Autologous or allogeneic hematopoietic cell transplant is considered **investigational** for the following malignancies in adults:

- Cancer of the bile duct
- Cancer of the fallopian tubes
- Cervical cancer
- Colon cancer
- Esophageal cancer
- Gall bladder cancer
- Lung cancer, any histology
- Malignant melanoma
- Nasopharyngeal cancer
- Neuroendocrine tumors
- Pancreatic cancer
- Paranasal sinus cancer
- Prostate cancer
- Rectal cancer
- Renal cell cancer
- Soft tissue sarcomas
- Stomach cancer
- Thyroid tumors
- Tumors of the thymus
- Tumors of unknown primary origin
- Uterine cancer

The transplantation of Hepatitis C Virus (HCV)-viremic solid organs (kidney, lung, heart, liver, small bowel, pancreas) to a HCV non-viremic recipient with a plan to use direct-acting antiviral treatment for HCV is considered **investigational**.

**Policy Guidelines**

The American Society of Transplantation Consensus Conference on the use of hepatitis C viremic donors in solid organ transplantation concluded that the transplantation of organs from HCV viremic donors into HCV-negative recipients should be conducted only under monitored IRB-approved protocols and studies. (See Supplemental Information).

**Description**

Hematopoietic cell transplantation (HCT) is an established treatment for certain hematologic malignancies and has been investigated for a variety of adult solid tumors. Interest continues in exploring nonmyeloablative allogeneic HCT (allo-HCT) for a graft-versus-tumor effect of donor-derived T-cells in metastatic solid tumors.

**Related Policies**

- Hematopoietic Cell Transplantation for Central Nervous System Embryonal Tumors and Ependymoma
- Hematopoietic Cell Transplantation for Epithelial Ovarian Cancer
Benefit Application

Benefit determinations should be based in all cases on the applicable contract language. To the extent there are any conflicts between these guidelines and the contract language, the contract language will control. Please refer to the member’s contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

Some state or federal mandates (e.g., Federal Employee Program [FEP]) prohibits plans from denying Food and Drug Administration (FDA)-approved technologies as investigational. In these instances, plans may have to consider the coverage eligibility of FDA-approved technologies on the basis of medical necessity alone.

Regulatory Status

The U.S. Food and Drug Administration regulates human cells and tissues intended for implantation, transplantation, or infusion through the Center for Biologics Evaluation and Research, under Code of Federal Regulation, title 21, parts 1270 and 1271. Hematopoietic stem cells are included in these regulations.

Rationale

Background

Hematopoietic Cell Transplantation

HCT is a procedure in which hematopoietic stem cells are infused to restore bone marrow function in cancer patients who receive bone-marrow-toxic doses of cytotoxic drugs with or without whole body radiotherapy. Hematopoietic stem cells may be obtained from the transplant recipient (autologous HCT) or from a donor (allogeneic HCT [allo-HCT]). They can be harvested from bone marrow, peripheral blood, or from umbilical cord blood shortly after delivery of neonates. Although cord blood is an allogeneic source, the stem cells in it are antigenically “naive” and thus are associated with a lower incidence of rejection or graft-versus-host disease (GVHD). Cord blood is discussed in detail in Blue Shield of California Medical Policy: Placental and Umbilical Cord Blood as a Source of Stem Cells.

Immunologic compatibility between infused hematopoietic stem cells and the recipient is not an issue in autologous HCT. However, immunologic compatibility between donor and patient is critical for achieving a good outcome of allo-HCT. Compatibility is established by typing of human leukocyte antigens (HLAs) using cellular, serologic, or molecular techniques. HLA refers to the tissue type expressed at the HLA-A, -B, and -DR (antigen-D related) loci on each arm of chromosome 6. Depending on the disease being treated, an acceptable donor will match the patient at all or most of the HLA loci (with the exception of umbilical cord blood).

Conditioning for Hematopoietic Cell Transplantation

Conventional Conditioning

The conventional (“classical”) practice of allo-HCT involves administration of cytotoxic agents (e.g., cyclophosphamide, busulfan) with or without total body irradiation at doses sufficient to destroy endogenous hematopoietic capability in the recipient. The beneficial treatment effect in this procedure is a result of a combination of initial eradication of malignant cells and subsequent graft-versus-malignancy (GVM) effect mediated by non-self-immunologic effector cells that develop after engraftment of allogeneic stem cells within the patient’s bone marrow space. While the slower GVM effect is considered to be the potentially curative component, it may be
overwhelmed by extant disease without the use of pretransplant conditioning. However, intense conditioning regimens are limited to patients who are sufficiently fit medically to tolerate substantial adverse events that include pre-engraftment opportunistic infections secondary to loss of endogenous bone marrow function and organ damage and failure caused by the cytotoxic drugs. Furthermore, in any allo-HCT, immunosuppressant drugs are required to minimize graft rejection and GVHD, which also increases susceptibility to opportunistic infections. The immune reactivity between donor T cells and malignant cells that is responsible for the GVM effect also leads to acute and chronic GVHD.

The success of autologous HCT is predicated on the ability of cytotoxic chemotherapy with or without radiation to eradicate cancerous cells from the blood and bone marrow. This permits subsequent engraftment and repopulation of bone marrow space with presumably normal hematopoietic stem cells obtained from the patient before undergoing bone marrow ablation. As a consequence, autologous HCT is typically performed as consolidation therapy when the patient’s disease is in complete remission. Patients who undergo autologous HCT are susceptible to chemotherapy-related toxicities and opportunistic infections before engraftment, but not GVHD.

Reduced-Intensity Conditioning for Allogeneic Hematopoietic Cell Transplantation
RIC refers to the pretransplant use of lower doses or less intense regimens of cytotoxic drugs or radiation than are used in conventional full-dose myeloablative conditioning treatments. The goal of RIC is to reduce disease burden but also to minimize as much as possible associated treatment-related morbidity and nonrelapse mortality in the period during which the beneficial GVM effect of allogeneic transplantation develops. Although the definition of RIC remains arbitrary, with numerous versions employed, all seek to balance the competing effects of nonrelapse mortality and relapse due to residual disease. RIC regimens can be viewed as a continuum in effects, from nearly totally myeloablative, to minimally myeloablative with lymphoablation, with intensity tailored to specific diseases and patient condition. Patients who undergo RIC with allo-HCT initially demonstrate donor cell engraftment and bone marrow mixed chimerism. Most will subsequently convert to full-donor chimerism, which may be supplemented with donor lymphocyte infusions to eradicate residual malignant cells. For this evidence review, RIC will refer to all conditioning regimens intended to be nonmyeloablative, as opposed to fully myeloablative (conventional) regimens.

Hematopoietic Cell Transplantation in Solid Tumors in Adults
HCT is an established treatment for certain hematologic malignancies. Its use in solid tumors is less well established, although it has been investigated for a variety of solid tumors. With the advent of nonmyeloablative allogeneic transplant, interest has shifted to exploring the generation of alloreactivity to metastatic solid tumors via a graft-versus-tumor effect of donor-derived T cells.1

HCT as a treatment for ovarian cancer, germ cell tumors, ependymoma, or malignant glioma is addressed separately (Blue Shield of California Medical Policies: Hematopoietic Cell Transplantation for Epithelial Ovarian Cancer, Hematopoietic Cell Transplantation in the Treatment of Germ Cell Tumors, and Hematopoietic Cell Transplantation for Central Nervous System Embryonal Tumors and Ependymoma, respectively). HCT as a treatment for breast cancer is not addressed. This evidence review collectively addresses other solid tumors of adults for which HCT has been investigated, including lung cancer, malignant melanoma, tumors of the gastrointestinal tract (affecting the colon, rectum, pancreas, stomach, esophagus, gallbladder, or bile duct), male and female genitourinary systems (e.g., renal cell carcinoma, prostate cancer, cervical cancer, uterine cancer, fallopian tube cancer), tumors of the head and neck, soft tissue sarcoma, thyroid tumors, tumors of the thymus, and tumors of unknown primary origin.

Literature Review
Evidence reviews assess the clinical evidence to determine whether the use of technology improves the net health outcome. Broadly defined, health outcomes are the length of life, quality of life, and ability to function including benefits and harms. Every clinical condition has specific
outcomes that are important to patients and managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of technology, two domains are examined: the relevance, and quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

This evidence review was initially based on a 1995 Blue Cross Blue Shield Association Technology Evaluation Center (TEC) Assessment that focused on adult solid tumors other than breast cancer, epithelial ovarian cancer, germ cell tumors, and glial cell–derived brain cancers. Literature on solid tumors identified in the Assessment included lung cancers, melanoma, tumors of gastrointestinal organs, genitourinary system tumors, tumors of the head and neck, soft tissue sarcomas of the extremities and torso, thyroid tumors, tumors of the thymus, undifferentiated tumors, and tumors of unknown primary. The Assessment offered the following conclusions:

- While 125 articles were identified that reported on the results of autologous hematopoietic cell transplantation (HCT) in a variety of solid tumors, only 17 included survival data from groups of patients with the same cancer. These studies reported on four indications: advanced small cell lung cancer (SCLC), advanced colorectal cancer (CRC), malignant melanomas, and inoperable gastric cancer.
- The evidence did not permit conclusions on the effect of autologous HCT on patient survival.

A 1999 TEC Assessment evaluated the use of allogeneic HCT (allo-HCT) as salvage therapy after a failed autologous HCT for solid tumors. The evidence was inadequate to permit conclusions.

**Autologous Hematopoietic Cell Transplantation in Solid Tumors**

The evidence on the use of autologous HCT for the solid tumors of adults addressed in this evidence review consists primarily of small series.

**Adult Soft Tissue Sarcomas**

**Clinical Context and Therapy Purpose**

The purpose of autologous HCTIs to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with adult soft tissue sarcomas.

The question addressed in this evidence review is: does HCT improve health outcomes for adults with adult soft tissue sarcomas?

The following PICOTS were used to select literature to inform this review.

**Patients**

The relevant population of interest are individuals with adult soft tissue sarcomas.

**Interventions**

The therapy being considered is autologous HCT.
Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are overall survival (OS), disease-specific survival (DSS), treatment-related mortality (TRM), and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.

Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using the following principles:

a. To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
b. In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies;
c. To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought;
d. Studies with duplicative or overlapping populations were excluded.

The prognosis of patients with unresectable or metastatic soft tissue sarcomas is poor, with a median survival of one year and a five-year survival estimate of less than 10%. A variety of single-agent and combination regimens are used for treatment, with targeted therapies available for some subtypes. Based on initial observations that patients who achieved complete remission (CR) had longer survival, several phase 1 and 2 trials using autologous HCT were conducted in the 1990s in an attempt to improve outcomes. These trials were composed of small numbers of patients (range, 2-55 patients), yielding overall response rates (ORRs) from 20% to 65%, with CR ranging from 10% to 43%. The longest reported 5-year progression-free survival (PFS) rate was 21%, and 5-year OS rate was 32%. One study (2007) of 21 patients with soft tissue sarcoma showed a PFS and OS benefit only in patients with no evidence of disease prior to HCT. In another phase 2 study (2006), 21 (38%) of 55 patients responded to doxorubicin-based induction chemotherapy, but estimated OS did not differ statistically between those who did (14%) and did not (3%) receive an autologous HCT (p = 0.003).

In 2017, a Cochrane systematic review evaluated the use of autologous HCT following high-dose chemotherapy (HDC) for non-rhabdomyosarcoma soft tissue sarcomas. One RCT (2012) assessing 83 patients was identified. In the RCT, OS did not differ statistically between autologous HCT following HDC and standard-dose chemotherapy (hazard ratio, 1.26; 95% confidence interval [CI], 0.70 to 2.29; p = 0.44), and the point estimate for survival at 3 years was 32.7% compared with 49.4%. Peinemann and Labeit (2014) conducted another systematic review that included an RCT (described above) and 61 single-arm studies. The pooled TRM rate across 61 single-arm studies was 15 (5.1%) of 294.

A small number of studies not included in the Cochrane review have described outcomes after HCT for soft tissue sarcoma. Kasper et al (2010) reported the results of a prospective, single-institution phase 2 study that enrolled 34 patients with advanced and/or metastatic soft tissue sarcoma. After four courses of chemotherapy, nine patients with at least a partial response underwent HDC and autologous HCT. All other patients continued chemotherapy for two more cycles. Median PFS for patients treated with HCT was 11.6 months (range, 8-15 months) and 5.6 months for patients treated with standard chemotherapy (p = 0.047); median OS for the 2 groups was 23.7 months (range, 12-34 months) and 10.8 months (range 0-39 months; p = 0.027), respectively.
Hartmann et al (2013) reported on results from a phase 2 study of HDC with ifosfamide, carboplatin, and etoposide followed by peripheral blood stem cell transplantation in patients with grade 2 or 3 histologically proven soft tissue sarcoma considered unresectable or marginally resectable.12 After a median follow-up of 50 months (range, 26-120 months) in surviving patients, median PFS for all patients was 21 months (range, 1-94 months) and median OS was 37 months (range, 3-120 months), corresponding to 5-year PFS and OS rates of 39% and 48%, respectively.

A 2014 case report on the use of autologous HCT for treatment of an adult histiocytic sarcoma was identified, in which the patient was alive with no evidence of disease 30 months posttreatment.13

Section Summary: Adult Soft Tissue Sarcomas
Overall, one RCT and several, small phase 2 studies have reported outcomes after autologous HCT in adults with soft tissue sarcoma. Although one small phase 2 study reported longer survival for patients treated with HCT than with standard chemotherapy, the available RCT did not show a survival benefit with autologous HCT.

Small Cell Lung Cancer
Clinical Context and Therapy Purpose
The purpose of autologous HCT is to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with SCLC.

The question addressed in this evidence review is: does HCT improve health outcomes for patients with SCLC?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals with SCLC.

Interventions
The therapy being considered is autologous HCT.

Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are OS, DSS, TRM, and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.

Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using the principles described above.

The interest in treating SCLC with autologous HCT stems from the extremely high chemosensitivity and poor prognosis of this tumor type. A phase 3 trial (2005) randomized 318 patients with SCLC to standard chemotherapy or to HCT.14 No statistically significant difference in response rates was seen between the 2 groups (response rate, 80% in standard arm group vs 88% in HCT group; difference, 8%; 95% CI, -1% to 17%; p=0.09). There was no statistically significant difference in OS between groups, with a median OS of 13.9 months in the standard arm (95% CI, 12.1 to 15.7 months) and 14.4 months in the HCT arm (95% CI, 13.1 to 15.4 months; p=0.76). One smaller, randomized study and several single-arm studies of HCT and autologous HCT for SCLC are
summarized in a 2007 review article. Overall, most of the data from these studies, including the randomized study, showed no increase in OS with autologous HCT.

Jiang et al (2009) performed a meta-analysis of English-language studies through October 2008 using intensified chemotherapy with autologous hematopoietic progenitors to treat SCLC. The meta-analysis consisted of 5 RCTs (3 phase 3 trials, 2 phase 2), with a total of 641 patients. Reviewers found no significant increase in the odds ratio for response rate with autologous transplant vs control chemotherapy (odds ratio, 1.29; 95% CI, 0.87 to 1.93; p=0.206). No statistically significant increase in OS was seen among the autologous transplant patients compared with control regimens (hazard ratio =0.94; 95% CI, 0.80 to 1.10; p=0.432). Reviewers concluded that current evidence did not support the use of intensified chemotherapy and autologous HCT for treating SCLC.

Section Summary: Small Cell Lung Cancer
Treatement of SCLC with autologous HCT has been studied in a meta-analysis, RCTs, and small series. None of these studies showed a survival benefit with autologous HCT.

Other Tumors
Uncontrolled pilot studies of autologous HCT for patients with refractory urothelial carcinoma and recurrent or advanced nasopharyngeal carcinoma have not demonstrated adequate evidence of improved outcomes to alter previous conclusions. In a 2014 small series (n=8) of bilateral retinoblastoma survivors with secondary osteosarcoma, 2 patients (of 7 treated with multimodal chemotherapy) received HDC with autologous peripheral blood stem cell support. The 2 HCT-treated patients were alive with no evidence of disease at 33.4 and 56.4 months of follow-up.

Allogenic Hematopoietic Cell Transplantation in Solid Tumors
The evidence base for the treatment of patients with types of solid tumors using allog-HCT consists of single-case reports and small series.

Renal Cell Carcinoma
Clinical Context and Therapy Purpose
The purpose of allo-HCT is to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with RCC.

The question addressed in this evidence review is: does allo-HCT improve health outcomes for patients with RCC?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals with RCC.

Interventions
The therapy being considered is allo-HCT.

Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are OS, DSS, TRM, and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.
Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using principles described above.

Metastatic RCC has an extremely poor prognosis, with a median survival of less than one year and a five-year survival of less than 5%22. RCC is relatively resistant to chemotherapy but is susceptible to immune therapy, and interleukin-2 and/or interferon-α have induced responses and long-term PFS rates of in 4% to 15% of patients.21 In addition, seven targeted therapies are approved by the U.S. Food and Drug Administration for treatment of advanced RCC: sunitinib, sorafenib, pazopanib, axitinib, temsirolimus, everolimus, and bevacizumab.23 Based on the susceptibility of RCC to immune therapies, the immune-based strategy of a graft-versus-tumor effect possible with an allogeneic transplant has led to an interest in its use in RCC. Childs et al (2000) published on the first series of patients with RCC treated with nonmyeloablative allo-HCT.22 The investigators showed tumor regression in 10 (53%) of 19 patients with cytokine-refractory, metastatic RCC who received a human leukocyte antigen-identical sibling allo-HCT. Three patients had a CR and remained in remission 16, 25, and 27 months after transplant. Four of 7 patients with a partial response were alive without disease progression 9 to 19 months after transplantation. Other pilot trials have demonstrated the graft-versus-tumor effect of allo-HCT in metastatic RCC, but most have not shown as high a response rate as the Childs et al (2000) study. ORRs in these pilot trials have been approximately 25%, with CR rates of approximately 8%.20 Prospective, randomized trials are needed to assess the net impact of this technique on the survival of patients with cytokine-refractory RCC.20

Bregni et al (2009) assessed the long-term benefit of allografting in 25 patients with cytokine-refractory metastatic RCC who received reduced-intensity conditioning (RIC) with allo-HCT from a sibling who was human leukocyte antigen-identical.24 All patients received the same conditioning regimen. Response to allograft was available in 24 patients, with a CR in 1 patient and partial response in 4 patients. Twelve patients had a minor response or stable disease, and seven had progressive disease. ORR (complete plus partial) was 20%. Six patients died because of transplant-related mortality. Median survival was 336 days (range, 12-2332+ days). The 1-year OS rate was 48% (95% CI, 28% to 68%) and the 5-year OS rate was 20% (95% CI, 4% to 36%). The authors concluded that allografting can induce long-term disease control in a small fraction of cytokine-resistant patients with RCC but that with the availability of novel targeted therapies for RCC, future treatment strategies should consider incorporating these therapies into the transplant regimen.

Section Summary: Allogenic Hematopoietic Cell Transplantation in RCC
Evidence on the use of allo-HCT for RCC is based on a TEC Assessment and multiple case series. TEC Assessments found that HCTs did not meet the criteria for treatment of RCC or other solid tumors. In absence of RCTs, current evidence is insufficient to conclude whether allo-HCT results in improved OS among RCC patients.

Colorectal Cancer
Clinical Context and Therapy Purpose
The purpose of allo-HCT is to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with CRC.

The question addressed in this evidence review is: does allo-HCT improve health outcomes for patients with CRC?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals with CRC.
Interventions
The therapy being considered is allo-HCT.

Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are OS, DSS, TRM, and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.

Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using principles described above.

Aglietta et al (2009) reported on their experience with 39 patients with metastatic CRC who underwent RIC allo-HCT between 1999 and 2004 at 9 European Group for Blood and Marrow Transplantation centers. Patients were treated with one of five RIC regimens. Endpoints assessed were an achievement of mixed chimera, the incidence of graft-versus-host disease, TRM, and toxicities, OS, and time to treatment failure (in patients who responded to the therapy). Patient population characteristics were heterogeneous; pretransplant disease status was a partial response in 2 patients, stable disease in 6 patients, and progressive disease in 31. Thirty-eight (97%) patients had previous treatment, some with only chemotherapy and others with surgery, chemotherapy, or both. After the transplant, tumor responses were complete and partial in 2% and 18% of patients, respectively, and 26% of patients had stable disease, for overall disease control in 46% of patients. Transplant-related mortality was 10%. Median overall follow-up was 202 days (range, 6-1020 days), after which time 33 patients had died and 6 were still alive. Tumor progression was the cause of death in 74% of patients. An assessment of OS of patients was performed after stratifying by potential prognostic factors. Achievement of response after transplantation was associated with a difference in OS, with the 18 patients who had a response having a median OS of approximately 400 days vs approximately 120 days for those who had no response (p<0.001). The authors concluded the allo-HCT approach should be reserved for patients with a partial response or stable disease after second-line therapy for metastatic CRC and that second-generation clinical trials in these patients would be warranted.

Section Summary: Allo-Hematopoietic Cell Transplantation in Colorectal Cancer
Evidence on the use of allo-HCT for CRC is based on a TEC Assessment and a case series. The TEC Assessment concluded that allo-HCT did not meet the criteria for treatment of solid tumors. In the absence of RCTs, current evidence is insufficient to conclude whether allo-HCT improves OS among CRC patients.

Pancreatic Cancer
Clinical Context and Therapy Purpose
The purpose of allo-HCT is to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with pancreatic cancer.

The question addressed in this evidence review is: does allo-HCT improve health outcomes for patients with pancreatic cancer?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals with pancreatic cancer.
Interventions
The therapy being considered is allo-HCT.

Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are OS, DSS, TRM, and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.

Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using principles described above.

Kanda et al (2008) reported on the efficacy of RIC allo-HCT for advanced pancreatic cancer in 22 patients from 3 transplantation centers in Japan. RIC regimens differed across centers, and the patient population was fairly heterogeneous, with 15 patients having metastatic disease and 7 having locally advanced disease. All but one patient received chemotherapy of various combinations before a transplant, and ten patients received localized radiotherapy. After allo-HCT, 1 patient achieved CR, 2 had a partial response, 2 had a minor response, and 8 had stable disease, with an ORR of 23%. Median survival was 139 days, and the major cause of death was tumor progression (median duration of survival in advanced pancreatic cancer in the nontransplant setting is less than 6 months, even in patients treated with gemcitabine). Only one patient survived longer than one year after transplantation. The authors concluded that a tumor response was observed in 25% of patients with advanced pancreatic cancer who underwent allo-HCT and that the response was not durable. However, based on their observation of a relation between longer survival and the infusion of a higher number of CD34-positive cells or the development of chronic graft-versus-host disease, they recommended additional study to evaluate the immunologic effect on pancreatic cancer.

Abe et al (2009) reported on outcomes for 5 patients with chemotherapy-resistant, unresectable pancreatic adenocarcinoma who received nonmyeloablative conditioning with allo- HCT. Median age was 54 years (range, 44-62 years). All patients had advanced disease, either with metastases or peritonitis, and had received at least one course of chemotherapy including gemcitabine. After allo-HCT, tumor response was only observed in 2 patients—one had complete disappearance of the primary tumor and the other had a 20% reduction in tumor size; the remaining patients had progressive disease (n=2) or stable disease (n=1). Four patients died of progressive disease (median, 96 days; range, 28-209 days posttransplant). One patient died at day 57 secondary to rupture of the common bile duct from rapid tumor regression. The authors concluded that findings showed a graft-versus-tumor effect, but to obtain durable responses, an improved conditioning regimen and new strategies to control tumor growth after nonmyeloablative allo-HCT would be needed.

Omazic et al (2017) reported on outcomes for 2 patients who received allo-HCT from human leukocyte antigen-identical sibling donors following resection of pancreatic ductal adenocarcinoma. These patients were compared with six controls who underwent radical surgery for pancreatic ductal adenocarcinoma but did not receive HCT. Both patients receiving HCT were tumor free after nine years following diagnosis, whereas all the patients in the control group died within four years of diagnosis.
Section Summary: Allo-Hematopoietic Cell Transplantation in Pancreatic Cancer
Evidence on the use of allo-HCT for pancreatic cancer is based on a TEC Assessment, multiple case series, and a small comparative study. The TEC Assessment concluded that allo-HCT did not meet the criteria for treatment of solid tumors. In absence of RCTs, current evidence is insufficient to conclude whether allo-HCT improves OS among pancreatic cancer patients.

Nasopharyngeal Cancer
Clinical Context and Therapy Purpose
The purpose of allo-HCT is to provide a treatment option that is an alternative to or an improvement on existing therapies in patients with nasopharyngeal cancer.

The question addressed in this evidence review is: does allo-HCT improve health outcomes for patients with nasopharyngeal cancer?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest are individuals with nasopharyngeal cancer.

Interventions
The therapy being considered is allo-HCT.

Comparators
Comparators of interest include standard of care.

Outcomes
The general outcomes of interest are OS, DSS, TRM, and treatment-related morbidity.

Timing
Follow-up over months to years is of interest to monitor relevant outcomes.

Setting
Patients are actively managed by oncologists in an outpatient clinical setting.

Study Selection Criteria
Methodologically credible studies were selected using principles described above.

Toh et al (2011) reported on outcomes of a phase 2 trial of 21 patients with pretreated metastatic nasopharyngeal cancer. Median patient age was 48 years (range, 34-57 years), and patients had received a median of 2 previous chemotherapy regimens (range, 1-8 regimens). All patients had extensive metastases. Patients underwent a nonmyeloablative allo-HCT with sibling allografts. Seven (33%) patients showed a partial response and 3 (14%) achieved stable disease. Four patients were alive at 2 years, and 3 showed prolonged disease control of 344, 525, and 550 days. After a median follow-up of 209 days (range, 4-1147 days), the median PFS was 100 days (95% CI, 66 to 128 days) and the median OS was 209 days (95% CI, 128 to 236 days). One- and 2-year OS rates were 29% and 19%, respectively, comparable to the median 7- to 14-month OS rates reported in the literature for metastatic nasopharyngeal patients treated with salvage chemotherapy without HCT.

Section Summary: Allo-Hematopoietic Cell Transplantation in Nasopharyngeal Cancer
Evidence on the use of allo-HCT for nasopharyngeal cancer is based on a TEC Assessment and a phase 2 trial. The TEC Assessment concluded that allo-HCT did not meet the criteria for treatment of solid tumors. In absence of RCTs, current evidence is insufficient to conclude whether allo-HCT improves OS among nasopharyngeal cancer patients.
Mixed Tumor Types
Omazic et al (2016) reported on long-term follow-up for 61 patients with a variety of solid tumor types considered incurable with conventional therapies who were treated with allo-HCT from 1999 to 2012. Tumors included metastatic renal carcinoma (n=22), cholangiocarcinoma (n=17), colon cancer (n=15), prostate cancer (n=3), pancreatic adenocarcinoma (n=3), and breast cancer (n=1). Most patients (n=59) had undergone surgical debulking of the primary tumor, and 31 patients had previously undergone additional therapy with cytotoxic chemotherapy, radiotherapy, or immunotherapy. Conditioning was myeloablative in 23 patients, reduced-intensity in 36 patients, and nonmyeloablative in 2 patients. Over a median follow-up of 8 years, OS rates at 5 and 10 years were 15% and 9%, respectively.

Summary of Evidence
Autologous Hematopoietic Cell Transplantation
For individuals who have adult soft tissue sarcomas who receive autologous HCT, the evidence includes two TEC Assessments, an RCT, and a number of phase 2 single-arm studies, some of which have been summarized in a systematic review. The relevant outcomes are OS, DSS, and treatment-related mortality and morbidity. The 1995 and 1999 TEC Assessments, focusing on autologous HCT as primary and salvage therapy for a variety of solid tumors, found the available evidence did not permit conclusions about the effect of HCT on patient survival. Although a small phase 2 RCT reported longer survival for patients treated with autologous HCT than with standard chemotherapy, this trial did not show a survival benefit with HCT. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have SCLC who receive autologous HCT, the evidence includes two TEC Assessments, several RCTs, and systematic reviews of these studies. The relevant outcomes are OS, DSS, and treatment-related mortality and morbidity. The 1995 and 1999 TEC Assessments, focusing on autologous HCT as primary and salvage therapy for a variety of solid tumors, found the available evidence did not permit conclusions about the effect of HCT on patient survival. Studies published since the TEC Assessments have not reported increased OS for patients with SCLC treated with autologous HCT. The evidence is insufficient to determine the effects of the technology on health outcomes.

Allo-Hematopoietic Cell Transplantation
For individuals who have RCC, CRC, pancreatic cancer, or nasopharyngeal cancer who receive allo-HCT, the evidence includes a TEC Assessment and small single-arm series. The relevant outcomes are OS, DSS, and treatment-related mortality and morbidity. The 1995 and 1999 TEC Assessments, focusing on allo-HCT as primary and salvage therapy for a variety of solid tumors, found the available evidence did not permit conclusions about the effect of allo-HCT on patient survival. Since the publication of the TEC Assessments, the evidence for allo-HCT to treat RCC, CRC, pancreatic cancer, and nasopharyngeal cancer has been limited to small case series. The evidence is insufficient to determine the effects of the technology on health outcomes.

Supplemental Information
Practice Guidelines and Position Statements
The American Society of Transplantation (2017) convened a consensus conference of experts to address issues related to the transplantation of hepatitis C virus (HCV) viremic solid organs into HCV non-viremic recipients. Key findings and recommendations are summarized in Table 1.

Table 1. American Society of Transplantation Consensus Conference - Use of HCV Viremic Donors
<table>
<thead>
<tr>
<th>Content Area</th>
<th>Key Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Definition of HCV positive</td>
<td>HCV -viremic reflecting a positive NAT should be adopted</td>
</tr>
<tr>
<td>2. Data interpretation</td>
<td>HCV antibody status alone limits interpretation of outcomes of transplantation of HCV “positive” organs</td>
</tr>
<tr>
<td>3. Transmission and Treatment</td>
<td>Highest risk for unexpected HCV transmission is associated with organ donation from a person who injected drugs within the eclipse or pre-viremic period</td>
</tr>
</tbody>
</table>
Content Area | Key Point
--- | ---
4 | OPTN policy
No current policies prevent transplantation of HCV-viremic organs into HCV non-viremic recipients

5 | Ethical considerations
Transplantation of HCV-viremic organs into HCV non-viremic recipients should be conducted under site specific IRB approved protocols with multi-step informed consent.

**National Comprehensive Cancer Network**
Current National Comprehensive Cancer Network guidelines (2017-2018) on the tumors addressed in this evidence review do not discuss hematopoietic cell transplantation (HCT) as a treatment option.\(^3\)

**American Society for Blood and Marrow Transplantation**
The American Society for Blood and Marrow Transplantation (2015) issued guidelines related to indications for autologous and allogeneic HCT.\(^3\) The tumors addressed herein for which the Society has provided recommendations are listed in Table 2.

**Table 2. Recommendations for Use of Autologous and Allogeneic HCT**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Treatment Option</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewing sarcoma, high risk</td>
<td>Allogeneic HCT</td>
<td>Not generally recommended</td>
</tr>
<tr>
<td></td>
<td>Autologous HCT</td>
<td>Standard of care, clinical evidence available</td>
</tr>
<tr>
<td>Renal cancer, metastatic</td>
<td>Allogeneic HCT</td>
<td>Developmental</td>
</tr>
<tr>
<td></td>
<td>Autologous HCT</td>
<td>Not generally recommended</td>
</tr>
</tbody>
</table>

HCT: hematopoietic cell transplantation.

**U.S. Preventive Services Task Force Recommendations**
Not applicable.

**Medicare National Coverage**
The Centers for Medicare & Medicaid Services currently have the following national noncoverage decision on autologous stem cell transplantation: “Insufficient data exist to establish definite conclusions regarding the efficacy of AuSCT [autologous stem cell transplantation] for the following condition[s]: Solid tumors (other than neuroblastoma),”\(^3\).

**Ongoing and Unpublished Clinical Trials**
Some currently unpublished trials that might influence this review are listed in Table 3.

**Table 3. Summary of Key Trials**

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td>NCT03236883</td>
<td>Phase I Study of Nonmyeloablative Allogeneic Hematopoietic Stem Cell Transplantation in the Treatment of Pancreatic Cancer</td>
<td>30</td>
</tr>
</tbody>
</table>

**References**


- Diagnosis (including disease staging) and prognosis
- Synopsis of alternative treatments performed and results
- Specific transplant type being requested
- Surgical consultation report and/or progress notes
- Results of completed transplant evaluation including:
  - Clinical history
  - Specific issues identified during the transplant evaluation
  - Consultation reports/letters (when applicable)
  - Correspondence from referring physicians (when applicable)
  - Identification of donor for allogeneic related bone marrow/stem cell transplant (when information available)
- Medical social service/social worker and/or psychiatric (if issues are noted) evaluations including psychosocial assessment or impression of patient’s ability to be an adequate candidate for transplant
- Radiology reports including:
  - Chest x-ray (CXR)
  - PET scan, CT scan, and bone survey (as appropriate)
- Cardiology procedures and pulmonary function reports:
  - EKG
  - Echocardiogram
  - Pulmonary function tests (PFTs)
- Biopsy/Pathology reports including:
  - Bone marrow biopsy
  - Lymph node biopsy (as appropriate)
- Laboratory reports

### Coding

This Policy relates only to the services or supplies described herein. Benefits may vary according to product design; therefore, contract language should be reviewed before applying the terms of the Policy. Inclusion or exclusion of codes does not constitute or imply member coverage or provider reimbursement.

**IE**

The following services may be considered investigational.

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT®</td>
<td>38204</td>
<td>Management of recipient hematopoietic progenitor cell donor search and cell acquisition</td>
</tr>
<tr>
<td></td>
<td>38205</td>
<td>Blood-derived hematopoietic progenitor cell harvesting for transplantation, per collection; allogeneic</td>
</tr>
<tr>
<td></td>
<td>38206</td>
<td>Blood-derived hematopoietic progenitor cell harvesting for transplantation, per collection; autologous</td>
</tr>
<tr>
<td></td>
<td>38207</td>
<td>Transplant preparation of hematopoietic progenitor cells; cryopreservation and storage</td>
</tr>
<tr>
<td></td>
<td>38208</td>
<td>Transplant preparation of hematopoietic progenitor cells; thawing of previously frozen harvest, without washing, per donor</td>
</tr>
<tr>
<td></td>
<td>38209</td>
<td>Transplant preparation of hematopoietic progenitor cells; thawing of previously frozen harvest, with washing, per donor</td>
</tr>
<tr>
<td></td>
<td>38210</td>
<td>Transplant preparation of hematopoietic progenitor cells; specific cell depletion within harvest; T-cell depletion</td>
</tr>
<tr>
<td></td>
<td>38211</td>
<td>Transplant preparation of hematopoietic progenitor cells; tumor cell depletion</td>
</tr>
<tr>
<td></td>
<td>38212</td>
<td>Transplant preparation of hematopoietic progenitor cells; red blood cell removal</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>38213</td>
<td>Transplant preparation of hematopoietic progenitor cells; platelet depletion</td>
<td></td>
</tr>
<tr>
<td>38214</td>
<td>Transplant preparation of hematopoietic progenitor cells; plasma (volume) depletion</td>
<td></td>
</tr>
<tr>
<td>38215</td>
<td>Transplant preparation of hematopoietic progenitor cells; cell concentration in plasma, mononuclear, or buffy coat layer</td>
<td></td>
</tr>
<tr>
<td>38220</td>
<td>Diagnostic bone marrow; aspiration(s)</td>
<td></td>
</tr>
<tr>
<td>38221</td>
<td>Diagnostic bone marrow; biopsy(ies)</td>
<td></td>
</tr>
<tr>
<td>38222</td>
<td>Diagnostic bone marrow; biopsy(ies)</td>
<td></td>
</tr>
<tr>
<td>38240</td>
<td>Hematopoietic progenitor cell (HPC); allogeneic transplantation per donor</td>
<td></td>
</tr>
<tr>
<td>38241</td>
<td>Hematopoietic progenitor cell (HPC); autologous transplantation</td>
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</tr>
</tbody>
</table>

**HCPCS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2150</td>
<td>Bone marrow or blood-derived stem cells (peripheral or umbilical), allogeneic or autologous, harvesting, transplantation, and related complications including: pheresis and cell preparation/storage; marrow ablative therapy; drugs, supplies, hospitalization with outpatient follow-up; medical/surgical, diagnostic, emergency, and rehabilitative services; and the number of days of pre and post transplant care in the global definition</td>
</tr>
</tbody>
</table>

**ICD-10 Procedure**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>07DQ0ZZ</td>
<td>Extraction of Sternum Bone Marrow, Open Approach</td>
</tr>
<tr>
<td>07DQ3ZZ</td>
<td>Extraction of Sternum Bone Marrow, Percutaneous Approach</td>
</tr>
<tr>
<td>07DR0ZZ</td>
<td>Extraction of Iliac Bone Marrow, Open Approach</td>
</tr>
<tr>
<td>07DR3ZZ</td>
<td>Extraction of Iliac Bone Marrow, Percutaneous Approach</td>
</tr>
<tr>
<td>07DS0ZZ</td>
<td>Extraction of Vertebral Bone Marrow, Open Approach</td>
</tr>
<tr>
<td>07DS3ZZ</td>
<td>Extraction of Vertebral Bone Marrow, Percutaneous Approach</td>
</tr>
<tr>
<td>30233G0</td>
<td>Transfusion of Autologous Bone Marrow into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233G2</td>
<td>Transfusion of Allogeneic Related Bone Marrow into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233G3</td>
<td>Transfusion of Allogeneic Unrelated Bone Marrow into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233G4</td>
<td>Transfusion of Allogeneic Unspecified Bone Marrow into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233X0</td>
<td>Transfusion of Autologous Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233X2</td>
<td>Transfusion of Allogeneic Related Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233X3</td>
<td>Transfusion of Allogeneic Unrelated Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
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<td>Transfusion of Allogeneic Unspecified Cord Blood Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233Y0</td>
<td>Transfusion of Autologous Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233Y2</td>
<td>Transfusion of Allogeneic Related Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233Y3</td>
<td>Transfusion of Allogeneic Unrelated Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30233Y4</td>
<td>Transfusion of Allogeneic Unspecified Hematopoietic Stem Cells into Peripheral Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30243G0</td>
<td>Transfusion of Autologous Bone Marrow into Central Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>30243G2</td>
<td>Transfusion of Allogeneic Related Bone Marrow into Central Vein, Percutaneous Approach</td>
</tr>
<tr>
<td>Type</td>
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**Policy History**

This section provides a chronological history of the activities, updates and changes that have occurred with this Medical Policy.

<table>
<thead>
<tr>
<th>Effective Date</th>
<th>Action</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/07/2011</td>
<td>BCBSA Medical Policy adoption</td>
<td>Medical Policy Committee</td>
</tr>
<tr>
<td>03/30/2015</td>
<td>Policy revision without position change</td>
<td>Medical Policy Committee</td>
</tr>
<tr>
<td>04/01/2016</td>
<td>Policy revision without position change</td>
<td>Medical Policy Committee</td>
</tr>
<tr>
<td>03/01/2017</td>
<td>Policy title change from Hematopoietic Stem Cell Transplantation for Miscellaneous Solid Tumors in Adults</td>
<td>Medical Policy Committee</td>
</tr>
<tr>
<td>01/01/2018</td>
<td>Coding update</td>
<td>Administrative Review</td>
</tr>
<tr>
<td>03/01/2018</td>
<td>Policy revision without position change</td>
<td>Medical Policy Committee</td>
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<tr>
<td>03/01/2019</td>
<td>Policy revision without position change</td>
<td>Medical Policy Committee</td>
</tr>
<tr>
<td>11/01/2019</td>
<td>Policy revision without position change</td>
<td>Administrative Review</td>
</tr>
</tbody>
</table>

**Definitions of Decision Determinations**

**Medically Necessary:** A treatment, procedure, or drug is medically necessary only when it has been established as safe and effective for the particular symptoms or diagnosis, is not investigational or experimental, is not being provided primarily for the convenience of the patient or the provider, and is provided at the most appropriate level to treat the condition.

**Investigational/Experimental:** A treatment, procedure, or drug is investigational when it has not been recognized as safe and effective for use in treating the particular condition in accordance with generally accepted professional medical standards. This includes services where approval by the federal or state governmental is required prior to use, but has not yet been granted.

**Split Evaluation:** Blue Shield of California/Blue Shield of California Life & Health Insurance Company (Blue Shield) policy review can result in a split evaluation, where a treatment,
procedure, or drug will be considered to be investigational for certain indications or conditions, but will be deemed safe and effective for other indications or conditions, and therefore potentially medically necessary in those instances.

**Prior Authorization Requirements (as applicable to your plan)**

Within five days before the actual date of service, the provider must confirm with Blue Shield that the member’s health plan coverage is still in effect. Blue Shield reserves the right to revoke an authorization prior to services being rendered based on cancellation of the member’s eligibility. Final determination of benefits will be made after review of the claim for limitations or exclusions.

Questions regarding the applicability of this policy should also be directed to the Transplant Case Management Department. Please call 1-800-637-2066 ext. 3507708 or visit the Provider Portal www.blueshieldca.com/provider.

Disclaimer: This medical policy is a guide in evaluating the medical necessity of a particular service or treatment. Blue Shield of California may consider published peer-reviewed scientific literature, national guidelines, and local standards of practice in developing its medical policy. Federal and state law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over medical policy and must be considered first in determining covered services. Member contracts may differ in their benefits. Blue Shield reserves the right to review and update policies as appropriate.