Reducing Hospital Readmissions:
A Review of the Evidence

The Washington State Legislature directed the Washington State Institute for Public Policy (WSIPP) to “calculate the return on investment to taxpayers from evidence-based prevention and intervention programs and policies.” Additionally, WSIPP’s Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts to extend WSIPP’s benefit-cost analysis to certain health care topics. The Pew-MacArthur Results First Initiative identified the goal of reducing hospital readmissions as an important health care challenge for states.

As part of the Pew-MacArthur Results First Initiative, identifying policies that can reduce hospital readmissions was determined to be an important health care topic for states. One important goal is to determine the extent to which programs can reduce readmissions and help states control Medicaid and other health care costs.

This report examines evidence for the effectiveness of “transitional care” services in reducing hospital readmissions. In a subsequent report, WSIPP will present benefit-cost results for these and other health care interventions.

Summary
WSIPP’s Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts to extend WSIPP’s benefit-cost analysis to certain health care topics. The Pew-MacArthur Results First Initiative identified the goal of reducing hospital readmissions as an important health care challenge for states.

For this report, we reviewed the national and international evaluation literature to determine whether transitional care programs have been shown to reduce hospital readmissions. Components of transitional care include coaches, patient education, medication reconciliation, individualized discharge planning, enhanced provider communication, and patient follow-up after discharge.

We find that, on average, transitional care programs reduce hospital readmissions. Comprehensive programs that include both pre- and post-discharge services and programs that target higher-risk, elderly, and chronically ill patients appear to be especially effective. For example, we find that the average comprehensive program in the US could reduce readmission rates for higher-risk patients from 22% to 15%.

In a subsequent report, WSIPP will present benefit-cost results for these programs, assessing the extent to which they could help states control Medicaid and other health care costs.


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1 Engrossed Substitute House Bill 1244, Section 610(4), Chapter 564, Laws of 2009.
I. Background

Hospital readmissions are common and costly. According to the federal Agency for Healthcare Research and Quality (AHRQ), in 2011, about 14.7% of all hospital stays resulted in re-admissions among adult patients in the US. These readmissions were associated with about $41.3 billion in hospital costs—about $12,500 per readmission.\(^3\) Exhibit 1 displays national hospital readmission rates.

Not all readmissions are preventable but many apparently are. The federal Medicare Payment Advisory Commission estimates that three quarters of readmissions among Medicare beneficiaries may be avoidable, accounting for $12 billion in excess health care costs.\(^4\)

Several factors appear to contribute to avoidable readmissions. At the health care system level, inadequate communication between providers, poor patient education, a lack of continuity of care, and limited access to services have been found to be important.\(^5\) At the patient level, readmission rates are higher among those with chronic conditions, functional deficits, cognitive impairments, and emotional problems. According to one study, older patients with heart failure have the highest readmission rates.\(^6\)

\(^{3}\) Agency for Healthcare Research and Quality, 2014.
\(^{4}\) Hansen et al., 2011.
\(^{5}\) Naylor et al., 2004.
\(^{6}\) Ibid.
Since October 2012, the Centers for Medicare and Medicaid Services have imposed financial penalties for hospitals with higher than expected 30-day readmission rates among Medicare enrollees.

In Washington State, hospitals have the opportunity to earn incentive payments for actions taken to reduce readmissions under the Medicaid Quality Incentive Program, administered by the Washington State Health Care Authority.  

This report examines evidence for the effectiveness of transitional care services in reducing hospital readmissions. These services include coaches, patient education, medication reconciliation, individualized discharge planning, scheduling follow-up provider visits, provider communication, and telephone and home visit follow-up.  

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7 Incentives reward efforts to share discharge information with primary care providers and for phone follow-up with discharged patients with certain conditions. Targeted conditions include acute myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disease, and stroke.

8 Hansen et al., 2011.
II. Research Methods

When WSIPP carries out study assignments from the legislature to identify what works in public policy, we implement a set of standardized procedures. We analyze all available high-quality studies to identify program effects. We look for research studies with strong evaluation designs and exclude studies with weak research methods.

Given the weight of the evidence, we calculate an average expected effect (“effect size”) of a policy on a particular outcome of interest and estimate of the margin of error for that effect.

An effect size measures the degree to which a program has been shown to change an outcome (such as hospital readmissions) for program participants relative to a comparison group. Our methodology is described in detail in WSIPP’s Technical Documentation.9

We searched for studies in PubMed, Google Scholar, and the Cochrane Library. After examining abstracts, we conducted full reviews of 142 studies, and 30 were included in the meta-analysis. These studies: (a) met our methodological requirements; (b) reported all-cause hospital readmission rates for one to three months after discharge;10 (c) included patients discharged to home rather than a nursing facility; and (d) excluded pediatric, obstetric, and psychiatric patient populations.

Among the selected studies, 29 were randomized controlled trials, and one had a quasi-experimental design. Half the studies were from countries other than the US.

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10 Most studies (20) report 30-day rates, which is the current policy focus in the US.
III. Meta-Analysis Findings

Transitional care programs vary in terms of intervention services and patient populations. In terms of services, we categorized programs as “comprehensive” or “post-discharge only.” Comprehensive interventions include pre-discharge assistance (e.g., a coach, enhanced discharge planning, and primary care provider communication) and post-discharge services. Post-discharge interventions include only patient assistance after release from the hospital.

Many of these programs recruit high-risk, elderly, or chronically ill patients. Others recruit from general populations of admitted patients, without regard to age or medical condition.

In all, we located 30 rigorous evaluations of transitional care programs. We find that these programs can reduce hospital readmissions (Exhibit 2). For example, the average program could reduce readmission rates from 14.7% to 11.8%.

Programs in the US have larger mean effects than those based in other countries. This is partially due to the mix of intervention types and recruited patient populations. Studies outside the US are less likely to evaluate comprehensive programs and are more likely to recruit non-chronically ill, elderly patients. Differences in health care systems may also contribute to differences in program effects across countries.

Our analysis of intervention types focuses on studies conducted in the US. Transitional care programs in the US typically recruit high-risk, elderly, and/or chronically ill patients (with chronic heart disease, coronary artery disease, diabetes, and stroke). Fewer studies recruit from general populations of admitted patients.

Exhibit 3 and Exhibit 4 present mean effect sizes for US studies by intervention type and patient population. We find that transitional care programs can reduce hospital readmissions, especially the comprehensive programs and those that target high risk patients. For example, the typical comprehensive program reduced readmission rates from a base of 22% down to 15%.

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11 Six studies did not fall into these categories. Two studies reported on interventions with only pre-discharge services (treatment review and patient education). Four non-US studies examined other specific services that were difficult to categorize (e.g., follow-up at a clinic, pharmacist only interventions).
12 See Appendix Exhibit A1 for study descriptions and citations.
13 The 30 included studies produced a total of 32 effect sizes.
14 Jaarsma et al., 1999 and Shepperd et al., 2013. We used weighted OLS regression to examine the effects of US versus non-US study location, controlling for one versus three-month readmission rate measurement, phone versus home visit follow-up, and participant population (elderly, chronic, and general) on study effect sizes. The analysis included 15 studies of comprehensive interventions. Study location was found to be the only significant factor determining effect sizes.
15 We use an intraclass correlation coefficient (ICC) of 0.01 to adjust estimates for studies that do not take participant clustering into account. This ICC is based on estimates reported by Kul et al., 2014; Li et al., 2012; and Singh et al. 2013. Sensitivity analysis, allowing the ICC to vary between 0.01 and 0.05, suggests that most inferences are not sensitive to choice of ICC. Note that a higher ICC value does increase the size and statistical significance for the mean effect size of post-discharge only interventions, though the effect remains smaller than that for comprehensive programs.
16 We could not assess the relative effectiveness of home versus phone follow-up because of differences in patient populations across studies.
Other reviews of the literature have found similar evidence indicating that transitional care programs do reduce readmission rates.\textsuperscript{17}

**Exhibit 2**
Transitional Care Effects on Readmissions: All, US, and Non-US Studies

<table>
<thead>
<tr>
<th>Location</th>
<th>Average effect size</th>
<th>Standard error</th>
<th>p-value</th>
<th>Number of effect sizes</th>
<th>Number in treatment groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>-0.152</td>
<td>0.041</td>
<td>0.000</td>
<td>32</td>
<td>4901</td>
</tr>
<tr>
<td>US</td>
<td>-0.205</td>
<td>0.056</td>
<td>0.000</td>
<td>17</td>
<td>2590</td>
</tr>
<tr>
<td>Non-US</td>
<td>-0.091</td>
<td>0.060</td>
<td>0.125</td>
<td>15</td>
<td>2311</td>
</tr>
</tbody>
</table>

**Exhibit 3**
Transitional Care Effects on Readmissions: US Studies by Intervention Type

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Average effect size</th>
<th>Standard error</th>
<th>p-value</th>
<th>Number of effect sizes</th>
<th>Number in treatment groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive*</td>
<td>-0.289</td>
<td>0.061</td>
<td>0.000</td>
<td>11</td>
<td>1,597</td>
</tr>
<tr>
<td>Post-Discharge**</td>
<td>-0.143</td>
<td>0.089</td>
<td>0.107</td>
<td>5</td>
<td>750</td>
</tr>
</tbody>
</table>

* Includes pre- and post-discharge services (coaches, patient education, enhanced discharge planning, primary care physician communication, and home or phone follow-up).

**Exhibit 4**
Transitional Care Effects on Readmissions: US Studies by Patient Population

<table>
<thead>
<tr>
<th>Patient Population</th>
<th>Average effect size</th>
<th>Standard error</th>
<th>p-value</th>
<th>Number of effect sizes</th>
<th>Number in treatment groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk*</td>
<td>-0.278</td>
<td>0.060</td>
<td>0.000</td>
<td>12</td>
<td>1,375</td>
</tr>
<tr>
<td>General</td>
<td>-0.155</td>
<td>0.107</td>
<td>0.147</td>
<td>4</td>
<td>972</td>
</tr>
</tbody>
</table>

* High-risk populations include the elderly and/or chronically ill.

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\textsuperscript{17} See Leppin et al., 2014 and Naylor et al., 2011.
IV. Conclusion

After systematically reviewing the available evaluation literature, we find that transitional care programs can reduce hospital readmissions. We found larger effects for comprehensive programs that include both pre- and post-discharge services and programs that target higher-risk patients.

In a subsequent report, WSIPP will present benefit-cost results for transitional care programs, assessing the extent to which they could help Washington State control Medicaid and other health care costs.
### Exhibit A1
Characteristics of Studies Included in WSIPP’s Meta-Analysis of Transitional Care Programs

<table>
<thead>
<tr>
<th>Study</th>
<th>Locations</th>
<th>Treatment group size</th>
<th>Readmission effect size</th>
<th>Intervention type</th>
<th>Intervention components</th>
<th>Patient category</th>
<th>Study recruitment criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balaban et al., 2008</td>
<td>US</td>
<td>47</td>
<td>0.024</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, phone (1)</td>
<td>no age/condition criteria</td>
<td>general (drawn from a safety net system)</td>
</tr>
<tr>
<td>Bostrom et al., 1996</td>
<td>US</td>
<td>445</td>
<td>0.062</td>
<td>post-discharge only</td>
<td>phone follow-up only (1+)</td>
<td>no age/condition criteria</td>
<td>general (no age, risk, or condition restrictions)</td>
</tr>
<tr>
<td>Brand et al., 2004</td>
<td>Australia</td>
<td>83</td>
<td>0.000</td>
<td>comprehensive</td>
<td>coach; enhanced DP, PCP communication, follow-up visit at clinic within 2 weeks</td>
<td>elderly and chronic</td>
<td>65+ with at least one of following: prior admission in last 6 months, 2+ comorbidities, CHF (and not COPD)</td>
</tr>
<tr>
<td>Braun et al., 2009</td>
<td>Israel</td>
<td>153</td>
<td>-0.044</td>
<td>post-discharge only</td>
<td>phone follow-up only (2) (usual care and treatment groups had detailed discharge reports and instructions)</td>
<td>no age/condition criteria</td>
<td>general admissions with stays of 2+ days</td>
</tr>
<tr>
<td>Coleman et al., 2006</td>
<td>US</td>
<td>379</td>
<td>-0.320</td>
<td>comprehensive</td>
<td>coach, enhanced DP communication, phone follow-up (3), home visit (1)</td>
<td>elderly and chronic</td>
<td>elderly (65+) with selected diagnoses (CHF, COPD, CAD, diabetes, stroke, back, hip, vascular disease)</td>
</tr>
<tr>
<td>Coleman et al., 2004</td>
<td>US</td>
<td>158</td>
<td>-0.396</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP follow-up, phone follow up (3+1), home visits (1)</td>
<td>elderly and chronic</td>
<td>elderly (65+) with selected diagnoses (CHF, COPD, CAD, diabetes, stroke, back, hip, vascular disease)</td>
</tr>
<tr>
<td>Dudas et al., 2001</td>
<td>US</td>
<td>110</td>
<td>-0.384</td>
<td>post-discharge only</td>
<td>phone follow-up only (1) by a pharmacist</td>
<td>no age/condition criteria</td>
<td>general; no restrictions by age or risk; had to have had counseling on discharge prescriptions</td>
</tr>
<tr>
<td>Dunn et al., 1994</td>
<td>United Kingdom</td>
<td>102</td>
<td>0.085</td>
<td>post-discharge only</td>
<td>home visit (1) by health visitor (only intervention)</td>
<td>elderly and chronic</td>
<td>geriatric admissions 65+</td>
</tr>
<tr>
<td>Einstadter et al., 1996</td>
<td>US</td>
<td>243</td>
<td>0.232</td>
<td>pre-discharge only</td>
<td>coach, enhanced DP, PCP follow-up (no post discharge follow-up)</td>
<td>no age/condition criteria</td>
<td>all medical admissions (no restrictions by age or risk of readmission or chronic condition)</td>
</tr>
<tr>
<td>Forster et al., 2005</td>
<td>Canada</td>
<td>157</td>
<td>0.241</td>
<td>comprehensive</td>
<td>coach (nurse), enhanced DP, phone follow-up (1)</td>
<td>no age/condition criteria</td>
<td>general admissions</td>
</tr>
<tr>
<td>Harrison et al., 2002</td>
<td>Canada</td>
<td>92</td>
<td>-0.246</td>
<td>comprehensive</td>
<td>coach (nurse), enhanced DP (especially evidence-based education); phone follow-up (2+), hospital nurse consults with community (home) nurse visits (1)</td>
<td>chronically ill</td>
<td>CHF admissions</td>
</tr>
<tr>
<td>Huang et al., 2005</td>
<td>Taiwan</td>
<td>63</td>
<td>-0.809</td>
<td>comprehensive</td>
<td>coach (nurse), enhanced DP, phone follow-up (12 - one per week), home visit (1)</td>
<td>acute/other high risk</td>
<td>elderly 65+ with hip fractures</td>
</tr>
<tr>
<td>Jaarsma et al., 1999</td>
<td>Netherlands</td>
<td>84</td>
<td>-0.100</td>
<td>other</td>
<td>structured patient education; phone follow-up (1), home visit (1)</td>
<td>elderly and chronic</td>
<td>patients age 50+ admitted for heart failure</td>
</tr>
<tr>
<td>Jack et al., 2009</td>
<td>US</td>
<td>370</td>
<td>-0.242</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, phone follow-up (1)</td>
<td>no age/condition criteria</td>
<td>general, no SNF</td>
</tr>
<tr>
<td>Kwok et al., 2004</td>
<td>Hong Kong</td>
<td>70</td>
<td>0.249</td>
<td>comprehensive</td>
<td>coach, enhanced DP, home visits (10)</td>
<td>elderly and chronic</td>
<td>patients age 60+ admitted for chronic lung disease</td>
</tr>
<tr>
<td>Study</td>
<td>Locations</td>
<td>Treatment group size</td>
<td>Readmission effect size</td>
<td>Intervention type</td>
<td>Intervention components</td>
<td>Patient category</td>
<td>Study recruitment criteria</td>
</tr>
<tr>
<td>------------------</td>
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<td>-----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Laramee et al., 2003</td>
<td>US</td>
<td>131</td>
<td>0.000</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, phone (9), promotion of optimal CHF medications</td>
<td>chronically ill</td>
<td>CHF as primary or secondary admission diagnosis and at risk for readmission (based on history of CHF, knowledge deficits of treatment plan, ongoing lack of adherence, previous CHF admission, living alone)</td>
</tr>
<tr>
<td>Legrain et al., 2011</td>
<td>France</td>
<td>317</td>
<td>-0.272</td>
<td>pre-discharge only</td>
<td>comprehensive treatment review (focusing on adverse drug reactions, depression, and malnutrition), education, transition-of-care communication(with PCPs, etc.)</td>
<td>elderly</td>
<td>patients 70+ admitted to geriatric units</td>
</tr>
<tr>
<td>McDonald et al., 2002</td>
<td>Ireland</td>
<td>51</td>
<td>-0.719</td>
<td>heart failure clinic</td>
<td>Specialist-led patient education, dietician consults, phone follow-up (13), HF clinic visits (2)</td>
<td>chronically ill</td>
<td>HF admissions</td>
</tr>
<tr>
<td>Naylor et al., 1994</td>
<td>US</td>
<td>72</td>
<td>-0.468</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, phone (2+)</td>
<td>elderly and chronic</td>
<td>70+ admitted for CHF, Angina/MI coronary bypass, cardiac valve replacement (medical admissions)</td>
</tr>
<tr>
<td>Naylor et al., 2004</td>
<td>US</td>
<td>118</td>
<td>-0.521</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, home visits (B+), evidence based protocol for heart failure</td>
<td>elderly and chronic</td>
<td>65+ admitted with diagnosis of heart failure</td>
</tr>
<tr>
<td>Nazareth et al., 2001</td>
<td>United Kingdom</td>
<td>171</td>
<td>-0.005</td>
<td>pharmacist led</td>
<td>pharmacist assessment and discharge plan; copy of plan shared with GP; home visit by pharmacist (1)</td>
<td>elderly</td>
<td>patients 75+ taking 4+ medications</td>
</tr>
<tr>
<td>Parry et al., 2009</td>
<td>US</td>
<td>49</td>
<td>-0.608</td>
<td>comprehensive</td>
<td>coach, enhanced DP, PCP communication, phone (3), home (1)</td>
<td>elderly and chronic</td>
<td>elderly (65+), Medicare FFS, 11 diagnoses (stroke, CHF, CAD, COPD, diabetes, spine, hip, vascular, pulmonary)</td>
</tr>
<tr>
<td>Rich et al., 1993</td>
<td>US</td>
<td>63</td>
<td>-0.314</td>
<td>comprehensive</td>
<td>coach, enhanced DP, phone (not reported), home (not reported, at least 4)</td>
<td>elderly and chronic</td>
<td>70+ admitted to hospital, diagnosed with CHF, at moderate to high risk for readmission (based on 4 criteria—see page 586)</td>
</tr>
<tr>
<td>Rich et al., 1995</td>
<td>US</td>
<td>142</td>
<td>-0.352</td>
<td>comprehensive</td>
<td>coach, enhanced DP, phone (not reported), home (not reported, at least 4)</td>
<td>elderly and chronic</td>
<td>70+ admitted to hospital, diagnosed with CHF, at moderate to high risk for readmission (based on 4 criteria—see page 1190)</td>
</tr>
<tr>
<td>Riegel et al., 2002</td>
<td>US</td>
<td>35</td>
<td>-0.303</td>
<td>post-discharge only</td>
<td>phone follow-up (17), PCP communication</td>
<td>chronically ill</td>
<td>Hispanics admitted with HF</td>
</tr>
<tr>
<td>Riegel et al., 2006</td>
<td>US</td>
<td>69</td>
<td>-0.168</td>
<td>post-discharge only</td>
<td>phone follow-up (13.5), PCP communication</td>
<td>chronically ill</td>
<td>Hispanics admitted with HF</td>
</tr>
<tr>
<td>Shyu et al., 2005</td>
<td>Taiwan</td>
<td>66</td>
<td>-0.336</td>
<td>comprehensive</td>
<td>enhanced DP; geriatric consultation; rehabilitation program (including both inpatient and 8 home visits)</td>
<td>acute/other high risk</td>
<td>patients 60+ admitted for hip fracture</td>
</tr>
<tr>
<td>Townsend et al., 1988</td>
<td>United Kingdom</td>
<td>464</td>
<td>0.000</td>
<td>post-discharge only</td>
<td>home visit by care attendant (first day and 12 hours/week for 2 weeks)</td>
<td>elderly</td>
<td>admitted patients 75+</td>
</tr>
<tr>
<td>Wong et al., 2008</td>
<td>Hong Kong</td>
<td>166</td>
<td>-0.063</td>
<td>post-discharge only</td>
<td>home visit by community nurse (1 during first week; additional 4 could be arranged if issues not addressed)</td>
<td>acute/other high risk</td>
<td>high risk group—prior admission within last 28 days; respiratory, cardiac, or renal condition</td>
</tr>
<tr>
<td>Wong et al., 2011</td>
<td>Hong Kong</td>
<td>272</td>
<td>-0.171</td>
<td>post-discharge only</td>
<td>phone follow-up (2 by nurse case manager); home visits (1 by nurse; 1 by trained volunteer); volunteer focus on social supports</td>
<td>elderly</td>
<td>admitted patients 60+</td>
</tr>
</tbody>
</table>

DP = Discharge planning  
PCP = Primary care physician  
CHF = Congestive heart failure  
COPD = Chronic obstructive pulmonary disease  
CAD = Coronary artery disease  
MI = Myocardial infarction
A2. Studies Included in the Meta-Analysis


Kwok, T., Lum, C. M., Chan, H. S., Ma, H. M., Lee, D., & Woo, J. (August 01, 2004). A Randomized, Controlled Trial of an Intensive Community Nurse-Supported Discharge Program in Preventing Hospital Readmissions of Older Patients with Chronic Lung Disease. *Journal of the American Geriatrics Society, 52* (8), 1240-1246.


McDonald, K., Ledwidge, M., Cahill, J., Quigley, P., Maurer, B., Travers, B., Ryder, M., ... Ryan, E. (January 01, 2002). Heart failure management: multidisciplinary care has intrinsic benefit above the optimization of medical care. *Journal of Cardiac Failure, 8* (3), 142-8.


A3. Additional References


Hansen, L. O., Young, R. S., Hinami, K., Leung, A., & Williams, M. V. (2011) Interventions to reduce 30-day hospitalization: A systematic review. *Annals of Internal Medicine, 155*(8), 520-528.


The Washington State Legislature created the Washington State Institute for Public Policy in 1983. A Board of Directors—representing the legislature, the governor, and public universities—governs WSIPP and guides the development of all activities. WSIPP’s mission is to carry out practical research, at legislative direction, on issues of importance to Washington State.