IPEDS were sorted and recombined in Excel (.xlsx) files. Each of the 4 institutions was separated into its own Excel file with the associated variables. One aggregated Excel sheet containing all the institutions remained to compare all the variables across all the institutions. Since the data was not downloaded until equal reporting by each institution had been verified, there existed no data cleanup, although some data was rearranged. Finally, the data from the Excel files were copied and pasted into

Statistical Package for Social Sciences (IBM SPSS) software, version 28, to conduct the statistical tests.

Research model

To answer the research questions, independent samples t-tests are used to compare group means before and after RCM implementation for each institution for the data relating to retention, graduation, and financial aid. In the analysis the following formula is used when the equal variance assumption is violated:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

where \bar{x}_1 and \bar{x}_2 represent the means of the first and second samples respectively. $n_1, s_1; n_2, s_2$ represent the sample size and standard deviation of the first and second samples. In this case, the degrees of freedom are expressed as:

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{1}{n_1 - 1} \left(\frac{s_1^2}{n_1}\right)^2 + \frac{1}{n_2 - 1} \left(\frac{s_2^2}{n_2}\right)^2}$$

When the equal variance assumption is met, the test statistics were computed as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

such that:

$$s_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

where $\bar{x}_1, \bar{x}_2, n_1, n_2, s_1,$ and s_2 have the same meaning as in the case where the equal variance assumption is violated. However, s_p represents the pooled standard deviation. The degree of

freedom can be expressed as $df = n_1 + n_2 - 2$. The two formulas are necessary because the variables examined at the four institutions passed the equal variance assumption test except for financial aid at Iowa State University. For the ones that did pass, Levene's test for equality of variance was used.

Scatterplots create a visual understanding between the variables enrollment and financial aid awarded for the periods before and after RCM implementation using R-squared quadratic and cubic lines. Because the relationship between any of the two variables is non-linear, using Pearson's or Spearman's correlations was determined to be inappropriate for this study.

These statistical analyses are the most effective for the sample size, which is robust enough for these tests, but inappropriate for regression models which would require additional data points.

Findings

In what follows, the results of three t-tests for the variables graduation rates, the amount of financial aid awarded, and retention rates are reported for each of the 4 public institutions. Additionally, scatterplots for the variables financial aid awarded and undergraduate enrollment depict relationships between the two variables.

Iowa State University

Table 1 shows that the difference in financial aid ($t = 5.51, p < .001$) amounts and retention ($t = 3.78, p = .01$) before and after RCM implementation were statistically significant. Inspection of the two group means indicates that the average size of a financial aid package ($M = 3394.40$) is significantly lower before RCM than the size of the financial aid package ($M = 4981.20$) after RCM implementation. The difference between financial aid packages is 1586.8, which represents a \$1,586.80 difference in financial aid packages before and after RCM

implementation. The effect size $d = 5.06$ [95% CI = (7.764, 2.306)] which is a very large effect size. Comparing the retention means after RCM implementation, the mean increased by 2 percentage points and there was a higher amount of retention after the implementation of RCM ($t = 3.78, p = .01$) which was statistically significant. The effect size, d , is approximately 2.39 [95% CI = (4.043, .661)] which is a very large effect size. RCM implementation did not significantly impact graduation rates ($t = 1.03, p = .33$).

Variable	M	SD	t	df	p	d (95% CI)
Graduation			1.03	8	.33	.65 (1.910, .647)
Before	2747.30	188.11				
After	2888.80	244.12				
Financial Aid			5.51	8	< .001	5.06 (7.764, 2.306)
Before	3394.40	179.64				
After	4981.20	405.24				
Retention			3.78	8	.01	2.39 (4.043, .661)
Before	84.8	0.84				
After	86.8	0.84				

Table 1 Comparison of RCM at Iowa State University before and after implementation on graduation, financial aid, and retention

When examining the relationship between enrollment (y-axis) and financial aid (x-axis) before and after the implementation of RCM at Iowa State University, the R-squared cubic line yielded the highest result at 0.964 or 96% fit for the data for year groups 2003-2007 and 2011-2015 (Figure 1). The skewness for all 13 years considered together is .560 for financial aid and .894 for enrollment so the assumption of normality is met. As seen in the scatterplot, the

association between the variables is a strong, positive, nonlinear one. The data set did not contain any outliers.

This scatterplot represents a very strong relationship, but such a correlation should not be understood to be causation. A curvilinear relationship indicates that the relationship between the two variables is not constant. Just as increased enrollment does not necessarily cause an increase in financial aid, necessarily, and vice versa, RCM implementation took place during the dates included in this study, but it may not have been the strongest factor causing the increase of both variables as depicted by the scatterplot. The shape of the line indicates that there may first have been a decline in the financial aid offered but it has increased during the period studied. The points are very close to the line at some points but more distant at other others. The shape of the line would indicate that the amount of financial aid will continue to increase.

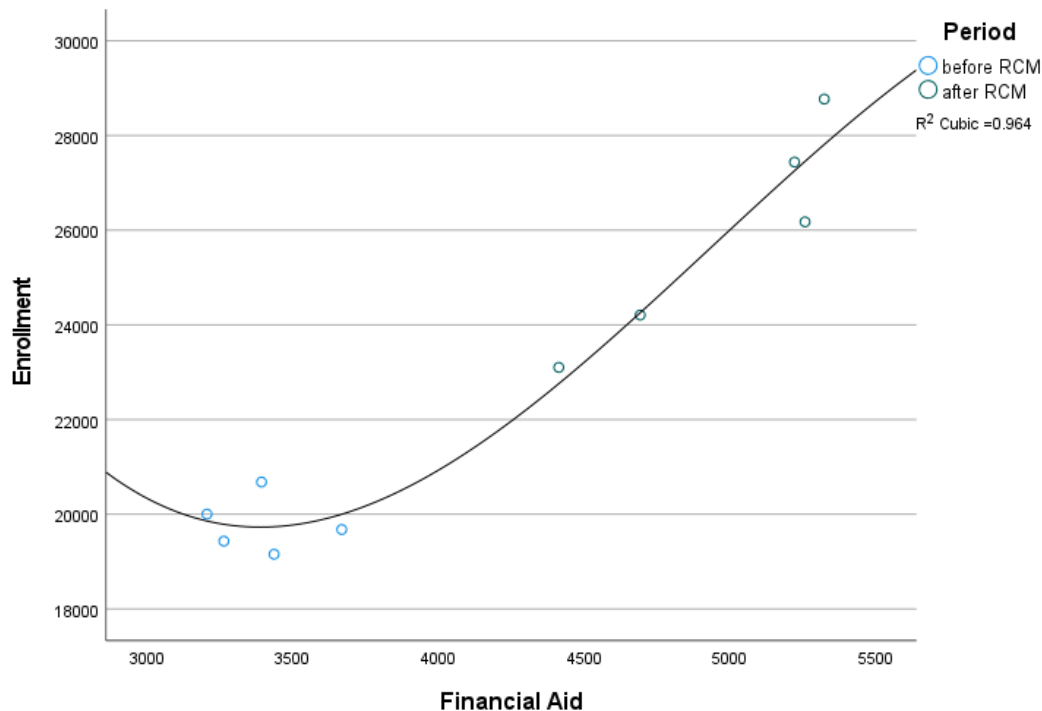


Figure 1: Scatterplot showing the relationship between enrollment and financial aid at Iowa State University before and after implementation of RCM.

Kent State University

Table 2 shows that there were statistically significant differences in all variables, graduation ($t = 3.84, p = .005$), financial aid ($t = 10.01, p < .001$), and retention ($t = 3.81, p = .005$) before and after RCM implementation at Kent State University. Inspection of the two group means indicates that the average number of graduates before RCM implementation ($M = 1552.8$) is significantly lower than after RCM implementation ($M = 1984$). The difference in the means is 431.2 (or approximately an increase of 431 students in a graduating class). The effect size for d is 2.43 [95% CI = (4.097, .688)] which is very large. In comparing the means for financial aid the average financial aid package before RCM implementation was ($M = 3167.20$) which is significantly lower than the financial aid package of ($M = 3941.00$) which is a difference in means of 773.8 or \$773.80 in financial aid packages before and after RCM implementation. The effect size for d is 6.33 [95% CI = (9.587, 3.027)] which is a very large effect size. A comparison of means for percent of retention before RCM implementation ($M = 72.96$) is lower than after RCM implementation ($M = 78.6$) or a 5.64 percentage point increase in the retention rate following RCM implementation. The effect size for d is 2.41 [95% CI = (4.069, .674)] which is a very large effect size.

Variable	M	SD	t	df	p	d (95% CI)
Graduation			3.84	8	.005	2.43 (4.097, .688)
Before	1552.80	191.03				
After	1984.00	162.63				
Financial Aid			10.01	8	< .001	6.33 (9.587, 3.027)
Before	3167.20	96.45				
After	3941.00	143.54				

Retention			3.81	8	.005	2.41 (4.069, .674)
Before	72.96	1.64				
After	78.60	2.88				

Table 2 *Comparison of RCM at Kent State University before and after implementation on graduation, financial aid, and retention*

When examining the relationship between enrollment (y-axis) and financial aid (x-axis) before and after the implementation of RCM at Kent State University, the R-squared cubic line yielded the highest result at 0.964 or 96% fit for the data for year groups 2003-2007 and 2011-2015 (Figure 2). The skewness for all 13 years considered together is .248 for financial aid and .042 for enrollment so the assumption of normality is met. As seen in the scatterplot, the association between the variables is a reasonably strong, positive, nonlinear one. The data set did not contain any outliers.

This scatterplot represents a strong relationship particularly during the 2003-2007 period before RCM, with only a moderate relationship after RCM implementation. The shape of the line indicates that there may first have been a decline in the financial aid offered but it has increased during the period studied with a downward trajectory predicted in the future. The shape of the line would indicate that the amount of financial aid will continue to increase. Comparatively, the relationship at Kent State University between enrollment and financial aid has the same R-squared value as Iowa State University. In 2012 and 2013, the average financial aid amounts awarded were \$3,916 and \$3,926 while enrollment was 18,533 students (2012) and 18,538 students (2013) so the \$10 difference in financial aid is adhering closely to the difference in enrollment of 5 students. In looking at these data points that are sitting somewhat removed from

the line, it appears a factor outside of RCM may be responsible for the closeness of these amounts.

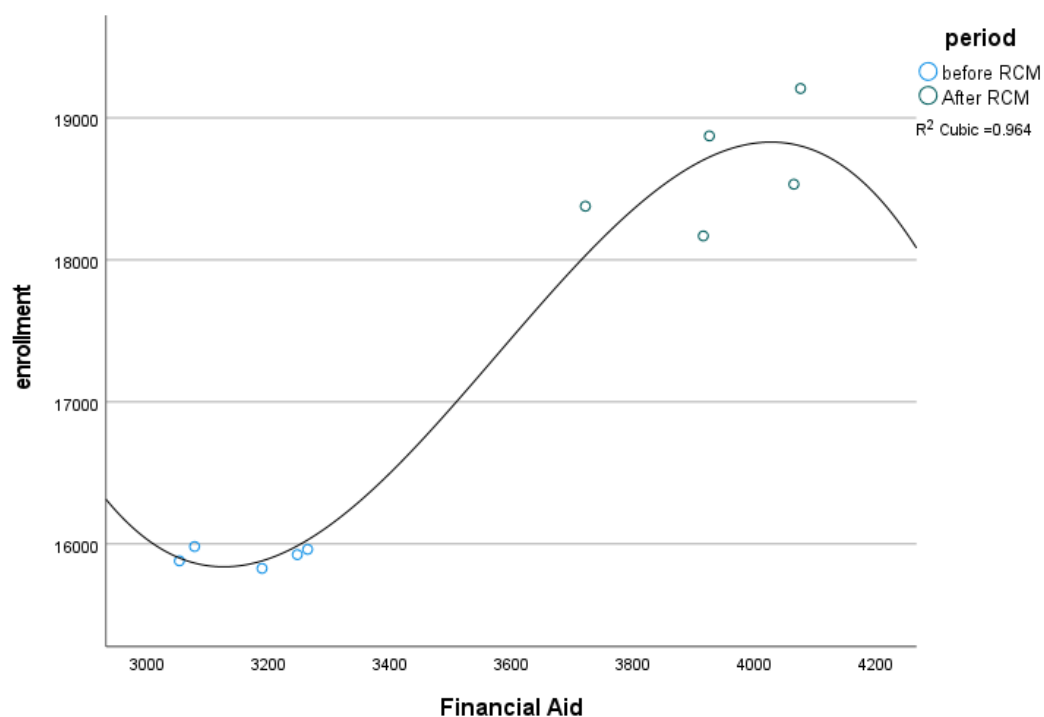


Figure 2: Scatterplot showing the relationship between enrollment and financial aid at Kent State University before and after implementation of RCM.

University of Cincinnati

Table 3 shows that there were statistically significant differences in all variables, graduation ($t = 6.212, p < .001$), financial aid ($t = 2.4, p < .043$), and retention ($t = 4.73, p = .001$) before and after RCM implementation at the University of Cincinnati. Inspection of the two group means indicates that the average number of graduates before RCM implementation ($M = 1505.0$) is significantly lower than after RCM implementation ($M = 2264.60$). The difference in the means is 759.6 (or approximately an increase of 760 students in a graduating class). The effect size for d is 3.93 [95% CI = (6.154, 1.637)] which is very large. In comparing the means for financial aid the average financial aid package before RCM implementation was ($M =$

3038.60) which is significantly lower than the financial aid package of (M = 3622.40) which is a difference in means of 585.8 or \$585.80 in financial aid packages before and after RCM implementation. The effect size for d is 1.52 [95% CI = (2.923, .044)] which is a very large effect size. A comparison of means for the percent of retention before RCM implementation is (M = 80.22) is lower than after RCM implementation (M = 86) or a 5.78 percentage point increase in the retention rate following RCM implementation. The effect size for d is 3.01 [95% CI = (4.882, 1.068)] which is a very large effect size.

Variable	M	SD	t	df	p	d (95% CI)
Graduation			6.212	8	< .001	3.93 (6.154, 1.637)
Before	1505.00	104.66				
After	2264.60	252.62				
Financial Aid			2.4	8	.043	1.52 (2.923, .044)
Before	3038.60	522.09				
After	3622.40	152.641				
Retention			4.73	8	.001	3.01 (4.882, 1.068)
Before	80.22	2.42				
After	86.00	1.22				

Table 3: Comparison of RCM at the University of Cincinnati before and after implementation on graduation, financial aid, and retention

When examining the relationship between enrollment (y-axis) and financial aid (x-axis) before and after the implementation of RCM at the University of Cincinnati, the R-squared quadratic and cubic lines yielded the highest identical result at 0.818 or 82% fit for the data for year groups 2003-2007 and 2011-2015. For this reason, the quadratic line was selected and is

represented. (Figure 3). The skewness for all 13 years considered together does not deviate significantly from the assumption.

As seen in the scatterplot, the association between the variables is a strong, positive, nonlinear one. The data did contain an outlier; an average financial aid package of \$2,134 in 2003 which was significantly lower than the \$3,068 average financial aid package in 2004 which started an upward trend in financial aid award amounts that never again dipped below \$3,000 during the period studied. The curve of the line indicates that financial aid had decreased rather significantly when compared to enrollment, but the strong upward trajectory of the line seems to indicate that the amount of financial aid is anticipated to increase with the enrollment trends over time. Across the period studied, enrollment increased from 15,725 students in 2003 to 21,017 students in 2015.

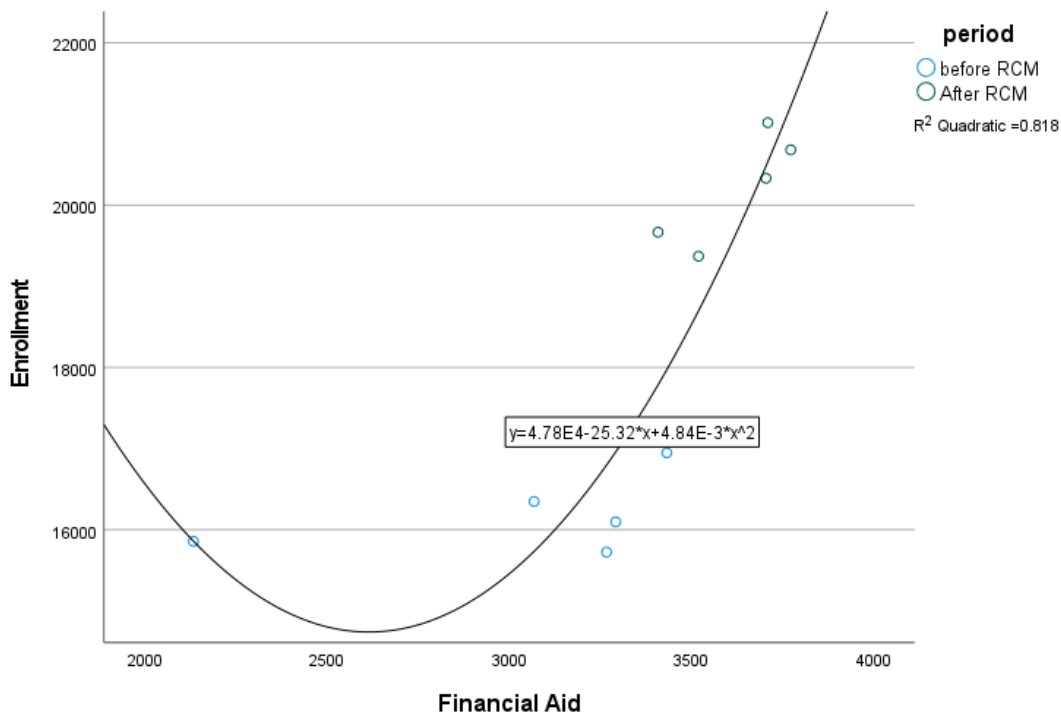


Figure 3: Scatterplot showing the relationship between enrollment and financial aid at the University of Cincinnati before and after the implementation of RCM.

University of Florida

Table 4 shows that there were statistically significant differences in all variables; graduation ($t = 3.869, p = .005$), financial aid ($t = -3.163, p = .007$), and retention ($t = 4.811, p = .001$) before and after RCM implementation at the University of Florida. Inspection of the two group means indicates that the average number of graduates before RCM implementation ($M = 4851.80$) is significantly lower than after RCM implementation ($M = 5657.60$). The difference in the means is 805.8 (or approximately an increase of 806 students in a graduating class). The effect size for d is 2.45 [95% CI = (4.118, .699)] which is very large. In comparing the means for financial aid, the average financial aid package before RCM implementation was ($M = 6453.60$) which is significantly higher than the financial aid package of ($M = 6178.40$) which is a difference in means of -275.20 or \$275.20 less in financial aid packages after RCM implementation. The effect size for d is 2 [95% CI = (.393, 3.533)] which is a very large effect size. A comparison of means for percent of retention before RCM implementation is ($M = 94$) is lower than after RCM implementation ($M = 95.8$) or a 1.8 percentage point increase in the retention rate following RCM implementation. The effect size for d is 3.04 [95% CI = (4.923, 1.087)] which is a very large effect size.

Variable	M	SD	t	df	p	d (95% CI)
Graduation			3.869	8	.005	2.45 (4.118, .699)
Before	4851.80	402.06				
After	5657.60	235.06				
Financial Aid			-3.163	8	.007	2 (.393, 3.533)
Before	6453.60	126.46				
After	6178.40	147.85				

Retention			4.811	8	.001	3.04 (4.923, 1.087)
Before	94.0	.71				
After	95.80	.45				

Table 4: *Comparison of RCM at the University of Florida before and after implementation on graduation, financial aid, and retention*

When examining the relationship between enrollment (y-axis) and financial aid (x-axis) before and after the implementation of RCM at the University of Florida, the R-squared cubic line yielded the highest result at 0.475 or 48% fit for the data for year groups 2003-2007 and 2011-2015 (Figure 4). The skewness for all 13 years considered together is .162 for financial aid and .411 for enrollment so the assumption of normality is met. (Figure 4). The association between the variables is a moderate, positive, nonlinear one. The data set did not contain any outliers.

The curve of the line indicates that financial aid had increased rather significantly when compared to enrollment, but it leveled off a bit before beginning an upward trajectory again. The data points before and after RCM at the University of Florida do not adhere as closely to the line as any of the previous institutions examined. This, in addition to a 48% fit to the cubic line and less for the linear (28.7%) and quadratic lines (29%) indicates that at the University of Florida the correlation between enrollment and financial aid is not nearly as strong as it is at the other institutions.

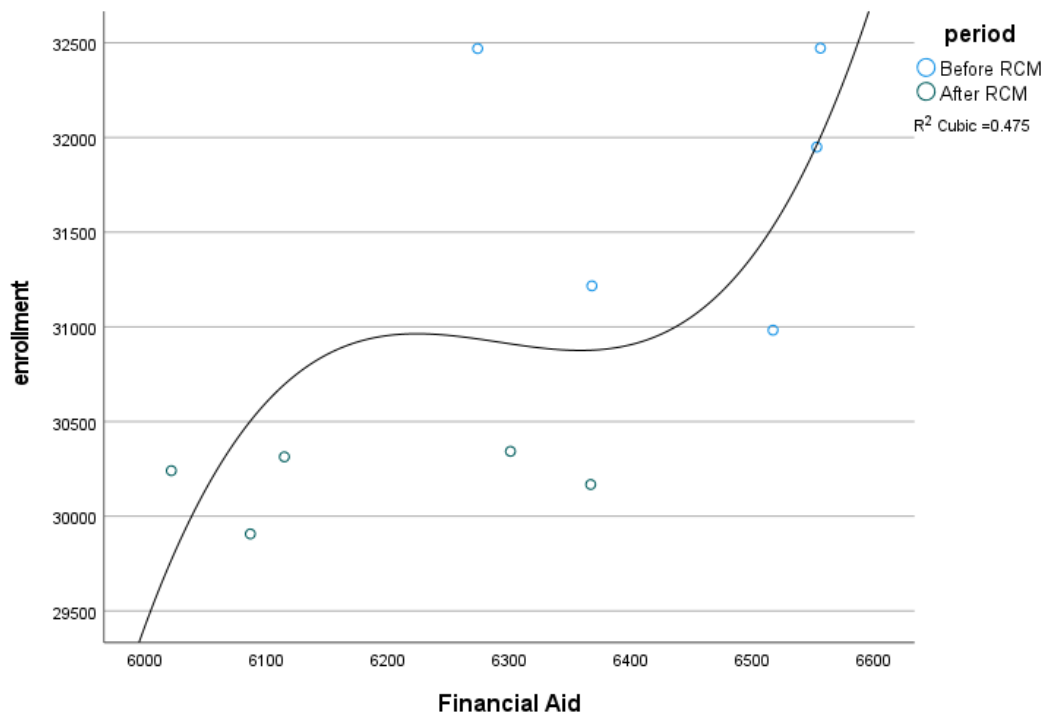


Figure 4: Scatterplot showing the relationship between enrollment and financial aid at the University of Florida before and after the implementation of RCM.

Aggregated Institutions

Table 5 shows that there were increases in all variables; graduation, financial aid, and retention before and after RCM implementation at the 4 institutions combined the results in aggregate were not statistically significant. Inspection of the two group means indicates that the average number of graduates before RCM implementation ($M = 2666.20$) is less than after RCM implementation ($M = 3198.75$). The difference in the means is 532.55 (or approximately an increase of 533 students in a graduating class across all institutions combined). In comparing the means for financial aid the average financial aid package before RCM implementation was ($M = 4013.45$) which is significantly lower than the financial aid package of ($M = 4680.75$) which is a difference in means of 667.3 or \$667.30 in financial aid packages before and after RCM implementation. A comparison of means for the percent of retention before RCM

implementation is ($M = 82.99$) is lower than after RCM implementation ($M = 86.8$) or a 3.81 percentage point increase in the retention rate following RCM implementation.

Variable	M	SD	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i> (95% CI)
Graduation			1.157	38	.254	.366 (.989, .262)
Before	2666.20	1411.14				
After	3198.75	1509.13				
Financial Aid			1.649	38	.107	.521 (1.149, .113)
Before	4013.45	1475.07				
After	4680.75	1049.38				
Retention			1.663	38	.105	.526 (1.153, .108)
Before	82.99	7.96				
After	86.80	6.44				

Table 5: *Comparison of RCM across all 4 institutions before and after implementation on graduation, financial aid, and retention*

When examining the relationship between enrollment (y-axis) and financial aid (x-axis) before and after the implementation of RCM for all the institutions aggregated, the R-squared cubic line yielded the highest result at 0.950 or 95% fit for the data (Figure 5). The association between the variables is a strong, positive, nonlinear one. The data set did not contain any outliers.

The larger data set (38 data points) shows a very strong correlation between enrollment and financial aid. The data points sit close to the cubic line and show a predicted trajectory of an increase in financial aid as enrollment increases. It is still impossible to determine with certainty that RCM is the only or even the strongest catalyst behind this trend.

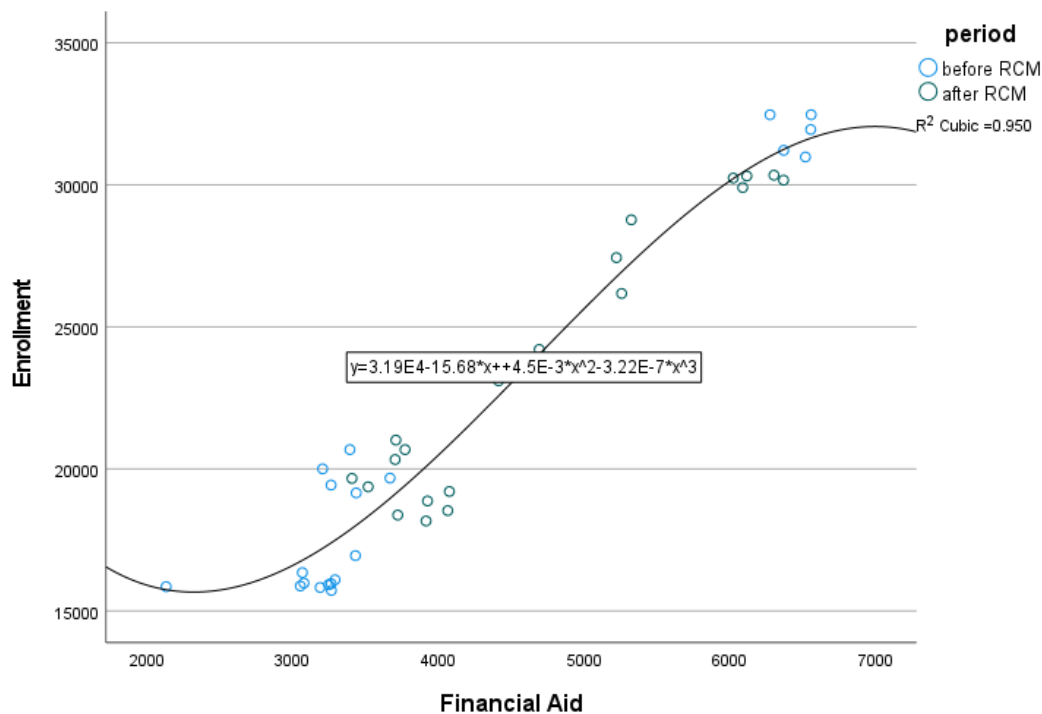


Figure 5: Scatterplot showing the relationship between enrollment and financial aid at the aggregated institutions before and after the implementation of RCM.

Discussion and Implications

While Jaquette, Kramer, and Curs (2018) employed a synthetic control method (SCM) to analyze tuition revenue, the present study leveraged t-tests and correlations to compare different variables for each of the four institutions, independently and then together as one group. Although simpler to conduct than SCM, t-tests and correlations (effectively depicted in the scatterplots) supported the findings of the initial study and tested the additional variables of graduation, financial aid, retention, and enrollment as well. In so doing, RCM as understood in a before and after implementation context emerged. There was no need to introduce non-RCM adopters into this study when the data readily available in IPEDS demonstrated specific outcomes on each of the variables per institution when analyzed and compared in a pre-and post-RCM environment.

In this study, the implementation of RCM appears to have increased the means for the variables of graduation, financial aid, and retention. By comparing the means of the before and after implementation periods, variables enjoyed an increase with only a few exceptions. It is important to note that in keeping with the research of Jaquette, Kramer, and Curs (2018), the University of Florida, which has the highest enrollment of all the schools, saw the weakest effects of RCM implementation. It is possible that its large size reduced the impact that RCM implementation had on the variables. Very large institutions and very small institutions often yield the least successful results with RCM implementation (Dick 1993; Hillman et al. 2015; Palmer 2014). Furthermore, the University of Florida is the only institution wherein a variable, namely financial aid, was offered at a higher rate before RCM implementation than after. No other variable within this study saw a decrease after the implementation of RCM.

RCM's correlation with these outcomes may seem to be a resounding endorsement for institutions to adopt it as a model, despite the drawbacks identified in the literature (Adams 1997; Agostino 1993; Bouillon, Smith, and Ehoff 2021; Deering and Sa; Hearn et al 2006). The substance of these findings, however, should not be interpreted as RCM providing the best solution for all institutions. Individual goals of an institution need to be considered before implementing RCM as a budgetary model (Deering and Lang 2017; Fethke and Policano 2019).

In further consideration of the institution size, it is interesting that the largest impact of RCM on the variables selected for this study was observed at the two universities that have the smallest (and most closely related) enrollment numbers. With an enrollment of 15,828 to 19,207 students between 2003 and 2015 at Kent State University and 15,725 to 21,017 students from 2003-2015 at the University of Cincinnati, the two institutions proved similar in the impact of RCM on the variables. This relationship might indicate that RCM has a more beneficial impact

on institutions with smaller enrollment numbers. Future research might examine RCM adopters with similarly sized enrollments to further support this idea.

RCM implementation had the greatest impact on Kent State University followed closely by the University of Cincinnati as understood by the results of the t-tests and p -values for each of the variables. It is at these two institutions that RCM showed its most significant impact in this study. In this way, they are the two most successful results coming from RCM implementation as considered by the outcomes of these tests. Iowa State University and Kent State University both had a 96% cubic line fit for the relationship between enrollment and financial aid. Although not linear, the relationship between the two variables was very strong.

Although it was an artificial strategy to combine all four institutions to compare the means of the variables, an increase in graduation numbers, financial aid packages, and retention percentages was observed although the results of the p -value for each were not statistically significant. The r-squared cubic line on the scatterplot showed a 95% relationship between enrollment and financial aid. As enrollment increased throughout the RCM years, so too did financial aid.

Limitations and Future Research Directions

By design, this article is confined to an investigation of a sample of 4 public, 4-year universities in the United States that have implemented RCM financial models in a similar chronology to each other. It includes enrollment only as it pertains to first-time full-time undergraduates, seeking a bachelor's degree, excluding graduate students and graduate program information. It includes statistical data available on IPEDS and presupposes the accuracy of this data which is self-reported by institutions of higher education. IPEDS also represents high-level data, which may not demonstrate subtlety in trends the way that departmental-level data might.

Inherent to statistical testing by year dates, it is difficult to understand whether RCM is the only or the most impactful catalyst for observed changes. Another factor or factors may have intervened to account for the outcomes across the period studied. In this way, a quantitative study involving only reported numbers is limited in identifying the reasons behind trends though the combination of variables assists in illuminating possible relationships between the variables during the period when RCM was implemented. A qualitative study involving interviews with stakeholders at each of the institutions would perhaps best provide information about other initiatives and policies that could have impacted the observed changes during these years and such a study should be conducted by future researchers.

Since tuition income is critical to the success of RCM, an investigation of the impact of its implementation on graduate programs and graduate students may demonstrate additional trends. Confining this study to only undergraduates means that the added value that graduate programs bring to RCM as well as the benefits they might realize from the implementation of RCM are unknown. Future research should examine the impact of the variables used in this study, or a selection of additional variables, to understand the impact of RCM on graduate students and graduate programs.

This study intentionally excludes more recent data. In part, this is due to maintaining the parameters of the 2008-2010 RCM implementation dates for these institutions, but data that ends in 2015 does not account for the status of these institutions today. Regardless, this study would intentionally exclude the academic year 2019-2020, forward, to avoid anomalies in enrollment caused by the global COVID-19 pandemic. Enrollment data from these years was undoubtedly directly affected by COVID-19, but in their raw number form, it may be difficult to identify and discard, thereby potentially skewing the results. RCM-incentivized behaviors may help

institutions survive budget anomalies created by the pandemic (Gray 2020). Additional research is needed to investigate the impact of RCM during the COVID-19 pandemic by examining the years leading up to the pandemic, the pandemic years, and the post-pandemic landscape to better understand any relationship between RCM implementation and the COVID-19 pandemic.

For the sake of consistency, all the data was collected via IPEDS. Therefore, the selection of variables was heavily influenced by availability. Some variables that may have been interesting to examine were not recorded evenly for each institution, which would skew the statistical tests. Therefore, any variable missing data for any institutions during the dates examined had to be excluded from the study. One such example is data on program creation. Whether and how RCM creates additional programs and what those programs are is of continuing interest to a study of this budget model. While this information was not available in IPEDS, future qualitative research, conducted via interviews, would help inform this aspect of RCM's impact.

Conclusion

Responsibility center management (RCM) is a budget model that may benefit certain academic institutions. This study brought together several variables to compare means before and after RCM implementation. In the case of each variable examined, there was a demonstrable increase in enrollment, graduation rate, financial aid packages, and retention although the specific impacts at each institution were to a greater or lesser effect. Only one variable at one institution did not appreciate after RCM implementation. Numbers, however, only tell one part of the story. Administrators looking to implement RCM as a budget model must understand the full context of their institution to determine if RCM is a worthwhile approach. A prioritization of

specific goals needs to transpire to understand what RCM might be able to provide, and at what cost to other initiatives on campus.

Mindful and careful planning, coordination, and rollout are paramount to success in transitioning to any new budget model (Deering and Sa 2017; Dick 1993), as is creating an environment of open communication and avoiding misunderstanding (Hearn et al. 2006). Year-end reporting needs to include student success outcomes such as retention and degree completion along with financial outcomes (Kosten 2016). Goals such as access, quality, and efficiency should relate to existing academic programs and units and should inform the creation of new academic programs (Hearn et al. 2006). Policy design, in this case, RCM and administrative responses to it, ultimately determine the efficacy of the program as governance and organizational performance are intrinsically linked (Rabovsky 2012).

Deans (and other RCM implementors) need to advocate for their areas (Stocum and Rooney 1997). Provided that deans are expected to bring complex budget management skills to their units regardless of their background or experience (Harris 2020a), they have a chance at creating organizational change, a culture of enhanced camaraderie, and a new or renewed trust in leadership within their units by requesting input and engagement within their units toward the success of RCM (Andrews and Hill 2003; Harris 2020b; Vonasek 2011). Deans must understand that academic priorities lead the discussion, rather than the budget, and develop an aptitude for determining priorities and supporting them with RCM budget decisions (Adams 1997; Neal and Smith 1995). Not surprisingly a dean's budget under RCM can indicate the priorities of their leadership (Harris 2020a). At no point in the process should RCM be weaponized or used punitively against units, even those struggling (McBride, Neiman, and Johnson 2000). RCM can

bring transparency to the ways in which supportive, but not self-reliant units (cost centers) can rely on cross subsidies toward greater efficiency (Fethke and Policano 2019).

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