# An Evaluation of the Veterans Health Administration Health Services Research and Development Career Development Award Program

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# EXECUTIVE SUMMARY

To ensure future generations of investigators focusing on health services research that will improve health care for Veterans, the Veterans Health Administration (VHA) Office of Research and Development (ORD) Health Services Research and Development (HSR&D) Service has had a Career Development Award (CDA) Program since 1991. Via salary support, training and mentoring, this program strives to transform promising investigators into productive health services researchers who can advance VHA's mission of providing high quality health care to Veterans. Although the HSR&D CDA Program has been in existence for more than two decades, it has not been systematically evaluated during that time.

It is difficult, if not impossible, to isolate the causal effects of career development awards from that of the selection process in comparisons of funded and unfunded applicants for awards. A more interpretable approach is to compare the outcomes of award recipients to those of awardees in other, well-regarded career development programs that have comparable selection criteria. In addition, useful information can be obtained from identifying predictors of "success" among career development awardees. Thus, the current evaluation had two primary aims:

*Aim 1: Compare the academic advancement and research productivity of HSR&D Career Development Awardees, National Institutes of Health (NIH) K awardees in health services research and Agency for Healthcare Research and Quality (AHRQ) K awardees.*

*Aim 2: Predict the academic advancement, research productivity and VA involvement of HSR&D CDA recipients.*

As secondary aims, we also (a) gathered information from HSR&D Center of Excellence (CoE) Directors, HSR&D CDA Review Committee members, directors of other research career development programs, and two past HSR&D Service Directors regarding how career development programs might be improved, and (b) compiled the accomplishments of outstanding VHA health services researchers who have received HSR&D Research Career Scientist Awards to provide salary support for their work. Results addressing these secondary aims are presented in separate reports.

## METHODS

Of 244 researchers granted and accepting HSR&D CDAs from FY1991 through FY2010, 219 (90%) provided a curriculum vita (CV). Of the 124 unique individuals serving as primary mentors for the 219 HSR&D CDAs, 118 (95%) provided a CV. Those mentors providing a CV had mentored 212 of the 219 CDAs. Of 226 selected NIH K01, K08 and K23 awardees from FY1991 through FY2010 who conducted health services research (HSR) comparable to that of HSR&D CDAs, 154 (68%) provided a CV. Finally, of 91 AHRQ K01 and K08 awardees from FY2000 (the first year AHRQ granted K awards) through FY2010 conducting VA-comparable HSR, 69 (76%) provided a CV. Relevant information from CVs was coded through 2010 and entered into a MicroSoft Access database. In addition, the Hirsch *h*-index, an indicator of the extent to which researchers' publications are cited, was downloaded for the HSR&D CDA, NIH K and AHRQ K awardees from the Thomson Reuters Web of Knowledge database as an indicator of the quality of their publications.

## FINDINGS

We compared the full samples of HSR&D and NIH awardees, controlling for years since award. In order to provide additional control for nonlinear effects of time, we also compared the samples of HSR&D, NIH and AHRQ awardees from 2000 through FY2010. Some HSR&D CDAs had received more than one award. When multiple awards had been received, the mid-level Research Career Development (RCD) award, Merit Review Entry Program (MREP) award, or Career Development Award-2 (CDA-2) was considered the relevant award for this evaluation, as these were most similar to K awards.

### Awardees' Pre-award Characteristics

The three groups of awardees were between 37 and a little over 38 years of age, on average, when they received the awards. Men were more predominant among all of the HSR&D CDAs relative to the full sample of NIH awardees (Table 3b, pg. 18). For the awardees from 2000 or later, majorities of the HSR&D CDAs and AHRQ K awardees were male. Researchers from minority (white-Hispanic or non-white) groups were proportionately fewer among all HSR&D CDAs in comparison to all NIH K awardees; this difference held for these two groups among awardees from 2000 and later, with AHRQ K awardees having an intermediate percentage of minority group researchers. The higher percentages of minority NIH and AHRQ K awardees were due primarily to the much larger percentages of Asian researchers in those two groups, although the percentage of African-American researchers in the two K awardee samples also was higher than in the HSR&D CDA sample. Almost two-thirds of all HSR&D CDAs and NIH K awardees had an MD degree (Table 3c, pg. 19). Among the three groups of awardees from 2000 and later, the percentage of HSR&D CDAs with an MD dropped to 56%, versus 64% of NIH K awardees and 71% among AHRQ K awardees. Most of the remaining awardees in all three groups had a PhD as their highest degree (other pre-award characteristics of the participants are provided in Table 3d, pg. 19).

### Comparing the Career Advancement and Productivity of HSR&D, NIH and AHRQ Awardees

To compare the outcomes through 2010 of HSR&D, NIH and AHRQ awardees, analyses of covariance for continuous outcomes and (multinomial) logistic regressions for dichotomous outcomes controlled for multiple covariates to adjust for pre-existing differences in the groups. Table I below provides summary data on the outcome comparisons for all HSR&D and NIH awardees, and for HSR&D, NIH and AHRQ awardees since 2000.

No significant differences emerged in covariate-adjusted mean tenure track academic rank between the full samples of HSR&D CDA and NIH K awardees, or among the three groups of awardees from 2000 or later. Collectively, the 219 HSR&D CDAs had been the Principal Investigators (PI) on 1,147 grants of $5000 or more (when funding amounts were provided; if not, the grant was still included), whereas the 154 NIH K awardees had been PI on 564 such grants (Table 6, pg. 21). Relative to the full sample of NIH K awardees, HSR&D CDAs had a higher adjusted mean number of grants as PI, but the difference was not statistically significant (Table 7, pg. 22). Likewise, no significant differences emerged in the adjusted number of grants as PI among the three groups of awardees since 2000. However, the HSR&D CDAs in

the full sample who reported funding levels had been PI on more grants of $100,000 or more relative to those in the full sample of NIH K awardees who reported grant amounts (Table 7, pg. 22).

### Table I: Summary of Outcome Comparisons Between All HSR&D and NIH Awardees, and Among HSR&D, NIH and AHRQ Awardees Since 2000

| Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) Total, Mean or % | NIH K (n=154) Total, Mean or % | HSR&D (n=161) Total, Mean or % | NIH K (n=132) Total, Mean or % | AHRQ K (n=69) Total, Mean or % |
| **Adjusted Mean Tenure-Track Academic Rank*** | 1.2 | 1.3 | .9 | 1.0 | 1.0 |
| **One or more grants as PI** | 83% | 77% | 78% | 76% | 62% |
| **PI on at least one grant of $100,000 or more (n=number reporting grant amounts as PI)** | 84% (n=154) | 87% (n=91) | 78% (n=107) | 86% (n=76) | 58% (n=31) |
| **Total grants as PI** | 1,147 | 564 | 547 | 401 | 146 |
| **Total grants as PI over $100,000** | 585 | 226 | 234 | 157 | 57 |
| **Adjusted mean number of grants as PI** | 4.8 | 4.3 | 3.2 | 2.9 | 2.7 |
| **Adjusted mean number of grants as PI over $100,000** | 2.4[1] | 1.8 | 1.3 | 1.2 | 1.2 |
| **Major journal articles** | 9,350 | 4,234 | 4,346 | 2,949 | 1,271 |
| **Major journal articles as first or sole author** | 2,480 | 1,497 | 1,449 | 1,053 | 527 |
| **Adjusted mean number of major journal articles** | 39.0[1] | 32.8 | 25.3 | 22.8 | 21.6 |
| **Adjusted mean number of major journal articles as first or sole author** | 10.4 | 11.0 | 8.4 | 8.1 | 8.8 |
| **Adjusted mean *h*-index** | 15.8 | 15.6 | 12.2 | 12.9 | 12.0 |
| **Adjusted journal editorship/editorial board position[+]** | 33% | 40% | 23% | 27% | 32% |
| **Adjusted grant review committee membership [+]** | 15% | 11% | 10% | 8% | 6% |
| **Adjusted Number of Postgraduate Mentees** | 8.5 | 7.3 | 6.7 | 5.5 | 7.2 |

*0=None, 1=Assistant Professor, 2=Associate Professor, 3=Professor. [1] $p<.05$ difference between all HSR&D and NIH K awardees. "Adjusted" outcomes are with covariates controlled. [+]Covariate adjusted predicted probabilities.

In all, the 219 HSR&D CDAs had published over 9,000 major journal articles (i.e., articles that were not editorials, letters to the editor, brief commentaries or book reviews), almost 2,500 as first or sole

author (Table 8, pg. 23); the full sample of 154 NIH K awardees had published over 4,000 major journal articles, almost 1,500 as first or sole author. Relative to all NIH K awardees, HSR&D CDAs had a significantly higher adjusted mean number of major journal articles (Table 9, pg. 23). However, no significant differences were found between the two samples in the adjusted number of major journal articles as first or sole author or in the *h*-index, or among awardees since 2000 on any of these indices.

No significant differences emerged between the full samples of HSR&D and NIH awardees, or among the three groups of awardees since 2000, on the likelihood of having a journal editorship position or serving as a standing review committee member for a major granting entity (Table 10, pg. 24), or on the number of postgraduate researchers who subsequently had been mentored (Table 11, pg. 24).

## Predictors of Career Advancement and Productivity Among HSR&D CDAs

Seven outcomes were the focus of predictive analyses. For the 212 HSR&D CDAs whose primary mentors had provided a CV, the CDAs' average academic rank in 2010 was slightly above an Assistant Professor level (Table 13, pg. 26). They had published a mean of over 40 major journal articles and they had a mean Hirsch *h*-index of almost 17, indicating that, on average, they had about 17 publications each of which had been cited 17 times or more. The CDAs had secured a mean of over five grants as PI and 38% had at least one journal editorship position. With respect to VA-related outcomes, 80% of the 212 CDAs were in VA at the end of 2010, with 74% in research positions. Forty-one percent of them had been involved in some capacity in the VHA Quality Enhancement Research Initiative (QUERI), an HSR&D program that focuses on implementing evidence-based practices to improve health care for Veterans.

The 112 participating mentors had mentored as few as one to as many as eight CDAs (Table 14, pg. 27); information on the mentors' predictive characteristics is in Table 13. The universities that were the primary academic affiliates of the VHA facilities at which CDAs were located when they received their awards had an average ranking of slightly over 80 (a ranking of 100 was the best possible) in terms of the amount of NIH grant funding received by the universities' medical centers in that year (Table 13, pg. 26). HSR&D Centers were established with the goals of promoting VHA HSR and enhancing VHA's HSR research capacity by developing new HSR investigators. Over 70% of the awardees were located at VHA facilities that had an HSR&D Center at the point they received their CDA.

The general outcomes (tenure-track rank, number of major journal articles, *h*-index, number of grants as PI, and at least one journal editor position) were moderately to strongly intercorrelated, indicating these indices tap aspects of general progress in a research career (Table 15, pg. 28). All of the general outcomes also were significantly, though modestly, positively correlated with retention in VA, and all but one were modestly and positively correlated with stronger involvement in the HSR&D QUERI.

In multivariate analyses, the covariate, years since the relevant CDA, not surprisingly, was consistently and strongly positively correlated with each of the outcomes (Table 16, pg. 29). Significant independent relationships of the predictors with the seven outcomes were relatively few and generally modest in magnitude; thus, some may be due to chance. Gender was unrelated to the outcomes, except that female CDAs tended to published fewer major journal articles than males. Whereas minority group status was unrelated to any of the outcomes, CDAs with MD degrees tended to have

higher tenure-track academic positions and were more likely to have held at least one journal editorship position. CDAs who received their highest degrees from universities with higher (better) NIH research funding rankings were more likely to be involved in the HSR&D QUERI. Those who received a CDA after more years had expired after receiving their doctoral degree or, for MDs, completing a residency, had higher tenure-track academic ranks, whereas receipt of postdoctoral training was unrelated to any of the outcome variables. Although number of grants as PI received prior to the CDA also was unrelated to outcomes, those awardees who had published more major journal articles up to the first year of their award published more major journal articles subsequently and had higher *h*-indices.

None of the characteristics of primary mentors independently predicted outcomes for HSR&D CDAs, except that mentors who had received more grants tended to advise CDAs who subsequently had lower citation indices. However, those CDAs whose affiliated university had a better NIH research ranking published more journal articles and were more likely to attain a journal editorship position and to be retained in VA. Finally, the presence of larger HSR&D Centers was linked to receiving more grants as PI and greater involvement in the QUERI, but a lower likelihood of having had a journal editorship position.

Overall, when data from only 118 independent CDA-mentor dyads were analyzed, many of the relationships between the predictors and HSR&D CDAs' outcomes were similar to those for the sample of 212 CDAs (see Appendix C), some of latter of whom were "clustered" within the same primary mentors. However, some relationships were no longer significant in the independent sample, perhaps reflecting reduced statistical power, and a few were significant that had not been so with the larger N.

## DISCUSSION

### Comparing Outcomes for HSR&D, NIH and AHRQ Awardees

HSR&D CDA, NIH K, and AHRQ K awardees, on average, were between 37 and a little over 38 years old at the point they received there awards; one-quarter (HSR&D and NIH) to one-third (AHRQ) were age 40 or older. Although this may appear to be an advanced age for a "career development" award, it was increased by the fact that researchers with MDs (two-thirds of all participating awardees had MD degrees) typically do not begin their research careers until after completing a residency or later. A more informative statistic is that, on average, the groups of awardees were from 5.4 to 6.9 years into their research careers (post-residency for MDs and post-doctoral degree for others) at the point they received their awards. Moreover, about three-quarters or more of the awardees in each group had received some form of postdoctoral training. Thus, it may not be surprising that highly competitive CDA and K awards, which sometimes require multiple applications, are received by individuals who have approximately 30 years remaining in their research careers (assuming they work until age 67).

Some differences emerged in the pre-award characteristics of the HSR&D, NIH and AHRQ awardees. Although 43% of all HSR&D CDAs and 47% of those receiving a CDA in 2000 or later were women, the percentages of women among the NIH and AHRQ awardees were higher. It also is noteworthy was that the percentages of researchers from racial/ethnic minorities were higher among NIH/AHRQ K awardees than among HSR&D CDAs. Those differences were driven by the substantially higher percentages of

Asian researches among NIH and AHRQ K awardees, but the percentages of Hispanic, Native American, and, especially, African-American researchers also were larger relative to those for the HSR&D CDAs.

Controlling for pre-existing differences, the most important conclusion emerging from this evaluation is that HSR&D CDAs typically performed as well or better than K awardees in health services research from the highly regarded NIH and AHRQ programs on key metrics of academic advancement and research productivity (e.g., number of grants as PI, major journal articles as first or sole authors, citation (*h*) index scores). The exceptions to the no-difference findings favored the HSR&D CDAs. For those awardees reporting grant funding amounts, the HSR&D CDAs had been PI on significantly more grants of $100,000 or more, and HSR&D CDAs also had a significantly higher covariate-adjusted mean number of major journal articles than did the full sample of NIH K awardees. These findings support the quality of the HSR&D CDA Program. At a minimum, the overworked Dodo bird verdict would seem to apply regarding the three career development programs: "All have won and all must have prizes."

### Predictors of Academic Advancement, Research Productivity and VA-related Outcomes for HSR&D CDAs

At 80%, VA retention of HSR&D CDAs was substantial. Thus, the CDA Program is achieving its goal of retaining productive health services researchers in VA. Overall, awardees who had received their CDAs earlier were more likely to still be in the VA. One might have thought that years since CDA would be negatively related to VA retention, given that current awardees were in VA. In addition, over 40% of the HSR&D CDAs had been involved in the HSR&D QUERI. Thus, many past and current HSR&D CDAs have worked directly to improve VHA health care for Veterans through their participation in this quality enhancement program. These two VA-related outcomes for HSR&D CDAs, as well as five general career development outcomes (tenure-track academic rank, grants as PI, major journal articles, the *h* citation index, and having at least one journal editorship position) were the focus of predictive analyses.

**Pre-Award Personal Characteristics.** Female and male CDAs did not differ on outcomes in multivariate predictive analyses, except that female CDAs tended to publish fewer major journal articles. Given the number of relationships examined, this finding may be due to chance. However, prior research has documented the greater challenges faced by women with research careers in terms of the impact of child birth, child-rearing, and greater household responsibilities. We found no significant relationships between minority group status and either general or VA-related outcomes. However, CDAs with MD degrees exhibited greater academic advancement and research success than those with PhDs or other terminal degrees. These outcome differences may reflect pre-award differences in the personal characteristics and/or environmental contexts of MDs relative to awardees with PhDs and other terminal degrees. However, it also is the case that the careers of health services researchers likely follow other than linear trajectories over time; more recent awardees may advance less rapidly at their academic institutions or publish at a lower rate than those who received awards longer ago. If this is so, given that physicians were more prevalent in the early years of the CDA Program, controlling for years since award would not fully adjust for the "effects of time" in comparing their academic career advancement and productivity with that of non-MD researchers.

**Pre-Award Productivity Indices.** Having obtained more grants (presumably mainly pilot and other relatively small grants) prior to receiving a CDA was not linked to any of the subsequent outcomes. This finding suggests that securing grants prior to applying for a CDA, in the context of all the other predictors examined here, is not an indicator of potential to which the HSR&D CDA Review Committee should attend strongly in reviewing CDA applications. On the other hand, having published more major journal articles prior to receiving a CDA was related in the multivariate analyses to both the later publication of more major journal articles and to higher citation indices. These findings support the CDA Review Committee's placing significant weight on major journal publications in its evaluations of applications for CDAs, as this past behavior seems predictive of future performance.

**Primary Mentor Pre-Award Characteristics.** Of the primary mentor characteristics, only the number of grants as PI up to the time of award was significantly related to lower subsequent *h*-indices for awardees in the multivariate analyses. The lack of significant findings mirrors the evaluation by Ross et al. (2009), who found that mentor characteristics (gender, PhD degree, funded R01 grants, publication rate, and the *h*-index) were unrelated to the later publication productivity of postdoctoral trainees (Ross et al. reported bivariate analyses, not analyses with other predictors controlled, however). Having data on other members of CDAs' mentoring teams may have improved the prediction of CDAs' subsequent outcomes from mentor characteristics. However, such aspects of mentorships as the time devoted, the quality of the awardee-mentor relationships and the quality of mentors' advice are likely to be more influential for awardees' future productivity than objective characteristics of mentors. These more in-depth and qualitative aspects of mentorships and mentoring relationships, along with their relationships to CDAs' satisfaction, academic advancement, research productivity and VA involvement, will be examined in an ongoing second phase of the HSR&D CDA Program evaluation.

**Research Ranking of the Affiliated University.** This evaluation provides relatively rare information on the influence of the contexts in which CDAs were located on their future productivity and VA involvement. Holding other factors constant, if the research ranking of the university affiliated with the VHA medical center where an awardee was located at time of award was higher, the awardee tended to publish more major journal articles, to be more likely to have a journal editorship position, and to be more likely to remain in the VA. Thus, the standing of affiliated universities appears to play a role in facilitating the research progress of CDAs, as well as enhancing the likelihood of retaining them in VA.

**Presence of HSR&D Centers.** VHA has devoted substantial resources to building its capacity for health services research by establishing HSR&D research centers at various VHA medical centers. Given that over 70% of the 212 CDAs came from VHA facilities with some type of HSR&D Center, the Center program has been highly successful in increasing the number of health services researchers in VHA. In the multivariate analyses, a higher level (i.e., with more investigators and more funding) of HSR&D Center (if any) located at CDAs' VHA medical centers at the time of award was predictive of awardees' later having more grants as PI and greater involvement in the HSR&D QUERI, but also a lower likelihood having at least one journal editor position.

**Multivariate Predictive Analyses.** Our multivariate analyses accounted for 13% of the variance in QUERI involvement to 66% of the variance in *h*-indices, with 2% to 49% of the variance in those

outcomes, respectively, explained solely by the number of years since award. These findings suggest that data on additional factors are needed to better account for CDAs' subsequent academic advancement, research productivity, and VA involvement. Capturing a CDA applicant's passion for research, drive, and VA commitment requires more than such simple indicators as the number of previous grants or publications. Presumably, some clues on other important determinants of career potential are contained in the written applications for CDAs that are evaluated by the CDA Review Committee. In addition, great knowledge of the qualitative aspects of mentorships and mentoring relationships may provide additional insights into the determinants of HSR&D CDAs' career trajectories.

## LIMITATIONS

Although this evaluation provides important findings, it is not without limitations. To the extent that 10% of HSR&D CDAs who did not return a CV are likely to have lower productivity and VA retention than the 90% who provided a CV, the data presented here are overestimates the productivity and retention of all HSR&D CDAs. However, participation rates were lower among NIH and AHRQ K awardees. Thus, although the productivity of all groups of is likely overestimated using data from only those who returned CVs, the overestimation should be less for the HSR&D CDAs. On the other hand, time since award was greater for HSR&D CDAs than for NIH K awardees, which may have allowed them to exhibit greater productivity, even after only a linear control for years since award. Another limitation is that, for the comparisons of outcomes for HSR&D, NIH and AHRQ awardees, although 17 covariates were controlled, not all possible covariates were assessed. Their exclusion may have biased the comparisons.

## CONCLUSION

Those limitations notwithstanding, the findings presented here support the conclusion that the HSR&D CDA Program is selecting particularly promising applicants for CDAs and mentoring them effectively, as indicated by their academic advancement, grants, publications, honors and subsequent mentoring of young investigators, which, at a minimum, are equal to the accomplishments of K awardees from the highly regarded NIH and AHRQ programs. Moreover, the HSR&D CDA Program has been successful in retaining health services researchers in the VA where their research can make substantial contributions to improving the care of Veterans in VHA. This evaluation also provides findings that validate some of the criteria that HSR&D CDA Review committee members use in evaluating applications. In terms of personal characteristics, CDAs who had published more major journal articles prior to their awards published more after the award and had higher citation indices. For the contextual predictors, a higher NIH research funding ranking of the universities affiliated with awardees' VHA medical centers at the time of award was associated with the subsequent publication of more major journal articles, as well as a greater likelihood of holding at least one journal editorship position and of remaining in the VA. Likewise, the presence of a larger HSR&D Centers at awardees' VHA medical centers was predictive of their later securing more grants as PI and greater involvement in the QUERI program. The second phase of this evaluation should provide additional insights into the determinants (e.g., research commitment, greater accessibility to mentors) of HSR&D CDAs' career trajectories, as well as information that will inform even more effective mentoring of them.

# I. BACKGROUND

Health services researchers in the Veterans Health Administration (VHA) play a crucial role in enhancing the organization, delivery, quality and efficiency of health care for Veterans. To ensure that future generations of health services researchers can continue making such critical contributions, the VHA Health Services Research and Development (HSR&D) Service has supported a Career Development Award (CDA) Program for promising health services researchers since Fiscal Year (FY) 1991. Via salary support, training and mentoring, the HSR&D CDA Program seeks to develop and retain physician, other clinician, and non-clinician awardees as productive, impactful VHA health services researchers. Given an investment in the HSR&D CDA Program for more than 20 years, an evaluation of the program was warranted. This report presents findings from a comprehensive evaluation funded as a HSR&D Service Directed Research (SDR) Project. The evaluation had two primary aims:

Aim 1: Compare the academic advancement and research productivity of HSR&D Career Development Awardees, National Institutes of Health (NIH) K awardees in health services research and Agency for Healthcare Research and Quality (AHRQ) K awardees.

Aim 2: Predict the academic advancement, research productivity and VA involvement of HSR&D CDA recipients.

As secondary aims, we also (a) gathered information from HSR&D Center of Excellence (CoE) Directors on how they foster CDA applications and mentorship; (b) examined the current HSR&D CDA application and review processes, and solicited recommendations for improvement from HSR&D CDA Review Committee members; (c) queried directors of other research career development programs regarding how they select applicants, and support and monitor awardees and mentors; (d) interviewed two past Directors of the VHA HSR&D Service regarding their perceptions of the CDA Program's strengths and how it could be improved; and (e) compiled the accomplishments of outstanding VHA health services researchers who have received the HSR&D Research Career Scientist Award to support their salaries. Results addressing these secondary aims are presented in separate reports.

## A. VHA Health Services Research and Development (HSR&D) Service

HSR&D Service is one of four Research Services within the VHA Office of Research and Development (ORD). The other three are the Biomedical/Laboratory, Clinical Sciences, and Rehabilitation Research and Development Services (a report on the accomplishments of CDAs in these other three services is available). The mission of the HSR&D Service is described as follows on the HSR&D Website (accessed November, 2012):

> Health services research in VA examines the organization, delivery, and financing of health care, from the perspectives of patients, caregivers, providers, and managers to improve the quality and economy of care. Specifically, HSR&D is interested in evaluations of the structure, processes, and outcomes of care, including issues of patient safety and equity. HSR&D also is concerned with system-level outcomes such as assessments of cost and access, as well as effective ways to translate clinical knowledge into practice. The underlying objective of health services research in VA

is to understand and improve clinical decision-making and care, inform patients, evaluate changes in the health care system, and inform VA policymaking.

## B. HSR&D Career Development Award Program

In the early years of the HSR&D CDA Program, awards consisted of an Associate Investigator (AI) Award, a Research Career Development (RCD) Award, and an Advanced Research Career Development (ARCD) Award (more established researchers also could apply for ARCDs). AI awards offered individuals with little research experience the opportunity to work on projects funded by research grants their mentors had secured. Clinician-scientists could receive an RCD award and subsequently apply for an ARCD award if they required further support. Later, the Merit Review Entry Program (MREP) was initiated to provide three years of salary support and mentoring to PhD and other non-clinician researchers.

For many years, variations existed in the duration and review processes for awards across the four VHA Research Services. Consequently, in 2006, the career development awards of the four Services were "harmonized." Excerpts below from the *2006 VHA Handbook 100.4, Office of Research and Development Research Career Development Program* describe three types of career development awards resulting from that effort – the Career Development Award-1, which is similar to the earlier AI award; the Career Development Award-2, which is similar to the earlier RCD and MREP awards; and the Career Development Transition Award (CDTA), which is similar to the earlier ARCD:

- The **Career Development Award-1 (CDA-1)** provides an initial mentored research experience, consisting of up to two years of salary support, to highly qualified scientists with demonstrated abilities in key research areas who have not benefited previously from research fellowship-level training. Nominees must express a clear commitment to a VA career and enlist the support of at least one appropriately qualified VA mentor. . . . Non-clinician nominees need to be no more than two years beyond completion of their PhD or doctoral equivalent. Clinician nominees need to be no more than two years beyond clinical training (i.e., residency, internship, clinical fellowship, etc.). The suggested academic rank is Instructor. Nominees must not have been principal investigator (PI) or co-principal investigator (Co-PI) on a peer-reviewed independent research project supported by a national public or private organization.

- The **Career Development Award-2 (CDA-2)** provides salary and/or project funds to support a three to five year program of research career development and mentoring. Nominees need to demonstrate a high degree of potential in their area of interest and a strong VA commitment. By the end of the CDA-2, it is anticipated that the awardees are to have competed for independent funding. . . . Non-clinician nominees need to be no more than five years beyond completion of their PhD or doctoral equivalent. Clinician nominees need to be no more than five years beyond clinical training (i.e., residency, internship, clinical fellowship, etc.). The suggested academic rank is assistant professor. Nominees need not have been PI on a peer-reviewed independent research project supported by a national-level public or private organization in excess of

$50,000 a year. Nominees need to have at least one first-authored research publication pertinent to the general proposed research area.

- The **Career Development Transition Award (CDTA)** award provides up to three years of salary support for mid-career clinician scientists seeking to transition into careers as independently-funded VA investigators. Nominees must demonstrate the need for mentoring but need not have received a CDA-1 or CDA-2 previously. . . . Nominees must be VA clinicians. They need to be no more than 10 years beyond completion of their last residency, internship, clinical fellowship, etc. Suggested academic rank is associate professor. To be considered competitive, nominees need to have a strong publication record with several first-authored research publications in areas pertinent to the proposed career development area. The narrative portion of an approved (submitted, though not necessarily funded) VA merit review project must be attached as an appendix to the CDTA application.

A fourth type of CDA is the Career Development Enhancement Award (CDEA) which allows accomplished investigators to learn new research skills. Because the CDEA is a career enhancement award for established investigators, and not a career development award, individuals receiving only a CDEA were not included in this evaluation.

For the purposes of this evaluation, the RCD, CDA-2 or MREP award was considered the "relevant award" for those individuals receiving more than one HSR&D CDA. These three CDAs are the most comparable to National Institutes of Health (NIH) and Agency for Healthcare Research and Quality (AHRQ) individual-mentored K awards. If a researcher received only one HSR&D CDA, it was considered the relevant award, regardless of whether it was less advanced (e.g., AI, CDA-1) or more advanced (e.g., ARCD, CDTA) than an RCD, CDA-2, or MREP award.

## C. Competitive Review Process and Progress Monitoring

To apply for an HSR&D CDA, a candidate first sends in a Letter of Intent (LOI). If the LOI is approved, the candidate submits an application prior to one of two annual deadlines. As noted in the *2006 VHA Handbook 100.4, Office of Research and Development Research Career Development Program*, the application describes the applicant's and mentors' qualifications, a training/mentoring program and a research program. Submitted applications are considered by the HSR&D Career Development Award Review Committee, which evaluates the candidate's training and research experience, productivity in terms of publications, the appropriateness of the research and training plans, the qualifications of the proposed mentors in relation to the candidate's training plan and research goals, the relevance of the planned research to VA, the commitment of the candidate to a VA career, the commitment of the host VHA medical center to the candidate's VHA career, the significance, merit and feasibility of the proposed research, and the likely long-term contributions of the candidate to VHA. If the candidate's application is approved, progress reports are submitted annually during the period of the award. Criteria for evaluating the reports include progress exhibited in research and career development, publishing, and presenting at scientific and professional meetings.

## D. Prior Evaluations of Academic/Research Career Development Programs

Evaluating the quality of research or academic career development programs is challenging. Most prior evaluations of such programs have been single-group studies that have simply documented the retention of award recipients in research or academia, their productivity (publications, grants), and/or their academic advancement/retention (e.g., Rings et al, 2008; Steiner et al, 2002; Thompson et al, 2007). Others have compared the achievements of award recipients with those of unsuccessful applicants, often without attempting to adjust for baseline differences between the two groups (e.g., Fang & Meyer, 2003; Lichtman & Oakes, 2001; Mahoney et al. 2006; Mavis & Katz, 2003; Pion, 2001; Smith et al., 2009). In such evaluations, it is impossible to know to what extent differences in subsequent outcomes can be attributed to the receipt of a career development award versus the selection of more meritorious applicants for awards.

In an attempt to isolate award effects from selection effects, a recent evaluation of the NIH K award program (Discovery Logic, 2011) compared applicants whose priority scores were just below the "pay-line" with funded applicants whose scores were just above the cut-point. K award recipients were significantly more likely to have research publications, to have applied for NIH grants, and to have received NIH grants than unfunded applicants. Even this approach, however, leaves open the possibility that awardees were stronger applicants than those who were not funded, accounting for at least some of the differences in subsequent productivity. That concern was reinforced by Pion and Cordray's (2008) rigorous evaluation of the Burroughs Wellcome Career Awards in Biomedical Sciences Program. Although unadjusted analyses indicated awardees were more successful in terms of publications, securing NIH R01 grants, and obtaining faculty positions than applicants who had been selected for finalist interviews but not for awards, the two groups could not be balanced on pre-application characteristics using propensity scores (i.e., the conditional probability of being in the awardee group given measured covariates). Pion and Cordray concluded it was impossible to isolate the causal impact of awards from that of the selection process (see also Scriven & Coryn, 2008).

A more interpretable approach is to compare outcomes among the recipients of HSR&D CDAs with awardees in prominent career development programs in health services research (HSR) with comparable selection criteria. Thus, we compared the accomplishments of HSR&D CDA recipients with those of NIH and AHRQ K awardees in HSR. The NIH award program is a benchmark because of its size, national scope and reputation, and AHRQ's program is a benchmark because of its reputation for excellence in health services research. A comparative effectiveness evaluation has a strong advantage over a comparison of funded and unfunded applicants for a career development award: The programs are likely to draw from somewhat comparable applicant pools and select somewhat similar awardees. Thus, although we anticipated that some adjustment would be needed to "equate" awardees on pre-award characteristics, we did not expect a pre-existing merit gap among awardees from the three programs similar to that which has been found in evaluations comparing awardees with unfunded applicants for awards. Accordingly, for Aim 1 for the evaluation, we sought to compare the post-award academic advancement and research productivity of HSR&D CDAs and NIH and AHRQ K awardees in health services research.

## E. Aim 1: Compare the Academic Advancement and Research Productivity of HSR&D, NIH and AHRQ Awardees

Three types of individual-mentored NIH K awards, each lasting 3-5 years, provide salary support and protected research time with the goal of preparing researchers for productive careers:

- **K01 Mentored Research Scientist Development Awards** are intended to lead to research independence in the biomedical, behavioral, clinical sciences, or HSR (the focus here). Although awards typically are granted to young investigators, awards sometimes support individuals wanting training in a new field or who have had a research hiatus; they also are used to enhance researcher diversity.

- **K08 Mentored Clinical Scientist Research Career Development Awards** are for individuals with clinical doctoral degrees to prepare them for health-related careers in biomedical or behavioral research.

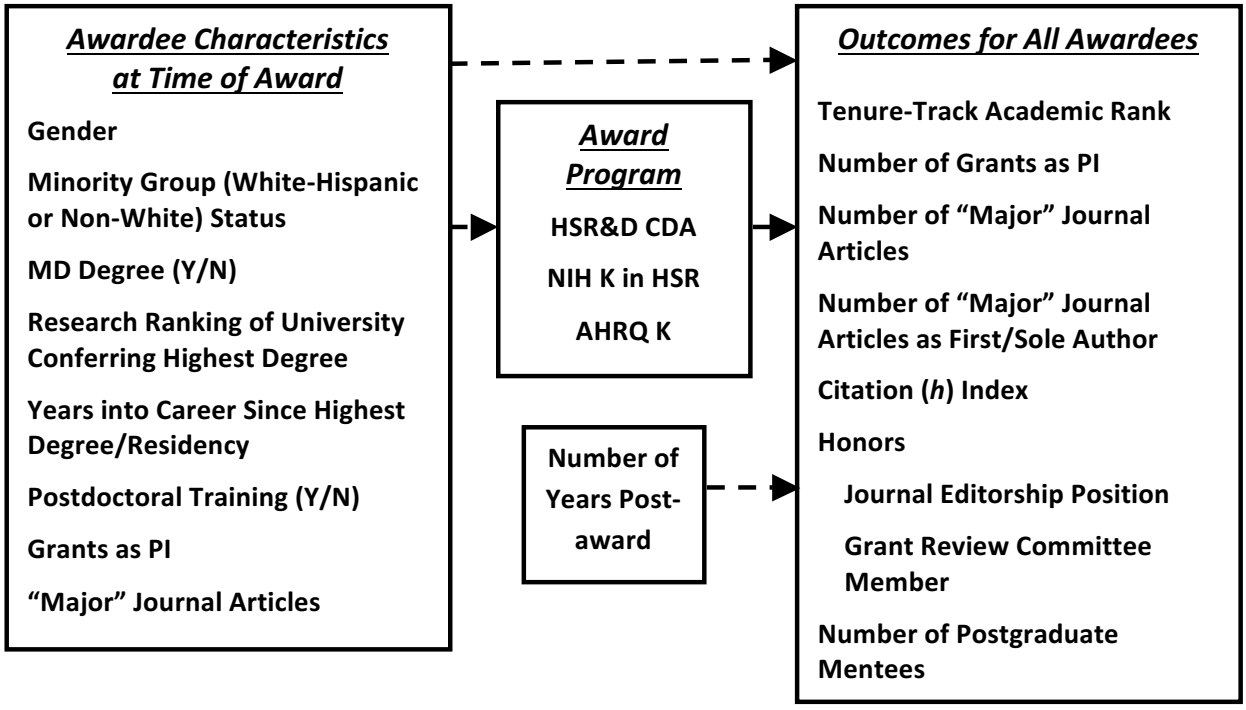
- **K23 Mentored Patient-Oriented Research Career Development Awards** allow clinicians to obtain experience with advanced research methods in order to attain independence as investigators focused on patient-oriented research.

Whereas NIH K awardees support researchers in multiple fields (we selected only those with awards in HSR), all AHRQ K awardees focus on HSR. For several years after the inception of the AHRQ K award program in FY2000, only K08 awards were provided. However, to support non-clinician (largely, PhD) researchers, AHRQ began granting K01 awards in FY2009. Applications for NIH and AHRQ K awardees are evaluated either by specific K award review panels or by broader research grant review committees.

After adjusting for such covariates as years since award, gender, minority group status, highest degree type, NIH research ranking of the university conferring the highest degree, postdoctoral training, pre-award grant and publication productivity (left-hand panel in Figure 1), we determined if there were any differences between HSR&D CDAs and NIH K awardees on the outcomes depicted in the right-hand panel in Figure 1. In addition to academic advancement, number of grants as PI and number of major journal publications (i.e., articles that were not editorials, brief commentaries, letters to the editor, etc.), and citation of publications as captured by the Hirsch (2005) *h*-index, various honors indicate that researchers are respected in their fields (see the right-hand panel in Figure 1). For honors, we tallied the proportions of HSR&D, NIH and AHRQ K awardees who held at least one journal editorship position and who had served as a standing member on at least one review panel for a major granting entity, such as VA, NIH, other federal agencies, and the Robert Wood Johnson Foundation. Finally, we compared the extent to which the HSR&D CDAs and NIH K awardees had mentored postgraduate researchers.

Because academic advancement, research productivity and accruing honors are not necessarily linear processes that can be controlled adequately by covariate adjustment for years since award, and because AHRQ only began granting K awards in FY2000, we also compared only those investigators who had received a relevant HSR&D CDA, NIH K award or AHRQ K awards since 2000 on the outcomes given in Figure 1.

**Figure 1: Conceptual Model for Comparing HSR&D, NIH and AHRQ Awardees**



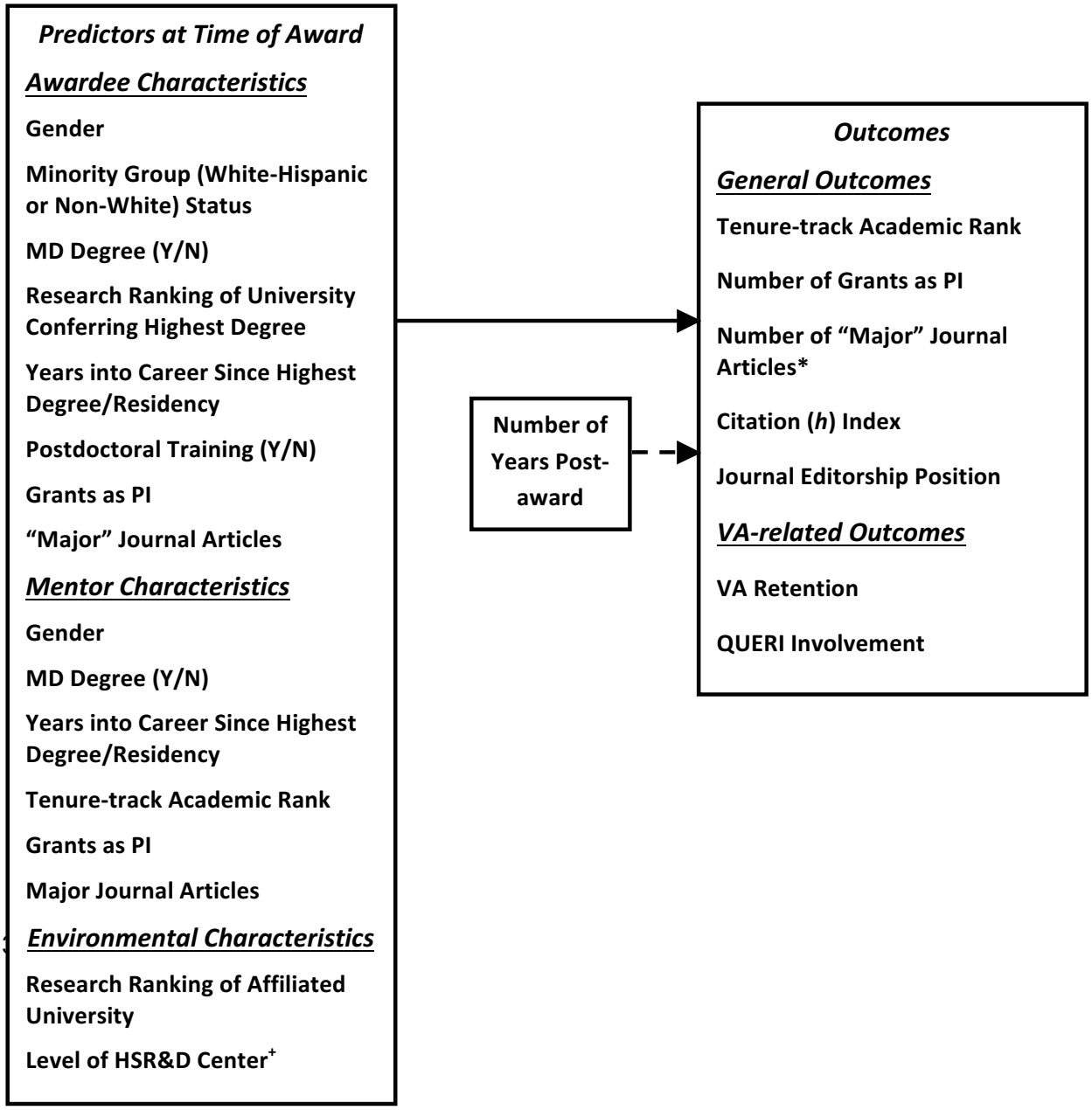

Note: Dashed arrows indicate the control of covariates. "Major" journal articles are reports of empirical research, reviews, guideline reports, extended commentaries, etc. (i.e., not editorials, letters to the editor, brief commentaries or book reviews).

## F. Aim 2: Predict the Academic Advancement, Research Productivity and VA Involvement of HSR&D CDAs

Identifying pre-award factors that predict positive outcomes among career development awardees can be highly useful in improving the selection of future awardees. Despite this utility, few evaluations of career development program have focused on such predictors. One study that did was conducted by Ross et al. (2009), who examined postdoctoral trainee and mentor factors as predictors of subsequent trainee productivity. For the 92 trainees, bivariate analyses indicated that younger age at the beginning of postdoctoral training was related to a higher publication rate following training. In addition, the number of publications during the training period and additional subsequent training (e.g., an individual National Research Service Award (NRSA) or an NIH K or other career development award – also a predictor of receiving R01 funding) were predictive of subsequent publication rates. In contrast, none of the characteristics of the 35 mentors of the trainees, including gender, PhD degree, funded R01 grants, publication rate, or the Hirsch (2005) *h* citation index, was a significant predictor of trainee later publication rate.

To provide information to HSR&D Service to assist in selecting future recipients of CDAs, we examined HSR&D CDAs' characteristics at the time of award (see the panel on the left in Figure 2) as predictors of the general and VA-related outcomes depicted in the right-hand panel in Figure 2, controlling for years since award. In addition to the characteristics of awardees at the time of award, we

**Figure 2: Conceptual Model for Predicting Outcomes Among HSR&D CDAs**




*See explanation in the note for Figure 1. +The "Level of HSR&D Center" ranged from the largest (in terms of funding and number of investigators) Centers of Excellence (CoEs, coded 3), to smaller Research Enhancement Award Programs (REAPS, 2), to the smallest Targeted Research Enhancement Programs (TREPs, 1), to no HSR&D Center (0).

also examined characteristics of the CDA's primary mentor at time of award and two environmental variables – the NIH research ranking of the university that was the primary academic affiliate of the VHA medical center at which the awardee was located and the type of HSR&D Center, if any, that was present at the awardee's VHA facility at the time of award. Overall, we expected that recipients with such characteristics as having a terminal degree from a more highly-ranked academic institution, postdoctoral training prior to an award, more pre-award grants as PI and more major journal

publications pre-award would show greater academic career advancement and research productivity, and would be more likely to accrue honors as their careers unfolded. We also examined gender, minority group status, and number of years since terminal degree or residency training as additional predictors of those outcomes.

In addition, despite the findings of Ross et al. (2009), we expected that CDAs with primary mentors who had certain characteristics (a higher academic rank, more grants as PI, and more major journal articles at time of the CDA's award), and CDAs who were located at VHA medical centers whose affiliated academic institutions had higher NIH research rankings and which had a higher-level HSR&D Center, would exhibit better subsequent academic advancement and research productivity. As indicated in the note below Figure 2, in terms of the number of investigators and funding levels, HSR&D Centers ranged from Centers of Excellence (CoEs, which had the most investigators and the highest level of funding), to Research Enhancement Award Programs (REAPs; a facility had to have three or more funded HSR investigators to apply for a REAP), to Targeted Research Enhancement Programs (TREPs; a facility could apply for a TREP if its researchers did not have a history of HSR&D grant or CDA funding), to no HSR&D Center.

In addition to predicting CDAs' general outcomes on indices appropriate for all three research career development programs under Aim 1, we also used the same predictors to try to account for the two VA-relevant outcomes for HSR&D CDAs that are listed in the lower portion of the right-hand panel in Figure 2. They were retention in VA (a goal of the CDA Program) and involvement in the Quality Enhancement Research Initiative (QUERI), an HSR&D program that focuses on improving VHA care by implementing evidence-based practices.

# *II. METHODS*

This evaluation was carried out as a Service Directed Research Project (SDR 10-182) funded by the VHA Health Services Research and Development Service. A human subjects protocol for the evaluation was approved by the VA Palo Alto Health Care System/Stanford University Institutional Review Board with a waiver of documentation. Although written consent forms were not required, participants received an Information Sheet describing the project, the voluntary nature of participation, and, if they chose to participate, their rights as participants.

## A. Samples

To address our primary aims, we focused on (1) recipients of HSR&D CDAs between FY1991 and FY2010; (2) recipients of individual-mentored NIH K01, K08 or K23 awards in health services research between FY1991 and FY2010; (3) recipients of individual-mentored AHRQ K01 and K08 Awards between FY2000 (the first year AHRQ K awards were granted) and FY2010; and (4) primary mentors of the HSR&D CDAs.

***HSR&D CDA recipients***. Information from HSR&D Service indicated that, as of October 1, 2010, a population of 244 surviving individuals had received and accepted an HSR&D CDA that was among the types considered in this evaluation (AI, CDA-2, RCD, MREP, CDA-2, ARCD, CDTA). The information

provided included the person's name, highest degree, VHA facility at the time of the award, and an email address at the time of award, which facilitated contacting awardees for the evaluation.

***NIH HSR K awardees***. Data on NIH K awards are included in the NIH Research Portfolio Online Reporting Tools – Expenditures & Results (RePORTer; http://projectreporter.nih.gov/reporter.cfm) database, which is the successor to and expands upon information that was in the Computer Retrieval of Information on Scientific Projects (CRISP) database. The NIH RePORTer provides (a) the name of the award recipient, (b) the recipient's email address, and (c) the recipient's institution. Entering the three types of K awards (K01, K08 and K23) relevant for this evaluation, the time period FY1991-FY2010, and "health services" as search terms yielded records for 758 award recipients. A perusal of the award titles and, in some cases abstracts, indicated that 440 awards were not on HSR topics comparable to those which might have been conducted by HSR&D CDA recipients. We imposed this eligibility criterion because we wanted to select K awardees who would be more likely to publish in the same journals and compete for the same grants (except VA grants) as HSR&D CDAs. Thus, we excluded from the sampling pool investigators whose K awards focused on different insurance payment plans (not relevant for VHA care), care for children (not provided by VHA), adolescents or citizens of other countries (not eligible for VHA care), prevention in criminal justice or other community settings (not provided by VHA), and clinical science or biomedical topics (neither of which is health services research). We included investigators whose K awards focused on evaluating the effectiveness of health care, examining different approaches to health care delivery, determining the cost-effectiveness of health care services, etc. This search process initially identified 318 K awardees with HSR topics comparable to those studied by HSR&D CDAs. Because the number of NIH K awardees from FY1991 to FY1999 was small relative to the number of HSR&D CDAs during that period, we selected all of those early NIH K awardees. We randomly selected K awardees from FY2000 to FY2010 for a total sample of 226 NIH K awardees (71% of those eligible).

***AHRQ K awardees.*** As noted previously, the AHRQ began granting individual-mentored K awards in FY2000. Given AHRQ's mission, all of the awards are for health services research. Most of the awards have been clinician-focused K08's, with K01 awards only being offered beginning in FY2009 to include non-clinician researchers (K23 awards are not granted by AHRQ). Data on AHRQ K awardees are included in the NIH RePORTer and are listed by AHRQ. We examined the research topics (titles and abstracts) of 120 AHRQ K01 and K08 awardees between FY2000 and FY2010, and deemed 29 not to have health services areas comparable to those focused upon by HSR&D CDAs (see discussion above re NIH K awardees eligibility). Thus, we attempted to obtain a CV from 91 researchers who had received an AHRQ K award between FY2000 and FY2010.

***Primary mentors of HSR&D CDAs***. HSR&D Service provided the names of CDAs' primary mentors, although in some cases we received the name of the mentor from the CDA. Even though CDAs often had multiple mentors, we focused on primary mentors because (a) they were likely to have been the most influential in imparting research and career knowledge during an award period; and (b) no approach to combining data (e.g., averaging) on multiple mentors seemed feasible or defensible.

## B. Data Sources

Data to address our two primary aims were derived mainly from the curriculum vitae (CVs) that we attempted to obtain from HSR&D CDAs, primary mentors of HSR&D CDAs, NIH HSR K awardees, and AHRQ K awardees. CVs have been used successfully as a data source in other evaluations of research training and career development programs, and previous research indicates that information in them can be coded reliably (Dietz et al., 2000). In eight cases (two HSR&D CDAs, four NIH K awardees, and two AHRQ K awardees), all that could be obtained from awardees was an incomplete document, usually a biosketch form from a grant application. Because the percentage of awardees submitting only biosketch forms was small (<2%), we use "CV" throughout this report to encompass either a CV or a biosketch. Variables from CVs (see below) were coded by Project Assistants. Following that, the PI, Co-PI, and/or data analysts performed data quality control by reviewing the coding to make final determinations.

In addition, for information on the "quality" of awardees' publications, we used the Thomson Reuters Web of Knowledge (WoK) Citation Index database. After entering a researcher's last name and initials, a list of publications (mainly journal articles) was retrieved. A project staff member went through the list to eliminate those citations that were not authored by the specified awardee based on information from the awardee's CV. The awardee's Hirsch (2005) *h*-index (described later) that included self-citations was downloaded.

Finally, we coded the NIH research ranking of the academic institution from which awardees had obtained their highest degree and for the primary university that was affiliated with the VHA medical center at which they were located when they received their award. Because we could not locate NIH research rankings prior to FY1990, for the ranking of the university conferring the highest degree we used the ranking of the degree-granting university in the year that the CDA or K award was received. For both variables, rankings were based on the NIH support received by the medical schools associated with the universities. NIH data for the years FY1991-FY2000 came from the IMPAC - IRS Program RFMCLKE4. NIH rankings for the years FY2001 to FY2005 came from DSA PUBDATA files and rankings for FY2006-FY2010 came from the Blue Ridge Institute for Medical Research.

## C. Data Collection and Coding

We used searches of the VHA Outlook email directory and Google to identify the current locations of HSR&D, NIH and AHRQ awardees. We attempted to contact award recipients by email when possible. If necessary, email messages were followed by a telephone call or a (FAXed) letter. The communications described the evaluation in more detail, solicited a comprehensive CV, and asked for information on the awardee's gender, racial/ethnic background and the number of postgraduate researchers whom the awardee had mentored. To monitor progress in contacting potential participants and in securing CVs, contact information and the current data collection status for each participant was entered and updated in a tracking database using MicroSoft Access.

Likewise, MicroSoft Access, which is a relational database, was used to enter information from CVs, citation index searches, and NIH research rankings. A relational database allows information in

particular domains that vary in the number of entries across individuals to be stored in separate tables and linked to an individual by an ID number. Information for each of our predictor and outcome domains was entered into domain-specific tables. Data from CVs on predictor and outcomes variables were entered (mostly copied and pasted from the CV) by Project Assistants into a MicroSoft Access domain-specific table. For example, there was a table on publications that contained the full citation, as well as a code indicating the type of publication (major journal article, letter to a journal editor, journal editorial or commentary, book review, book chapter, book, or edited volume). The table also included information on the awardee's author position in the publication (we focused on first-authored and sole-authored publications).

## D. Variables and Measures

Below we summarize the measures for the descriptive, covariate/predictor, and outcome variables for the evaluation.

***Baseline descriptive/predictor variables and covariates.*** We gathered information on the *personal characteristics* of HSR&D CDA, and NIH and AHRQ K award recipients at the time of award to use as covariates in comparing the subsequent academic advancement and research productivity of the three groups, and as a covariate (years since award) or as predictors in analyses accounting for the subsequent academic advancement, research productivity and VA involvement of HSR&D CDAs. The variables included demographic information (age at time of award, assuming an age of 22 when receiving a bachelor's degree; gender, minority group status), highest degree (e.g., MD, PhD), the research ranking for the year the award was received of the university conferring the highest degree (rankings were reversed scored so a higher ranking was better), number of years since highest degree or completion of a residency to receiving an award and through 2010, and receipt of postdoctoral training (Y/N) prior to the career development award. In addition, we recorded the grants (see below) as PI and the number of "major" (see below) journal articles published prior to the year in which the award was received.

For HSR&D CDAs, we also assessed two *environmental factors* as potential predictors of subsequent career advancement and research productivity. One was the NIH research funding ranking of the primary affiliated university with the VHA medical center at which the awardee was located in the year of the award. The rankings were reversed scored, so that higher scores would indicate a better ranking. The second contextual predictor was the level of the HSR&D Center at the VHA medical center at which the awardee was located (3=Center of Excellence, 2=Research Enhancement Award Program, 1=Targeted Research Enhancement Program, and 0=no center). We also gathered information on the HSR&D CDAs' *primary mentors' characteristics* at time of award – gender, type of terminal degree (MD versus other), years since completion of the highest degree or residency, tenure-track academic rank, number of grants as PI and number of major journal articles.

***Outcome variables.*** Four categories of general outcome variables were examined for the period from the year of award through the end of calendar year 2010 in the comparisons of HSR&D, NIH and AHRQ awardees: (1) academic advancement and, for HSR&D CDAs, VA positions; (2) research productivity in terms of grants or , in a few cases, contracts or subcontracts as PI (referred to hereafter

as “grants”); (3) research productivity in terms of publications, especially the publication of major journal articles, and (4) honors that had been received. The a*cademic advancement* outcome was indexed by highest attained tenure-track rank in 2010 (0=none, 1=assistant professor, 2=associate professor, and 3=professor). We assumed an academic position was a tenure-track position, unless it was qualified by a modifier (e.g., “clinical” professor, “research” professor).

In terms of *research productivity*, grant-related outcomes were based on research grants of $5,000 or more (if the funding amount was provided; grants without funding amounts indicated were included). We chose this minimum funding level to exclude very small grants, but to include local seed grants or pilot funding that may have been helpful for obtaining subsequent larger grants. We calculated (a) the number of all grants as PI, (b) the number of non-local VA grants as PI, (c) the number of NIH grants as PI; (d) the number of AHRQ grants as PI, and (e) the number of grants as PI over $100,000 (when funding amount was provided in the CV). Funding amounts were not inflation-adjusted and it was impossible to determine in many cases whether direct costs or total costs had been reported. Based on data from CVs, we also recorded books, book chapters, and other publications. However, the primary outcomes were (a) the number of “major” journal publications (i.e., reports of empirical research, literature reviews, extended commentaries or essays, guideline panel reports, case studies, etc.), as differentiated from letters to a journal editor, brief commentaries, editorials, and book reviews, and (b) the number of major journal articles as first or sole author.

In addition, the *quality* of publications through calendar year 2010 was determined by the Hirsch (2005) *h*-index reported in the Thomson Reuters Web of Knowledge Citation Index (access to the Thomson Reuters database was secured via a contract). According to Hirsch (2005), a researcher would have an index of *h* if *h* of his or her total number of publications (N) had at least *h* citations each and none of his or her remaining publications (N - *h*) had more than *h* citations. Thus, the higher the number of highly-cited papers, the higher the *h*-index. Citation Index searches were conducted between October 31, 2012, and January 3, 2013, for the HSR&D CDAs, between January 25 and February 11, 2013, for the NIH K awardees, and between February 13 and April, 2, 2013 for the AHRQ K awardees. Awardees whose searches were conducted later had the opportunity to achieve a slightly higher *h*-index for their 2010 and earlier publications than those for whom a search was conducted earlier. Most of the publications in the Citation Index database are journal articles, but some are of other types (e.g., citations of presentations). In general, however, journal articles are much more likely to be cited than other publications and thus drive the *h*-index.

We also gathered information on receipt of two *honors*. One was whether or not an individual had held at least one editor, associate editor, guest editor of a special section or issue, or member of an editorial board position for at least one journal (labeled a “journal editorship position”). Second we recorded whether or not an awardee had served as a standing member of at least one grant review panel for a large funding entity, including the VA, NIH, other federal agencies and the Robert Wood Johnson Foundation. To assess the extent of *mentoring* provided by awardees, we recorded the number of the postdoctoral researchers whom awardees indicated they had mentored through calendar year 2010.

In addition, two *VA-related outcomes* were assessed for HSR&D CDAs. One was retention of awardees in VA, particularly in VA research. Initially, we intended to track retention in VA research only by coding research positions listed in CVs. However, we found that some awardees involved in research did not list VA research positions, particularly if they also held clinical positions. Thus, involvement in VA research was indicated by (a) a research or research administration position being listed in a CV, (b) involvement in a VA research grant during 2010, or (c) being a current HSR&D CDA in 2010. We also recorded CDAs' *involvement in the HSR&D QUERI* program (Demakis et al., 2000) to improve VHA health care by implementing evidence-based practices and de-implementing ineffective practices. QUERI involvement was coded as follows: Director/Research Coordinator, Clinical, or Implementation Research Coordinator of a QUERI Group = 3; PI on a QUERI Service Directed Project or QUERI Group Executive Committee member = 2; PI on a QUERI Rapid Response Project or other involvement, such as a QUERI workgroup member = 1; and no involvement = 0.

## E. Methodological Notes

In some cases, multiple awardees had been mentored by the same individual. We only had information on the primary mentors of HSR&D CDAs, so we did not know the extent to which mentees were "clustered" within the same primary mentors for the NIH and AHRQ K awardees. However, VHA is a more "closed system," so the mentoring of awardees by the same individual is likely to have been more prevalent among HSR&D CDAs than among NIH or AHRQ K awardees. We present information on the extent of clustering of HSR&D CDAs within mentors in Section III below. Although multi-level analyses (e.g., Raudenbush & Bryk, 2002) are available to account for clustering of lower-level units (e.g., CDAs) within higher-level units (e.g., primary mentors), we did not employ them in comparing HSR&D, NIH and AHRQ awardees for the following reasons: (1) As noted, we did not know the extent to which NIH and AHRQ awardees were clustered within mentors. (2) We did not have a sufficient N to take into account multiple levels of clustering, including the VA medical centers at which HSR&D CDAs were located at the time of award or the universities within which HSR&D, NIH and AHRQ awardees were situated when they received their awards. (3) In contrast to the typical applications of multi-level analyses in which multiple lower-level units are clustered within each of the higher-level units, many primary mentors had mentored only one of the CDAs participating in the evaluation. (4) Likewise, in contrast to typical multi-level analyses with constant data for higher-level units, some of the higher-level data on individual mentors varied when their different mentees obtained awards in different years (e.g., the number of major journal articles for the mentor typically would be higher for a later awardee than for an earlier awardee who was mentored by that individual). (5) Finally, as will be seen, most of the covariate-adjusted comparisons of all HSR&D CDAs with all NIH K awardees, and of HSR&D, NIH, and AHRQ awardees from 2000 and later were not significant. If clustering is not taken into account, there is no effect on group means for continuous outcomes or predicted probabilities for dichotomous outcomes relative to means and predicted probabilities from analyses that take clustering into account. Rather, the effect is to underestimate standard errors, so that comparisons in such analyses are more likely to be significant than if clustering were incorporated. Given the absence of many significant differences, we simply advise caution in interpreting those that are.

We also did not account for clustering in using pre-award mentor characteristics to predict the subsequent academic advancement, research productivity and VA-related outcomes of HSR&D CDAs, primarily because not all mentors had more than one mentee. However, as a conservative check on results with data from all HSR&D CDAs with mentor data, we re-ran the predictive analyses with independent pairs of mentors and mentees – i.e., for those mentors with multiple CDAs, we randomly selected one of the awardees so as to have unique, independent mentor-mentee dyads. This approach is conservative in that the "effective N" with clustering is in between the N of mentors and the N of CDAs, whereas examining independent mentor-CDA pairs used the lowest N of mentors with the concomitant reduction in statistical power to detect significant predictive relationships.

Also, although the approach has drawbacks when a substantial amount of data on a variable are missing (Schaefer & Graham, 2002), we substituted the mean for the appropriate group (e.g., the mean for the other HSR&D CDAs on a variable when an HSR&D CDA did not provide information) for missing data. We used this approach because missing data generally were minimal (Rubin et al., 2007).

# *III. FINDINGS*

## A. Participation by Awardees

Overall, 90% of HSR&D CDA awardees, 68% of selected NIH K awardees, and 76% of AHRQ K awardees provided a CV for the evaluation. Participation statuses for the three groups are provided in Table 1.

### Table 1: Participation of HSR&D, NIH and AHRQ Awardees

| Awardee Group | Could Provide CV N | Provided CV n (%) | Refused n (%) | No Response n (%) |
|---|---|---|---|---|
| **HSR&D** | 244 | 219 (90%) | 5 (2%) | 20 (8%) |
| **NIH K** | 226 | 154 (68%) | 4 (2%) | 68 (30%) |
| **AHRQ K** | 91 | 69 (76%) | 5 (6%) | 17 (19%) |

## B. Awards Received

Information on the types of awards received by HSR&D CDA recipients is provided in Table 2. Some investigators received more than one CDA (289 awards were granted to the 219 unique HSR&D participants), so the percentages in Table 2 sum to more than 100%. The RCD was the most common award, followed by the ARCD, CDA-2, and MREP awards. In all, 31% of the HSR&D CDAs participating in the evaluation had received more than one VHA career development award, yielding a mean number of awards received of 1.32. For example, of 114 RCD recipients, 59 subsequently received another career development award (48 ARCD, 11 CDTA), and of 11 AI recipients, five received a subsequent award (four CDA-2 and one unspecified). Three recipients were granted three different awards (combinations of AI, RCD, ARCD, and CDTA awards).

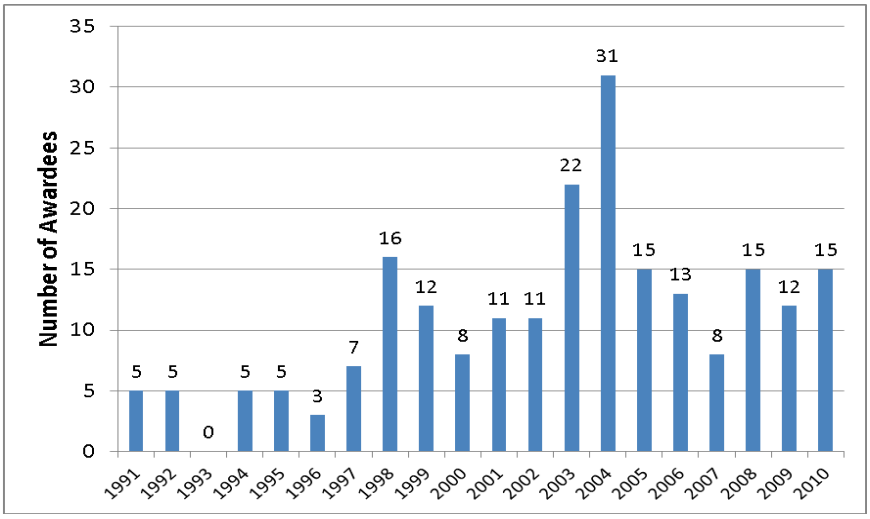
## Table 2. Types of Awards Received by 219 HSR&D CDAs

| Type of HSR&D Award (not mutually exclusive) | N | % |
|---|---|---|
| **Entry-Level Awards** | | |
| **AI** | 11 | 5% |
| **CDA-1** | 5 | 2% |
| **Mid-level Awards** | | |
| **RCD** | 114 | 52% |
| **MREP** | 33 | 15% |
| **CDA-2** | 44 | 20% |
| **Advanced or Transition Awards** | | |
| **ARCD** | 68 | 31% |
| **CDTA** | 13 | 6% |
| **Unspecified** | 1 | <1% |
| | | |
| **Multiple awards** | 67 | 31% |
| **Mean number of awards** | 1.32 | |

Note: See pages 2-3 for descriptions of the awards.

NIH and AHRQ awardees earned several variants of "K" Awards. Of the 154 NIH K awards, 84 (49%) were K23 awards, 41 (26%) were K01 awards, and 29 (18%) were K08 awards. Of the 69 AHRQ awards, 57 (83%) were K08s and 12 (17%) were K01s.

## Figure 3. Number of HSR&D Awardees by Year




As shown in Figures 3-5, the relevant awards received by the three groups of participants in the evaluation were concentrated in different periods between 1991 and 2010. For HSR&D CDAs, the peak year for relevant awards (N=219) was 2004, with 31 awardees (see Figure 3). We identified and obtained CVs from relatively few NIH K awardees between 1991 and 1997 (see Figure 4). That may reflect the imprecision of the search term "health services" in the NIH RePORTer database for those

**Figure 4. Number of NIH K Awardees by Year**

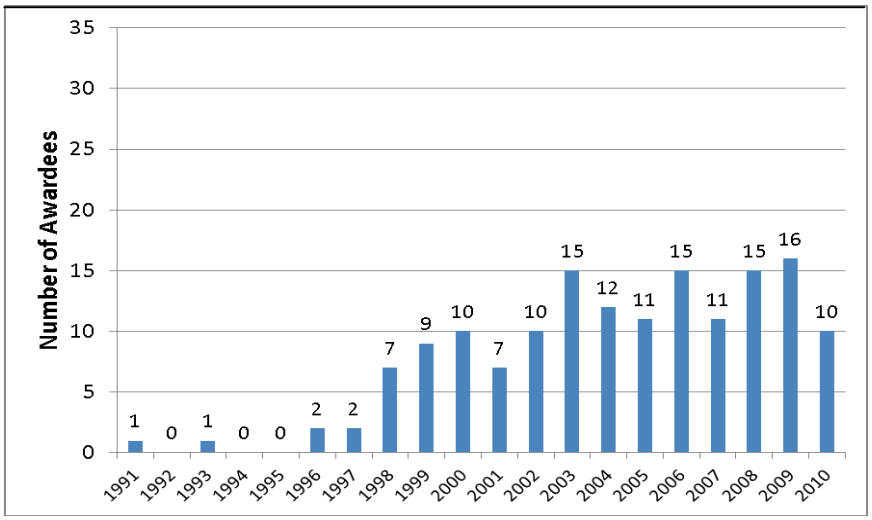
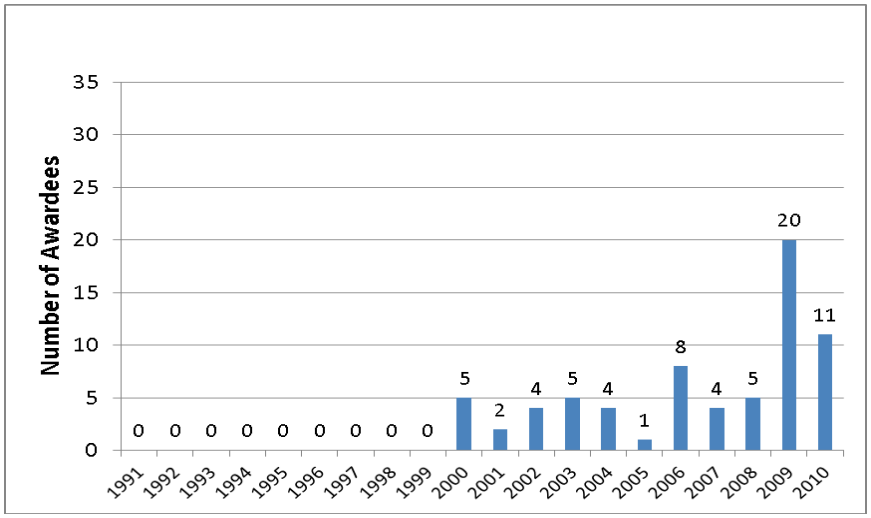



**Figure 5. Number of AHRQ K Awardees by Year**




earlier versus later years, as well as an increase in NIH K awardees over time with a health services research focus. In any event, the highest number of the 154 NIH K awardees in the participating sample was 16 in 2009 with 15 each in 2008, 2006, and 2003. For the AHRQ K award program, which did not begin until 2000, the highest number of awardees was 20, also in 2009, likely reflecting an influx of K01 awardees (see Figure 5).

## C. Pre-award Characteristics of HSR&D, NIH and AHRQ Awardees

Information on the characteristics of the investigators prior to receiving HSR&D CDA, NIH K, or AHRQ K awards is presented in Tables 3a-3d. The tables contain information for all HSR&D and NIH K awardees participating in the evaluation, as well as for HSR&D, NIH and AHRQ K awardees from 2000, the first year AHRQ K awards were granted. Assuming an age of 22 years at the time of a bachelor's degree, the full sample of HSR&D CDAs was an average of a little over 37 years old at the time of their

relevant award, versus 38 years of age, on average, for the full sample of NIH awardees (see Table 3a). The average ages at the time of award for the three groups of researchers who received awards in 2000 or later ranged from 37 for the HSR&D CDAs to over 38 for the NIH and AHRQ K awardees.

### Table 3a. Characteristics of HSR&D, NIH and AHRQ Awardees

| Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) Mean | NIH K (n=154) Mean | HSR&D (n=161) Mean | NIH K (n=132) Mean | AHRQ K (n=69) Mean |
| **Age at (Relevant) Award** | 37.3 | 37.9 | 37.1 | 38.3 | 38.4 |
| **Years into Career at Time of (Relevant) Award** | 5.9 | 6.7 | 5.4 | 6.9 | 6.5 |
| **Years Since (Relevant) Award** | 8.3 | 6.9 | 6.0 | 5.8 | 4.5 |

Assuming research careers start at the end of residency for MDs and immediately upon receipt of the degree for those with PhDs or other terminal degrees, the full sample of HSR&D CDAs was almost six years past the those points, on average, at the time of their relevant CDA versus a mean of almost seven years for all NIH K awardees. For the awardees from 2000 and later, the HSR&D CDAs were a mean of about five and half years into their careers when they received their awards, versus seven years for NIH K awardees and six and half years for AHRQ K awardees.

At the end of 2010, it had been slightly over eight years, on average, since the receipt of the relevant CDA for all of the HSR&D awardees versus almost seven years for all NIH K awardees. Obviously, the years since receiving a relevant CDA or K award were fewer for the researchers whose awards were received in 2000 or later (see Table 3a). Years since award is an important covariate that was controlled in comparing the academic career advancement and research productivity of the groups of awardees.

As noted in Table 3b, men were more predominant among all of the HSR&D CDAs relative to the full sample of NIH awardees. For the samples of awardees from 2000 and later, a smaller percentage than in the full sample, but still a majority of HSR&D CDAs, was male. Also, a smaller percentage of NIH K awardees since 2000 was male than in the full sample. For the AHRQ K awardees, slightly over half were men. "Race" and "ethnicity" are social constructs that refer more to how people view themselves and others, rather than to genetic or biological factors, and are useful for tracking the diversity of awardees. In terms of the racial and ethnic categories used by the U.S. Census Bureau, more than 80% of all HSR&D CDAs were white/non-Hispanic versus less than three-quarters of all NIH K awardees. Including white-Hispanics as minority group members, researchers from minority groups were proportionately fewer among all HSR&D CDAs than among all NIH K awardees (see Table 3b); a similar pattern held for these two groups among awardees from 2000 and later, with researchers from minority groups comprising 22% of the AHRQ K awardees. The higher percentages of minority NIH and AHRQ K awardees were due primarily to their much larger percentages of Asian researchers. Nevertheless, proportionately fewer African-American researchers were included in the full sample and post-1999 subsample of HSR&D CDAs relative to the either the full or post-1999 NIH K awardee sample.

## Table 3b. Gender and Racial/Ethnic Background of HSR&D, NIH and AHRQ Awardees

| Demographic Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) % | NIH K (n=154) % | HSR&D (n=161) % | NIH K (n=132) % | AHRQ K (n=69) % |
| **Female** | 43% | 54% | 47% | 58% | 48% |
| **Race/Ethnicity** | | | | | |
| **White Non-Hispanic** | 82% | 72% | 81% | 68% | 77% |
| **Asian** | 7% | 14% | 8% | 15% | 15% |
| **Hispanic/Latino/Latina** | 3% | 4% | 3% | 5% | 0% |
| **African American/Black** | 2% | 5% | 2% | 5% | 3% |
| **Mixed Race** | 2% | 1% | 3% | 2% | 4% |
| **American Indian/Alaskan Native** | 0% | 1% | 0% | 1% | 0% |
| **Unknown/Missing** | 4% | 4% | 4% | 5% | 1% |
| **Minority Group** | 14% | 24% | 15% | 27% | 22% |

Almost two-thirds of all HSR&D CDAs had an MD degree, including 3% whose degree was from a country other than the USA and 6% with both an MD and PhD (see Table 3c). A similar percentage of all NIH K awardees had an MD. Among the three groups of awardees from 2000 and later, the percentage with an MD among HSR&D CDAs dropped to 56% (likely reflecting the introduction of the MREP award), versus 64% of NIH K awardees and 71% among AHRQ K awardees. Almost a third of all HSR&D awardees had a PhD as their highest degree, similar to the 30% of all NIH K awardees. Among the awardees from 2000 and later, the percentages of those with a PhD as their highest degree were 42% for HSR&D CDAs, 33% for NIH K awardees, and 20% for AHRQ K awardees.

Average research rankings of the universities from which awardees received their highest degrees are provided in Table 3d. As noted earlier, rankings were based on NIH funding for the affiliated medical school, with the best ranking being "103." The average rankings for the full samples of HSR&D and NIH awardees were virtually identical; among the three groups of awardees from 2000 and later, the average rankings varied from about 62 for HSR&D CDAs to about 66 for the AHRQ K awardees. More researchers in the full sample of HSR&D CDAs had postdoctoral training than did those in the full sample of NIH K awardees. For the three groups of awardees from 2000 and later, the percentages with postdoctoral training varied from a high of 83% for the AHRQ K awardees to a low of 74% for the NIH K awardees.

As noted in Table 3d, prior to the first year of their awards, the full sample of NIH K awardees had secured more grants of $5,000 or more as PI, on average, than had all of the HSR&D CDAs, perhaps a result of some of the HSR&D CDAs having received only an entry level award (e.g., an AI or CDA-1). In any event, this difference held between the NIH and HSR&D awardees from 2000 and later, whereas the AHRQ K award recipients had the same average number of pre-award grants as the HSR&D CDAs. The HSR&D CDAs and NIH K awardees had published the same average number of major journal articles

### Table 3c. Highest Degrees for HSR&D, NIH and AHRQ Awardees

| Highest Degree | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) % | NIH K (n=154) % | HSR&D (n=161) % | NIH K (n=132) % | AHRQ K (n=69) % |
| MD Degree | 66% | 66% | 56% | 64% | 71% |
| MD – USA | 57% | 55% | 49% | 52% | 61% |
| MD – Foreign Country | 3% | 5% | 3% | 6% | 6% |
| MD, PhD | 6% | 6% | 4% | 5% | 4% |
| PhD Degree | 32% | 30% | 42% | 33% | 20% |
| Non-MD Doctoral Degree | 2% | 4% | 2% | 4% | 9% |
| DSc –Doctor of Science | 1% | 0% | 1% | 0% | 3% |
| DO – Doctor of Osteopathy | 0% | 1% | 0% | 1% | 0% |
| OD – Doctor of Optometry | 0% | 1% | 0% | 1% | 0% |
| Pharm.D. – Doctor of Pharmacy | 1% | 1% | 1% | 1% | 6% |
| DDS – Doctor of Dentistry | 1% | 1% | 0% | 1% | 0% |
| DC – Doctor of Chiropractic | 0% | 1% | 0% | 1% | 0% |

prior to receiving their awards. Among the awardees from 2000 and later, the average number of major journal articles published by AHRQ K awardees prior to their awards was higher than the average number of journal articles published previously by HSR&D and NIH awardees.

### Table 3d. Other Pre-Award Characteristics of HSR&D, NIH and AHRQ Awardees

| Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) Mean or % | NIH K (n=154) Mean or % | HSR&D (n=161) Mean or % | NIH K (n=132) Mean or % | AHRQ K (n=69) Mean or % |
| Ranking of Highest Degree University | 64.3 | 63.8 | 62.0 | 62.8 | 65.9 |
| Postdoctoral Training | 82% | 75% | 80% | 73% | 83% |
| Number of Pre-Award Grants as PI | 1.5 | 2.2 | 1.4 | 2.3 | 1.4 |
| Number of Pre-Award Major Journal Publications | 9.9 | 9.9 | 10.0 | 10.1 | 15.5 |

## D. Comparing the Academic Advancement and Research Productivity of HSR&D, NIH and AHRQ Awardees

The validity of comparisons of the post-award academic advancement and research productivity of HSR&D CDA, NIH and AHRQ K awardees rests on controlling pre-existing differences across the groups

on their characteristics prior to awards that are associated with outcomes. To adjust for pre-award differences among the HSR&D CDAs and the two groups of K awardees, we conducted analyses of covariance for continuous outcomes and (multinomial) logistic regressions for dichotomous outcomes, controlling for all of the covariates noted earlier (see Figure 1). Thus, adjusted means on continuous outcomes and adjusted predicted probabilities for dichotomous outcomes are presented for each group of awardees. These adjusted results can be interpreted as projections of what the means or probabilities would be if the groups of awardees were equal in terms of their standing on the covariates.

### Tenure-Track Academic Positions

Securing, maintaining and advancing in tenure-track academic positions is one, albeit somewhat indirect, indicator of a health services researcher's research productivity and stature. The unadjusted percentages of each group of awardees with tenure-track positions at the end of 2010 are presented in Table 4, along with their covariate-adjusted mean tenure-track academic ranks (0=no tenure-track position to 3=tenure-track professor). No significant differences emerged between the full samples of HSR&D and NIH awardees, or among the three groups of awardees from 2000 and later, on adjusted academic rank.

### Table 4. Tenure-track Academic Positions of HSR&D, NIH and AHRQ Awardees

| Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) Mean or % | NIH K (n=154) Mean or % | HSR&D (n=161) Mean or % | NIH K (n=132) Mean or % | AHRQ K (n=69) Mean or % |
| **Tenure-Track Positions** | 58% | 64% | 48% | 59% | 46% |
| **Full Professor** | 11% | 17% | 14% | 19% | 20% |
| **Associate Professor** | 26% | 36% | 29% | 34% | 20% |
| **Assistant Professor** | 21% | 11% | 5% | 6% | 6% |
| **Adjusted Mean Tenure-Track Academic Rank** | 1.2 | 1.3 | .9 | 1.0 | 1.0 |

### Grants as PI

Information on the unadjusted percentages of awardees who were PI on one or more research grants (or contracts or subcontracts) is displayed in Table 5. A somewhat higher percentage of all HSR&D CDAs than NIH K awardees had been PI on at least one grant of $5,000 or more. Among the three groups of awardees from 2000 and later, the percentage of AHRQ K awardees that had been PI on at least one grant was smaller than that among HSR&D and NIH K awardees, perhaps reflecting the AHRQ K awardees' being fewer years into their post-award careers (see Table 3a). With respect to non-local VA grants, such as Investigator-Initiated Research (IIR) and QUERI Rapid Response Project (RRP) grants, a much larger percentage of the full sample of HSR&D CDAs, not surprisingly, had been PI on such grants relative to the full sample of NIH K awardees. Similar differences are evident in Table 5 between the HSR&D and both the NIH and AHRQ awardees since 2000. In contrast, proportionately more of the NIH K awardees had obtained at least one NIH grant as PI than had HSR&D CDA recipients.

For the groups of awardees since 2000, again proportionately more of the NIH K award recipients had received NIH grant funding than had either HSR&D CDAs or AHRQ K awardees. Finally, AHRQ K awardees had been somewhat more likely to obtain AHRQ grants as PI than had either HSR&D CDAs or NIH HSR K awardees from 2000 and later. Of the awardees who reported funding amounts for their grants, 84% of HSR&D CDAs had been a PI on a grant of $100,000 or more versus 87% of the NIH K awardees. For award recipients from 2000 and later, NIH K awardees and HSR&D CDAs had been PI more frequently on a grant of $100,000 or more than had AHRQ K awardees.

### Table 5. Percentages of HSR&D, NIH and AHRQ Awardees Involved in Grants as PI

| Characteristic | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) % | NIH K (n=154) % | HSR&D (n=161) % | NIH K (n=132) % | AHRQ K (n=69) % |
| **One or more grants as PI** | 83% | 77% | 78% | 76% | 62% |
| **Non-local VA grant* as PI** | 64% | 7% | 55% | 7% | 3% |
| **NIH grant as PI** | 39% | 42% | 27% | 37% | 19% |
| **AHRQ grant as PI** | 11% | 13% | 6% | 11% | 17% |
| **PI on at least one grant of $100,000 or more (n=number reporting grant amounts as PI)** | 84% (n=154) | 87% (n=91) | 78% (n=107) | 86% (n=76) | 58% (n=31) |

*VA provides project funds that can be withdrawn without notice, so the funds are not technically "grants." However, the term "grant" is typically used to refer to those project funds.

As noted in Table 6, the 219 HSR&D CDAs collectively had been PI on a total of 1,147 grants of $5,000 or more, whereas the 154 NIH K awardees had been PI on 564 such grants. HSR&D CDAs had been PI on 436 non-local VA grants, 193 NIH grants and 46 AHRQ grants as PI. NIH K awardees had been PI on 17 non-local VA grants, 136 NIH grants and 25 AHRQ grants. For those grants on which funding amount was reported, the full sample of HSR&D CDAs had been PI on 585 grants of $100,000 or more and the NIH K awardees had been PI on 226 grants of $100,000 or more.

### Table 6. Total Number of Grants as PI for HSR&D, NIH and AHRQ Awardees

| Variable | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) | NIH K (n=154) | HSR&D (n=161) | NIH K (n=132) | AHRQ K (n=69) |
| **Total Grants as PI** | 1,147 | 564 | 547 | 401 | 146 |
| **Total Non-Local VA Grants as PI** | 436 | 17 | 210 | 15 | 3 |
| **Total NIH Grants as PI** | 193 | 136 | 82 | 81 | 18 |
| **Total AHRQ Grants as PI** | 46 | 25 | 11 | 14 | 26 |
| **Total Grants as PI Over $100,000** | 585 | 226 | 234 | 157 | 57 |

Whereas the data in Tables 5 and 6 are not covariate-adjusted, Table 7 compares the grant productivity of the three groups of awardees, controlling for covariates. Relative to the full sample of NIH K awardees, HSR&D CDAs had a higher adjusted mean number of grants as PI, although difference was not significant. Likewise, there were no significant differences in the adjusted number of grants as PI among the three groups of awardees since 2000. However, for those reporting funding amounts, the HSR&D CDAs had been PI on significantly more grants of $100,000 or more than the NIH K awardees. In general, HSR&D CDAs were more successful in obtaining VA grants, NIH K awardees were more successful in securing NIH grants, and AHRQ K awardees were more successful in obtaining AHRQ grants, as would be expected.

### Table 7. Covariate-adjusted Mean Number of Grants as PI for HSR&D, NIH and AHRQ Awardees

| Variable | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| | HSR&D (n=219) Mean | NIH K (n=154) Mean | HSR&D (n=161) Mean | NIH K (n=132) Mean | AHRQ K (n=69) Mean |
| **Adjusted Mean Number of Grants as PI** | 4.8 | 4.3 | 3.2 | 2.9 | 2.7 |
| **Adjusted Mean Number of Non-Local VA Grants as PI** | 1.9[1] | .3 | 1.2[2, a, b] | .1 | .2 |
| **Adjusted Mean Number of NIH Grants as PI** | .8 | 1.0 | .5 | .6 | .4 |
| **Adjusted Mean Number of AHRQ Grants as PI** | .2 | .2 | .1[2, b] | .1 | .4 |
| **Adjusted Mean Number of Grants as PI over $100,000** | 2.4[1] | 1.8 | 1.3 | 1.2 | 1.2 |

[1] *p*<.05 difference between all HSR&D and NIH K awardees. [2] p <.05 differences across HSR&D, NIH K, and AHRQ K awardees 2000-2010. [a]p <.001 post-hoc (Bonferroni corrected) difference between HSR&D and NIH K 2000-2010 awardees. [b]p <.001 post-hoc (Bonferroni corrected) significant difference between 2000-2010 HSR&D and AHRQ K awardees.

### Publications

Information on the percentages of awardees with at least one publication of each of several types is provided in Table 8. With respect to major journal articles, all or almost all of the awardees had at least one such publication. Across the groups of awardees, a minimum of 93% of the awardees had at least published one major journal article by 2010 as the first or sole author, except for the AHRQ K awardees of whom 88% had published at least on such article as first or sole author. Fourteen percent of all HSR&D CDAs had published at least one book, somewhat more than the percentage of all NIH K awardees who had published one or more books. On the other hand, proportionately more AHRQ K awardees had published at least one book than had either the HSR&D CDAs or NIH K awardees from 2000 or later. Very small percentages of awardees had edited at least one book. None of these comparisons is covariate-adjusted or tested for a statistically significant difference.

As noted in Table 8, the sample of 219 HSR&D CDA recipients had published over 9,000 major journal articles, almost 2,500 as first or sole author. The full sample of 154 NIH K awardees had

published over 4,000 major journal articles, almost 1,500 as first or sole author. The numbers of major journal articles produced by awardees from 2000 and later also were substantial.

Table 9 provides covariate-adjusted data on the productivity of the three groups of awardees on the publication of major journal articles, major journal articles as first or sole author and citation (*h*) indices. Relative to the full sample of NIH K awardees, all HSR&D CDAs had a significantly higher mean number of major journal articles; among the three groups of awardees since 2000, however, the differences were not significant on this outcome. Likewise, there were no significant differences in the adjusted mean number of major journal articles as first or sole author or citation (*h*) indices, either between the full samples of HSR&D and NIH awardees or among the three groups of awardees since 2000.

### Table 8: Percentages of HSR&D, NIH and AHRQ Awardees with at Least One Publication of Various Types and Total Numbers of Major Journal Articles

| | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| **Publication Type** | **HSR&D (n=219)** | **NIH K (n=154)** | **HSR&D (n=161)** | **NIH K (n=132)** | **AHRQ K (n=69)** |
| **At least one:** | | | | | |
| **Major Journal Article** | 100% | 99% | 99% | 99% | 96% |
| **Major Journal Article as First or Sole Author** | 97% | 94% | 96% | 93% | 88% |
| **Commentary/ Editorial** | 61% | 46% | 51% | 42% | 52% |
| **Letter to the Editor** | 32% | 23% | 23% | 21% | 25% |
| **Book** | 14% | 10% | 7% | 8% | 13% |
| **Book Review** | 7% | 8% | 6% | 4% | 4% |
| **Book Chapter** | 56% | 62% | 45% | 59% | 61% |
| **Edited Book** | 3% | 3% | 2% | 3% | 1% |
| **Major Journal Articles** | 9,350 | 4,234 | 4,346 | 2,949 | 1,271 |
| **Major Journal Articles as First or Sole Author** | 2,480 | 1,497 | 1,449 | 1,053 | 527 |

### Table 9. Covariate-adjusted Mean Number of Major Journal Articles and *h*-Indices for HSR&D, NIH and AHRQ Awardees

| | Awardees 1991-2010 | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| **Variable** | **HSR&D (n=219) Mean** | **NIH K (n=154) Mean** | **HSR&D (n=161) Mean** | **NIH K (n=132) Mean** | **AHRQ K (n=69) Mean** |
| **Adjusted Mean Number of Major Journal Articles** | 39.0[1] | 32.8 | 25.3 | 22.8 | 21.6 |
| **Adjusted Mean Number of Major Journal Articles as First or Sole author** | 10.4 | 11.0 | 8.4 | 8.1 | 8.8 |
| **Adjusted Mean Citation (*h*) Index** | 15.8 | 15.6 | 12.2 | 12.9 | 12.0 |

[1] $p < .05$ difference between all HSR&D and NIH K awardees.

## Honors

Researchers can accrue multiple and diverse honors during their careers. Because of that, there are few commensurate honors on which career development awardees can be compared. Although journal editor positions vary in their status, we settled upon this honor as the one that could be coded particularly accurately and reliably. Another variable that connotes recognition of a researcher's productivity and stature is serving as a standing member of a grant review panel for a major funding entity. Logistic regression analyses on the adjusted differences between either the full samples of HSR&D and NIH awardees, or on differences among the three groups of awardees from 2000 and later, revealed no significant differences in either the likelihood of having had a journal editorship position or a grant review committee membership. The adjusted predicted probabilities of achieving the two honors are presented in Table 10.

### Table 10: Covariate-adjusted Predicted Probabilities of Honors for HSR&D, NIH and AHRQ Awardees

| | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| Honor | HSR&D (n=219) | NIH K (n=154) | HSR&D (n=161) | NIH K (n=122) | AHRQ K (n=69) |
| **Adjusted Journal Editorship Position (Y/N)** | 33% | 40% | 23% | 27% | 32% |
| **Adjusted Grant Review Committee Membership (Y/N)** | 15% | 11% | 10% | 8% | 6% |

## Mentoring

Ideally, career development programs would foster individuals who later would mentor young investigators. We had considerable missing data from awardees on the number of postgraduate researchers they had mentored (see the Ns in Table 11). Therefore, we did not use mean substitution for these missing data. For the awardees providing information, no significant difference emerged in the adjusted mean number of postgraduate mentees between the full sample of HSR&D CDAs and the full sample of NIH K awardees (see Table 11). As expected, the adjusted average numbers of mentees for the HSR&D, NIH and AHRQ awardees since 2000 were smaller than that for the full HSR&D and NIH samples; the differences among the three groups also were not significant.

### Table 11: Covariate-adjusted Mean Number of Postgraduate Mentees for HSR&D, NIH and AHRQ Awardees

| | All Awardees | | Awardees 2000-2010 | | |
|---|---|---|---|---|---|
| Outcome | HSR&D (n=183) Mean | NIH K (n=110) Mean | HSR&D (n=133) Mean | NIH K (n=95) Mean | AHRQ K (n=53) Mean |
| **Adjusted Number of Postgraduate Mentees** | 8.5 | 7.3 | 6.7 | 5.5 | 7.2 |

## E. Predicting the Academic Advancement, Research Productivity and VA Involvement of HSR&D CDAs

This section focuses on the prediction of five general (academic advancement, grants as PI , major journal articles, citation of publications, and achieving at least one journal editorship position) and two VA-specific (VA retention and QUERI involvement) outcomes for the 212 HSR&D CDAs on whom we also had primary mentor data. The seven outcomes were selected to cover representative general outcomes and to focus on two important VA-related indices, while also providing some constraints on the number of statistical tests for predictors. First, we present descriptive information on the general and VA-related outcomes for the HSR&D CDAs, and then descriptive information on the predictors. Next, we provide the bivariate correlations among the outcome variables. Finally, we present the results of multivariate linear and logistic regression analyses to estimate the independent relationships of each predictor to each of the outcomes for the HSR&D CDAs.

### Outcomes for HSR&D CDA Recipients

Data on the outcomes for the 212 HSR&D CDAs are presented in Table 12. Their average academic rank was slightly above that of an Assistant Professor. They had published over 42 major journal articles, on average, and their average *h*-index indicated that they had almost 17 publications, each of which had been cited almost 17 times at the least. They had secured a mean of over five grants as PI and 38% had at least one journal editorship position by 2010.

**Table 12. General and VA-Related Outcomes for HSR&D CDAs (N=212)**

| Outcome | HSR&D CDAs (n=212) % or Mean |
|---|---|
| **General Outcomes** | |
| **Tenure-Track Rank** | 1.2 |
| **Number of Major Journal Articles** | 42.7 |
| **Average Citation (*h*) Index** | 16.8 |
| **Number of Grants as PI** | 5.2 |
| **Journal Editor Position** | 38% |
| **VA-related Outcomes** | |
| **Retention in VA** | 80% |
| **Retention in VA Research** | 74% |
| **QUERI Involvement - Mean** | 0.8 |
| **Any QUERI Involvement** | 41% |
| **Workgroup Member or PI on Local QUERI Project = 1** | 9% |
| **Executive Committee Member or PI on Either RRP or SDP = 2** | 28% |
| **Research Director, or Clinical, or Implementation Research Coordinator = 3** | 4% |

Of the 212 HSR&D CDAs, 80% were in VA at the end of 2010, with 74% in research positions. Forty-one percent of the awardees were or had been involved in the QUERI, including 4% who served in key positions as Research Directors/Coordinators, Clinical Coordinators, or Implementation Research Coordinators for this program to implement evidence-based health care for Veterans.

## Descriptive Information on Predictors of General and VA-related Outcomes

Table 13 provides descriptive information on the predictors, including individual awardee, primary mentor, and two environmental predictors, of the general and VA-related outcomes of the HSR&D CDAs. Descriptive data on the full sample of HSR&D CDAs in Tables 3a-3d provided information on the characteristics of the 219 CDAs. Not surprisingly, the information on the characteristics of the 212 CDAs with primary mentor data differs little from that for the full sample of 219 awardees presented earlier.

### Table 13. Pre-award CDA, Primary Mentor and Environmental Characteristics

| Characteristic | Mean or % |
|---|---|
| **Awardee Characteristic (N=212)** | |
| Years since relevant award | 8.2 |
| Female | 43% |
| Minority Group | 13% |
| MD Degree | 67% |
| Research Ranking of Highest Degree University | 64.7 |
| Years into Career at Time of Relevant CDA | 5.9 |
| Postdoctoral Training | 83% |
| Number of Pre-award Grants as PI | 1.5 |
| Number of Pre-award Major Journal Articles | 9.7 |
| **Mentor Characteristic (N=118* or 212)** | |
| Female* | 29% |
| MD Degree* | 76% |
| Years into Career (When Mentee Received CDA) | 18.5 |
| Academic Rank (When Mentee Received CDA) | 2.5 |
| Assistant Professor | 7% |
| Associate Professor | 38% |
| Professor | 55% |
| Number of Pre-award Grants as PI | 9.4 |
| Number of Pre-award Major Journal Articles | 72.2 |
| **Environmental Characteristic (N=212)** | |
| Ranking of Affiliated University | 80.3 |
| Level of HSR&D Center | 2.1 |
| None = 0 | 27% |
| TREP = 1 | 3% |
| REAP = 2 | 9% |
| CoE = 3 | 62% |

The 219 HSR&D CDAs who provided a CV had 124 unique primary mentors. Of those, 118 (95%) provided a CV for the evaluation. The 118 mentors had trained 212 (97%) of the 219 participating HSR&D awardees. The number of awardees for each mentor ranged from one to eight (see Table 14).

### Table 14. Number of CDAs for HSR&D Primary Mentors

| Number of Awardees Mentored | Number of Mentors with the Specified Number of Awardees | Awardees with Participating Primary Mentors |
|---|---|---|
| 1 | 73 | 73 |
| 2 | 23 | 46 |
| 3 | 7 | 21 |
| 4 | 9 | 36 |
| 5 | 3 | 15 |
| 6 | 1 | 6 |
| 7 | 1 | 7 |
| 8 | 1 | 8 |
| TOTALS | 118 | 212 |

As noted in Table 13, among the primary mentors of HSR&D CDAs, almost 30% were women and a little over three-quarters had an MD degree. On average, mentors were over 18 years into their careers (after their highest degree or residency) when each of their mentees received a CDA; more than half were full professors at that point. The mentors had received an average of over nine grants as PI and had published over 70 major journal articles, on average, prior to their mentees' receiving CDAs. With respect to the two environmental predictors (see Table 13), the universities that were the primary academic affiliates of the VHA facilities at which CDAs were located when they received their award had an average NIH research ranking of over 80 (with a ranking of 100 being the best possible). Almost three-quarters of the awardees were located at facilities with an HSR&D center at the point they received their (relevant) CDA and the preponderance of those were at facilities that had HSR&D CoEs.

## Intercorrelations Among General and VA-related Outcomes

Table 15 provides the correlations between pairs of the general and VA-related outcomes for the 212 HSR&D CDAs (intercorrelations among the predictors are given in Appendix A). The general outcomes (tenure-track rank, number of major journal outcomes, *h*-index, number of grants as PI, and at least one journal editor position) were modestly to strongly intercorrelated from .33 to .87, indicating these indices tap aspects of general research career progress. All of the general outcomes also were significantly, though modestly, correlated from .17 to .28 with a greater likelihood of VA retention. All but the journal editorship outcome likewise were correlated with stronger QUERI involvement, although the correlations tended to be small in magnitude, ranging from .13 to .25.

### Table 15. Intercorrelations Among Outcome Variables for HSR&D CDAs (N=212)

| Outcome Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **1.Tenure-track Rank** | 1 | .52** | .53*** | .40*** | .33*** | .18** | .17* |
| **2.Major Journal Articles** | | 1 | .87*** | .71*** | .50*** | .19** | .15* |
| **3.Citation (*h*) Index** | | | 1 | .59*** | .54*** | .17** | .13* |
| **4.Grants as PI** | | | | 1 | .35*** | .28*** | .25*** |
| **5.Journal Editor Position** | | | | | 1 | .18** | - .07 |
| **6.VA Retention** | | | | | | 1 | .16* |
| **7.QUERI Involvement** | | | | | | | 1 |

*$p$<.05, ** $p$ <.01, ***$p$<.001

### Multivariate Prediction of General and VA-related Outcomes Among HSR&D CDAs

Table 16 provides summary information on the prediction of seven outcomes for the sample of 212 CDAs in the form of standardized regressions coefficients (*βs*) for continuous outcomes and odds ratios (*OR*s) for dichotomous outcomes from multiple ordinary least squares or logistic regressions, respectively (the bivariate correlations between predictors and outcomes are given in Appendix B). Results from multivariate predictions of the outcomes of the 118 independent CDA-mentor dyads are presented in Appendix C.

Although, in general, significant independent predictive relationships were relatively few (even with no correction for multiple tests) and usually of modest or small magnitude, the covariate of a greater number of years since the relevant CDA, not surprisingly, was a consistent and strong correlate of awardees' subsequent higher tenure-track rank, more major journal articles published, a higher *h*-index, a larger number of grants obtained as PI, and a higher likelihood of holding at least one journal editor position and of remaining in the VA. With that covariate controlled, gender was not related to CDAs' outcomes, except that female awardees tended to publish fewer major journal articles. Minority group status was unrelated to any of the outcomes.

In contrast, CDAs with MD degrees had significantly higher tenure-track faculty ranks and higher *h*-indices, and were more likely to have held at least one journal editorship position. The NIH research ranking of the university from which CDAs received their degrees was unrelated to any of the outcomes, with the exception that those whose degrees were from higher-ranked universities had greater involvement in the QUERI. Years into career (i.e., years post completion of the highest degree or residency) when the CDA was received was associated only with subsequently having a higher tenure-track academic rank, whereas receipt of postdoctoral training and number of grants as PI prior to the award were not significantly predictive of any of the outcomes. In contrast, awardees who had published more journal articles up to the year of their awards published more major journal articles following their awards and had higher *h*-indices.

### Table 16. Standardized Regression Coefficients or Odds Ratios from Ordinary Least Squares or Logistic Regressions Predicting Outcomes for HSR&D CDAs (N=212)

| Predictor/Outcome | Tenure-track Rank *β* | Major Journal Articles *β* | Citation (*h*) Index *β* | Number Grants as PI *β* | Journal Editor Position OR | VA Reten-tion OR | QUERI Involve-ment *β* |
|---|---|---|---|---|---|---|---|
| **Covariate** | | | | | | | |
| **Years Since Relevant Award** | .54*** | .70*** | .69*** | .63*** | 1.22*** | 1.16** | .18* |
| **Awardee Characteristic** | | | | | | | |
| **Female** | -.01 | -.13* | -.09 | -.05 | .98 | 1.13 | -.12 |
| **Minority Group (Y/N)** | -.05 | -.09 | -.04 | -.07 | 0.93 | .56 | .03 |
| **MD (Y/N)** | .14* | .09 | .13* | .07 | 4.00* | .98 | -.06 |
| **Ranking of Highest Degree University** | .04 | .03 | -.02 | .03 | .99 | 1.00 | .16* |
| **Years into Career at Relevant CDA** | .19** | -.06 | -.05 | -.07 | 1.03 | 1.03 | .09 |
| **Postdoctoral Training (Y/N)** | .01 | .00 | -.01 | -.03 | 0.37 | 1.18 | -.05 |
| **Number of Pre-award Grants as PI** | -.03 | .05 | .02 | .03 | 1.14 | 1.28 | -.04 |
| **Number of Pre-award Major Journal Articles** | .08 | .21*** | .35*** | .12 | 1.01 | .99 | -.03 |
| **Mentor Characteristic** | | | | | | | |
| **Female** | -.02 | .05 | -.00 | .11 | .64 | .93 | .12 |
| **MD Degree** | .06 | -.03 | -.01 | -.03 | .51 | .40 | -.04 |
| **Years into Career (When Mentee Received CDA)** | .15 | .08 | .04 | -.05 | 1.00 | .95 | -.06 |
| **Academic Rank** | -.01 | -.03 | .03 | .13 | 0.75 | .84 | .06 |
| **Number of Pre-Award Grants as PI** | -.01 | -.06 | -.14** | -.10 | 0.95 | .96 | -.14 |
| **Number of Major Journal Articles** | -.16 | -.03 | -.01 | .02 | 1.00 | 1.00 | .10 |
| **Environmental Characteristic** | | | | | | | |
| **Research Ranking of Affiliated University** | .00 | .13* | .07 | .05 | 1.02* | 1.02* | .03 |
| **Level of HSR&D Center** | .10 | .06 | .01 | .19** | .68** | 1.06 | .25** |
| **$R^2$** | | | | | | | |
| **$R^2$ Yrs Since Award** | .37 | .48 | .49 | .35 | .22 | .07 | .02 |
| **Total $R^2$** | .47 | .58 | .66 | .43 | .31[#] | .17[#] | .13 |

*$p$<.05, ** $p$ <.01, ***$p$<.001. [#]Cox & Snell (1989) pseudo $R^2$

With one exception, none of the characteristics of primary mentors independently predicted subsequent outcomes for their HSR&D CDAs. The exception was that mentors who had more grants as PI prior to their mentees' awards, tended to have mentees with lower subsequent *h*-indices. For the

environmental predictors, those CDAs whose VHA medical centers' affiliated universities had higher (better) NIH research rankings published more major journal articles and were more likely to attain a journal editor position. Finally, the presence of a higher level HSR&D Center was independently linked to awardees' receiving more grants as PI and to their greater involvement in the QUERI, but also to a lower likelihood of awardees' having had any journal editorship position.

Overall, the independent relationships between the predictors and HSR&D CDAs' outcomes when data from only 118 independent CDA-mentor dyads were included in the analyses (see Appendix C) were generally similar to those in Table 16, although in some cases they were no longer significant, perhaps reflecting reduced statistical power with the lower N. For example, the relationship indicating that female CDAs tended to publish fewer major journal articles was no longer significant in the analysis of data from the 118 CDAs. In addition, the number of grants obtained by the mentor, which had a significant, but small, negative relationship with awardees' subsequent *h*-indices in the sample of 212 awardees, had virtually a zero relationship to *h*-indices in the smaller sample of 118 awardees.

A significant relationship that was not present in the analyses of the 212 awardees was that awardees with female mentors obtained more grants as PI subsequently, although the relationship was modest in magnitude in the sample of 118 CDAs. Also, having a higher research ranking for affiliated universities was linked to higher *h*-indices later among awardees in the smaller sample, but not in the larger sample. Finally, having a higher level HSR&D center was significantly related to achieving a higher academic rank among the 118 awardees, but not in the larger sample

Our multivariate analyses accounted for between 13% (QUERI involvement) and 66% (*h*-index) of the variance in the seven outcomes for the 212 HSR&D CDAs, with 2% (QUERI involvement) to 49% (*h*-index) explained solely by the covariate of number of years since award (see Table 16). Overall, independent of the years since award, the 16 predictors we examined together accounted for between 8% and 17% of the variance in the seven outcomes examined.

# *IV. DISCUSSION*

The Veterans Health Administration (VHA) is the largest, fully-integrated health care system in the U. S. It has special significance in that its patients comprise men and women who have served in the Armed Forces of the United States. A priority in the VA Strategic Plan 2006-2011 was to maintain VHA's "status as the highest rated health care provider in the U.S." VHA health services research has been a significant contributor in moving VHA care to its current level of excellence through such activities as evaluating the quality, safety and cost-effectiveness of health care services, identifying efficient mechanisms of service delivery, and studying how evidenced-based practices can be effectively implemented in routine VHA care. A continuing influx of well-trained, highly productive health services researchers focusing on such issues is essential if VHA is to continue to provide increasingly higher quality care to the nation's Veterans. The HSR&D CDA Program offers training unique to VHA and thus promotes the development of researchers dedicated to improving health care for Veterans. Graduates of the VHA HSR&D CDA Program have become national and international leaders in HSR.

Although the rationale supporting the HSR&D CDA Program rests on strong conceptual grounds and clearly some of its awardees have excelled, the findings from the current evaluation provide a more objective empirical basis for gauging the return on investment in the CDA Program with respect to the research productivity and dedication to VHA that the U.S. Congress and U.S. taxpayers expect from this program. In addition, the evaluation produced findings that validate at least some of the criteria currently used to select CDA recipients.

## A. Academic Advancement and Research Productivity of HSR&D, NIH and AHRQ Awardees

### Characteristics of Awardees

HSR&D CDAs and NIH and AHRQ K awardees typically were between ages 37 and 38, and were six to seven years after the receipt of their doctoral degrees or completion of their residencies at the time of receiving their awards. About a quarter of the HSR&D and NIH K awardees were age 40 or more, as were a third of the AHRQ awardees. Although awardees' average ages may appear advanced for a "career development" award, they were increased by the fact that researchers with MDs (two-thirds of all participating awardees) typically do not begin their research careers until after completing residencies or later. A more informative statistic is that, on average, the groups of awardees were from 5.4 to 6.9 years into their research careers (post-residency for MDs and post-doctoral degree for others) at the point they received their awards. Moreover, about three-quarters or more of the awardees in each group had received some form of postdoctoral training. Thus, it may not be surprising that highly competitive CDA and K awards, which sometimes require multiple applications, are received by individuals who have only approximately 30 years remaining in their research careers (assuming they work until age 67 or 68).

Although 43% of the HSR&D CDAs were women, more women (53%) were included in the full NIH K awardee sample. That gender difference held in the samples of 2000 and later awardees, with the AHRQ K awardees having a similar percentage of women as did the HSR&D awardees. A total of 14% of the HSR&D CDAs was from minority racial/ethnic groups versus 25% for the full sample of NIH K awardees. This difference held in the 2000 and later samples of awardees, with both the NIH and AHRQ groups having higher percentages of minority group researchers than did the HSR&D CDA sample. These differences across groups were present within most of the racial/ethnic categories. For example 15% of the full sample of NIH K awardees was Asian versus 7% of the HSR&D sample. Similarly, 5% of the full sample of NIH awardees was African-American relative to 2% of the HSR&D CDAs. These differences in part may reflect the NIH K01 program's being used to increase diversity.

In the full HSR&D and NIH samples, almost two-thirds of the awardees had MD degrees. For the HSR&D sample of awardees from 2000 and later, proportionately fewer had MDs than in the NIH and, especially, the AHRQ sample. These findings may reflect the influx of non-physician HSR&D CDAs following the initiation of the MREP program in 2002 and the development of the CDA-1 and CDA-2 award programs beginning in 2006, for which both clinician and non-clinician researchers were eligible to apply. Similarly, non-clinicians were not able to apply for the AHRQ K08 awards that were offered up to FY2009, at which point AHRQ K01 awards became available to non-clinician researchers.

## Comparing Outcomes for HSR&D, NIH and AHRQ Awardees

The quality of the HSR&D CDA Program is supported by the fact that its awardees typically performed as well or better than NIH K awardees in health services research and AHRQ K awardees on such key general metrics as academic career progress, number of grants as PI, number of major journal publications, citation of publications, having attained at least one journal editorship position, serving as a standing member on one or more grant review committees for major funding agencies, and mentoring postgraduate researchers. Although fewer HSR&D CDAs overall held tenure-track academic positions, their covariate-adjusted mean academic rank (including those with no academic position) was essentially the same (slightly above the Assistant Professor level) as their NIH K awardee counterparts. Similar findings emerged in the 2000 and later samples of HSR&D CDA, NIH K, and AHRQ K awardees. Given that VHA can be a "stand-alone" employer for at least some researchers who may have no ties or somewhat tenuous ties with their affiliated universities, this equivalence across groups in tenure-track rank is noteworthy.

Not surprisingly, proportionately more HSR&D CDAs had obtained VA grants, more NIH K awardees had secured NIH grants, and more AHRQ awardees had been PIs on AHRQ grants. All together, HSR&D CDAs had been PIs on an impressive 1,147 grants and the smaller number of NIH K awardees had been PI on 564 grants; obviously, fewer grants had been obtained by the three groups of awardees since 2000. The important finding is that adjusted means on grants as PI did not differ significantly between either the full samples of HSR&D and NIH awardees, or among the three groups that had received awards in 2000 or later. However, HSR&D CDAs who reported grant funding amounts had been PI on significantly more grants of $100,000 or more than had NIH K awardees who reported grant funding in their CVs.

In total, the 219 HSR&D CDAs had produced 9,350 major journal articles, including 2,480 on which they were first or sole author, whereas the 154 NIH K awardees had 4,234 such articles, with 1,497 as first or sole author. Even though these two groups of awardees had received awards between FY1991 and FY2010, more HSR&D CDAs had earlier awards and the two groups differed on other pre-award characteristics. When time since award and pre-award characteristics were taken into account, the full sample of HSR&D CDAs had a significantly higher adjusted mean number of major journal articles than did the full sample of NIH K awardees. However, the differences in the number of major articles as first or sole author were not significant, either between the full samples of HSR&D and NIH awardees, or among the HSR&D, NIH and AHRQ awardees since 2000. Likewise, there were no significant differences among groups in the citation of their publications, as captured by the Hirsch (2005) *h*-index.

Serving in a journal editor position and as a standing member of a grant review committee for a major funding entity are indirect indicators of research productivity and stature in a researcher's field. Similar percentages of HSR&D and NIH K awardees overall had held at least one such position, as had the HSR&D, NIH and AHRQ awardees from 2000 and later, and no significant differences emerged in the covariate-adjusted analyses. Likewise, there were no differences across groups in the numbers of their post-graduate mentees, after adjusting for covariates.

In light of these findings, at a minimum, the overworked Dodo bird verdict would seem to apply regarding the three career development programs: "All have won and all must have prizes." The conclusion applies in part given that multiple statistical tests of significance were conducted, with some significant findings expected by chance. The conclusion also seems apt, even though the known clustering of HSR&D CDAs within mentors and the unknown, but likely lower levels of mentor clustering among NIH and AHRQ K awardees, were not (and could not be) taken into account. Clustering affects significance tests, not the adjusted means and percentages on outcomes variables.

Other factors may have contributed to the few significant differences between groups. Awardees in the early years of their awards may publish fewer major journal articles per year than do past award recipients who are at middle or later points of their research careers. Given that the HSR&D CDAs were further into their post-award receipt careers than either the full sample of NIH awardees, and both the NIH and AHRQ awardees from 2000 and later, simply controlling for years since award may not have fully adjusted for the "effects of time" in the comparisons across groups, especially the comparisons between the full samples of HSR&D and NIH awardees. On the other hand, assuming that more productive researchers would have been more likely to submit a CV (although it is possible that others may have felt too busy to do so), the lower percentages of NIH (67%) and AHRQ K awardees (76%) who participated in the evaluation, casts a more favorable light on the accomplishments of the HSR&D CDAs, of whom 90% submitted a CV. It should be noted, however, that the accomplishments of all three groups of awardees are somewhat overstated, given the 10% to 33% non-participation rates. Weighing all of these considerations, it can be stated confidently that the accomplishments of HSR&D CDAs are at least equal to, if not better than, those of awardees from the highly regarded NIH and AHRQ K award programs.

## B. Predicting HSR&D CDAs' Academic Advancement, Research Productivity and VA Involvement

We examined predictors of seven outcomes for the 212 of the 219 HSR&D CDAs on whom we also had CV-based primary mentor data. As noted previously, the mean tenure track academic rank of the CDAs (with zero indicating no tenure-track position) was somewhat above the Assistant Professor level. During and after their awards, CDAs had secured an average of over five grants as PI, had published over 40 journal articles (about seven a year), on average, and had a mean Hirsch (2005) *h*-index of almost 17, which indicates that they had a mean of almost 17 publications, each of which had been cited a minimum of almost 17 times. In addition, almost 40% held one or more journal editorship positions.

The HSR&D CDA Program seeks to not only foster health services researchers who are productive in term of the outcomes above, but also to retain investigators in the VA who will participate in research relevant to Veterans and their care, and become involved in efforts to improve their care, for example through participation in the Quality Enhancement Research Initiative (QUERI). VA retention among HSR&D CDAs was substantial. Fully 80% of the 212 HSR&D CDAs were still in the VA in 2010, with 74% involved in VA research. In addition, over 40% of the HSR&D CDAs were or had been involved in the QUERI, as either Directors or Coordinators of a QUERI group, members of a QUERI group executive committee and/or workgroup, or as PIs on local QUERI projects, Rapid Response Projects (RRPs), or larger-scale Service Directed Project (SDP) grants to implement evidence-based practices. Thus, many

past and current HSR&D CDAs have been involved directly in this effort to improve VHA care for Veterans.

The five general outcomes tapping academic advancement and research productivity were modestly to strongly intercorrelated, indicating that each of these indices taps an aspect of general research career progress. Thus, results of previous evaluations of faculty and research career development programs that examine only one or two of these outcomes may be suggestive of outcomes on other dimensions of research productivity and career progress. All of the general outcomes also were significantly, though modestly, correlated positively with a greater likelihood of VA retention, and all but the dichotomous journal editorship outcome were likewise correlated with stronger QUERI involvement. It is gratifying that awardees who were performing better on general indicators of accomplishment and productivity for health services researchers, also were more likely to remain in VA and to be more involved in a program to improve VHA care.

In multivariate analyses, years since award had strong and consistent relationships with greater academic advancement, greater research productivity in the form of grants as PI, major journal publications, *h*-indices, and having had an editorial position on at least one journal. Such results are not surprising in that years into career is better conceptualized as a covariate (see Figure 2), rather than a predictor of CDAs' outcomes, given that it spans the period of the CDA's award through 2010, rather than being a pre-award characteristic. These findings reinforce both the "publish or perish" axiom and the simple fact that a health services researcher can publish more, obtain more grants, and accrue more honors if s/he has a longer career. Of more interest in a VA context, however, is that researchers who had received their awards earlier were somewhat more likely still to be in VA. One might have thought that years since receipt of a CDA would be negatively related to VA retention, given that current CDAs were still in VA.

In light of the consistent and generally strong relationships of years since award with other outcomes, it is instructive to consider the predictors with which it was significantly correlated (see Appendix A). Awardees who were further into their post-award careers in 2010 were more likely to have MD degrees and to have mentors with MDs, likely reflecting the earlier emphasis in the CDA Program of providing awards for clinician-scientists. In addition, investigators who had received awards earlier tended to have mentors who were not as far into their careers and who had fewer grants and major journal articles, and, not surprisingly, to have been located at VHA facilities without an HSR&D Center, given that such Centers became more prevalent over time.

Female and male CDAs did not differ on outcomes in the multivariate analyses, except that female CDAs tended to publish fewer major journal articles (the magnitude of the relationship was not strong). Although chance is one explanation for this relationship given the total number of predictive relationships examined, an extensive literature exists indicating the greater challenges faced by women in research careers in terms of the impact of child birth, child-rearing, and greater family and household responsibilities (e.g., Mason & Goulden, 2004; Suitor et al., 2001). Such factors may account for this finding.

We found no significant relationships between minority group status and either general or VA-related outcomes. In contrast, having an MD degree (in some cases together with a PhD) was predictive of higher-ranked tenure-track academic positions, higher *h*-indices, and a greater likelihood of having had at least one journal editor position. The greater academic advancement and research success of CDAs with MDs may reflect differences in their personal characteristics relative to PhDs and awardees with other terminal degrees, but they also may reflect differences in promotion criteria, journals targeted for publications, etc. Another possible explanation flows from the likelihood, raised earlier, that the careers of health services researchers follow other than linear trajectories over time, with more recent awardees advancing less rapidly academically or publishing at a lower rate than those who received awards longer ago. If that is the case, controlling for years since award may not fully adjust for the "effects of time" on the academic advancement and research productivity of physicians, who were more prevalent in the early years of the CDA Program.

NIH ranks universities each year in terms of the amount of NIH funding going to their medical schools. In this evaluation, with other factors controlled, having received a terminal degree from universities which had higher (better) research rankings in the years that CDAs were granted, was unrelated to any of the seven outcomes, except a higher level of involvement in the HSR&D QUERI. Awardees who were further into their careers at the point of receiving their (relevant) CDAs had higher tenure-track ranks in 2010, as might be expected. On the other hand, a dichotomous indicator of whether or not postdoctoral training had been received was unrelated to any of the outcome variables for the HSR&D CDAs. Perhaps years of postdoctoral training might have been predictive of at least some of the outcomes, but a lack of complete information on the dates of postdoctoral training precluded our examining the number of years of such training as a predictor.

Obtaining more grants (presumably mainly pilot and other relatively small grants) prior to receiving a CDA was not linked to any of the subsequent outcomes. Thus, in the context of the other predictors examined here, previously securing grants is not an indicator of potential to which the HSR&D CDA Review Committee should attend strongly in reviewing CDA applications. On the other hand, having published more major journal articles prior to receiving a CDA was independently related in the multivariate analyses to both the later publication of more major journal articles and to higher citation indices. These findings support the CDA Review Committee's placing significant weight on major journal publications in its evaluations of applications for CDAs, as this is an instance in which past behavior seems predictive of future performance.

The relationships of primary mentor characteristics with the subsequent performance of their mentees are intriguing. The negative bivariate correlations between mentor productivity indices and mentee outcomes in Appendix B might seem to suggest that selection committees are wise to raise questions about the time that especially accomplished mentors may have to devote to their mentees. However, of all the significant bivariate relationships of mentor pre-award characteristics with mentees' subsequent outcomes, only the number of grants as PI that mentors had at the time of award remained significantly related to lower subsequent *h*-indices for awardees in the multivariate analyses. Thus, in the context of all the predictors, objective mentor characteristics are not that predictive of CDA applicants' potential. Likewise, Ross et al. (2009) found that mentor characteristics (gender, PhD

degree, funded R01 grants, publication rate, or the Hirsch *h*-index) were unrelated to the later publication productivity of postdoctoral trainees in simple bivariate analyses. By focusing on the primary mentor at the time of award, we did not take into account the characteristics of other members of a CDA's mentoring team, including one or more mentors who may have been more influential than the primary mentor. In addition, the primary mentor may have changed after the award in at least a few cases. In any event, such aspects of mentorships as the time devoted to mentoring, the quality of the mentor-mentee relationships and the quality of mentoring are likely to have a greater impact on awardees' future productivity than objective characteristics of mentors or even those of the mentoring team (Paglis et al., 2006). These more in-depth and qualitative aspects of mentorships and mentoring relationships, along with their linkages to CDAs' satisfaction, academic advancement, research productivity and VA involvement, will be examined in an ongoing second phase of the HSR&D CDA Program evaluation.

The current evaluation provides relatively rare information on the potential influence of the contexts in which CDAs were located when they received awards on their future productivity and VA involvement. The multivariate analyses indicated that, holding other factors constant, if the NIH research ranking of the university affiliated with the VHA medical center where an awardee was located at the time of award was better (higher), the awardee tended to publish more major journal articles, to be more likely to have a journal editorship position, and to be more likely to remain in the VA. Thus, the standing of affiliated universities appears to play a role in facilitating the research progress of CDAs, as well as enhancing the likelihood of retaining them in VA.

VHA has devoted substantial resources to building its capacity for health services research by establishing HSR&D Centers at various VHA medical centers. Types of centers have ranged in the number of core health services researchers and the level of funding from no center, to Targeted Research Enhancement Programs (TREPs), to Research Enhancement Award Programs (REAPs), to Centers of Excellence (CoEs). As noted earlier, over 70% of the 212 CDAs came from VHA facilities with some type of HSR&D Center. This finding suggests that the Center Program has been highly successful in increasing the number of health services researchers in VHA. In the multivariate analyses, a higher level of HSR&D Center (if any) located at the CDA's VHA medical center at the time of award was predictive of awardees' later having more grants as PI and greater involvement in the HSR&D QUERI, but a lower likelihood of having at least one journal editor position (a surprising finding that might be due to chance, given the number of tests of predictor significance). The positive relationships of Center level with some of the CDAs' outcomes, after controlling for the other predictors and years since award, contrast with the negative bivariate relationships for the HSR&D Center variable in Appendix B. However, Centers have become more prevalent over time. Controlling for years since award and the other predictors allowed for independent relationships of Center type to outcomes to emerge.

Our multivariate analyses accounted for between 13% (QUERI involvement) and 66% (*h*-index) of the variance in the seven outcomes for HSR&D CDAs, with the 2% (QUERI involvement) to 49% (*h*-index) explained solely by the covariate of number of years since award and any variance it shared with the other predictors. Overall, independent of the years since award, the 16 predictors we examined accounted for 8% and 17% of the variance in the seven outcomes. More variance might have been

explained by examining interactions among predictors. For example, the relationships of having an MD degree to at least some of the outcomes we examined may differ for female and male CDAs. We did not explore interactions between or among predictors in relation to CDAs' outcomes, however, because we only had an N of 212 awardees (ignoring clustering) and had 16 predictors and the years since award covariate to account for the seven outcomes, so the number of tests of predictor significance already was very high. Examining interactions between predictors would have increased the likelihood of chance findings.

Overall, our findings suggest that additional factors are needed to better account for CDAs' subsequent academic advancement, research productivity, and VA involvement. Capturing a CDA applicant's passion for health services research, drive, and VA commitment requires more than such simple indicators as the number of previous publications. Presumably, some clues on other important determinants of career potential are contained in the written applications for CDAs that are evaluated by the CDA Review Committee. In addition, information on the qualitative aspects of mentorships and mentoring relationships to be derived from Phase II of this evaluation may provide additional insights into the determinants of HSR&D CDAs' career trajectories.

## C. Conclusions

Overall, the findings presented here indicate that the HSR&D CDA Program is selecting particularly promising applicants for CDAs and mentoring them very effectively, as indicated by their advancing in academic positions, securing grants, publishing, garnering honors and mentoring young investigators at levels that, at a minimum, are equal to those of K awardees from the highly regarded NIH and AHRQ programs. Moreover, the HSR&D CDA Program has been quite successful in retaining outstanding health services researchers in the VA where they can make substantial research contributions to help improve the VHA care for Veterans. In addition, this evaluation has provided findings that validate some of the criteria that HSR&D CDA Review committee members use in evaluating applications. In terms of personal characteristics, CDAs who had published more major journal articles prior to their awards subsequently published more after the award and had higher citation indices. For the contextual predictors, the NIH research funding ranking of the universities affiliated with awardees' VHA medical centers at the time of award was associated with the subsequent publication of more major journal articles, as well as a greater a likelihood of holding at least one journal editorship position and of remaining in the VA. Likewise, the presence of a larger HSR&D Center at awardees' VHA medical center was predictive of later securing more grants as PI and greater involvement in the VHA QUERI. The second phase of this evaluation should provide more information on indicators of CDA applicants' potential (such as their research commitment), as well as the characteristics of their mentoring, that can be used to improve an already successful program.

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## VII. List of Acronyms

AHRQ---Agency for Healthcare Research and Quality

AI---Associate Investigator award

ARCD---Advance Research Career Development award

CDA---Career Development Award

CDTA---Career Development Transition Award

CV---curriculum vita

FY---Fiscal Year

HSR---health services research

HSR&D---Health Services Research and Development

NIH---National Institutes of Health

NRSA—National Research Service Award

ORD---Office of Research and Development

PI---Principal Investigator

QUERI---Quality Enhancement Research Initiative

RCD---Research Career Development award

REAP---Research Enhancement Award Program

RRP---Rapid Response Project (QUERI)

SDP---Service Directed Project (QUERI)

SDR---Service Directed Research Project

TREP---Targeted Research Enhancement Program

VA---Department of Veterans Affairs

VHA---Veterans Health Administration

# *VIII. Appendices*

## Appendix A. Intercorrelations Among Predictors of Academic Career Advancement and Productivity for 212 HSR&D CDAs

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Covariate** | | | | | | | | | | | | | | | | | |
| **1. Years Since Relevant Award** | 1 | -.09 | .03 | .34*** | .13 | .15* | .06 | .02 | -.13 | -.11 | .19** | -.30*** | -.16* | -.25*** | -.33*** | .00 | -.31*** |
| **Awardee Characteristic** | | | | | | | | | | | | | | | | | |
| **2. Female** | -- | 1 | -.06 | -.29*** | -.07 | .09 | .00 | .08 | -.03 | .12 | -.18** | -.05 | -.04 | -.08 | -.07 | .10 | .08 |
| **3. Minority Group (Y/N)** | -- | -- | 1 | .17* | .06 | .05 | .06 | .03 | -.02 | -.05 | .05 | -.06 | -.02 | .18** | .01 | .01 | .04 |
| **4. MD Degree (Y/N)** | -- | -- | -- | 1 | .21** | .18** | .36*** | .07 | -.05 | .00 | .34*** | -.13 | -.02 | -.11 | -.13 | -.06 | -.12 |
| **5. Ranking of Highest Degree University** | -- | -- | -- | -- | 1 | .01 | .03 | .09 | -.01 | -.11 | .02 | -.07 | -.06 | -.11 | -.02 | .05 | -.16* |
| **6. Years into Career at Relevant CDA** | -- | -- | -- | -- | -- | 1 | -.03 | .31*** | .33*** | .07 | .08 | -.04 | .08 | .04 | -.10 | -.08 | -.07 |
| **7. Postdoctoral Training (Y/N)** | -- | -- | -- | -- | -- | -- | 1 | .03 | -.03 | .06 | .03 | -.01 | .01 | -.19** | -.01 | .08 | .06 |
| **8. Number of Grants as PI** | -- | -- | -- | -- | -- | -- | -- | 1 | .40*** | .08 | .07 | .02 | -.01 | .04 | -.03 | .03 | .04 |
| **9. Number of Major Journal Articles** | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .06 | .04 | .02 | .11 | .01 | .05 | -.06 | -.14* |
| **Mentor Characteristic** | | | | | | | | | | | | | | | | | |
| **10. Female** | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .00 | .01 | -.15 | -.10 | -.28*** | -.04 | .06 |
| **11. MD Degree** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -.24*** | .06 | .05 | -.11 | .02 | -.06 |
| **12. Years into Career at Mentee's Relevant CDA** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .62*** | .17* | .63*** | .04 | .04 |
| **13. Academic Rank** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .25*** | .47*** | .01 | .00 |
| **14. Number of Grants as PI** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .39*** | -.09 | .09 |
| **15. Number of Major Journal Articles** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | -15* | .07 |
| **Environmental Characteristic** | | | | | | | | | | | | | | | | | |
| **16. Ranking of Affiliated University** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | .20** |
| **17. Level of HSR&D Center** | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 |

*$p$<.05, ** $p$ <.01, ***$p$<.001.

## Appendix B. Correlations Between Predictors and Outcomes for HSR&D CDAs (N=212)

| Variable | Tenure-track Rank | Major Journal Articles | Citation (*h*) Index | Number Grants as PI | Journal Editor Position | VA Reten-tion | QUERI Involve-ment |
|---|---|---|---|---|---|---|---|
| **Covariate** | | | | | | | |
| **Years Since Relevant Award** | .61*** | .69*** | .70*** | .59*** | .47*** | .26*** | .14* |
| **Awardee Characteristic** | | | | | | | |
| **Female** | -.08 | -.19** | -.18** | -.09 | -.07 | .08 | -.08 |
| **Minority Group (Y/N)** | -.02 | -.07 | -.03 | -.06 | -.01 | -.08 | .03 |
| **MD (Y/N)** | .36*** | .31*** | .35*** | .23** | .28*** | .04 | .03 |
| **Ranking of Highest Degree University** | .12 | .15* | .11 | .09 | .05 | .04 | .14 |
| **Years into Career at Relevant CDA** | .31*** | .11 | .18** | .08 | .14* | .05 | .06 |
| **Postdoctoral Training (Y/N)** | .09 | .09 | .10 | .06 | .00 | .08 | -.02 |
| **Number of Pre-award Grants or Contracts as PI** | .10 | .13 | .15* | .08 | .09 | .11 | -.01 |
| **Number of Pre-award Major Journal Articles** | .03 | .09 | .25*** | .02 | .03 | -.05 | -.05 |
| **Mentor Characteristic** | | | | | | | |
| **Female** | -.01 | -.02 | -.06 | .03 | -.08 | .02 | .06 |
| **MD Degree** | .19** | .14* | .18* | .12 | .06 | -.04 | -.02 |
| **Years into Career at Mentee's Relevant CDA** | -.16* | -.16* | -.18* | -.16* | -.15* | -.20** | -.04 |
| **Academic Rank** | -.07 | -.11 | -.06 | -.04 | -.13 | -.18** | -.03 |
| **Number of Pre-award Grants as PI** | -.21** | -.27*** | -.32*** | -.24** | -.24** | -.24*** | -.11 |
| **Number of Pre-award Major Journal Articles** | -.29*** | -.23** | -.23** | -.20** | -.18* | -.22** | -.04 |
| **Environmental Characteristic** | | | | | | | |
| **Ranking of Affiliated University** | -.02 | .12 | .05 | .09 | .08 | .16* | .04 |
| **Level of HSR&D Center** | -.13 | -.18** | -.27*** | -.05 | -.27*** | -.02 | .16* |

*$p$<.05, ** $p$ <.01, ***$p$<.001.

## Appendix C. Standardized Regression Coefficients or Odds Ratios from Ordinary Least Squares or Logistic Regressions Predicting Outcomes for 118 Independent CDA-Mentor Dyads

| Variable | Tenure-track Rank *β* | Major Journal Articles *β* | Citation (*h*) Index *β* | Number Grants as PI *β* | Journal Editor Position OR | VA Reten-tion OR | QUERI Involve-ment *β* |
|---|---|---|---|---|---|---|---|
| **Covariate** | | | | | | | |
| **Years Since Relevant Award** | .56*** | .69*** | .72*** | .66*** | 1.36*** | 1.24** | .21 |
| **Awardee Characteristic** | | | | | | | |
| **Female** | -.03 | -.12 | -.06 | -.13 | 1.84 | .99 | -.06 |
| **Minority Group (Y/N)** | -.06 | -.13 | -.07 | -.09 | 1.19 | .53 | -.02 |
| **MD (Y/N)** | .17 | .12 | .17* | .07 | 2.16 | .87 | -.04 |
| **Ranking of Highest Degree University** | .16* | .00 | -.08 | .06 | .99 | 1.00 | .15 |
| **Years into Career at Relevant CDA** | .17* | -.01 | -.03 | -.05 | 1.19 | 0.98 | .02 |
| **Postdoctoral Training (Y/N)** | -.05 | .03 | -.06 | -.12 | .43 | .42 | .05 |
| **Number of Pre-award Grants as PI** | -.05 | -.00 | -.05 | .03 | .83 | 1.38 | .05 |
| **Number of Pre-award Major Journal Articles** | .11 | .19* | .37*** | .13 | 1.01 | .98 | -.02 |
| **Mentor Characteristic** | | | | | | | |
| **Female** | -.02 | .11 | .05 | .18* | .36 | .92 | .00 |
| **MD Degree (Y/N)** | .09 | -.02 | -.01 | -.07 | .80 | .31 | -.02 |
| **Years into Career** | .17 | .03 | .05 | -.09 | .99 | .97 | -.08 |
| **Academic Rank** | -.02 | .02 | .01 | .14 | .30 | .38 | .00 |
| **Number of Grants as PI** | -.06 | -.04 | -.04 | -.04 | .98 | 1.02 | -.13 |
| **Number of Major Journal Articles** | -.11 | -.05 | -.03 | .01 | 1.00 | 1.00 | .17 |
| **Environmental Characteristic** | | | | | | | |
| **Ranking of Affiliated University** | .02 | .21** | .19** | -.09 | 1.04* | 1.03 | -.20 |
| **Level of HSR&D Center** | .19* | .02 | -.05 | .25** | .50** | .75 | .28** |
| **$R^2$** | | | | | | | |
| **$R^2$ Years Since Award** | .41 | .49 | .52 | .38 | .27 | .08 | .05 |
| **Total $R^2$** | .55 | .61 | .70 | .50 | .41[#] | .23[#] | .16 |

*$p$<.05, ** $p$ <.01, ***$p$<.001. [#]Cox & Snell (1989) pseudo $R^2$