Implementation of Medicare Part D and Nondrug Medical Spending for Elderly Adults With Limited Prior Drug Coverage

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Context Implementation of Medicare Part D was followed by increased use of prescription medications, reduced out-of-pocket costs, and improved medication adherence. Its effects on nondrug medical spending remain unclear.

Objective To assess differential changes in nondrug medical spending following the implementation of Part D for traditional Medicare beneficiaries with limited prior drug coverage.

Design, Setting, and Participants Nationally representative longitudinal survey data and linked Medicare claims from 2004-2007 were used to compare nondrug medical spending before and after the implementation of Part D by self-reported generosity of prescription drug coverage before 2006. Participants included 6001 elderly Medicare beneficiaries from the Health and Retirement Study, including 2538 with generous and 3463 with limited drug coverage before 2006. Comparisons were adjusted for sociodemographic and health characteristics and checked for residual confounding by conducting similar comparisons for a control cohort from 2002-2005.

Main Outcome Measure Nondrug medical spending assessed from claims, in total and by type of service (inpatient and skilled nursing facility vs physician services).

Results Total nondrug medical spending was differentially reduced after January 1, 2006, for beneficiaries with limited prior drug coverage ($−306/quarter [95% confidence interval (CI), $−586 to $−51]; P = .02), relative to beneficiaries with generous prior drug coverage. This differential reduction was explained mostly by differential changes in spending on inpatient and skilled nursing facility care ($−204/quarter [95% CI, $−447 to $2]; P = .05). Differential reductions in spending on physician services ($−67/quarter [95% CI, $−134 to $5]; P = .03) were not associated with differential changes in outpatient visits ($0.06 visits/quarter [95% CI, −0.21 to 0.08]; P = .37), suggesting reduced spending on inpatient physician services for beneficiaries with limited prior drug coverage. In contrast, nondrug medical spending in the control cohort did not differentially change after January 1, 2004, for beneficiaries with limited prior drug coverage in 2002 ($14/quarter [95% CI, $−338 to $324]; P = .93), relative to beneficiaries with generous prior coverage.

Conclusion Implementation of Part D was associated with significant differential reductions in nondrug medical spending for Medicare beneficiaries with limited prior drug coverage.

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fined by a measure of drug coverage generosity before 2006 that identified beneficiaries more likely to be affected by the program. We hypothesized that implementation of Part D was associated with differential reductions in nondrug medical spending for beneficiaries with limited prior drug coverage, relative to those with generous prior drug coverage. We conducted similar comparisons for a control cohort from 2002 to 2005 to test whether relative reductions in nondrug medical spending might have been expected over time for beneficiaries with limited drug coverage in the absence of a national expansion in drug coverage for seniors.

**METHODS**

**Study Population**

Through the enrollment of multiple cohorts (70%-82% response rates), the HRS has since 1998 been representative of the noninstitutionalized US population older than 55 years. In each biennial survey, participants eligible for Medicare were asked to provide their identification numbers for linkage to Medicare enrollment and claims files available through 2007.

Our study cohort included elderly participants in the 2004 survey who were linked to their Medicare claims and enrolled in traditional Medicare at the beginning of 2004. We excluded participants who became eligible for Medicare before age 65 years owing to end-stage renal disease or other qualifying disabilities, because they were likely to have distinct health care needs and spending trajectories. We also excluded military veterans likely to receive care in the Department of Veterans Affairs health system, because their health care utilization was unlikely to be captured completely by Medicare claims (eSupplement available at http://www.jama.com, Statistical Appendix A). We applied the same inclusion criteria to 2002 survey participants to identify a control cohort of beneficiaries whose health care utilization over the subsequent 4-year period was not affected by Part D.

The study protocol was approved by the Harvard Medical School Committee on Human Studies and the Privacy Board of the Centers for Medicare & Medicaid Services. Because informed consent was obtained previously by HRS investigators when participants were enrolled in the HRS, informed consent was not part of the protocol for the current study.

**Study Variables**

**Drug Coverage.** Starting in 2002, participants were asked if they regularly took prescription medications and, if so, whether medication costs were completely, mostly, partially, or not at all covered by insurance. Aside from Medicare, participants whose medications were partially or not at all covered in 2004 were more likely to report Part D enrollment by 2008 (46.2% and 65.5%, respectively) than those whose medications were mostly or completely covered (25.7% and 25.9%, respectively). Therefore, we categorized participants whose medications were mostly or completely covered as having generous drug coverage and those whose medications were partially or not at all covered as having limited drug coverage—and thus more likely to be affected by Part D.

Participants who reported not taking medications were not asked about coverage generosity but instead were asked, “if your doctor did prescribe medication, would you expect any of the costs to be covered by insurance?” We categorized those who answered “no” as also having limited coverage. We excluded those who answered “yes,” because we could not ascertain whether their medications would be partially, mostly, or completely covered.

**Nondrug Medical Spending.** Using linked claims files from 2004 to 2007 for the study cohort and from 2002 to 2005 for the control cohort, for each beneficiary we assessed quarterly spending on all services covered at least in part by Medicare Parts A or B. We summed Medicare reimbursements, cost-sharing amounts, and payments from other primary payers to approximate the total costs of these services, rather than analyzing Medicare spending only.

Because we hypothesized that Part D primarily affected spending on acute and postacute care, we analyzed spending on inpatient and skilled nursing facility institutional services covered by Part A separately from spending on physician and ancillary services covered by Part B. Because Part B covers inpatient as well as outpatient physician services, we also analyzed quarterly counts of outpatient visits to further distinguish changes in spending on inpatient care from changes in spending on outpatient care associated with the implementation of Part D.

We inflated nondrug spending amounts to constant 2008 US dollars, using the gross domestic product deflator.

**Covariates.** From baseline surveys, we assessed the sociodemographic and health characteristics listed in Table 1. Participants reported their race and ethnicity based on categories specified by HRS investigators; we included this information in the analysis because drug coverage differed by race and ethnicity. In addition to diagnosed conditions reported in surveys, we used claims-based measures from the Centers for Medicare & Medicaid Services Chronic Condition Data Warehouse to adjust comparisons for differences in chronic disease burden (Table 1).

**Statistical Analysis.** To compare nondrug medical spending before and after Part D implementation for beneficiaries with limited vs generous prior drug coverage, we fitted the following generalized linear model:

$$\log(E(Y_{it})) = \beta_0 + \beta_1(\text{Rx coverage in 2004}) + \beta_2(\text{Time}t) + \beta_3(\text{Part D}t) + \beta_4(\text{Characteristics})(i) \times (\text{Part D}t) + \beta_5(\text{Rx coverage in 2004}) \times (\text{Part D}t) + \beta_6(\text{Characteristics})(i)$$

where $Y_{it}$ is spending for the $i$th individual at time $t$; $\text{Rx coverage in 2004}$ is a dichotomous indicator of 2004 drug coverage (limited or generous); $\text{Time}t$
is a continuous measure of time in quarters centered around the first quarter of 2006 and ranging from −8 (first quarter of 2004) to 7 (last quarter of 2007); Part D is an indicator of the availability of the Part D benefit equal to 1 in all quarters of 2006 and 2007; and Characteristics includes all baseline sociodemographic and health characteristics listed in Table 1.

The quantity of interest estimated by this model (\(\beta_m\)) is the change in nondrug medical spending for participants with limited prior drug coverage associated with Part D implementation and not explained by contemporaneous changes in spending for those with generous prior drug coverage. To facilitate interpretation, we present this differential change graphically as the difference between observed spending after Part D implementation for participants with limited prior drug coverage and expected spending for this group in the absence of Part D. We calculated expected spending for participants with limited prior drug coverage by extrapolating from their quarterly spending trend before 2006 and subtracting changes in spending level and trend that occurred after January 1, 2006, for participants with generous prior drug coverage. Thus, the difference between observed and expected spending for participants with limited prior drug coverage is the differential change (\(\beta_m\)) estimated by the model.

Our main analytic model allowed a differential change in spending level after January 1, 2006, for beneficiaries with limited prior drug coverage relative to those with generous prior drug coverage but assumed that quarterly spending trends and changes in trends after January 1, 2006, were equivalent for the 2 comparison groups. Because Part D may have also differentially affected spending trends for beneficiaries with limited prior drug coverage, in a separate model we allowed spending trends before and after January 1, 2006, to differ between comparison groups by introducing all 2- and 3-way interactions between “Time,” “Part D,” and “Rxcoverage in 2004.” Because these interaction terms were not significant predictors of spending and only increased the size of estimated Part D effects, they were not included in our main analysis.
In addition to regression adjustments, we used a propensity score-weighting technique to balance baseline sociodemographic and health characteristics evenly between comparison groups (eSupplement, Statistical Appendix B). To adjust for geographic variation in spending, we included in propensity score and analytical models geographic identifiers at the level of Metropolitan Statistical Areas or non–Metropolitan Statistical Area counties. In addition, we weighted analyses to address claims data missing because of an incomplete linkage of survey participants to Medicare files (eSupplement, Statistical Appendix B). Our main results reflect all of these adjustments.

Effects of Part D estimated by these adjusted analyses may have been biased if differences in spending between comparison groups tended to widen or narrow over time as a consequence of unobserved differences between groups. Therefore, in a falsification test, we repeated our analysis for the control cohort from 2002 to 2005 to determine if nondon drug spending differentially changed after January 1, 2004, for participants with limited drug coverage in 2002, in the absence of a contemporaneous national expansion in drug coverage for seniors.

Because transitions to Part D plans may have disrupted access to important medications and increased spending on acute care for some dual-eligible beneficiaries with generous Medicaid drug coverage before 2006,20 in a sensitivity analysis we excluded dual-eligible participants who were previously enrolled in traditional Medicare in the first quarter of 2004.

We used a log-link and proportional-to-mean-variance function in spending models. To aid interpretation, we retransformed model predictions from log dollars into dollars to present key results in terms of both absolute (dollars) and relative (percentage) differential changes. We adjusted all analyses for the complex survey design21 using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina) and SUDAAN version 9.0 (Research Triangle Institute, Research Triangle Park, North Carolina). We used robust design-based variance estimators to account for geographic clustering and repeated measures when calculating 2-sided P values and constructing 95% confidence intervals (CIs).22 Statistical significance was defined as P <.05.

### RESULTS

Among 11 179 elderly HRS participants interviewed in 2004, we excluded 784 (7.0%) eligible for Medicare before age 65 years, 824 (7.4%) veterans likely to receive care in the Department of Veterans Affairs health system, and 18 (0.2%) with missing data on key characteristics. Of the remaining 9553 participants, 8613 (90.2%) could be categorized as having generous or limited drug coverage in 2004, and 7513 of these participants (87.2%) were linked to their Medicare enrollment files. The final study cohort included 6001 participants (79.9%) with linked Medicare data who were enrolled in traditional Medicare in the first quarter of 2004.

#### Table 1. Characteristics of 2004-2007 Study Cohort by Drug Coverage Before 2006 (continued)

<table>
<thead>
<tr>
<th>Baseline Characteristic</th>
<th>Generous Drug Coverage Before 2006 (n = 2538)</th>
<th>Limited Drug Coverage Before 2006 (n = 3463)</th>
<th>P Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported chronic conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>67.5</td>
<td>60.0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Heart disease</td>
<td>33.8</td>
<td>29.5</td>
<td>.005</td>
</tr>
<tr>
<td>History of stroke</td>
<td>9.9</td>
<td>9.3</td>
<td>.38</td>
</tr>
<tr>
<td>Diabetes</td>
<td>21.8</td>
<td>16.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Chronic lung disease (except asthma)</td>
<td>11.1</td>
<td>9.4</td>
<td>.05</td>
</tr>
<tr>
<td>Arthritis</td>
<td>69.0</td>
<td>67.2</td>
<td>.23</td>
</tr>
<tr>
<td>Cancer (except skin cancer)</td>
<td>18.8</td>
<td>17.7</td>
<td>.38</td>
</tr>
<tr>
<td>Psychiatric, emotional, or nervous condition</td>
<td>13.6</td>
<td>12.4</td>
<td>.26</td>
</tr>
<tr>
<td>Chronic conditions based on claimsb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemic heart disease or angina</td>
<td>43.8</td>
<td>40.9</td>
<td>.06</td>
</tr>
<tr>
<td>Heart failure</td>
<td>23.3</td>
<td>21.1</td>
<td>.04</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>11.3</td>
<td>10.7</td>
<td>.50</td>
</tr>
<tr>
<td>History of stroke or TIA</td>
<td>10.9</td>
<td>10.5</td>
<td>.67</td>
</tr>
<tr>
<td>Diabetes</td>
<td>26.8</td>
<td>21.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>8.7</td>
<td>7.2</td>
<td>.03</td>
</tr>
<tr>
<td>COPD</td>
<td>17.8</td>
<td>16.2</td>
<td>.12</td>
</tr>
<tr>
<td>Rheumatoid arthritis or osteoarthritis</td>
<td>32.9</td>
<td>34.8</td>
<td>.17</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>26.0</td>
<td>29.0</td>
<td>.02</td>
</tr>
<tr>
<td>Alzheimer disease or other dementia</td>
<td>5.9</td>
<td>6.1</td>
<td>.76</td>
</tr>
<tr>
<td>Depression</td>
<td>16.1</td>
<td>16.2</td>
<td>.96</td>
</tr>
</tbody>
</table>

Abbreviations: ADL, activities of daily living; CI, confidence interval; COPD, chronic obstructive pulmonary disease; GED, General Educational Development; TIA, transient ischemic attack.

aAll estimates have been weighted to account for the complex survey design.
bBy χ² test to compare distributions of categorical variables and t test to compare continuous variables.
cSelf-reported.
dFunctional limitations included reported difficulties with activities that required mobility (walking several blocks, walking 1 block, walking across a room, climbing several flights of stairs, and climbing 1 flight of stairs) or agility (getting up from a chair, sitting for 2 hours, pushing or pulling large objects, and stooping, kneeling, or crouching).

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quarter of 2004. This cohort yielded 85 669 quarterly spending observations from 2004 to 2007 and included 2538 participants (42.3%) with generous drug coverage and 3463 (57.7%) with limited drug coverage in 2004.

After applying similar inclusion criteria to 2002 survey participants, the control cohort included 5988 participants for analyses of medical spending from 2002 to 2005, including 2537 (42.4%) with generous and 3451 (57.6%) with limited drug coverage in 2002.

As illustrated in the Figure, adjusted total nondrug medical spending before implementation of Part D was consistently but not significantly higher for participants with limited drug coverage than for participants with generous drug coverage (7.6% relative difference [95% CI, −2.7% to 18.9%]; P=.15). Nondrug spending after Part D implementation for participants with limited prior drug coverage was expected to remain 7.6% higher and reflect changes in spending level and trend that occurred for participants with generous prior drug coverage after January 1, 2006. In contrast to this expected spending trend, nondrug medical spending after Part D implementation was observed to be 3.9% lower for participants with limited prior drug coverage than for those with generous prior drug coverage, constituting a significant differential reduction (−10.6% [95% CI, −18.5% to −2.0%]; P=.02). This differential reduction in relative terms corresponded to an average absolute difference of $306/quarter (95% CI, $586 to $51) between observed and expected spending for participants with limited prior drug coverage. For example, a spending level of $2880/quarter was estimated at the end of 2006 by the expected spending trend for this group, compared with $2574/quarter estimated by the observed spending trend (Figure).

As described in Table 2, the differential reduction in total nondrug spending for participants with limited prior drug coverage was explained mostly by differential changes in spending on Part A inpatient and skilled nursing facility institutional services (−$204/quarter [95% CI, −$447 to $2]; P=.05). Part D implementation was also associated with small differential reductions in spending on Part B physician and ancillary services for participants with limited prior drug coverage (−$67/quarter [95% CI, −$134 to −$51]; P=.03). These differential reductions in spending on Part B services were not associated with differential changes in outpatient visits (−0.06 visits/quarter [95% CI, −0.21 to 0.08]; P=.37) and were thus likely attributable to reduced use of inpatient rather than outpatient physician services.
In the 2002-2005 control cohort, which had no access to Part D benefits, differences in nondrug medical spending between participants with limited vs generous drug coverage in 2002 were similar before and after January 1, 2004. Thus, as illustrated in the Figure, observed spending after January 1, 2004, for participants with limited prior drug coverage was similar to expected spending for this group, based on their spending trend before 2004 and changes in spending level and trend after January 1, 2004, for those with generous prior drug coverage ($14/quarter [95% CI, −$338 to $324]; P = .93).

Annual rates of switching into Medicare Advantage before 2006 were 1.8% and 1.6% for beneficiaries with limited and generous drug coverage in 2004, respectively, and 5.3% and 5.1%, respectively, after implementation of Part D (differential change, 0.0%; P = .97). Results of claims analyses were not substantially altered by the weighting adjustment for Medicare Advantage enrollment or by exclusions in other sensitivity analyses.

**COMMENT**

In this nationally representative study, the implementation of Medicare Part D was followed by a significant differential reduction in nondrug medical spending for traditional Medicare beneficiaries with limited prior drug coverage, relative to beneficiaries with generous prior drug coverage. This differential change was largely explained by reduced spending on acute and postacute care for beneficiaries and did not occur for a control cohort of beneficiaries before Part D benefits became available. In concert with previous studies, these findings suggest that increased medication use and adherence achieved through expanded drug coverage for seniors have been associated with decreased spending for non-drug medical care.

The association between Part D implementation and reduced nondrug spending for traditional Medicare beneficiaries with limited prior drug coverage estimated in our study (−$302/quarter) is more than twice that estimated in a previous study for Medicare Advantage enrollees in Pennsylvania with significant coverage limits before 2006 (−$99/quarter to −$138/quarter). Nondrug spending just before 2006 for beneficiaries in our study cohort, however, was nearly twice the level of spending for these Medicare Advantage enrollees. Thus, the relative reductions estimated by our study (approximately 11%) and the previous study (approximately 7%-9%) are quite similar.

Our study builds directly on this and 2 other previous evaluations of Part D implementation and reduced nondrug medical spending for traditional Medicare beneficiaries and identifying potential offsets to the annual per-beneficiary costs of expanded drug coverage for seniors. Partially offsetting reductions in annual per-beneficiary Medicare Part A and B spending were not considered by the Congressional Budget Office in estimates of the costs of the Part D program or of provisions in the Patient Protection and Affordable Care Act to close the coverage gap in the standard Part D benefit by 2020.25-26 Our findings suggest that these provisions may reduce nondrug medical spending for beneficiaries whose use of beneficial medications is adversely affected by the coverage gap.27-32

Despite a lack of financial incentives for standalone Part D plans to design coverage and formularies to minimize Medicare Part A and B spending or to share claims data with clinical providers to assist them in monitoring medication adherence, expanded drug coverage for seniors provided by these plans was associated with significant reductions in non-drug spending. Greater coordination of benefits and delivery across Parts A, B, and D might augment this substitution of drug for non-drug services suggested by our findings and improve the overall cost-effectiveness of the traditional Medicare program. In particular, accountable care organizations may perform better against Part A and B spending targets by ensuring that assigned beneficiaries have drug coverage and by working with Part D plans to align drug benefits and data systems with quality-improvement and cost-saving efforts.

**Table 2. Differential Changes in Nondrug Medical Spending After Part D Implementation for Medicare Beneficiaries With Limited Prior Drug Coverage, Relative to Beneficiaries With Generous Prior Drug Coverage in the 2004-2007 Study Cohort**

<table>
<thead>
<tr>
<th>Measure of Quarterly Spending or Utilization</th>
<th>Difference Between Observed Spending After Part D Implementation and Expected Spending in the Absence of Part D for Beneficiaries With Limited Prior Drug Coveragea</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nondrug medical spending</td>
<td>−306 (−586 to −51) −10.6 (−18.5 to −2.0)</td>
<td>.02</td>
</tr>
<tr>
<td>Spending on Part A inpatient and skilled nursing facility services</td>
<td>−204 (−447 to 2) −15.2 (−28.3 to 0.2)</td>
<td>.05</td>
</tr>
<tr>
<td>Spending on Part B physician and ancillary services</td>
<td>−67 (−134 to −5) −7.5 (−13.9 to −0.6)</td>
<td>.03</td>
</tr>
<tr>
<td>Outpatient visit count</td>
<td>−0.06 (−0.21 to 0.08) −2.1 (−6.5 to 2.3)</td>
<td>.37</td>
</tr>
</tbody>
</table>

Abbreviation: CI, confidence interval.

a The differential change in total nondrug medical spending (−$306 or −10.6%) corresponds to the difference between observed and expected spending trends in panel A of the Figure. Differential changes in spending on Part A inpatient and skilled nursing facility services and Part B physician and ancillary services do not sum to the differential change in total nondrug medical spending because they do not include smaller contributions from spending on home health, durable medical equipment, hospice, and outpatient institutional services.

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cal spending by generosity of drug coverage before 2006, a rigorous empirical approach to identify effects of Part D, and use of a control cohort to check for residual confounding.

Our study also had several limitations. Because of limited statistical power and lack of drug claims, we were not able to assess changes in specific medications and services that might have explained our main results. Numerous previous studies suggest that our findings were explained largely by improved access and adherence to beneficial medications and more effective prevention of complications and exacerbations among seniors with drug-sensitive chronic conditions.  

Drug coverage gains may have also reduced early complications of acute conditions and facilitated outpatient receipt of treatments for acute illnesses, such as low-molecular-weight heparin for deep venous thrombosis or antibiotics for pneumonia, that before 2006 were covered by Medicare only for inpatients. More efficient treatment of acute conditions may have contributed to particularly early reductions in nondrug medical spending in 2006. Our study was not adequately powered, however, to test these potential mechanisms individually. Because of the lack of drug claims before and after Part D implementation, we also could not compare reductions in nondrug medical spending with contemporaneous increases in drug spending to determine the net effect of Part D on total annual medical spending per beneficiary.

We used survey data to assess drug coverage generosity before 2006. These reports lacked detail on the cost-sharing structure of beneficiaries’ drug benefits, could not be validated by administrative measures, and may have reflected both insurance coverage and medication needs. Beneficiaries taking few medications may have reported generous coverage even if their benefits were limited, and those taking many medications may have reported limited coverage even if their benefits were relatively generous. Nevertheless, for beneficiaries reporting limited coverage before 2006, Part D implementation was associated with substantial differential gains in self-reported drug coverage and reductions in out-of-pocket drug spending (eSupplement, Statistical Appendix C), suggesting that self-reports reliably measured coverage generosity and strongly predicted gains in drug benefits through Part D. Measurement error attributable to self-reports likely attenuated our estimated effects of Part D on nondrug spending for beneficiaries with limited prior drug coverage. For example, we assumed that beneficiaries reporting generous coverage in 2004 were not affected by Part D, but some may have gained more generous coverage through Part D, particularly if they misclassified their drug benefits in 2004 or lost coverage in 2005. Smaller gains in coverage for this group after Part D implementation may have led to smaller reductions in nondrug medical spending that our study was not adequately powered to detect.

In summary, the implementation of Medicare Part D was followed by significant reductions in nondrug medical spending, particularly on acute and postacute care, for elderly Medicare beneficiaries with limited prior drug coverage. The economic and clinical benefits suggested by these reductions may be enhanced by further expansions in prescription drug coverage for seniors, improvements in benefit designs for drug-sensitive conditions, and policies that integrate Medicare payment and delivery systems across drug and nondrug services.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

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Online-Only Material: The eSupplement and eTable are available at http://www.jama.com.

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REFERENCES


