This policy was written with advice from Dr S Ahmed, Consultant in Public Health, Greater Glasgow & Clyde. We would like to thank him for his guidance.

1. Background

It is recommended by EBMT and CDC that all patients who have had a haemopoietic stem cell transplant, whether autologous or allogeneic, should undergo a programme of re-vaccination following the procedure. Vaccination of household contacts may also be appropriate against certain infections e.g. influenza, chicken pox to reduce the chance of cross infection.

1.1. There is evidence that a patient receiving intensive chemo and/or radiotherapy particularly those receiving haemopoietic stem cell transplants, have significantly impaired immunity following the procedure which can last for many months.

1.2. Allogeneic transplant patients are frequently hyposplenic, particularly if total body irradiation (TBI) has been used.

1.3. Autograft patients who have total body irradiation (TBI) as part of the conditioning may be hyposplenic.

1.4. Chronic GVHD is not exacerbated by vaccination, but may reduce response to vaccine. These patients **MUST NOT** be given live vaccines.

1.5. It is clear that following haemopoietic stem cell transplantation, the recovering immune system is unlikely to respond appropriately to most vaccinations for **at least 6 months.**

1.6. The use of **live vaccines in immunocompromised patients is potentially dangerous.** Live vaccines should **NOT** be considered routinely for post BMT patients e.g. live Polio, MMR, Varicella, Shingles and yellow fever. However, they may be used in the following situations:

1.6.1. Autograft/ High dose therapy (i.e. patients own cells)

- More than 12 months post transplant and off all immunosuppressive treatment for at least 12 months (excluding shingles vaccine)
- Complete remission from underlying malignancy
- For shingles vaccine, more than 24 months post transplant and on complete remission

1.6.2. Allograft (i.e. someone else's cells)

- More than 2 years post allogeneic transplant
- Who have NOT received any immunosuppressive therapy for 12 months
- No evidence of active graft versus host disease (GvHD)

Live vaccines in post transplant patients should only be used if the risk of infection outweighs the potential risk of the vaccine e.g. Primary school teacher or if there is a significant risk of infection during an outbreak e.g. Measles.(Machado*, et al* 2005)

1.7. The use of BCG is not recommended for any patient post transplant unless at significant risk of exposure outwith UK

NB for unvaccinated at risk patients exposed to a transmissible infection e.g. measles, varicella etc. please contact the BMT unit or local Haematology team without delay for advice re passive immunisation and other prophylactic measures.

2. SPECIFIC VACCINES

2.1. Adsorbed Diphtheria (low dose), tetanus, pertussis (acellular component) and poliomyelitis (inactivated) Vaccine

Patient 6, 8 and 10 months post BMT with a 4th dose 5 years later

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Brand names include **Boostrix-IPV or Repevax**

2.2. Haemophilus Influenza B + Meningococcal C combined

The best protection is from conjugated vaccines

Patient:- 2 doses 6, 8 months post BMT

This is not licensed for adults, but it's use in the post HSCT setting has been approved by GG&C Public health.

Brand names include **Menitorix**

2.3 Meningococcal B Vaccine

The multicomponent 4CMenB vaccine (Bexsero) may protect against up to 88% of circulating meningococcal B strains in the UK. 4CMenB may also protect against infection by capsular groups other than group B.

Patient: 2 doses 8, 10 months post BMT

2.4 Quadrivalent ACWY meningococcal conjugate vaccine

Patient: One dose at 10 months post BMT

NB A booster dose of ACWY conjugate vaccine should be given if travelling to a region where AWY strains are endemic including for pilgrims visiting the Haj festival in Saudi Arabia.

2.5 Prevenar 13 (pneumococcal valent 13)

Patient:- 3 doses given 2 monthly starting at 6 months post transplant. For patients with cGVHD a 4th dose should be given before the pneumovax.

This is not licensed for adults, but it's use in the post HSCT setting has been approved by GG&C Public health.

2.6 Pneumovax II

Patient:- 1 dose at 15 months post BMT and then at 3-5 yearly intervals if remains immunosuppressed with cGVHD.

2.7 Influenza

Patient:- Vaccination from 6 months post-transplant to coincide with seasonal use, ideally in the autumn. In the event of an epidemic this can be given earlier at 4 months. Revaccinate annually.

Household contacts:- vaccination should be considered to reduce the risk of exposure to the patient. This should be continued for a minimum of 2 years, but may be for longer if the patient remains immunocompromised.

The following vaccines are NOT required for all patients, but only for those in specific risk groups detailed below

2.8 Shingles (Zostavax)

Zostavax is a live vaccine with significant contraindications and should only be given to those eligible patients: (if in doubt, please consult the consultant haematologist)

2.8.1 Those who have autologous transplant more than 24 months ago and in full remission

2.8.2 Those who have allogenic transplant more than 24 months ago AND not on immunosuppressive therapy AND no GVHD

2.9 Hepatitis B

ONLY for those patients originating from high risk areas, in high risk groups or in high risk occupational groups as per Green Book

Patient:- at 6, 7 and 11 months post-transplant.

2,10 MMR

This is ONLY for patients who are at high risk of exposure e.g. health care worker, primary school teacher or women planning a pregnancy who are rubella negative.
Patient:- Patients must not be taking any immunosuppressive drugs for at least 12 months, be more than 24 months post transplant and have no Chronic GVHD or active malignancy.
Minimum of 3 months apart, but second dose can be given 4 weeks after first in event of measles outbreak.
Household Contacts:- It is good practice for the purpose of protection of the recipient to ensure close family contacts have had appropriate MMR vaccination (2 doses). This can be given at any time as the viruses contained in the MMR vaccine are not transmissible from a vaccinee to an immunocompromised person.

2.11 Hepatitis A

This is an inactivated vaccine and may be given to patients 6 months post transplant from an endemic area or intending to travel to an endemic area according to standard scheduling

2.12 Yellow Fever

Patients intending travelling to endemic areas should be advised that this vaccine is live attenuated and can cause severe and sometimes fatal side effects even in healthy individuals. This risk seems to be genetically determined. Advice should be taken from Health Protection Scotland as to the risk of yellow fever which varies with season.
This is a live vaccine and should only be given if:

- >24 months post transplant
- No immunosuppression
- No evidence of cGVHD
- In complete remission

2.13 BCG

This is NOT recommended and should ONLY be considered in patients who are at high risk of contracting TB. If required it will be specifically stated by the BMT Consultant that this is needed. It is not recommended within 2 years of transplant. Prior tuberculin testing required.

2.14 Chickenpox (Varicella)

This may be considered in seronegative individuals who have a fully restored immune system who are in complete remission and only if they are at high risk of contracting chicken pox. Vaccination of household contacts is preferred for allograft patients.
Household Contacts:-Varicella vaccine should be considered for seronegative family members as a means of indirect protection for haemopoietic stem cell transplant recipients.
Patients: Not to be given without discussion with the transplant team and until at least 24 months post HSCT and until the patient has been off all immunosuppressive treatment for 12 months, and has no active GvHD.

*No evidence of vaccine virus transmission was found from healthy vaccinated contacts to immunocompromised siblings in a 1991 US study.

** New draft chapter of Green Book states, "It is recommended for healthy susceptible contacts of immunocompromised patients where continuing close contact is unavoidable."

***Vaccine manufacturers are naturally more cautious from a legalistic perspective. The SPC for the Aventis Pasteur product "Varivax " states that, "The vaccine virus may rarely be transmitted to contacts of vaccines who develop a varicella type rash" however, "this kind of transmission has been documented 3 times as of May 2003, since the product was first marketed in 1995, during this time, 40 million doses have been distributed."

3. Distribution of Information

A copy of the one page vaccination policy summary should be forwarded to the General Practice with the patients discharge summary at the time of discharge from the transplant procedure. A second copy will be sent with the letter from the day 100 clinic appointment.

4. References:

- Guidelines for Preventing Infectious Complications among Hematopoietic Cell Transplant Recipients: A Global Perspective Recommendations of the Center for International Blood and Marrow Transplant Research (CIBMTR®), the National Marrow Donor Program (NMDP), the European Blood and Marrow Transplant Group (EBMT), the American Society of Blood and Marrow Transplantation (ASBMT), the Canadian Blood and Marrow Transplant Group (CBMTG), the Infectious Disease Society of America (IDSA), the Society for Healthcare Epidemiology of America (SHEA), the Association of Medical Microbiology and Infectious Diseases Canada (AMMI), and the Centers for Disease Control and Prevention (CDC) *Biology of Blood and Bone Marrow Transplantation* 2009;15:1143–1238.
- Immunisation against infectious disease 2006 – The Green Book (http://www.dh.gov.uk)
- Immunisation for life http://www.immunisation.nhs.uk/
- Machado, C.M., de Souza, V., Sumita, L.M., da Rocha, I.F., Dulley, F.L. & Pannuti, C.S. (2005) Early measles vaccination in bone marrow transplant recipients. *Bone Marrow Transplant,* **35,** 787-791.
- Marissa B. Wilck and Lindsey R. Baden Vaccination after stem cell transplant: a review of recent developments and implications for current practice (2008) *Curr Op Infect Dis* **21**:399-408

5. Vaccine Schedule

This schedule should be used in conjunction with the notes above.
N.B. Those vaccinations in *italics* listed below may not be required for all patients (see notes above)

Allografts

Months post Transplant	**Vaccination**
From 4 - 6 months and then annually	Influenza
6 months	Prevenar 13 HiB + Men C Boostrix-IPV or Repevax *Hepatitis B (high risk only)*
7 months	*Hepatitis B (high risk only)*
8 months	Prevenar 13 HiB + Men C Boostrix-IPV or Repevax 4CMenB
10 months	Prevenar 13 Menveo/Nimenrix(ACWY conjugate) Boostrix-IPV or Repevax 4CMenB
11 months	*Hepatitis B (high risk only)*
12 months	*Prevenar 13* *cGVHD patients only*
14 months	Pneumovax
24 months	*MMR (if indicated)*
27 Months	*MMR (if indicated)* *Zostavax (if eligible and no contraindication)*
60 months	Boostrix-IPV or Repevax *Pneumovax (cGVHD patients)*

APPENDIX 1: VACCINATION POLICY SUMMARY FOR ALLOGRAFTS

All patients who have had an allogeneic haemopoietic stem cell transplant should undergo a programme of re-vaccination following the procedure as recommended by EBMT and CDC. This is because there is evidence that a patient have significantly impaired immunity following the procedure which can last for many months.

Re-vaccination should begin from 4 months following the transplant procedure and should follow the schedule detailed below:

Months post Transplant	**Vaccination**
From 4 - 6 months and then annually	Influenza
6 months	Prevenar 13 HiB + Men C Boostrix-IPV or Repevax *Hepatitis B (*high risk only)*
7 months	*Hepatitis B (*high risk only)*
8 months	Prevenar 13 HiB + Men C Boostrix-IPV or Repevax 4CMenB
10 months	Prevenar 13 Menveo/Nimenrix(ACWY conjugate) Boostrix-IPV or Repevax 4CMenB
11 months	*Hepatitis B (*high risk only)*
12 months	*Prevenar 13* *cGVHD patients only*
14 months	Pneumovax
24 months	*MMR **(if indicated)*
27 Months	*MMR **(if indicated)* *Zostavax **
60 months	Boostrix-IPV or Repevax *Pneumovax (cGVHD patients)*

* ONLY for those patients originating from high risk areas, in high risk groups or in high risk occupational groups as per Green Book

cGVHD- chronic Graft versus host disease

** MMR ONLY for patients who are at high risk of exposure e.g. health care worker, primary school teacher or women planning a pregnancy who are rubella negative.

For MMR and Zostavax- Patients must not be taking any immunosuppressive drugs for at least 12 months, be more than 24 months post transplant, be in remission and have no Chronic GVHD or active malignancy.

Boostrix IPV/**Repevax** are on occasion restricted medicines and are not always available on a GP10 via community pharmacy. In such instances they may be ordered directly by the practice nurse on a routine vaccine order form as per HPS via their local distribution centre.

If you have any specific queries regarding an individual patient please contact the transplant team. If you have queries about vaccination in general or sources of vaccines etc, these be should be addressed to your local public health team.

To review the full transplant vaccination policy please follow the link: http://scothaem.org/vaccination-policy-post-hsc-transplantation.asp The current national guidance on vaccination are available in the green book via the department of heath website (http://www.dh.gov.uk)

APPENDIX 2: VACCINATION POLICY SUMMARY FOR AUTOGRAFTS

Days post Transplant	Vaccination	Date Given
4-6 months	Influenza	
6 months	Prevenar 13	
	HiB + Men C	
	Boostrix-IPV or Repevax	
8 months	Prevenar 13	
	HiB + Men C	
	Boostrix-IPV or Repevax	
	4CMenB	
10 months	Prevenar 13	
	Menveo/Nimenrix(ACWY conjugate)	
	Boostrix-IPV or Repevax	
	4CMenB	
14 months	Pneumovax	
5 years	Boostrix-IPV or Repevax	

If high incidence of influenza in the community Flu can be given from 4 months post transplant

Hepatitis B 6, 7 and 11 months post-transplant
ONLY for those patients originating from high risk areas, in high risk groups or in high risk occupational groups as per Green Book

MMR 24 months and at least 3 months later
This is only for patients who are high risk of exposure eg due to occupation or women planning pregnancy who have been shown to be rubella negative
They must be off all immunosuppression, have a good immune response and with no evidence of underlying malignancy

Note: Boostrix IPV/Repevax are on occasion restricted medicines and are not always available on a GP10 via community pharmacy. In such instances they may be ordered directly by the practice nurse on a routine vaccine order form as per HPS via their local distribution centre.