For effective killing of cancer cells in an anticancer immune response, a series of events involving different immune cells needs to be initiated and allowed to proceed. This stage in the immune response cycle is associated with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands.

Now, a panel of immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD28, CD80, CD86, etc.) were profiled in breast cancer patients and healthy controls to determine their expression levels and to examine their relationships. The steps in the cancer immunity cycle start with the release of tumor cell antigens, which are recognized by and lead to the killing of cancer cells by cytotoxic T cells. This immune response is mediated by a variety of inhibitory and stimulatory factors.

Co-inhibitory receptors and ligands can modulate or inhibit these events thereby regulating the functions of immune cells; examples of stimulatory molecules include TCR/MHC, CD137L/CD137 and OX40L/CD40, while CTLA-4/CD80 or CD86 and PD-1/PD-L1 are potent inhibitory receptors and ligands. The circulating levels of 16 immune checkpoint-related proteins (BTLA, GITR, GITRL, HVEM, LAG-3, PD-1, PD-L1, TIM-3, CD27, CD40, CD137, ICOS, TLR-2 and CTLA-4), as well as chemokines (CXCL5, CCL26, CX3CL1, CXCL10, CXCL9, CCL23) and cytokines (IL2, IL4, IL6, IL8, IL10, etc.) were profiled in 98 early breast cancer patients (patient characteristics are summarized in table 1) and compared to those of 60 healthy controls.

The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group. The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group.

The circulating levels of immune checkpoint molecules, chemokines and cytokines were assayed using Bio-Plex Suspension Bead Array platforms (Milliplex® or Luminex xMAP®) at Netcare Breast Care Centre, 1 Smuts Ave, Johannesburg, South Africa. Peri-menopausal, pre-menopausal, post-menopausal and breast cancer status were significantly associated with various biomarkers in the breast cancer group.